SPECIAL AUDIO FEATURE ISSUE

RADIO & TELEVISION NEWS

NOVEMBER
1952

35 CENTS
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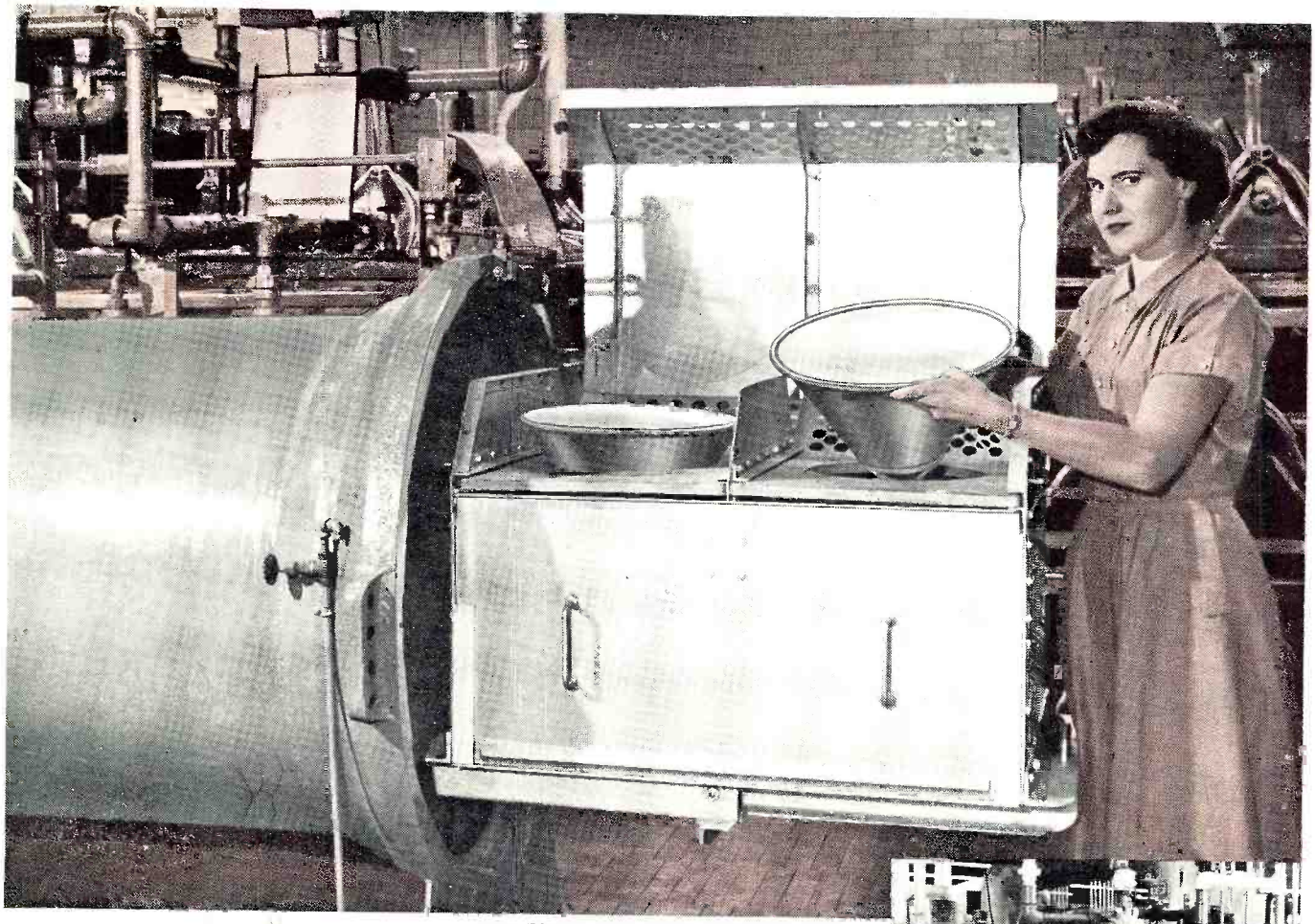
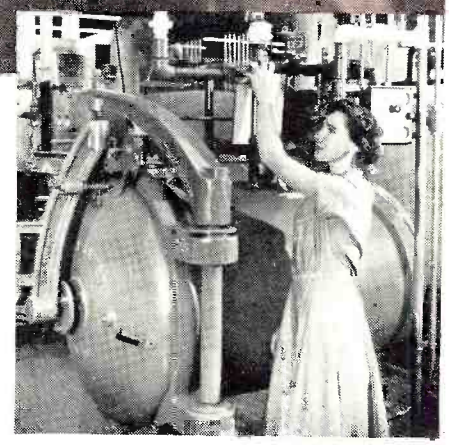
IN THIS ISSUE



Top: Picture tubes being placed into carriage before being rolled into chamber. **Right:** Operator admitting compressed air into chamber.



The Torture Chamber that tests the strength of RCA Picture Tubes

How *strong* is a picture tube? Well, certainly no stronger than its envelope. And that means that poor sealing of glass-to-glass or glass-to-metal, improper annealing of the glass—and even thermal or physical shock during manufacture—can contribute to structural weakness.

How *strong* should a picture tube be? Obviously, it must at least have adequate strength to be handled, transported, and installed safely. To insure safety, RCA has established a rigid standard of strength based on air-pressure tests evolved through unequaled years of experience.

Throughout the day, glass and metal picture tubes of each size are picked at random from the production lines, and placed in an air-compression chamber where they are subjected to "torturing" pressure for several minutes. Any tubes failing this test are examined by RCA production inspectors who can trace the fault and correct it on the production line almost as soon as it appears. Result . . . *structurally weak tubes never reach your shop.*

RCA's constant vigilance at *all* stages of manufacture is your assurance that only top-quality RCA picture tubes leave the factory. In this way, RCA closely guards its own reputation . . . *and yours as well.*

With RCA Receiving Tubes, as well as RCA Kinescopes, TOP-QUALITY CONTROL makes the difference.

TMK. ®

RADIO CORPORATION of AMERICA

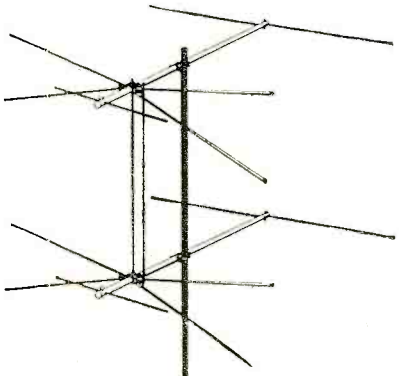
ELECTRON TUBES

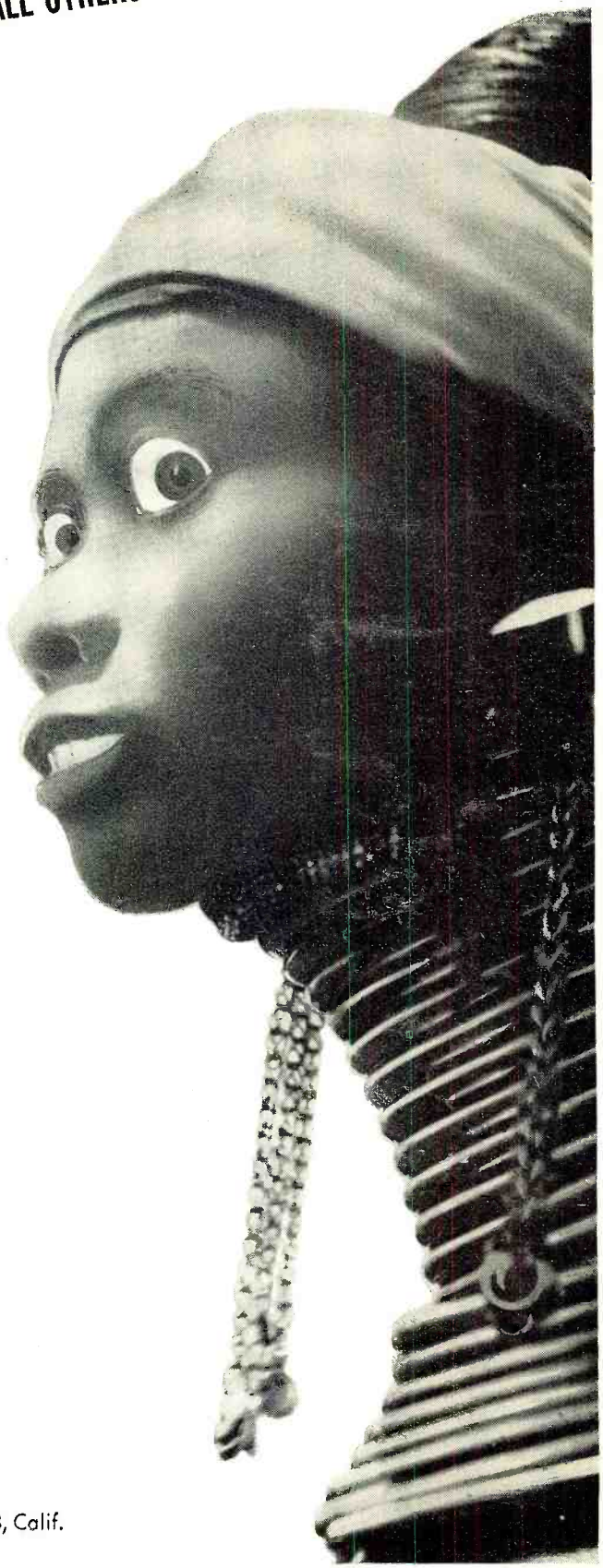
HARRISON, N. J.

OG BONGO WALSCO FRINGO

(Translation)

"WALSCO MODEL M ANTENNA OUT-PERFORMS ALL OTHERS IN FRINGE AREAS"





Almost *anywhere*, the WALSCO Model M Signal King will out-perform, out-last any competitive antenna. It's a fact... the Model M brings fringe areas closer to the TV transmitter... produces sharper, crystal-clear pictures.

And once you install... *that's all.* No costly call-backs that quickly eat up profit. Guaranteed sturdier, more dependable in any *climate.* Chromate-coated, magnesium cross-arms have a structural strength almost equal to steel, yet 1/3 lighter than aluminum. Positive corrosion resistance in severest weather. Elements are made of high-conductivity, super-strength aluminum alloy, reinforced with Swiss "Permalum." Here is quality you can trust *anywhere!*

WALSCO

Walsco quality *earned* its reputation

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COVER PHOTO: The compact preamplifier designed by RADIO & TELEVISION NEWS. Complete construction details are provided on page 50 of this issue. Included in the design are various equalizer circuits. Unit can be used with any phonograph pickup and all types of disc recordings. (Ektachrome by Bruce Downes)

First in radio-television-electronics

Average Paid Circulation over 220,000

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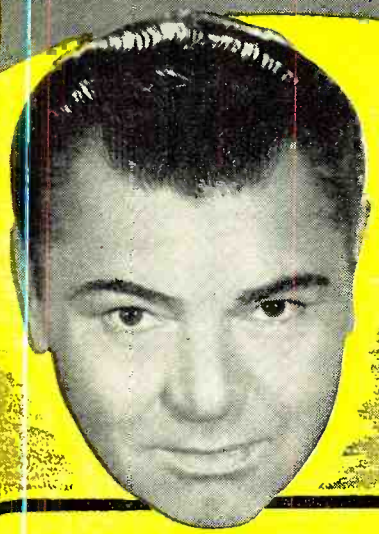

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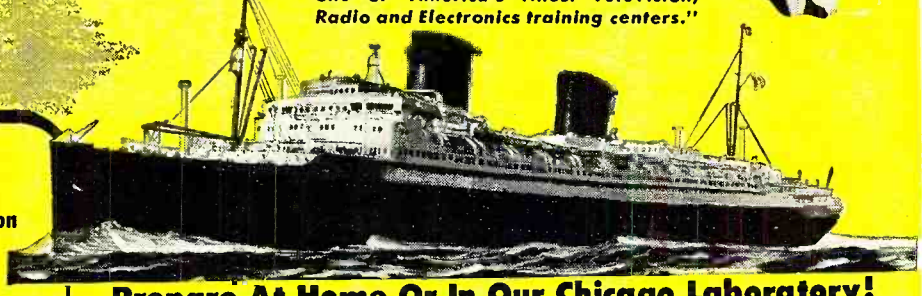
Radio Chief—Jean Desmas Says:

"DeForest's Training, Inc., of Chicago, is known not only throughout Europe, but also in many parts of the world as one of America's finest Television, Radio and Electronics training centers."



JACK DEMPSEY

Former World's Heavyweight Champion

TELLS WHY HE'S PROUD TO BE WITH D.T.I.

- I have been greatly impressed with D.T.I.'s wonderful spirit of friendliness and sincere determination to help its students make good in Television-Radio-Electronics.
- I admire its remarkable 20 year record of helping men build brighter futures.
- I also admire the business policy of its management and the thoroughness of its large faculty of instructors.
- Never have I heard young men praise a school as enthusiastically as do the students and graduates of D.T.I. They are its best boosters.

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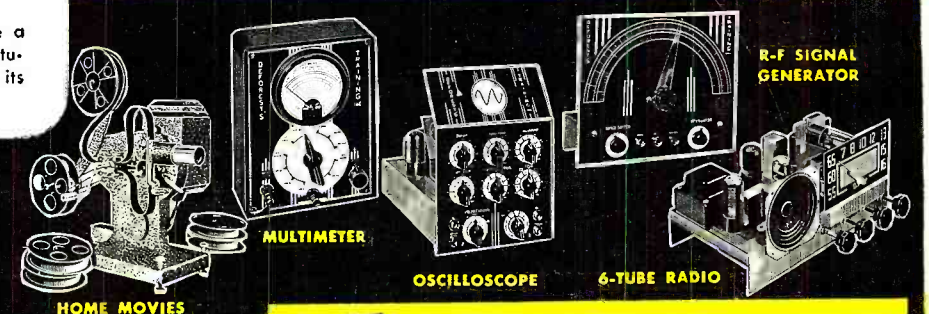
See for yourself how readily you may prepare at home, or in our modern Chicago laboratories, for a better job or business of your own in one of America's fastest-growing fields—TELEVISION-RADIO-ELECTRONICS.

If you train at home you get (1) the use of a 16-mm. movie projector and 16 reels of animated movies to help you learn important points faster . . . easier, (2) modern lessons and (3) sixteen shipments of electronic parts enabling you to get valuable practical experience from over 300 projects—including building and keeping the electronic equipment shown below. And upon completing training, you have the optional privilege of building and keeping a big 17-INCH TV set at moderate added cost. Get the full story. Mail coupon today!



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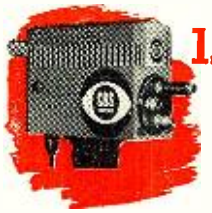
City_____ Zone____ State____

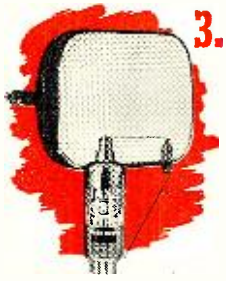
"WHY SHOULD I INSIST ON CBS-HYTRON?"

"YOU PROFIT MORE! HERE ARE 5 BIG REASONS WHY"



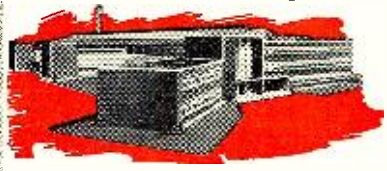
1. CBS-HYTRON IS *FAMOUS* . . . EASY TO SELL. The magic letters "CBS" are plugged for you on radio and TV station breaks . . . 102 BILLION times a year! CBS is known and respected by *all* your customers. CBS-Hytron is the profitable brand with endless sales assistance.

2. CBS-HYTRON *SPECIALIZES* IN RECEIVING TUBES. Since 1921, CBS-Hytron has concentrated on receiving types. Practice makes perfect. Put those years of know-how to work for you. Let time-proved CBS-Hytron dependability cut call-backs . . . make more money for you.

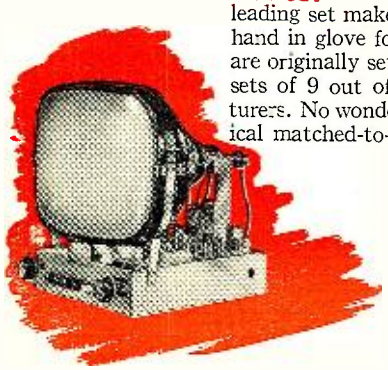


3. CBS-HYTRON *LEADS* IN TV TUBES. You know them. CBS-Hytron TV originals: 1AX2, 1X2A, 6BQ6GT, 12A4, 12B4, 12BH7, 12BY7, 12BZ7, 25BQ6GT, and the original rectangular 16RP4. Even CBS-Hytron standard TV tubes are designed-for-TV...tested-for-TV ...to give you peak performance and profit.

4. CBS-HYTRON IS *ULTRAMODERN*. CBS-Hytron is the tube of the future. Made in the world's most modern plants. On manufacturing equipment years ahead of the rest of the industry. CBS-Hytron advanced design and precision construction keep you always ahead. Give you tomorrow's trouble-free performance today.



5. CBS-HYTRON IS *MATCHED-TO-THE-SET*. Combined engineering skills of leading set makers and CBS-Hytron work hand in glove for you. CBS-Hytron tubes are originally set-engineered right into the sets of 9 out of 10 leading set manufacturers. No wonder CBS-Hytron is your logical matched-to-the-set replacement tube.



IT PAYS TO BE FUSSY! Just any standard brand won't do. If you want: Trouble-free, advanced performance. Maximum customer satisfaction. Minimum call-backs. More profit. Five big reasons point the way: Insist on CBS-Hytron!

CBS HYTRON RADIO TUBES

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Complete data yours for the asking. Write CBS-Hytron, DANVERS, MASS., today.

Finally! No More TV Interference Problems!

The New Hallicrafters HT-20 is T.V.I. proofed!*

Here's the news you've been waiting for—a medium power transmitter (100 watts) that solves the problem of television interference once and for all. The Hallicrafters HT-20 is the answer. Completely tested in the lab and in the field, here is a transmitter that is truly T.V.I. Proofed*.

This is not simply a revamped design, but completely new circuitry to meet this problem. Physically, too, the entire transmitter is new from the massive, two-piece, completely rigid chassis to the electrical air cooling system of the final amplifier tube.

See this newest Hallicrafters—get the complete story of the finest transmitter, dollar for dollar, on the market today. Or write Hallicrafters direct for full details.

Check these features!

- 100 watts carrier power with high level (Class AB2) modulation on any band.
- Continuous coverage, with overlapping bands, from 1.7 to 30 mc.
- Compact, efficient design. Amazing for its power. The HT-20 is 20½" long, 11¾" high and 16¾" deep.
- Weight of transmitter, in cabinet, 105 pounds.
- All transformers and chokes operate "cool"—maximum temperature rise of 40 degrees. This means fewer replacements, long operating life.
- Operates equally well from relay rack or in cabinet on table top.
- Uses 117 volts, 60 cycle AC.
- Moderate cost.

* **T.V.I. PROOFED**—means that this transmitter has circuitry specifically designed to eliminate spurious and harmonic energies that result in television interference.

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For the RECORD

BY THE EDITOR

AUDIO IS BIG BUSINESS

THIS, our fifth annual Audio Feature Issue, ushers in another season for the hi-fi enthusiast, the audio engineering groups, the audio experimenter, and an audio-minded public. Never before in the long history of radio has any segment of our industry faced a more lucrative field than audio, with the exception of television.

Like any lucrative field of endeavour audio has, by its wide appeal, created a popular demand for equipment in all price brackets. Unfortunately—this situation plus the urge to "make a quick buck" has encouraged many manufacturers, wholesalers, and retailers to flood the audio market with inferior components and equipment.

Claims are, in many cases, made for audio amplifier performance that cannot possibly be fulfilled. We recently saw an ad for one of these "terrific buys" and out of curiosity bought one of them for guinea pig purposes. Claims made for this audio amplifier kit included "frequency response from 20 to 20,000 cps at less than 1% distortion, power output to 25 watts for public address or high-fidelity wide-range music systems, input for any phono pickup and tuner, uses 2-6A3 output triodes with feedback, and has an 8-ohm output for hi-fi loudspeakers, etc., etc., etc." The price tag for this dream amplifier was less than 30 bucks —complete with 10 tubes.

Any audio engineer or other electronic technician worth his salt, in reading such claims, would pity the poor novice who might purchase such gear fully believing that he could satisfy his thirst for high-fidelity at such low cost. But would he be satisfied? Let's build this particular amplifier and see what happens:

All of the components are first laid out on the bench and checked against the parts list. With the exception of the wire, lugs, knobs, nameplate escutcheon, and chassis, all of the parts, tubes, and transformers were army surplus. Basically, there is nothing wrong with "surplus" if used for the proper application. Uncle Sam turned out a lot of good stuff. But these transformers were designed for *speech* frequencies in p.a. military gear and with response limited to *speech* frequencies—not for wide range audio. Only one (8 ohm) output is provided instead of an assortment of taps to match hi-fi speaker systems.

We knew, as construction progressed, that the final result would be somewhat shocking after listening to many home and studio equipments produced by reputable manufacturers. Three hours later found this audio masterpiece on the test bench—ready for the usual series of checks on voltage and bias and measurements of distortion, hum, noise, power output, and frequency response.

Space does not permit a complete analysis. A summary of the tests showed a frequency response from 60 to 8500 cycles within 2 db, a distortion figure approaching 18 per-cent, plate voltage on the push-pull 6A3's was 415 volts (normally 325), and power output at 1000 cycles was 17 watts. These results certainly would curl the hair of any audio man—unless he were seeking the perfect amplifier for directing artillery fire at an enemy.

Now for the listening test. This we approached with caution. The neighbors are sitting out in their patio and might not appreciate our demonstration. Our first setup was to feed a cheap crystal pickup to the one and only phono input (designed for microphone) as we were told in the instructions. We also connected a "good quality 12" speaker to the output" as instructed. The results? Phew!

Our second test was with a magnetic cartridge (still following instructions). Without proper equalization, not even mentioned in the book, the reproduction reminded us of the early stem-wound phonograph with its inherent distortion and other non hi-fi effects. At this point our disgust had reached the point where we were satisfied that our efforts to prove the fallacy of cheap audio equipment had not been made in vain.

The purpose of this "case history" is to warn the hi-fi prospect against the unscrupulous claims that are being made by certain suppliers of audio equipment. A top quality audio output transformer cannot be manufactured for less than many complete and so-called hi-fi audio amplifiers.

Our industry is well represented by manufacturers specializing in quality audio products and their ads appear regularly in this, and other, publications. The claims made by these firms have been found to be accurate in practically all instances and may be relied upon to satisfy the discriminating listener or audio technician.

Hi-fidelity audio equipment is not cheap. By its very nature—audio is a complex subject. To produce the desired effect requires near-perfection of each component in a hi-fidelity music system.

If any link in the chain from the original sound source to the ultimate destination of the human ear is weakened—there can be no true fidelity in audio . . . . . O.R.

THE O LY COMPLETE CATALOG FOR EVERYTHING IN TELEVISION, RADIO AND INDUSTRIAL ELECTRONICS

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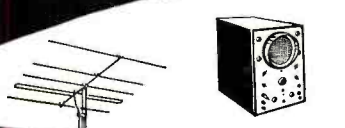

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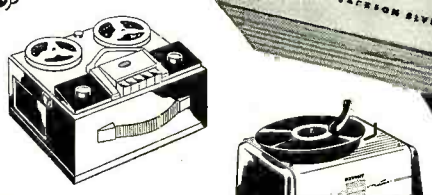

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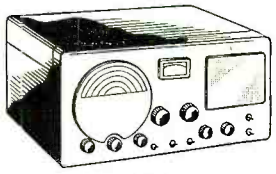

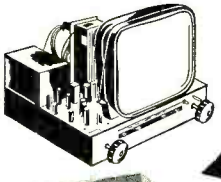

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RELIATRON T. M. ELECTRONIC TUBES

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Westinghouse proudly announces a completely new division of the Westinghouse Electric Corporation—the ELECTRONIC TUBE DIVISION, with headquarters at Elmira, New York.

This division is pledged to become THE leader in research, development, manufacture and marketing of electronic tubes. To achieve this aim rapidly and surely, Westinghouse has built two of the most magnificent, modern electronic tube plants in the world at Elmira and Bath, New York.

OLD IN EXPERIENCE; NEW IN FACILITIES, EQUIPMENT, TECHNIQUES

It has collected at these plants one of the greatest electronic tube engineering and production teams ever assembled. This experienced team was recruited from the most talented of Westinghouse's 100,000 employees and augmented by key experts from throughout the industry.

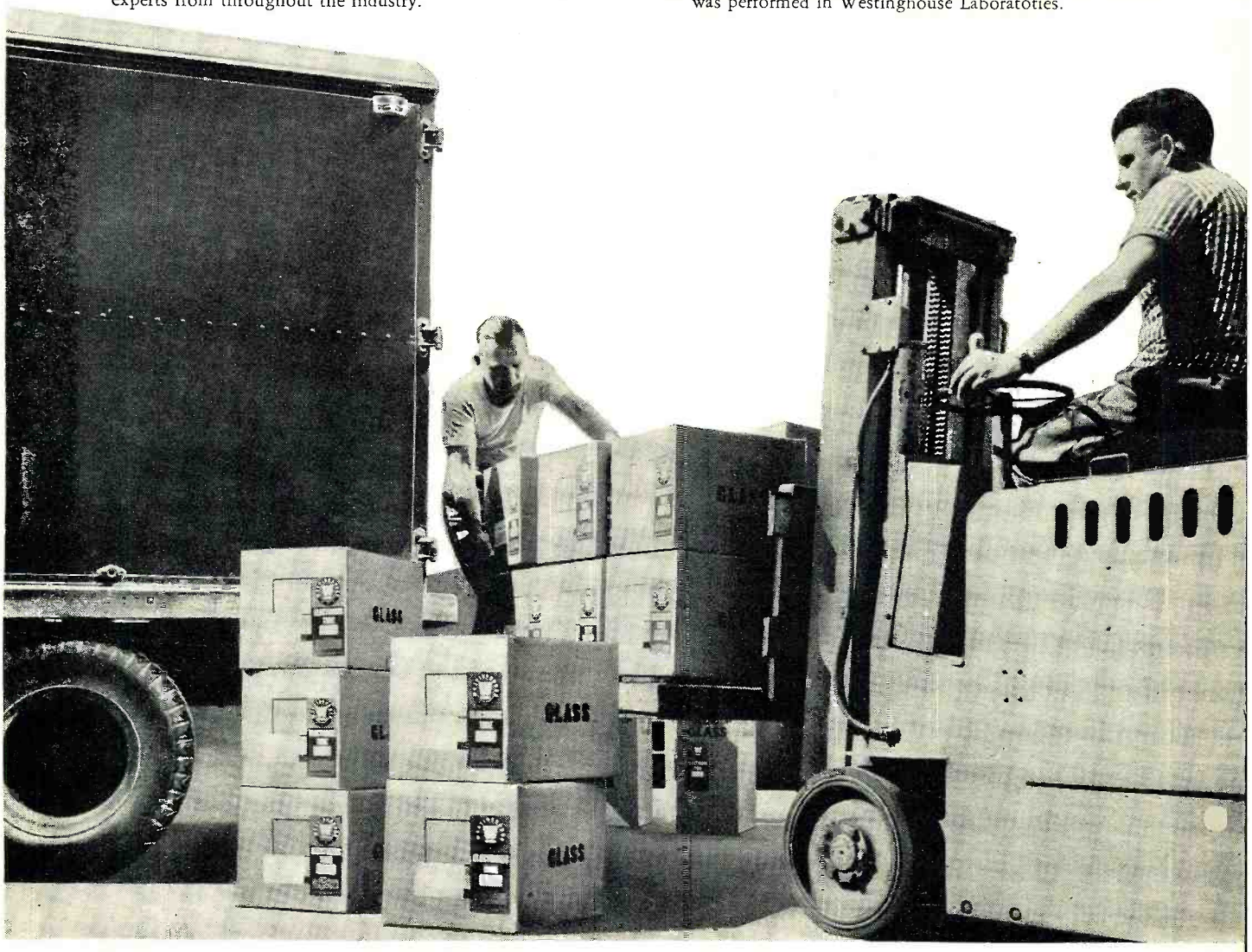
The Westinghouse Electric Corporation, too, is a veteran of wide electronic tube experience. To cite only a few instances:

★ Westinghouse produced the first dry-battery operated vacuum tube in America—the WD-11.

★ Westinghouse developed and produced the first vacuum tubes utilizing an indirectly heated cathode, introducing ac radio operation.

★ Westinghouse pioneered in high-powered transmitting tubes for use in both pulsed and CW radar applications. The famous Westinghouse Type WL-530 was in the Pearl Harbor radar set which gave the warning of the approach of Japanese planes in 1941. These tubes led the way to all subsequent radars.

★ Basic development of the cathode ray television system was performed in Westinghouse Laboratoties.



RELIATRON Tubes are backed by Westinghouse Reliability

Because of Westinghouse experience and the unlimited resources and facilities of its new Electronic Tube Division, it is now producing electronic tubes which are the finest ever made . . . Westinghouse RELIATRON Tubes.

TUBE RESEARCH AND DEVELOPMENT

Westinghouse tube leadership is based on the untiring efforts of its research staff. These men are now improving present tube types and developing new types for superior service and new applications, including UHF.

QUALITY CONTROL

RELIATRON Tube performance is assured by exacting quality control. Every step in the manufacture of RELIATRON Tubes—from raw materials to finished product—must meet standards which are the highest in the industry.

ENGINEERING AND SALES SERVICES

Whatever your tube problem, you will find Westinghouse electronic tube sales representatives and application engineers at your service. Sales and engineering offices are strategically located throughout the country to serve you.

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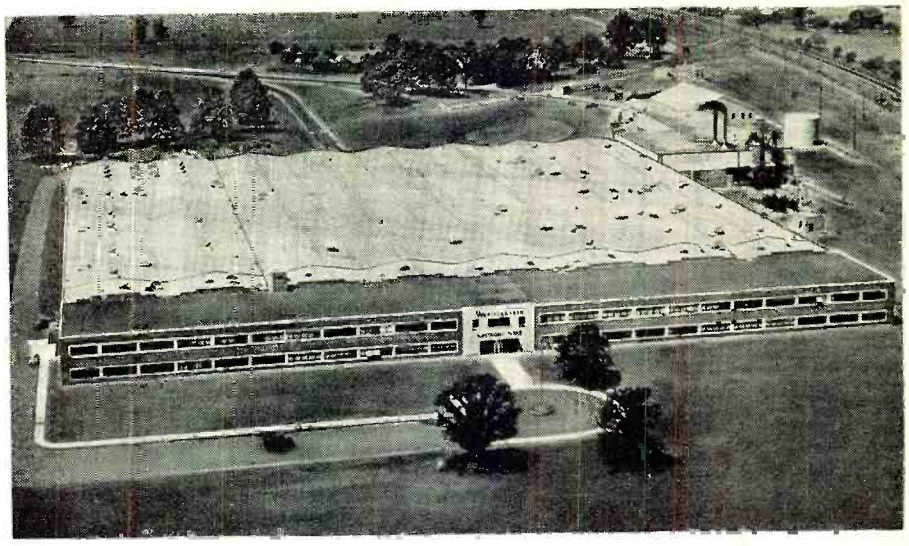
Trade acceptance of Westinghouse RELIATRON Tubes will be aided by a nationwide advertising campaign second to none. Sales promotion programs for distributors and service dealers will be hard-hitting sales builders. Your product or service will profit from the fullest consumer acceptance.

DISTRIBUTORS, EQUIPMENT MANUFACTURERS, WRITE NOW

For complete information on the Westinghouse line of RELIATRON Receiving Tubes, Television Picture Tubes, and transmitting, industrial, and special purpose tubes, write or wire Westinghouse Electric Corporation, Dept. G-11, Elmira, New York. Or call your nearest Westinghouse Electronic Tube Division Sales office.

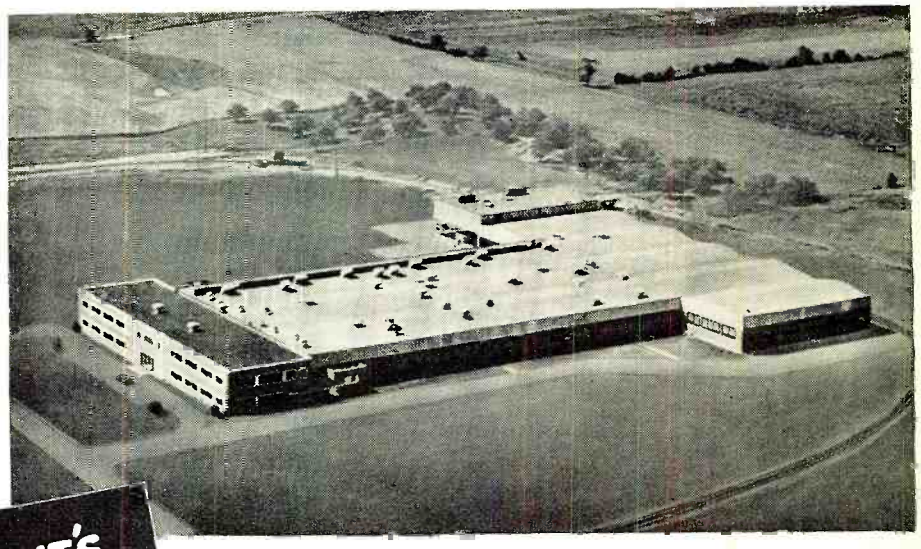


WESTINGHOUSE IN ELMIRA, NEW YORK

360,000 square feet of steel, glass and brick designed for one thing—to house the most efficient electronic tube production in the world. Here are produced Westinghouse RELIATRON television picture tubes, transmitting tubes, industrial tubes, special purpose tubes—all of unsurpassed quality. Here, too, is located the headquarters of the Westinghouse Electronic Tube Division with sales, engineering and production management ready to extend a warm welcome to you.

WESTINGHOUSE IN BATH, NEW YORK

This Westinghouse Receiving Tube plant is another 220,000 square feet of modern production efficiency. It lies only a few miles from a major source of glass tube envelopes. It is served by all modern transportation media to assure prompt shipment of your requirements—only hours away from all principal markets. Here at Bath the most modern equipment is operated by the industry's leading craftsmen. From it are shipped the finest receiving tubes in the industry—Westinghouse RELIATRON Tubes.



YOU CAN BE SURE...IF IT'S Westinghouse

ELECTRONIC TUBE DIVISION

WESTINGHOUSE ELECTRIC CORPORATION, ELMIRA, N. Y.

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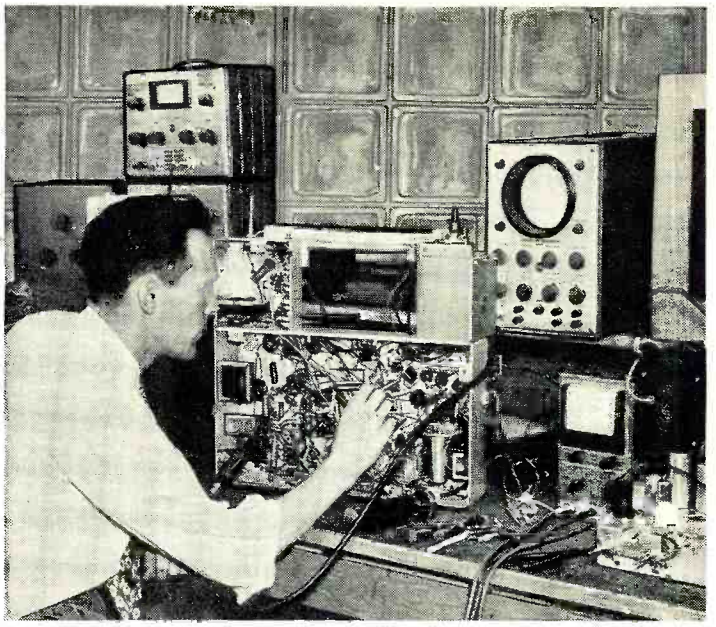
Here's your Opportunity



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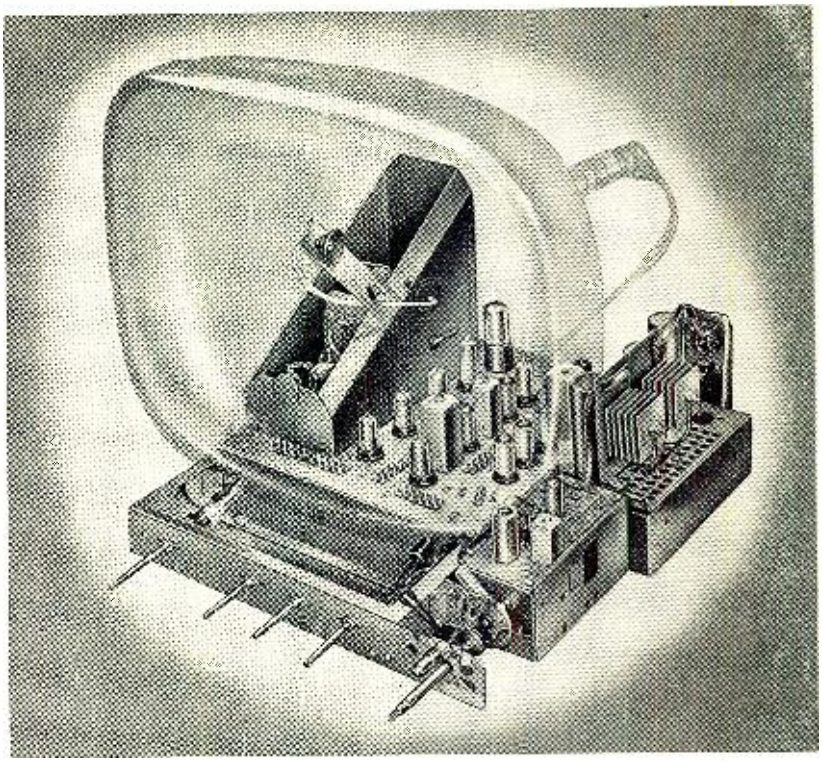

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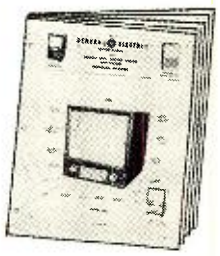

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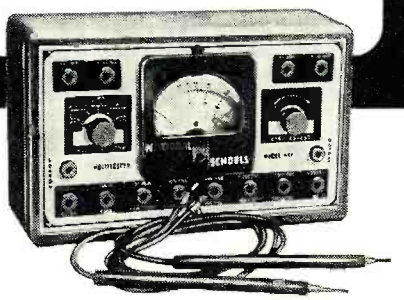

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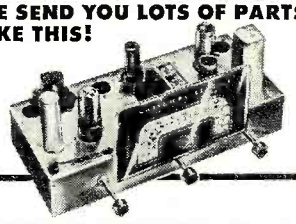

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Spot Radio News

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

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE ULTRA-HIGHS and the deep South, originally forecast as the future hub of buzzing activity in the post-freeze era, streaked through to the predicted prominence, as the FCC continued its grant race, in the early days of the Fall. Of the 44 authorized allocations, nearly half have been for southern areas, and the bulk of the allotted channels have been for the higher bands.

During the past few weeks, the following southern commitments have been announced: Jackson, Miss., Channel 25 *(Mississippi Publishers Corp.);* Mobile, Alabama, Channel 48 *(Pursley Broadcasting Service);* Chattanooga, Tenn., Channels 49 and 43 *(Chattanooga TV Inc.,* and *Tom Potter);* Austin, Texas, Channel 24 *(Tom Potter);* Baton Rouge, La., Channel 28 *(Modern Broadcasting Co.),* and Ashland, Ky., Channel 59 *(Polan Industries).*

The entry of Tom Potter, Texas oil millionaire, on the u.h.f. scene, re-emphasized the views of many, which noted that those who had been in radio or were slightly interested in video would re-enter broadcasting via TV, when the ice age came to an end. It has been reported that Potter, who had an interest in WFAA, expects to spend over $500,000 for his stations.

The additional allocations also brought TV channels to many new communities elsewhere in the country. In the midwest, Peoria (Ill.), South Bend (Ind.), Massillon and Akron (O.), received Channels 43, 34, 23, and 49, respectively. The FCC records revealed that WEEK would operate the Peoria station, which would have a power of 175 kilowatts; WSBT could control the South Bend outlet, whose power would be 170 kilowatts; the *Midwest TV Company* would place the Massillon station on the air with a power of 99 kilowatts, and the *Summit Radio Corporation* would start telecasting in Akron with a power of 145 kilowatts.

Pennsylvania also received a handsome share of channels from the Commission. Two went to Scranton for Channels 73 and 22, the former to be operated by the *Appalachian Company* on a power output of 11 kilowatts, and the latter to be controlled by *Scranton Broadcasters,* using a power of 290 kilowatts. Reading also received two approvals for Channels 61 and 33, WHUM operating the former and WEEU the latter, on powers of 260 and 225 kilowatts, respectively. The owners of WHUM told the Commission that they believed that they would be on the air before Christmas, shortly after *Empire Coil* in Portland, Oregon, starts telecasting using the transmitter formerly operated by *NBC* in Bridgeport. (*NBC* began dismantling its experimental station in Connecticut, as this column was being written, for shipment to Portland. Commenting on the closing of this pioneering u.h.f. station, Dr. Jolliffe of *RCA* said that the discontinuance of the ultra-high broadcasts from Bridgeport marked the end of an era, during which over 3 million dollars had been spent for research and the development of receiving and transmitting gear for the higher frequencies.)

Residents of Bridgeport will, early next year, have two stations on the high frequencies. Recently Channel 49 was approved and will be operated by *Harry L. Liftig.* Power output will be 99 kilowatts.

In Pennsylvania, New Castle also received a u.h.f. channel, 45, which will be operated by WKST with a power output of 20.5 kilowatts. Fall River, Mass., also appeared on the new-station program, receiving Channel 46, which will be manned by the *New England Television Company,* operating with a power output of 19.5 kilowatts. The *Winnebago Television Corp.,* of Rockford, Ill., was also given a channel, 39, and in Roanoke, Va., the *Roanoke Broadcasting Corp.* received permission to operate a low-band station on Channel 10. The *Tri-State Broadcasting Company,* El Paso, Texas, will also be on the air soon with a new very-high station, operating on Channel 9, according to FCC records.

PITTSBURGH, which has become the center of a boiling allocation debate, may soon be appeased through the assignment of Channel 4 to Irvin, Pennsylvania, which is seventeen miles from Pittsburgh, and thus falls outside of the 15-mile rule, permitting amendment of the allocation table. According to the Commission's rules, the new assignment would be in order since it covers a community not listed in the table, and the town is not within 15 miles of a city so listed. The

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new allocation would not require any deletions or substitutions of channels in any community listed in the table.

THE VIGOROUS STANDS of several telecasters, urging reconsideration of the allocation schedule in many areas, has begun to produce results that have brought broad smiles to the new operators.

In Ohio, *Polan Industries* received a unique verdict, even after they withdrew their petition to the Commission. They had filed a petition requesting the assignment of an additional ultra-high channel (21) to Youngstown, by substituting 67 for Channel 21 at Warren, or in the alternative, assigning 82 as an additional channel to Youngstown. It was also requested that in the event the city-city shifts could not be effected, either Channel 21 or 82 be assigned to Youngstown in place of 33. About thirty days after the brief was submitted, the broadcaster told the FCC that its request should be shelved. However, the Commission had begun an investigation and found that the new operator had raised some pertinent points which merited consideration.

The results of the probe prompted the air chiefs to admit that the assignment of Channels 33 and 47 to Youngstown and Pittsburgh were not in accordance with the Commission's mileage separation requirements, since these cities were separated only 57 miles, whereas the rules require a spacing of 60 miles between the channels to avoid sound-image interference. Continuing their review of the error, the Commission noted that they were aware of the withdrawal of the complaint, so entered because the petitioner had felt that his transmitter site would be more than 60 miles from Pittsburgh and thus there would be no need for a new assignment. This condition did not obtain, the Commission said, since minimum separation had to be met on a city-to-city basis, as well as on a transmitter-site basis. Accordingly, it was decided to eliminate the substandard separation and assign Channel 21 to Youngstown in place of 33 and substitute 67 for Channel 21 in Warren, Ohio.

THE REQUEST OF ANOTHER telecaster was severely censured by the Commission. *High Point Enterprise,* of High Point, N. C., had asked the FCC to assign Channel 6, which had been given to Beckley, W. Va., to them, since the size and economic importance of their city merited such consideration.

In rebuttal, Havens and Martin, retained by WTVR of Richmond, Virginia, argued that the technical and not economic conditions were involved; operation of Channel 6 at High Point would cause interference, since the assignment would fail to meet the minimum separation requirements for co-channel operation, Channel 6 having also been assigned to Wilmington,

(*Continued on page* 141)

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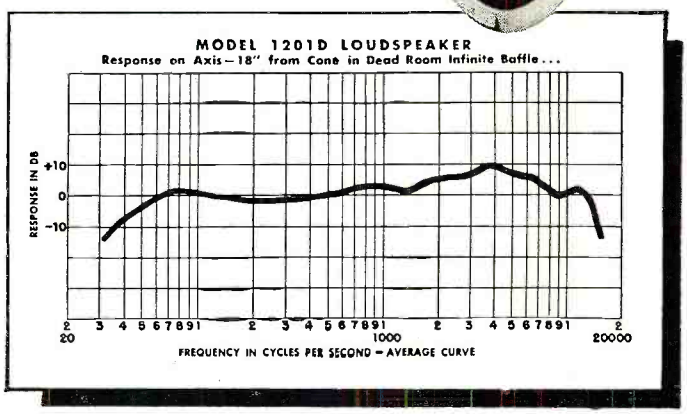

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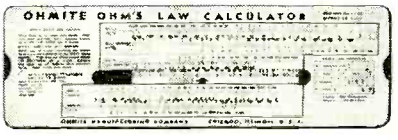

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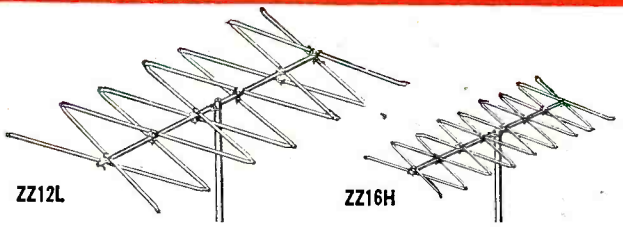
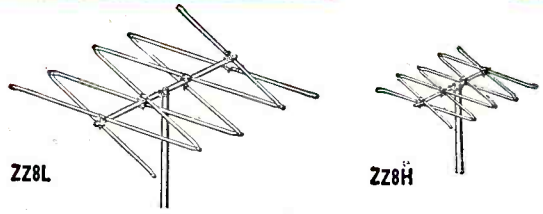


ZZ12L ZZ16H

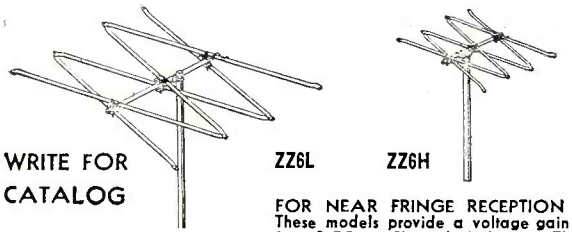
FOR EXTREME FRINGE RECEPTION — ZZ16H provides over 14 DB voltage gain as compared with a resonant reference dipole on Channels 7 thru 13, and ZZ12L provides gain of 12 to 14 DB on Channels 2 thru 6. Gain of the ZZ12L is 12 DB on Channels 2 and 3 and is 14 on Channels 4, 5 and 6. These models have narrowest forward lobe and highest front-to-back ratio and should be used in areas where co-channel interference is a problem.



ZZ8L ZZ8H

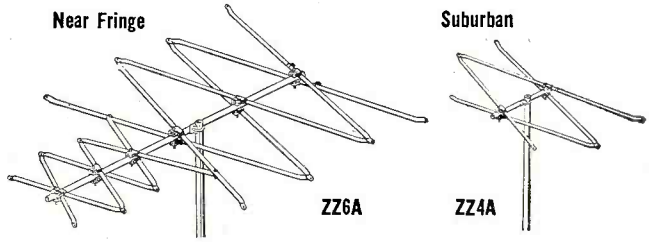
FOR NORMAL FRINGE RECEPTION — Where maximum gain is not necessary, these models are ideal. The ZZ8H for Channels 7 thru 13 and the ZZ8L for Channels 2 thru 6. Voltage gain is 9 DB on Channels 2 and 3 and 11 DB on Channels 4 thru 13. These models have patterns comparable to a well designed multi-element single channel yagi.

WRITE FOR CATALOG



ZZ6L ZZ6H

FOR NEAR FRINGE RECEPTION — These models provide a voltage gain of 8 to 9 DB on Channels 2 thru 13. These models have pattern and gain comparable to a cut-to-channel yagi. ZZ6L covers Channels 2 thru 6. ZZ6H covers Channels 7 thru 13.

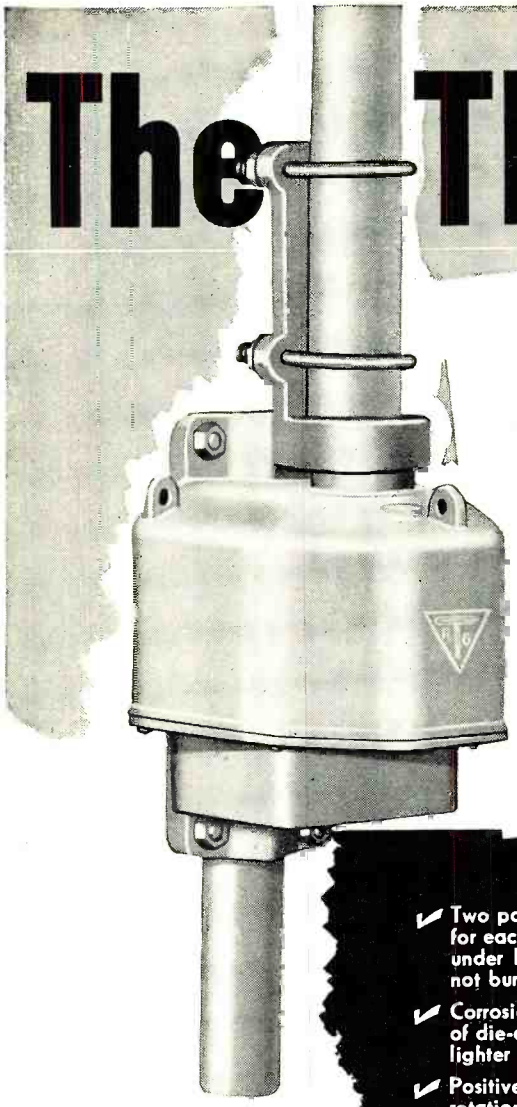


ZZ6A ZZ4A

SINGLE BAY ALL-CHANNEL RECEPTION — Model ZZ4A is a single bay antenna providing adequate gain and directivity on all channels, 2 thru 13, in suburban areas. Model ZZ6A is also an all-channel single bay antenna providing greater gain for near fringe use.

TRIO MANUFACTURING COMPANY • GRIGGSVILLE, ILLINOIS

The TRIO ROTATOR



Strongest Ever Built

The TRIO ROTATOR passes strength and endurance tests that impose weight loads 5 times greater than a Channel 4 yagi installation—endures without failure operation equalling 15 years normal use.

Backed by $50,000 of Research

To produce the best rotator made, TRIO spent $50,000 in exhaustive testing, research and engineering. Exhaustive tests on all makes of rotators were independently conducted by one of the nation's largest manufacturers of TV sets. The TRIO ROTATOR was the only one that passed these gruelling tests!

- ✔ Two powerful 24 volt motors used — one for each direction of rotation. Each motor under load only fraction of time — will not burn out!
- ✔ Corrosion resisting, weatherproof housing of die-cast aluminum for greater strength, lighter weight, perfect alignment of parts!
- ✔ Positive electrical stops at ends of 360° rotation prevent damaging or twisting of leads!
- ✔ Will support heavy TV arrays — even in 80 MPH winds!
- ✔ Permanently lubricated with special grease that functions perfectly in high and low temperature extremes!
- ✔ Ball-bearing end thrusts on all shafts, including motor! Main shaft vertical load carried on large oversized "Oilite" self-lubricating bearing!
- ✔ All motors, shafts and gears mounted on a rugged, one-piece casting for true alignment and longer life!
- ✔ 11/16" diameter tool steel main shaft and mast holder will withstand 4500 inch pounds bending moment!
- ✔ Rotator and mast holder fits any pipe size up to 2" OD!
- ✔ Precision built to extremely close tolerances!

Smartly Styled DIRECTION INDICATOR

The handsome TRIO ROTATOR is easy to operate. There's no need to hold control for continuous operation! A light touch of the "finger tip" control starts rotation in either direction. Another touch stops antenna at desired position! Gracefully styled, the smart TRIO ROTATOR is a handsome accessory—not just another "box".

FULLY TESTED— FULLY GUARANTEED

Every TRIO ROTATOR and DIRECTION INDICATOR is guaranteed against defective parts and workmanship for two years. Each TRIO ROTATOR is thoroughly factory tested to the equivalent of 3 months of constant operation. This, plus an additional torque test, guarantees each unit to be perfect in every detail of assembly!

R|O

TRIO Manufacturing Company

GRIGGSVILLE, ILLINOIS

Within the INDUSTRY

LEON A. WORTMAN has been appointed general manager of *Fine Sound, Inc.*, Tomkins Cove, New York.

He was formerly director of advertising and sales promotion for the *Audio & Video Products Corporation* of New York City and its subsidiaries, the *Audio-Video Recording Company, A-V Tape Libraries, Inc.*, and the *Magna-Crest Corporation.* He also served as advertising manager of the *Fairchild Recording Equipment Corporation* of Whitestone, New York, and as national publicity director of the Audio Engineering Society.

The recently-organized company is specializing in the creation of new sound and new recording techniques. The firm is headed by C. Robert Fine, formerly chief engineer of *Majestic Records,* and later of the disc and tape recording division of *Reeves Sound Studios* in New York.

* * *

RTMA has recently named a 12-man television committee, headed by Dr. W. R. G. Baker, to serve for the ensuing year. The top-level committee directs the television activities of the Radio-Television Manufacturers Association.

Serving with Dr. Baker are the following men: Benjamin Abrams, *Emerson Radio & Phonograph Corp.*; Robert S. Alexander, *Wells-Gardner & Co.*; Max F. Balcom, *Sylvania Electric Products Inc.*; H. C. Bonfig, *Zenith Radio Corp.*; John W. Craig, *Crosley Division, Avco Mfg. Corp.*; Allen B. Du Mont, *Allen B. Du Mont Laboratories, Inc.*; J. B. Elliott, *RCA Victor Division*; E. K. Foster, *Bendix Radio Division*; Paul V. Galvin, *Motorola, Inc.*; W. J. Halligan, *The Hallicrafters Co.*; L. F. Hardy, *Philco Corp.*; and W. A. MacDonald, *Hazeltine Electronics Corp.*

* * *

DALE SAMUELSON has been appointed sales promotion manager for *The Hammarlund Manufacturing Company, Inc.* of New York, producers of communications receivers, variable condensers, and remote supervisory control equipment.

He was formerly publicity supervisor and trade relations editor for the communications and electronics division of *Motorola, Inc.* of Chicago. He is a graduate in electrical engineering from Virginia Polytechnic Institute and holds an MS degree in Journalism from Northwestern University.

In his new position he is responsible for advertising, publicity, and all other sales promotion activities of the company.

* * *

TRANSDUCER CORPORATION OF BOSTON has merged with its parent company, **AMERICAN MACHINE & FOUNDRY COMPANY,** and will now be operated as the electronic division of the parent company . . . **SERVOTROL COMPANY** of Chicago has entered the field of precision potentiometers and servo components. It will manufacture these items under a license agreement with **TECHNOLOGY INSTRUMENT CORPORATION** . . . **LLOYD'S ENTERPRISES,** Box 313, Altadena, California, has been organized to manufacture test equipment for television and electronic research. Lloyd M. Jones, former operations engineer for KTTV, is the principal in the new firm . . . **RAYTHEON MANUFACTURING COMPANY** has voted to change the name of its television manufacturing subsidiary, **BELMONT RADIO CORPORATION,** to **RAYTHEON TELEVISION AND RADIO CORPORATION.** The present management will continue to operate the subsidiary.

* * *

ODEN F. JESTER has been appointed sales manager of the distributor division of *Standard Coil Products Co., Inc.*, manufacturers of television tuners, radio and TV coils, and electronic assemblies.

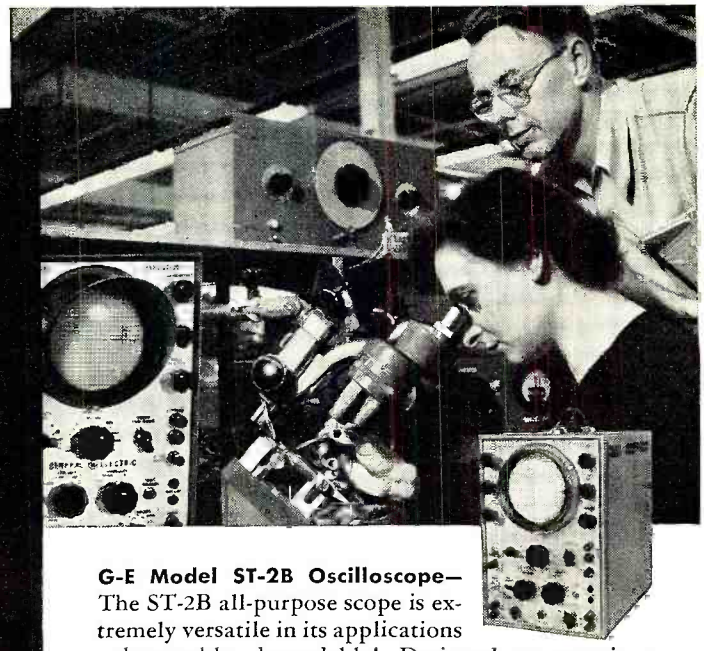
Mr. Jester is a former vice-president of the *Meissner-Thordarson-Radiart Division* of *Maguire Industries* and for a number of years was general sales manager of *Utah Radio Products Company* and radio sales manager of *Stewart-Warner Corporation.*

* * *

SYLVANIA ELECTRIC PRODUCTS INC. has begun construction of a 40,000 square foot facility near Mountain View, California, that will house a new group of product development laboratories of the company's electronics division . . . **TAYLOR FIBRE CO.** of Norristown, Pa., and La Verne, California, has broken ground for a new addition to its Norristown plant. The new unit will be used to increase production facilities for the manufacture of vulcanized fiber . . . **RAYTHEON**

PRECISION EQUIPMENT

Designed for laboratory, industrial and high quality test applications



G-E Model ST-2B Oscilloscope—The ST-2B all-purpose scope is extremely versatile in its applications—thoroughly dependable! Designed to permit a choice of short, medium or long persistence CR tubes, the unit incorporates identical direct coupled vertical and horizontal amplifiers. Filaments and screens on the first amplifier stages are regulated. Vertical selector switch allows choice of probe, calibration, AC or DC inputs.

Compared with 4 other well known scopes manufactured today, the General Electric ST-2B tests superior in 11 different characteristics.

Germanium Diode Checker Type ST-12A—A new G-E instrument for use in laboratories, quality control groups, service shops—wherever there is need for checking the static characteristics of diodes. Specifications—POWER REQUIREMENTS: 105-125 volts, 50/60 cycle, approximately 10 watts. FORWARD RANGES: Current—0.3, 1.2, 6 and 12 milliamperes full scale. Voltage—.3 and 1.2 volts full scale. INVERSE RANGES: Current—60, 120, 300 and 1200 microamperes full scale. Voltage—3, 12 and 120 volts full scale.

Other applications: general resistance checker (10 ohms to 6 megohms)... accurately-metered power supply... Forming electrolytic capacitors and checking DC leakage current.

SPECIFICATIONS—MODEL ST-2B

FREQUENCY RESPONSE

Vertical Amplifier
DC—0 to 400 kc, +0, −20%, not more than 50% down at 700 kc.
AC—10 cycles to 400 kc, +0, −20%, not more than 50% down at 700 kc.
Probe—2 cycles to 400 kc, +0, −20%, not more than 50% down at 700 kc.
Response independent of gain or attenuator setting.

Horizontal Amplifier
DC—0 to 400 kc, +0, −20%, not more than 50% at 700 kc.
AC—10 cycles to 400 kc, +0, −20%, not more than 50% down at 700 kc.
Response independent of gain or attenuator setting.

SENSITIVITY

Vertical	AC—10 mv. rms/inch DC—28 mv. dc/inch
Horizontal	AC—15 mv. rms/inch DC—42 mv. dc/inch
Probe	130 mv. rms/inch
Deflection Plates Direct	
Vertical	22 volts rms/inch
Horizontal	25 volts rms/inch

SWEEP

Range—Triggered or recurrent—2 cycles to 30 kc (may be extended downwards by adding external capacity across panel jacks).
Sync—±Internal, ±line and −Ext. (requires −.3 volts peak to peak for external sync).
Sweep Expansion—At least 4 times tube diameter.

PHASE SHIFT—Negligible phase shift between amplifiers from 0 to 300 kc.

BLANKING—Z-axis blanking requires 20 volts peak to blank.

CALIBRATION—Seven voltages available by selector switch: .1, .3, 1, 10, 30, 100 and 300 volts peak to peak ±15%.

DIRECT CONNECTIONS TO DEFLECTION PLATES—Available through capacitors—internal positioning circuits still function.

AMBIENT TEMPERATURE RANGE—0° to 40° C.

POWER REQUIREMENTS—105-125 volts, 50/60 cycles power consumption approximately 120 watts. (By a simple wiring change, may be operated from 210-250 volt line.)

You can put your confidence in—

GENERAL ELECTRIC

MANUFACTURING COMPANY has officially opened its new office building in Waltham, Massachusetts. The building, which is located at 3076 West 117th Street, was constructed for the company and provides ample space for offices and display rooms with facilities for the demonstration and storage of the company's products . . . The **SPEER RESISTOR DIVISION** has moved all of its manufacturing facilities to its new plant in Bradford, Pa. The sales and executive offices will continue to be located in St. Marys, Pa. . . . Sales and advertising offices of **MAGNECORD, INC.** have recently been moved from 360 North Michigan Avenue in Chicago to 225 West Ohio Street, Chicago 10 . . . **ELECTRONIC WHOLESALERS, INC.** of Washington, D. C., has recently opened a new "Sound Room" at 2345 Sherman Ave., N. W., which provides up-to-date audio facilities for sound dealers in the Washington metropolitan area . . . Work is nearing completion on two new wings of the **STANDARD TRANSFORMER CORPORATION'S** plant at Addison, Elston, and Kedzie Avenues in Chicago. When completed they will add approximately 35,000 square feet of production space to the transformer plant's manufacturing facilities . . . **PRIVAT-EAR CORPORATION** has moved its plant and administrative offices to 20 Mechanic Street in New Rochelle, New York. The company was formerly located in New York City . . . **WEATHERS INDUSTRIES** has opened a new one-story factory at 66 E. Gloucester Pike, Barrington, New Jersey, near the #3 interchange on the New Jersey Turnpike. The move was made from West Collingwood, N. J.

* * *

FRANCIS F. FLORSHEIM, of *Columbia Wire & Supply Co.,* Chicago, has been named chairman of the Association of Electronic Parts and Equipment Manufacturers, a trade association made up of 120 Midwest firms.

Karl W. Jensen of *Jensen Industries* was named vice-chairman. Helen Staniland Quam of *Quam-Nichols Co.* was re-elected to her fifteenth term as treasurer. Kenneth C. Prince was reappointed executive secretary of the association.

Mr. Florsheim, who has been vice-chairman of EP & EM, succeeds John H. Cashman of *Radio Craftsmen, Inc.* as chairman.

* * *

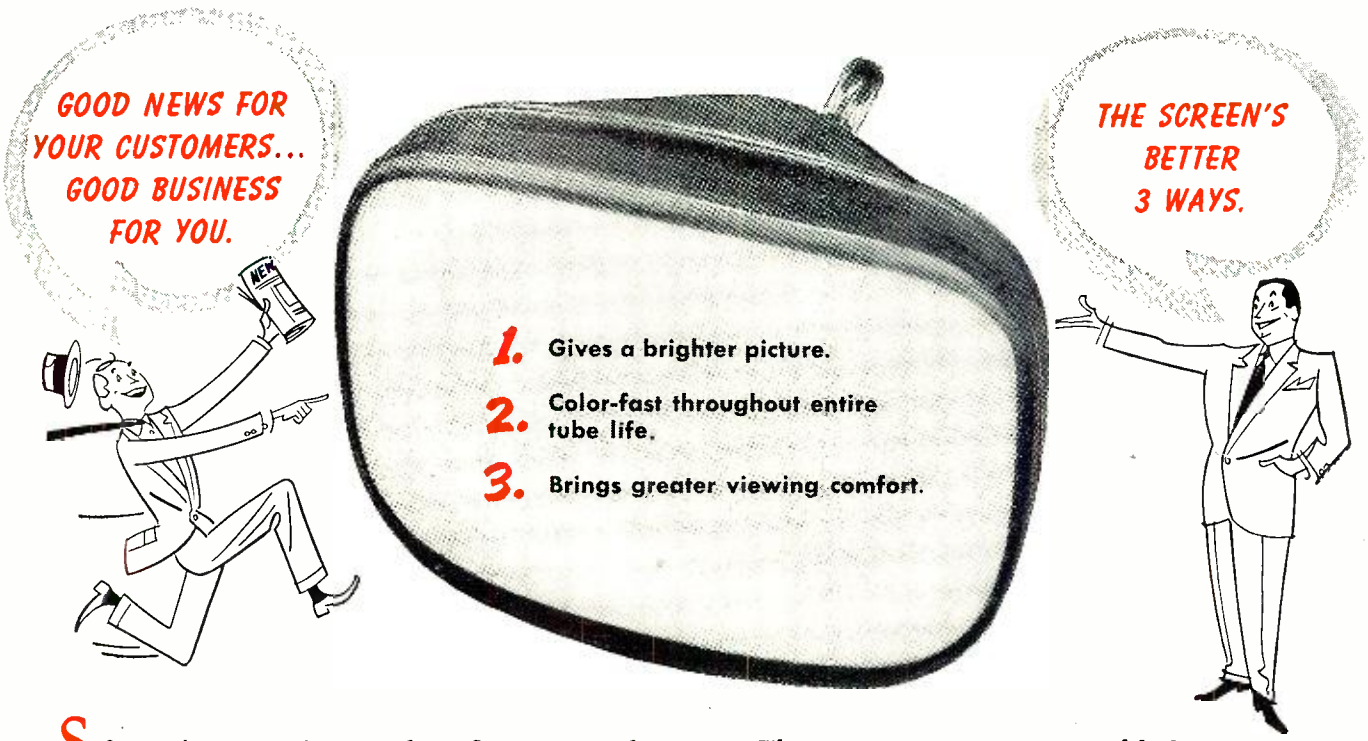
SKOTTIE ELECTRONICS, INC. has been recently formed in Peckville, Pa., to manufacture a line of ceramic, disc, plate, and tubular condensers.

Principals in the new firm include two men well-known in the radio-electronic industry. James Mitchell, who resigned recently as an executive of *Electrical Reactance Corp.,* is treasurer of the new company. Karl E.

(*Continued on page* 88)

3 REASONS WHY

Sylvania Picture Tubes keep customers happy!



Sylvania's years of research in fluorescent phosphors and lighting techniques have resulted in a vastly improved *picture-tube screen.*

This screen gives an increased light output over former screens . . . particularly when the tubes are operated at voltages below 14 kilovolts.

The face of this Sylvania screen is a restful blue-gray color for maximum viewing comfort. And, it is absolutely free from any discoloration . . . throughout the entire life of the tube.

So remember, you'll win more satisfied customers . . . good business and good will . . . when you install picture tubes trademarked *Sylvania.* For prices and complete information mail the coupon NOW!

FULL YEAR GUARANTEE ON ALL SYLVANIA PICTURE TUBES

Sylvania now guarantees all its Picture Tubes for one entire year from date of installation. This is your positive assurance of trouble-free performance.

SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

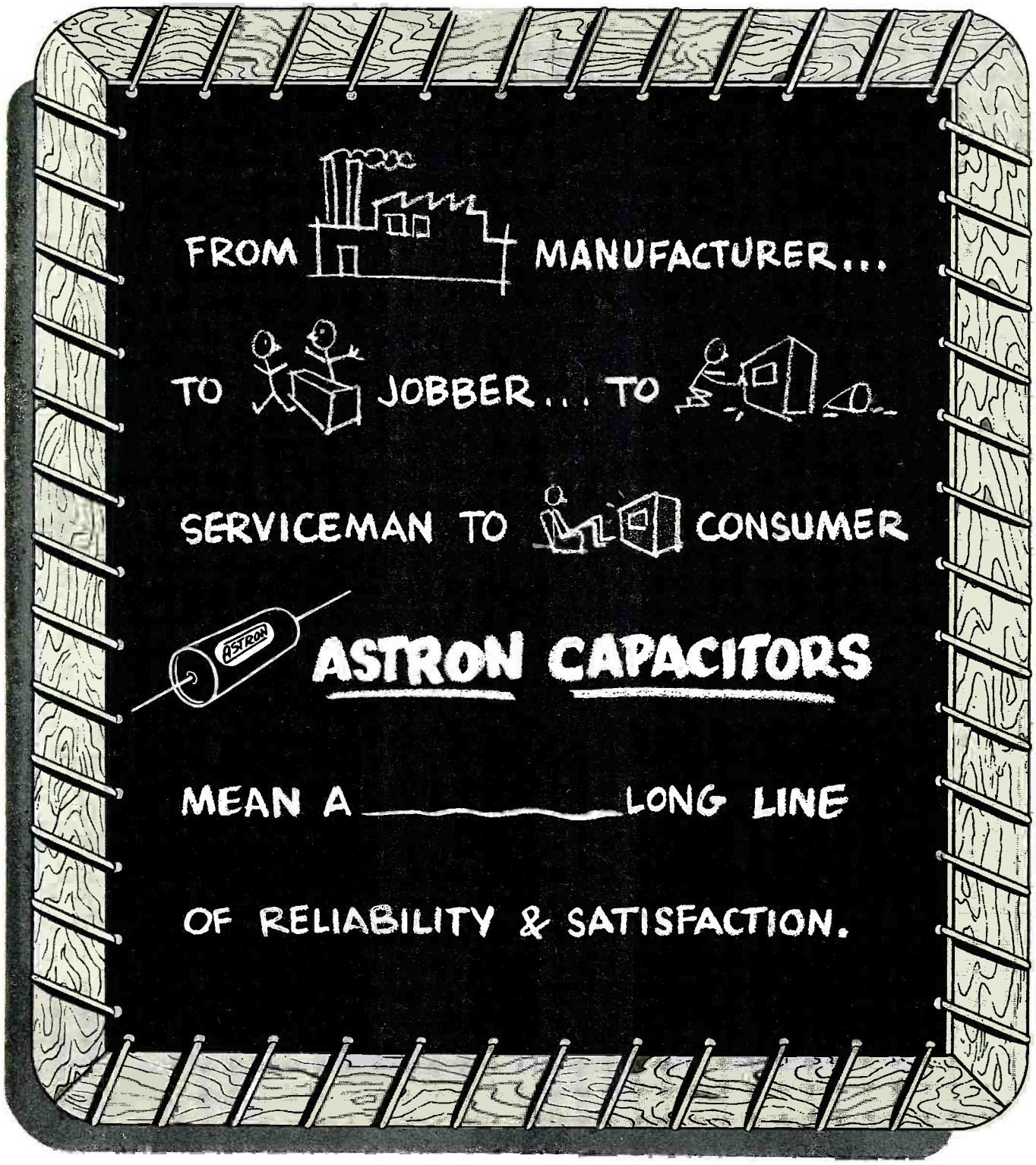
Sylvania Electric Products Inc.
Dept. R-2311, 1100 Main Street
Buffalo 9, N. Y.

Please send me full information about the improved screen on Sylvania Picture Tubes.

*Name*_____

*Street*_____

*City*_____ *Zone*___ *State*_____



You can *depend on* ASTRON Capacitors! They've earned a reputation for outstanding performance and reliability—a reputation that means something to YOU. When you replace with ASTRON, you build your reputation for high-quality service. Every step of the way, ASTRON means reliability . . . reliability that pays off in more satisfied customers, less call-backs, better earnings for you. Talk to your jobber about ASTRON Capacitors today, or write us for the name of the Astron Distributor nearest you.

DEPEND ON . . .
INSIST ON

ASTRON CORPORATION

ASTRON

255 Grant Avenue East Newark, N.J.

Service Clinic!

Engineering information to help you better service Raytheon

THE RAYTHEON TV UHF TUNER

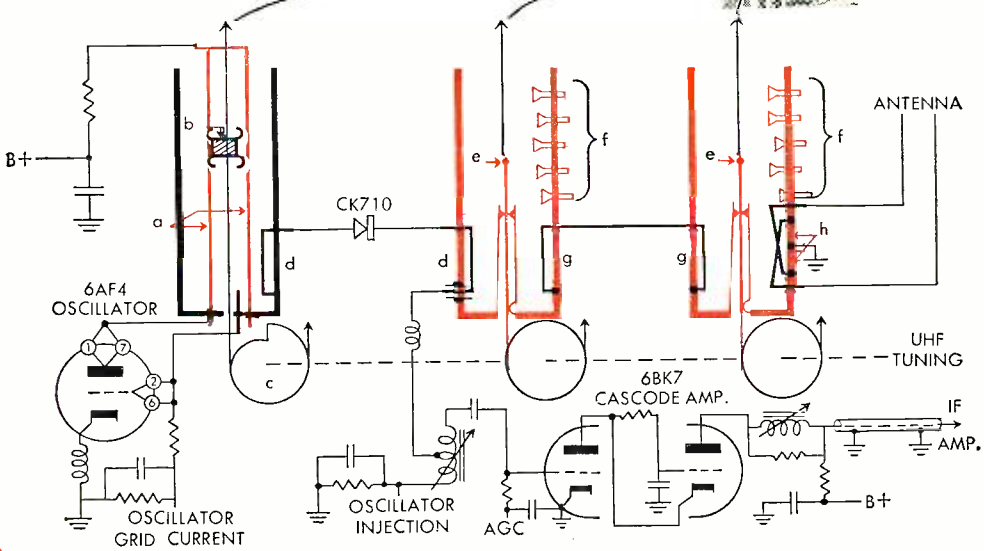
The new RAYTHEON UHF tuner selects all 70 allocated UHF channels by providing a 6 to 8 MC channel bandwidth throughout a continuous tuning range from 470 to 890 megacycles. The continuous UHF tuner, in conjunction with the continuous VHF tuner, will cover all 82 television channels (channel 2 through 83).

The design features the superior single step conversion that does not have VHF oscillator harmonics. This has the advantage of fewer spurious responses; double coaxial line preselection to provide high selectivity, low insertion losses, and uniform bandwidth; and the stability of a ¼ wave parallel line oscillator.

The engineering employs the separate type of circuitry which UHF demands. The ¼ wave parallel line (a) oscillator is tuned by the position of the shorting bar (b). The eccentric shape of the pulley wheel (c) provides the proper oscillator tracking. Oscillator and RF injection is supplied to the CK710 crystal mixer by the cavity coupling links (d).

The preselector coaxial cavities are tuned by the change in ribbon (e) length. Precise tracking of the preselector is provided by the capacity between the adjustment screws (f) and the ribbon. The coupling links (g) provide the preselector bandwidth. The antenna input couplings (h) maintain a fairly constant balanced input impedance of 300 ohms. Since the signal is not amplified in the R. F. preselector, a cascode IF pre-amplifier that features low noise and broad bandwidth will provide adequate sensitivity.

Improved circuitry such as this is one of the many reasons why you can feel free to recommend Raytheon TV to a friend or customer.



Dependably Built for Dependable Performance

REPLACEMENT OR REFUND OF MONEY
Guaranteed by Good Housekeeping
IF NOT AS ADVERTISED THEREIN

THE "CONTINENTAL" BERMUDA
Model C-2113

RAYTHEON

RAYTHEON TELEVISION & RADIO CORPORATION
5921 West Dickens Avenue, Chicago 39, Illinois

BUY DIRECT AND SAVE

COLLINS OFFERS FOR YOUR

COLLINS "PRE-FAB" TUNERS and RECEIVERS

4 ALL NEW Complete Kits for Every High-Fidelity Need

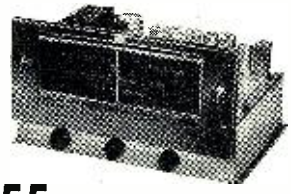
Each COLLINS KIT is complete with punched chassis, power transformer, power supply components, hardware, dial assembly, tuning eye, knobs, wire, etc. As well as the completed sub-assemblies: FM tuning units, IF amplifiers, power amplifiers, etc. where applicable. With all sub-assemblies wired, tested and aligned at factory, no specific skills are required. Hundreds of satisfied customers report that even without technical knowledge COLLINS Pre-Fab Kits are easily assembled and obtain wonderful high-fidelity performance. Modernize your old radio or sound reproduction system with a COLLINS Tuner or Receiver.

ASSEMBLE YOURSELF AND SAVE

Unsurpassed COLLINS workmanship makes this astounding announcement possible—A mighty proud FIRST FOR COLLINS!

The Famous COLLINS FM-11 *NOW IN KIT FORM*

FM TUNER KIT

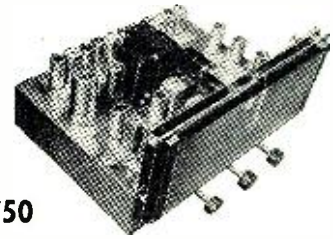


IF Amplifier mounted and wired right in Chassis. **$55**

A terrific value in an FM tuner! 11 tubes. Formerly sold for $87.50. Nothing has been changed. The tuner is available in kit form with the IF Amplifier mounted in the chassis and wired and tested by us. You mount the RF Tuning Unit, power supply and after some simple wiring, it's all set to operate. If you had a million dollars, you couldn't buy a finer tuner than this COLLINS unit. It's the best at a really fair price! Buy direct and save! Tube lineup: 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. Shipping weight 10 lbs.

The New 1953 Model Redesigned Smaller Chassis

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 17 lbs.

A New Addition To The Pre-fabs!

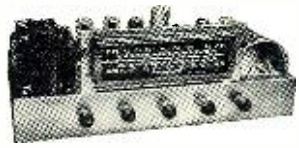
FM RECEIVER KIT

Tuning Eye and *ALL* Tubes Included **$78.50**

New! A complete 15 tube pre-fab Receiver Kit requiring only an antenna and speaker for operation. Where space is at a premium, the COLLINS Custom FM Receiver Kit can be conveniently mounted in a book shelf or end table with a remote speaker. Highly sensitive and selective, the COLLINS FM receiver will pull in those distant FM stations with clarity and fidelity. Kit includes all necessary parts for assembly and operation: punched chassis, dial assembly, power supply, tuning eye, wired and aligned components, all tubes and complete instructions. 6 to 10 microvolt sensitivity, IF band width 200 KC, 20 to 20,000 cycle response, low distortion, 6 watts output. Bass and treble tone controls, phonograph input. Tubes: 6J6 RF amp., 6AG5 converter, 6C4 oscillator, 6BA6 1st IF, (2) 6AU6 2nd and 3rd IF, (2) 6AU6 limiters, 6AL5 discriminator, 12AU7 1st audio, 6SN7-GT 2nd Audio, (2) 6K6-GT push-pull power output. Order today for the best FM package you'll ever find! Shipping weight 20 lbs.

Another New Star in the Pre-Fab Galaxy

FM-AM RECEIVER KIT $89.50



New! Another COLLINS FIRST. A complete FM/AM receiver kit on one chassis, with power amplifier capable of delivering 6 watts of high fidelity audio into a loud speaker. Tops in quality, easily recognizable in the fine workmanship and first grade materials. Kit includes all necessary parts for assembly and operation: punched chassis, dial assembly, power supply, tuning eye, wired and aligned components, all tubes and complete instructions. 20 microvolt sensitivity on FM, 10 on AM. Shipping weight 20 lbs.

COLLINS AUDIO PRODUCTS CO. is in no way affiliated with Collins Radio Co.

WHEN YOU THINK OF TUNERS,—

A COMPLETE LINE

LISTENING PLEASURE . . .

BUY DIRECT AND SAVE

Selected Basic Components For Those With Special Applications

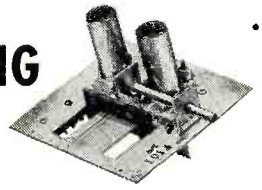
Coupled with tremendous popular demand for COLLINS Complete Pre-Fab Tuner and Receiver Kits, we have also supplied many users with many of the individual components shown below. These units, as well as being parts of the kits shown on the opposite page, are also available separately to builders and those who experiment and who wish to use their own chassis or special layouts. Each assembly is completely wired, tested and aligned ready for immediate use. In buying these COLLINS custom components direct from our factory, you save many dollars and are assured of the highest manufacturing standards. *All prices include tubes.* Diagrams and instructions furnished with each unit. Operating voltages are all that are necessary to place these units in operation!

FM IF AMPLIFIER

FM 10.7 MC, 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 for highest fidelity. 20 to 20,000 cycles. Distortion less than ½ of 1%. Chassis plate dimensions: 11 5/16" x 2½". Shipping weight: 3 lbs.

FM TUNING UNIT SPECIAL



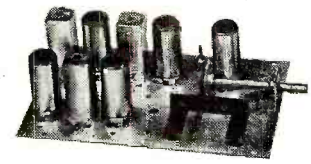
. . . at a NEW LOW PRICE **$10**

Slide Rule Tuning Dial Assembly $3.85

A precision FM tuning unit for a ten dollar bill! Permeability-tuned, 88 MC to 108 MC, stable and drift-free. Two tubes: 6AG5 converter, 6C4 oscillator. Sensitivity 20 microvolts. Used with 10.7 MC IF amplifier such as our model IF-6. Compact, small, light in weight, and adaptable to many, many FM applications. Chassis plate measures 4½" x 4½". Aligned, tested and calibrated—ready to operate. Tubes included as well as schematic and instructions. Shipping weight FMF-2: 2 lbs. Dial: 2 lbs.

COMPLETE FM TUNER CHASSIS

(RD-1C and Slide Rule Dial) **$28.50**

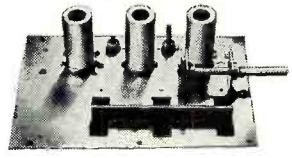


Only Power Supply and Amp. Required.

The COLLINS RD-1C FM tuner chassis is unique in the field. A whole, compact FM tuner that fits in the palm of you hand. Convert AM sets to FM/AM receivers for only a few dollars! Unlimited applications where space is at a premium. So compact that you can get two in a cigar box! 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. Tubes: 6AG5 converter, 6C4 oscillator, (2) 6AU6 IF amplifiers, 6AL5 in new ratio detector circuit. Shipping weight 2½ lbs. Dial: 2 lbs.

FM TUNING UNIT

FMF-3 FM Tuning Unit **$15.25**



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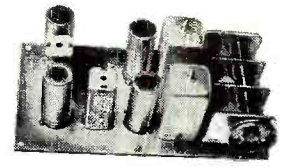

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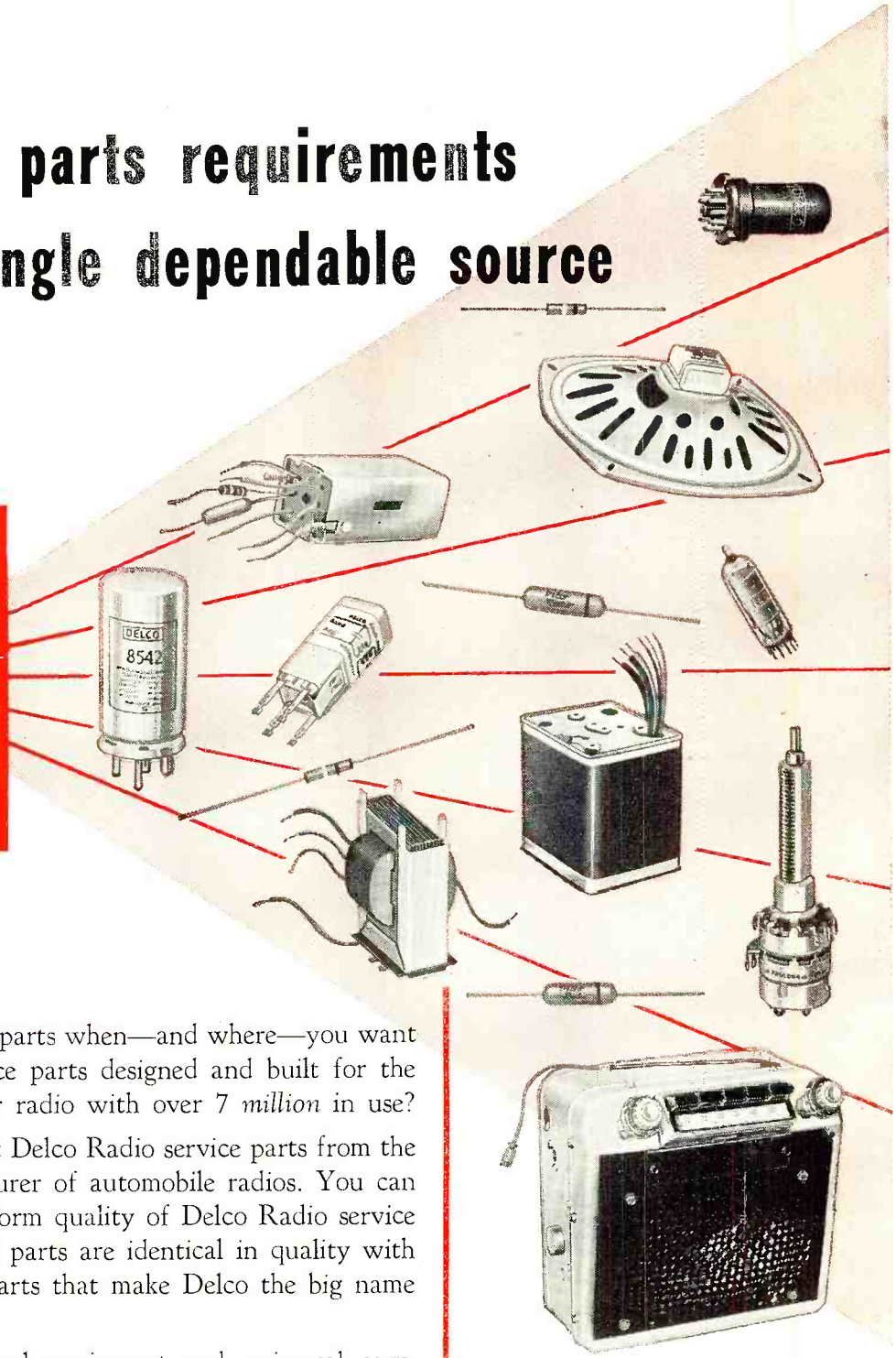

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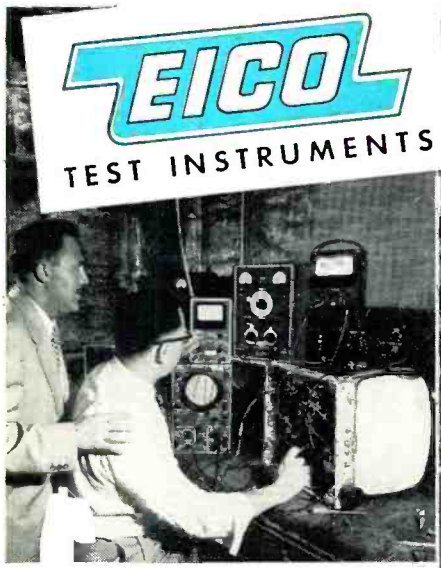

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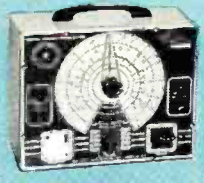

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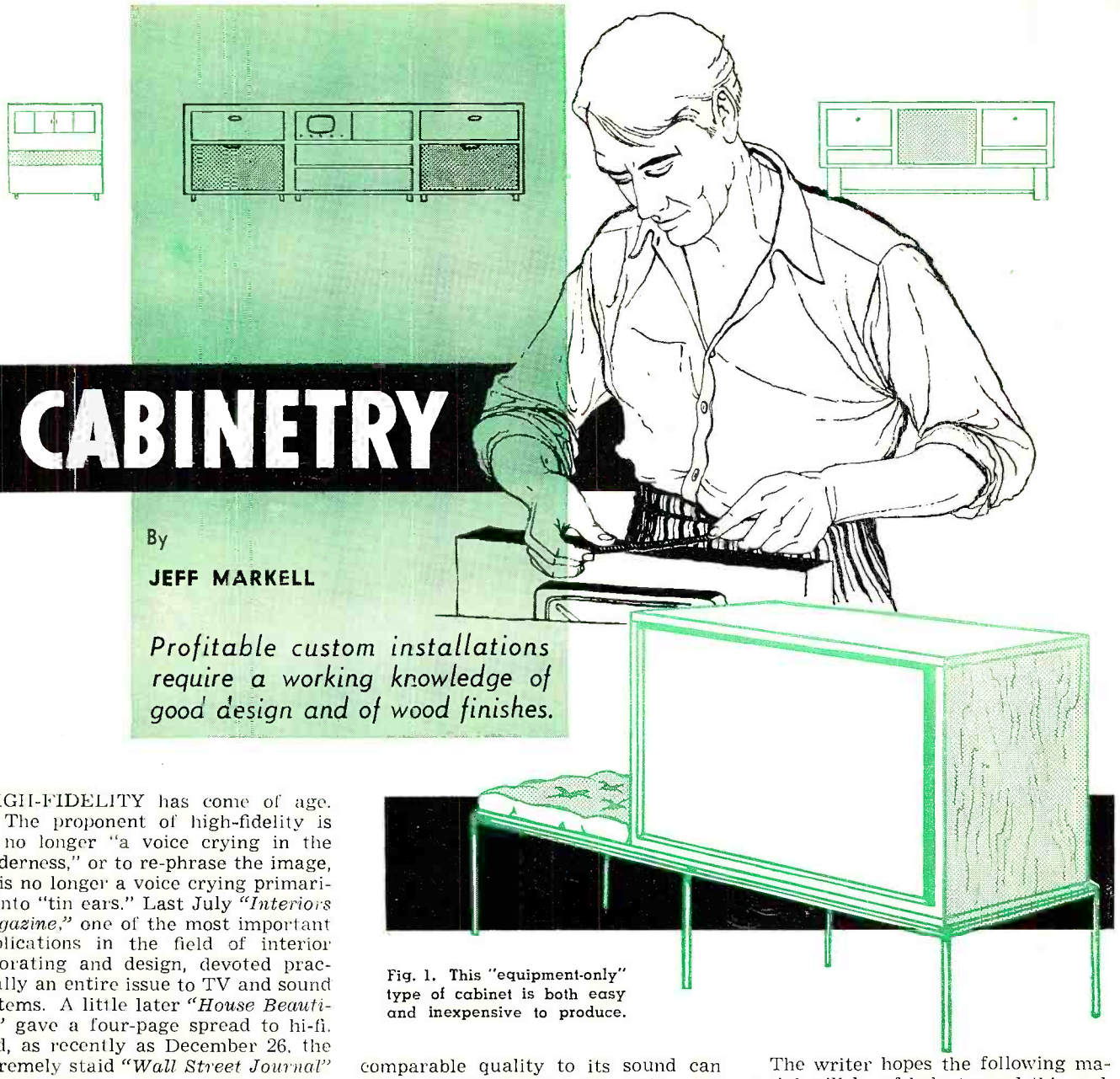


CABINETRY

By

JEFF MARKELL

Profitable custom installations require a working knowledge of good design and of wood finishes.

Fig. 1. This "equipment-only" type of cabinet is both easy and inexpensive to produce.

HIGH-FIDELITY has come of age. The proponent of high-fidelity is no longer "a voice crying in the wilderness," or to re-phrase the image, he is no longer a voice crying primarily into "tin ears." Last July *"Interiors Magazine,"* one of the most important publications in the field of interior decorating and design, devoted practically an entire issue to TV and sound systems. A little later *"House Beautiful"* gave a four-page spread to hi-fi. And, as recently as December 26, the extremely staid *"Wall Street Journal"* devoted about a half a page, starting with the complete first column on the first page, to the subject.

These cases are cited merely to emphasize a fact of which you are perhaps already aware; that in handling hi-fi sound and video systems we are no longer dealing mainly with a small group of critical cranks. The field is becoming an increasingly important mass market.

As far as electronic components are concerned the situation is pretty good. In most categories a good selection is currently available, covering various price ranges and performance characteristics.

However, as far as housings for residential systems are concerned the picture is not nearly so bright. Available ready-made cabinets are extremely limited both as to style and finish, which means they will rarely fit in with the client's other furnishings. The client who insists that the cabinetry of his system, both appearance and construction-wise, should be of comparable quality to its sound can hardly be considered unreasonable, and his number is becoming legion.

Competent designers and cabinet makers, familiar with the problems of housing hi-fi equipment, are available if the dealer cares to take the trouble to locate them. In the long run, the dealer who provides a complete service does himself as well as his customer a favor, and in addition the side money the dealer will make through handling the complete job will, doubtless, be welcome.

In order for the dealer to make a reasonably good choice of sources for designing and cabinet work it will certainly be helpful for him to have at least a nodding acquaintance with the subject of cabinetry and cabinet design.

There is little point or need to try to become an expert in the field, but it is a good idea, in terms of the satisfaction of your customers, to know at least enough to be able to judge the competence of the people you plan to commission to do the work.

The writer hopes the following material will be of help toward this end.

In approaching cabinet design the writer has found it convenient to consider the question in terms of three general categories. One of these types will be found applicable to most situations requiring a free-standing cabinet. The question of a built-in installation is purposely omitted, since this requires individual consideration in each case.

The first general category is the type of cabinet which houses electrical equipment only, and requires a separate speaker enclosure. Although there is disagreement on the point, a significant group among engineers is quite insistent that the inclusion of the speaker in the same cabinet with the other components impairs the operation of the whole system. This is one reason for separating the speaker. Another is that it will often develop that the location in the room which is most convenient for the placement of the equipment is a poor one acoustically for the speaker and *vice versa*.

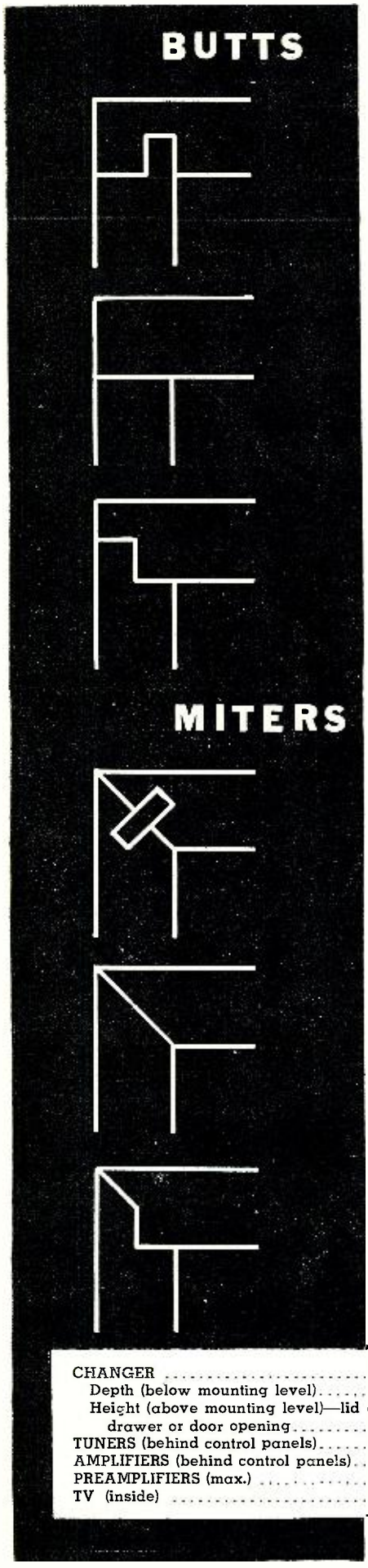


Fig. 1 is an example of the equipment-only type of enclosure. It is extremely simple in design and therefore relatively easy and inexpensive to produce. It is based on a standard cabinet module and is, therefore, most economical of materials, since material costs in plywood are based on the nearest square foot. It has the disadvantage that it opens from the top rather than from the front, necessitating installation of the tuner face up rather than face out. Another disadvantage of this type of cabinet is that the lady of the house will very likely put a pot of flowers on it as soon as it's moved in, and every time your client wants to use his rig he has to move the "garden."

The second general category is the type of enclosure housing the electrical equipment plus the speaker. Although some engineers take a dim view of this type of housing, it is often the treatment of choice for specific situations where space for a separate speaker enclosure is not available. Figs. 3 and 4 are examples of this type. In Fig. 3 the equipment is set in a line—changer, speaker, tuner, and amplifier—with record storage optional underneath. Placing the changer, tuner, and amplifier over the speaker is a more conventional arrangement (Fig. 4). It is considerably more economical of wall space, and less expensive to build than the cabinet shown in Fig. 3. Of course, record storage cannot be included.

The third general category is a complete wall unit housing equipment and speaker plus various subsidiary cabinet spaces, such as a bar, desk, utility cabinet, and bookshelves or record storage. This type constitutes an extremely extensive cabinet treatment, but where this type of unit is used little or nothing in the way of additional cabinetry is likely to be required in the room, leaving the remainder of the room available for conviviality. Fig. 5 is an example of a treatment of this type.

As regards the question of style, all of the examples have been treated in a strictly modern style, however there is no reason why similar treatments cannot be done in a wide variety of period styles to conform to the style of the other furnishings in the client's room. At the moment, for example, quite a lively revival seems to be going on in the French Provincial style. Any of the basic space arrangements could be translated into French Provincial. When constructing cases for use in period rooms it is always a question of designing, constructing, and finishing the cabinet in such a way as to blend harmoniously with the other furnishings. Only in the case of modern is this not necessarily so. To achieve an effective result as regards the over-all decor a modern cabinet can be designed either to match the existing furnishings or to contrast sharply with them. Sharp contrast, if employed, will often consist of dramatic color differences, for example, a mixture of bleached with cordovan mahogany pieces. Unfortunately space will not permit of elaboration of the point, however an extremely modest amount of good taste should keep you out of trouble in this department.

Fig. 2. Several types of wood joints used in cabinet work. See text for complete details.

CHANGER	16" x 16"
Depth (below mounting level)	4"
Height (above mounting level)—lid opening	6" min.
drawer or door opening	8" min.
TUNERS (behind control panels)	17½" x 12" x 10"
AMPLIFIERS (behind control panels)	17½" x 12" x 10"
PREAMPLIFIERS (max.)	12" x 8" x 3"
TV (inside)	22" x 23" x 26"

Table 1. Maximum dimensions for various pieces of equipment found in home systems.

8" speaker	5½ cu. feet
10" speaker	6¾ cu. feet.
12" speaker	8 cu. feet
15" speaker	10 cu. feet

Table 2. Cubic volumes required for various speaker diameters in infinite baffles.

Construction, for the purposes of this discussion, can be limited to two basic considerations: first the type stock and second the method of joining. You can build a cabinet in two kinds of stock—solid lumber or veneered plywood. In general the writer prefers a good grade of veneered plywood, for the reason that veneered plywood is, by virtue of its construction, less subject to warpage under conditions of changes in temperature and humidity. It is perfectly true that good-grade, well-seasoned, solid lumber is highly resistant to warpage when properly joined; however, it is increasingly difficult to obtain this kind of solid stock. Availability will differ depending on your location. When in doubt specify ¾ inch veneered plywood.

Finish is another factor influencing choice of stock. If, for example, a bleached mahogany finish is desired, veneer must be used since solid mahogany will not bleach evenly.

Fig. 2 illustrates a few types of joints in common use. Butt joining is cheaper than miter joining, however the miter is infinitely preferable. It looks better and is stronger.

Of course the joints illustrated are for use with standard ¾ inch stock. The writer has seen a number of cabinets done in ⅝ inch lumber, and has even seen them done in ¼ inch plywood on 1 x 2 frame. For a cabinet of any size ⅝ inch wood is not heavy enough to adequately resist warpage, and to build a cabinet of ¼ inch plywood on a frame is, to this writer's mind, a shoddy dodge not worthy of discussion.

In choosing specific types of woods (mahogany, oak, korina, prima vera, birch, etc.) it is well to be guided by the other woods in use in the room. For example, it would probably not be wise to place an oak cabinet in a room that already contains a number of mahogany pieces. A word of caution! It might be noted that strongly-

grained, exotic woods such as zebra wood or prima vera, should be used with restraint since the eye is likely to tire of a large area that is visually "busy."

As mentioned previously, veneered plywood, although generally more expensive than solid, is the material choice. However, having decided on the use of this material, do not be tempted to use cheap grades. Many cheaper brands of veneered plywood are subject to checking, buckling, or peeling of the veneer itself. Since the largest portion of the cost of a cabinet is labor, not materials, cutting corners on materials usually proves to be a false economy.

The writer has had occasion to see all too many cases of well constructed cabinets ruined by poor finishing. You should be extremely particular about the finish you accept. A good finish should be smooth and satiny, both to the touch and the eye. It will not be if the individual coats are put on too thick or the piece has not been well rubbed. Any competent shop should be able to give you at least a good smooth "commercial finish" at a reasonable price. Insist on it!

In designing cabinets for high-fidelity systems, the most important aspect of the problem is that the internal spaces be adequate to house the desired components. No matter how beautiful the cabinet job may be, if you can't put the equipment inside it's hardly better than useless. Internal space requirements can, of course, be determined by taking a specific set of components, measuring their over-all dimensions—thus arriving at the internal space requirements for the specific set-up. This method is news to no one, but it has one big disadvantage. It does not allow for flexibility in terms of later changes in the system. For example, the space that would be adequate for a *Meissner* 8BT would be totally inadequate for a *Browning* RJ20. For this reason the writer has found that the internal dimensions given in Table 1 are useful for practical purposes, since they are based on the largest commonly-used components in each category.

In regard to speaker systems, and their attendant enclosures, there is such widespread disagreement among engineers as to make this subject deserving of, at minimum, a separate article. Therefore, at the risk of appearing cowardly, the writer is leaving the subject alone except to give a tabulation of cubic volume for infinite baffles. The cubic volumes given in Table 2 will suffice for the speaker diameters given in infinite baffles of either rectangular or triangular corner types. In many cases smaller volumes will suffice; however, it will very seldom be necessary to exceed those given in the table.

Other than internal space requirements, the conditions imposed upon the cabinet designer by the equipment are neither many nor difficult to han-

(*Continued on page* 171)

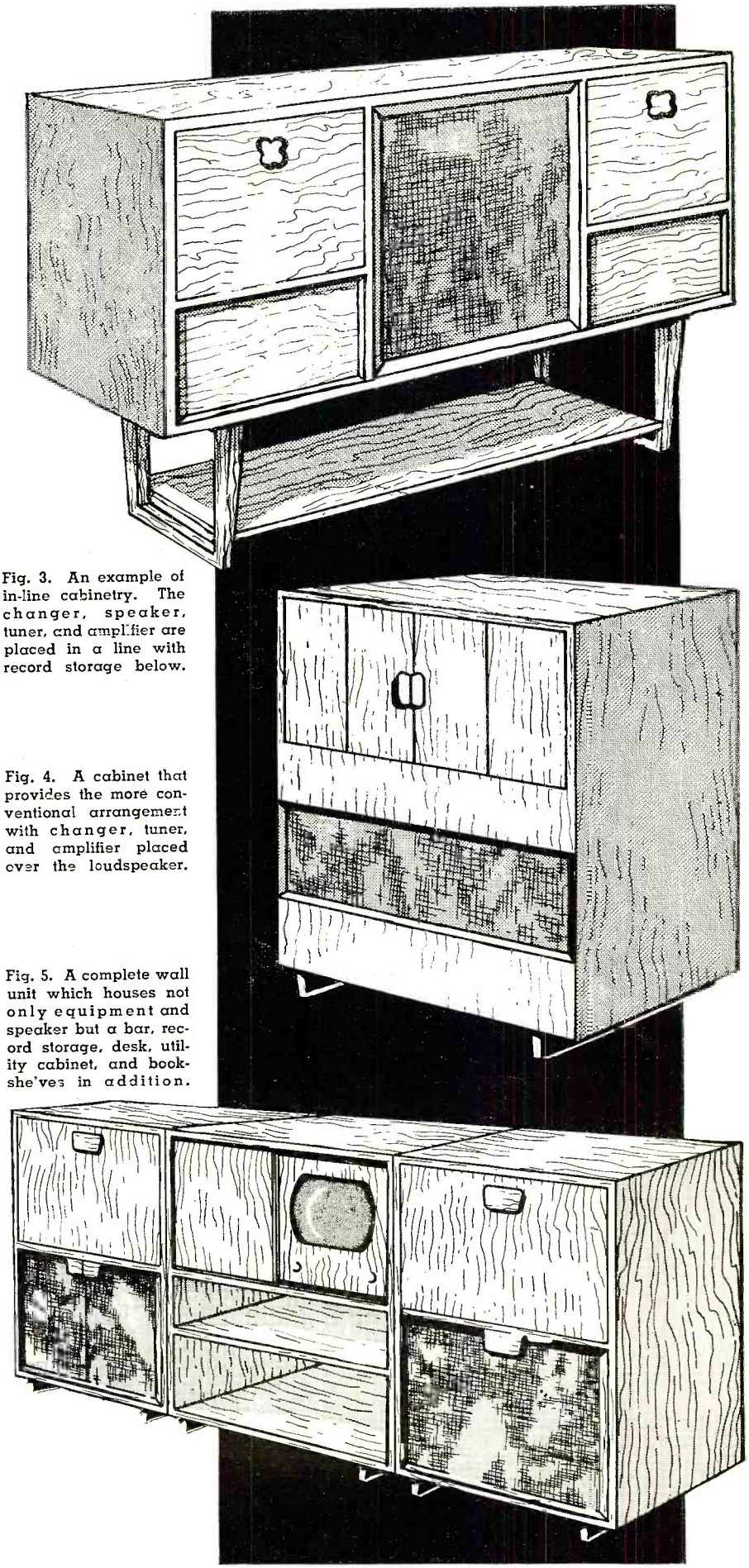
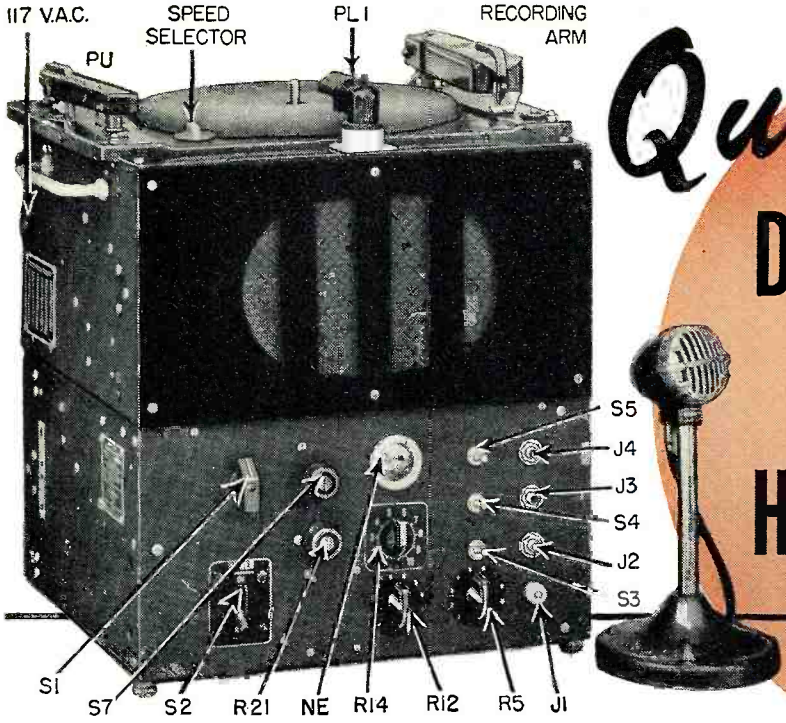


Fig. 3. An example of in-line cabinetry. The changer, speaker, tuner, and amplifier are placed in a line with record storage below.

Fig. 4. A cabinet that provides the more conventional arrangement with changer, tuner, and amplifier placed over the loudspeaker.

Fig. 5. A complete wall unit which houses not only equipment and speaker but a bar, record storage, desk, utility cabinet, and bookshelves in addition.



Front panel view of the disc recorder unit. To identify the various controls and components see diagrams of Figs. 3 and 6.

Quality DISC RECORDING WITH HOME EQUIPMENT

By JOHN T. MOORE

Construction data on a compact, high-quality unit which will handle all disc sizes up to and including 10 inches at 33⅓, 45, or 78 rpm with 120- or 160-line grooves.

THE home-built disc recorder illustrated in Fig. 1 fulfills a definite need in a wide variety of practical applications. It is a product of much technical research, combined with months of experimentation and careful planning, being constructed, in its final form, around the popular *General Industries* model R-85L cutting assembly. This particular unit cuts grooves at 160 lines-per-inch, which is comparable to the well-known microgroove, or long-playing pressed records which have been a commercial offering for quite some time. However, any constructor who prefers the standard 120-line cutting may obtain the *General Industries* model R-90L assembly, a structural counterpart of the R-85L with the exception of groove spacing. Both models are directly interchangeable on the basic recording set-up discussed in this article.

The chief advantage of the 160-line cutting is its proportional increase of recording time on a given disc size. For instance, a 10" disc recorded at 120 lines will run approximately 10 minutes at 33⅓ rpm. The 160-line cutting of identical size and speed will run upwards of 15 minutes. On the other hand, the microgroove recording is much more delicate, and therefore has less tolerance for modulation errors or improper depth of cut. With a little experience, however, one can easily master the groove cutting technique of his choice.

This recorder is capable of turning out a quiet, beautifully modulated groove which rivals even the best in professional recordings, despite the fact that no complicated volume compression or expander circuits whatever are used!

Briefly, the following essential features are incorporated: cutting and playback of all disc sizes up to and including 10 inches; cutting and playback at all commercial speeds (33⅓, 45, and 78 rpm), with choice of 120- or 160-line groove; recording from microphone, tape, radio tuner, or external phono, with fading or intermixing of any two of these sources; adjustable cutting level indicator; jack for external speaker; jack for feeding playback cartridge to external amplifier or p. a. system; separate mike, phono, and master gain controls; and other incidental refinements carefully planned to afford maximum ease and flexibility in the making of fine recordings.

The cutting assembly, shown in detail in Fig. 2, is a compact outfit consisting of: heavy duty motor, with weighted turntable and a retractable drive pin to prevent discs from slipping while cutting head pressure is being applied; spiral lead-screw and follower arm for uniform groove spacing; speed selector switch and associated rim-drive mechanism; recording arm, complete with either crystal or magnetic cutting head, according to individual preference; and playback arm, featuring an adjustable all-speed cartridge with dual styli of semi-permanent characteristics.

The Amplifier

Although not strictly a wide-range amplifier and designed somewhat contrary to accepted standards in that it does *not* employ inverse feedback of any kind, the circuit shown in Fig. 3 is nevertheless a straightforward layout, free from "bugs" or fancy embellishments, and built with but one fundamental purpose in mind—top-quality groove modulation for instantaneous disc recording!

The recorder's case is of crackle-finish cast aluminum, measuring 14¼" wide by 15" high and 13" deep. The particular unit shown is made from refitted sections of a surplus aircraft transmitter and this may or may not be practical for anyone interested in duplicating the equipment; however, plywood, sheet metal, or practically any other material will serve just as well. Since the case, speaker cut-out, and associated sections are mere routine construction well within the capabilities of any average workman, no detailed procedure should be necessary here. Adequate ventilation must be provided, however, and this is best accomplished through the use of louvers, or vents, in the back, with the entire bottom section being covered by a section of fine-mesh wire, so that upward and outward circulation of air is relatively unhampered.

With respect to the amplifier chassis, the case is designed slightly oversize front and back in order to facilitate wiring the controls, which are mounted not on the chassis but on the front panel. Such arrangement also makes for better air circulation in and around

the power section, where considerable heat is generated.

Underchassis and back-section arrangement, with ventilation louvers removed, may be seen in Fig. 7. Note that the metal framework of the case is in two superimposed sections, the amplifier section being positioned in the lower half, and cutter assembly in the top portion. This gives ready access to either section for adjustments.

The amplifier circuit itself needs very little explanation, but placement of parts and the usual precautions observed in wiring any high-gain audio system should receive special consideration, since hum or other noticeable defects will render the entire layout practically worthless, insofar as quality recording is concerned. (Note chassis specifications and placement of essential components in the amplifier proper, as shown in Fig. 4.) Besides freedom from residual hum, it must possess stability, and low order of distortion within the required modulation range—effectively, 3 to 4 watts across the cutter.

The circuit uses a 6J7 pentode as the microphone amplifier, with its gain control following, rather than preceding the tube, thus aiding substantially in minimizing hum pickup in the first (and, incidentally, the most troublesome) stage. Its grid leak resistor is soldered directly to the cap connector, then covered with a short length of spaghetti and enclosed in shielded braid along with the grid's input lead. It is impossible to overemphasize the need for great care in wiring this stage, for 90% of the original hum difficulties encountered in designing the circuit were eventually found to originate within the immediate area of the 6J7 input! In some instances it may be necessary to shock mount this tube, although careful planning and wiring will usually suffice. Specific applications may also warrant lowering the value of the plate load resistor in this tube, since over-all gain is adequate for general microphone use and frequency response might profit slightly.

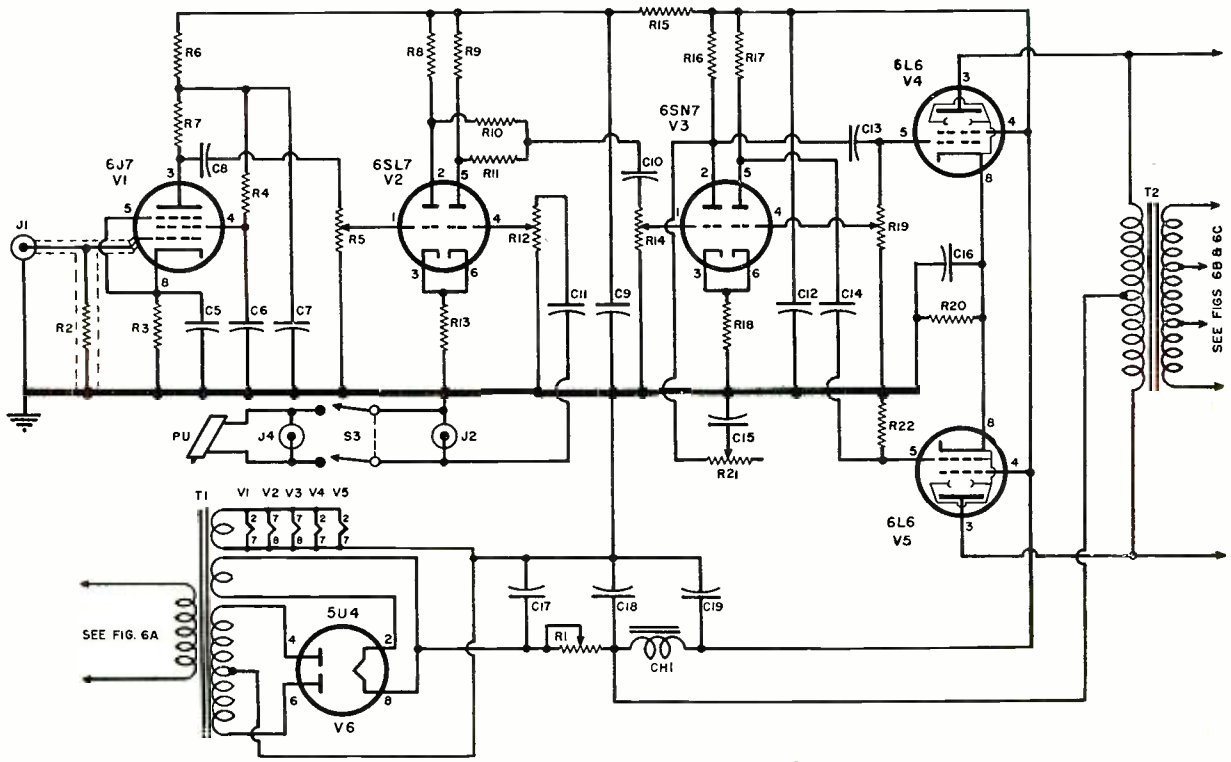
The second tube is a 6SL7, with one of its triode sections accommodating the phono input. A 6SN7 is used as the amplifier-phase inverter to drive the 6L6's, and this highly efficient phase inversion is accomplished through use of a one-half megohm control in the plate lead of one triode section, feeding a portion of this signal back into the grid of its companion in the 6SN7. Balancing is so simple, it can almost be accomplished by ear; however, this

Fig. 2. The General Industries' Model R-85L cutting assembly, showing playback arm at left and recording arm at right. Weighted turntable has retractable drive pin, near center post, to prevent slipping of disc. Speed selector switch is at the left.

is hardly precise enough for the job at hand, and a sensitive a.c. voltmeter at the 6L6 grids (and in series with a condenser to exclude d.c.) is the easiest method of matching input voltages at these two points, using a constant input signal in one of the previous stages. Better still, the use of an oscilloscope is highly advisable in critical matching of the phase balance.

It will be noted that a 1600-ohm rheostat is used in the power supply for accurate adjustment of "B-plus" requirements, and, while not strictly an essential, this feature is of value in arriving at peak performance with regards to tube bias and similar power

Fig. 3. Schematic diagram of the recording amplifier used in conjunction with the disc recorder. See Fig. 6. for variations.



R_1—1600 ohm, 170 ma. power rheostat
R_2—5 megohm, ½ w. res.
R_3—1300 ohm, 1 w. res.
R_4—1.5 megohm, ½ w. res.
R_5—500,000 ohm pot. ("Mike Gain")
R_6—50,000 ohm, ½ w. res.
R_7, R_8, R_9—250,000 ohm, ½ w. res.
R_{10}, R_{11}, R_{22}—500,000 ohm, ½ w. res.
R_{12}—500,000 ohm pot. ("Phono Gain")
R_{13}—1000 ohm, 1 w. res.
R_{14}—500,000 ohm pot. ("Master Gain")
R_{15}—20,000 ohm, ½ w. res.
R_{16}, R_{17}—68,000 ohm, ½ w. res.
R_{18}—1200 ohm, 1 w. res.
R_{19}—500,000 ohm pot. ("Phase Balance")
R_{20}—150 ohm, 10 w. wirewound res.
R_{21}—250,000 ohm pot. ("Tone Control")
C_1—50 μfd., 25 v. elec. cond.
C_6, C_9, C_{12}, C_{13}, C_{14}—.1 μfd., 600 v. cond.
C_7—8 μfd., 450 v. elec. cond.
C_8—.01 μfd., 600 v. cond.
C_{10}, C_{15}—.05 μfd., 600 v. cond.
C_{11}—.02 μfd., 600 v. cond.
C_{16}—50 μfd., 50 v. elec. cond.
C_{17}, C_{18}, C_{19}—20 μfd., 450 v. elec. cond.
J_1—Insulated input jack ("Mike")
J_2—Insulated external circuit jack ("Phono", "Radio Tuner", "Tape", etc.)
J_3—Insulated output jack (for pickup to external amp or p.a. system)
PU—Crystal playback cartridge
S_3—Two-circuit toggle sw. (cuts out playback cartridge)
CH_1—Filter choke, 10.5 hy., 110 ma., 225 ohm d.c. res.
T_1—Power trans. 400-0-400 v. @ 200 ma.; 5 v. @ 2 amps.; 6.3 v. @ 5 amps.
T_2—Output trans. 5000 ohms plate-to-plate to 3.2, 8, and 16 ohm sec.
V_1—6J7 tube
V_2—6SL7 tube
V_3—6SN7 tube
V_4, V_5—6L6 tube
V_6—5U4 tube

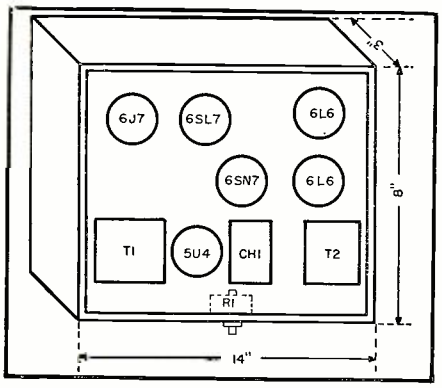


Fig. 4. Layout of essential components on the 14 x 8 x 3 inch steel chassis. See Figs. 3 and 6 for identification of parts.

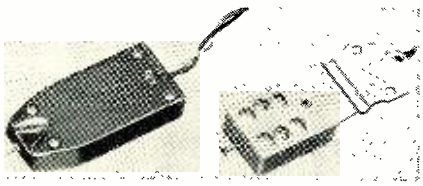


Fig. 5. Close-up view of the cutting heads available with the General Industries' recording assembly. The Astatic X-26 and X-29A, at left, are crystal types while the M-41, at right, is 10-ohm magnetic model. All are directly interchangeable in cutter arm but require different wiring (Fig. 6).

problems usually present in the designing of any piece of good electronic equipment. Best results are obtained with this adjustment delivering 295 volts to the circuit.

In rare instances, it may be found necessary to use a 250 $\mu\mu$fd. mica condenser from grid-to-ground in the inverted output tube as a suppressor of any tendency toward high frequency oscillation; however, even if indicated, this value has no appreciable effect on over-all quality or response.

Decoupling, as shown in the diagram, was found to be wholly adequate in this particular instance, but it is quite possible that individual wiring procedure may present a need for values somewhat higher than those originally listed.

During playback, a 5600 ohm resistor in series with a .005 μfd. condenser across the output plates will add a pleasing attenuation to the tone quality; however, if desired, a separate switch should be added to prevent a noticeable loss of highs during recording. Any such local attenuation is best accomplished during playback, rather than in the recording process.

A word of caution regarding the output section: *Don't* skimp on the output transformer! A bargain or surplus unit can be a risky saving, with poor audio quality and characteristic frequency loss as the result. The transformer should be of hefty construction and proven quality, capable of at least 15 watts—preferably 20. No amplifier, however elaborate and well-designed, can surpass its own output section, and a common fault with most experimenters in audio construction is to bottleneck their most diligent efforts with a transformer of poor capabilities.

The first consideration in obtaining a cutting assembly is the choice of cutting heads. These are available in either magnetic or crystal types, and as to quality in the final recording, very little difference would be apparent to the average critic, provided, of course, each cutting head had been properly installed at the amplifier, and used in strict accordance with its own limitations.

Cutting heads normally supplied with the *General Industries* assembly are the *Astatic* X-26 or X-29A, and the *Astatic* M-41—the former being crystal types, and the latter a magnetic. These two types, shown in detail in Fig. 5, are directly interchangeable in the recording arm, but entail somewhat different procedure for connection to the amplifier.

Generally speaking, the crystal type has somewhat greater frequency range, but the very fact that it *is* a crystal element has prompted many authorities to shy away from it, since it is an accepted fact that any crystal device lacks the over-all stability and ruggedness of its magnetic counterpart. Beyond question, it is also the more exacting of the two when it comes to proper loading and installation. Excessive voltage may damage the crystal cutter, and since it must be connected in the plate circuit of the output tubes, blocking condensers are required so that pure a.c. signal voltage alone be allowed to pass—and here, again, is another potential trouble-maker, for it can readily be seen that a shorted or leaky condenser in this circuit would instantly paralyze the crystal with a hefty surge of "B-plus." It is usually considered good practice to shunt a crystal cutter with a 1 megohm, 1 watt resistor although many manufacturers have not deemed this necessary.

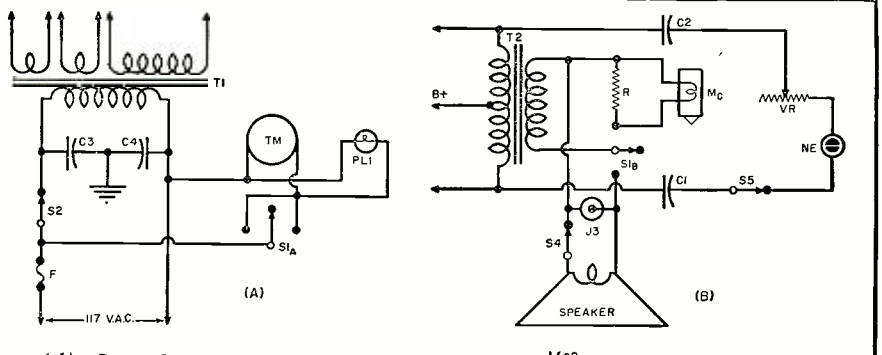
The magnetic cutting head, on the other hand, may be included in the speaker voice coil circuit, and is not nearly as sensitive to heat, shock, or excessive voltage damage. Its useful life, with reasonable care, is unlimited, and its frequency range, while generally under that of a crystal, is quite satisfactory for disc recording.

As to frequency characteristics, it is well to bear in mind that the M-41 has a useful upper frequency limit of about 7000 cycles, while the X-29A extends well into the 9000 cycle range. It is understandable, then, that the X-29A would receive logical preference in the recording of fine music—provided, of course, that a disc which is capable of receiving such delicate impressions as would be presented by a stylus vibrating at 9000 cps is used. This is but one of many technical bottlenecks which tend to bar home-recording enthusiasts from the sacred rites of true high-fidelity!

If a magnetic cutter is the final choice, proceed with wiring connections as shown in Fig. 6B. These are 10 ohm cutters at 400 cycles, and may be used at standard voice coil impedances in the transformer secondary, with simple switching from cutter to speaker for playback. The speaker used is an oval

(*Continued on page* 157)

Fig. 6. (A) Detailed wiring data on the power section. (B) Wiring variations if a magnetic cutting head is used. (C) Changes required if crystal cutter is employed.



(A) Power Section
C_3, C_4—.05 μfd., 400 v. cond.
TM—Turntable motor
PL_1—117 v., 6 w. lamp (see text)
S_{1A}—Ganged dual-wafer, 3-pos. rotary sw. (with S_{1B} in Figs. 6B or 6C)
S_2—S.p.s.t. switch ("Amplifier")
F—3 amp. fuse
T_1—Power trans.
(B) Magnetic Cutter
R—10 ohm res. (see text)
VR—½ megohm pot.
C_1, C_2—.1 μfd., 600 v. cond.
S_{1B}—Ganged dual-wafer, 3-pos. rotary sw. (with S_{1A} in Fig. 6A)
S_4—S.p.s.t. speaker switch
S_5—S.p.s.t. neon switch
J_3—Extension speaker jack
M_C—Magnetic cutter
Speaker—5 x 7 inch PM speaker, 3.2 ohm v.c.
NE—NE-51 neon bulb
T_2—Output trans.
(C) Crystal Cutter
R_x—4 ohm res. (see text)
R_1—50,000 ohm, 1 w. res.
C_1, C_2—.1 μfd., 600 v. cond.
C_x—.001 μfd. to .01 μfd., 400 v. cond. (see text)
VR—½ megohm pot.
X_C—Crystal cutter
S_{1B}—Ganged dual-wafer, 3-pos. rotary sw. (with S_{1A} in Fig. 6A)
S_{4A}—3-pos., center-off sw. (see text)
S_5—S.p.s.t. neon switch
S_7—Frequency-compensating sw.
J_3—External speaker jack
Speaker—5 x 7 inch PM speaker, 3.2 ohm v.c.
NE—NE-51 neon bulb
T_2—Output trans.

MINIATURE TVI WAVETRAPS

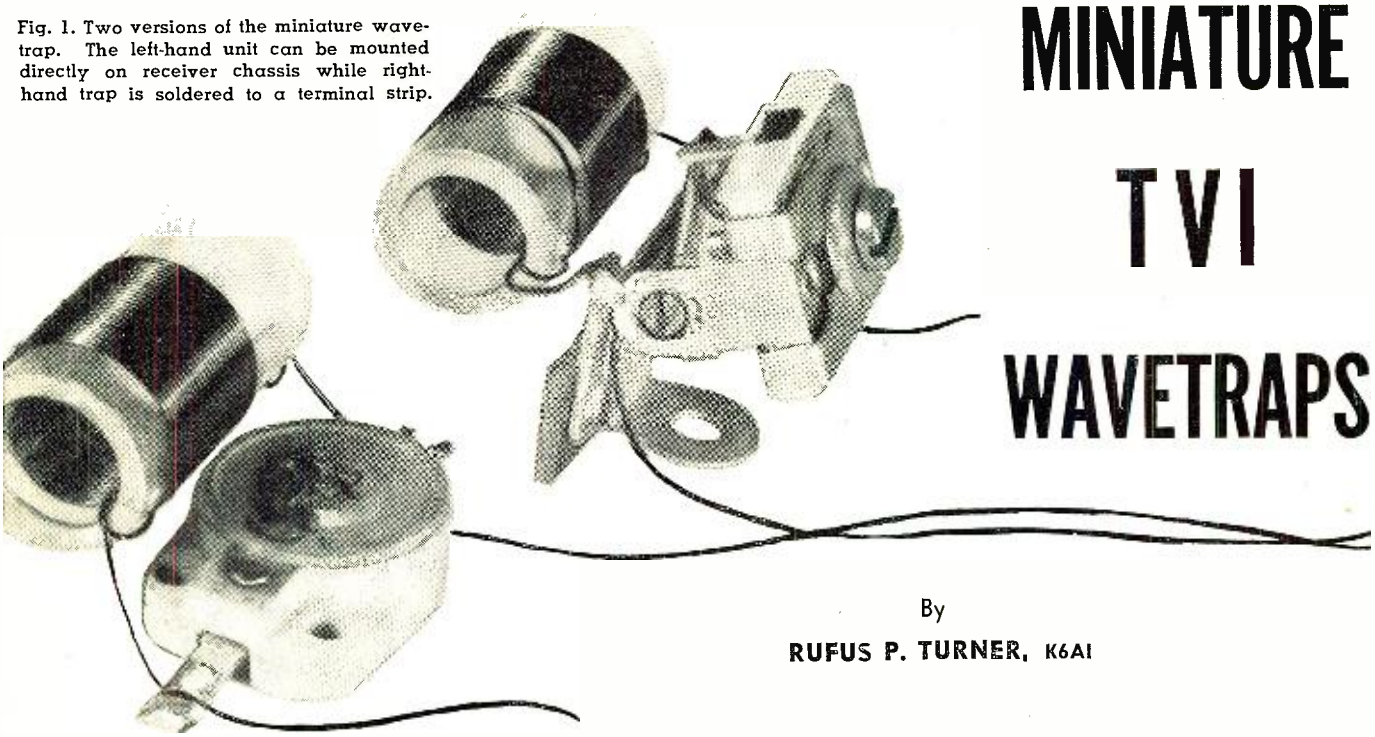


Fig. 1. Two versions of the miniature wavetrap. The left-hand unit can be mounted directly on receiver chassis while right-hand trap is soldered to a terminal strip.

By
RUFUS P. TURNER, K6AI

A simple method of curing interference troubles arising from amateur transmissions in new 21 to 21.45 mc. band

A GREAT deal of the TVI from the new 21-to-21.45 mc. amateur band probably will be caused by strong signals entering the i. f. stages of television receivers *directly* as the result of poor receiver shielding. But some interference will also arrive via the receiving antenna and lead-in. This signal energy will be capacitance-coupled through the front end and will find access to the i. f. stages. This is the same situation which existed some years ago when commercial low-frequency signals had to be trapped out of the antenna input of broadcast receivers lest they find coupling through to the i. f.

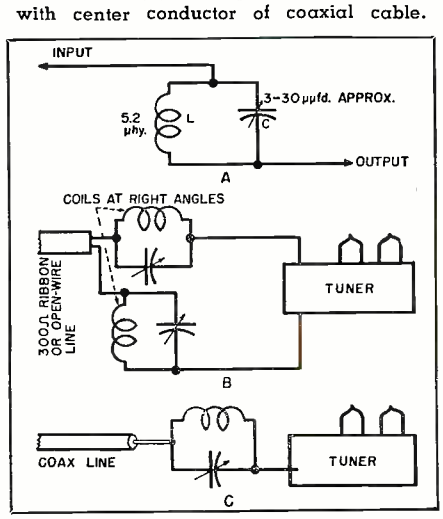
Lead-in-conducted interference is eliminated by means of wavetraps (see Fig. 2). The best practice is to connect one trap in series with each lead-in wire of a two-wire line (see Fig. 2B), or one in series with the center conductor of a coaxial line (see Fig. 2C). A 5.2-microhenry coil and approximately 11 micromicrofarads of capacitance are required in a wavetrap to tune to 21 mc., although other combinations can be used.

These 21-mc. wavetraps can be made simple, small, and inexpensive. Fig. 1 shows two types built by the author and used in laboratory TVI tests with a strong 21-mc. oscillator and sensitive TV receiver. The coil in each instance consists of 25 turns of No. 26 enameled wire closewound on a ½-inch-diameter form (winding length ½ inch). The tuning condenser in the left-hand unit is a 4-to-30 $\mu\mu$fd. *Erie* Style TS2A Ceramicon trimmer. A familiar 3-to-30 $\mu\mu$fd. leaf-type mica trimmer is used in the right-hand unit. These wavetraps can be built from spare materials by the service technician or amateur.

The left-hand unit may be mounted on the receiver chassis by means of machine screws passed through the two mounting holes in the base of the ceramic condenser. In the right-hand unit, the coil leads and trimmer lugs are soldered to the terminals of a two-lug terminal strip, the latter serving to hold the wavetrap to the receiver chassis. In each case, the coil is supported adequately by its own short leads. The trimmer capacitance ranges allow easy coverage of the 21-mc. band. Tuning is by means of screwdriver adjustment.

The wavetraps must be mounted in the receiver as close as possible to the tuner input. (See Fig. 2C.) To prevent mutual coupling when two traps are used, the units should be oriented so that their coils are at right angles. Shielding will not be required in most cases, but when necessary, may be obtained by slipping a small grounded metal can over each trap, leaving a small hole for insertion of the adjusting screwdriver.

Fig. 2. (A) How lead-in-conducted interference is eliminated by wavetraps. (B) One method of connecting trap by placing it in series with each lead-in wire of two-wire line. (C) A trap placed in series with center conductor of coaxial cable.



These little traps have given good account of themselves in soaking up signals in the 21-mc. region without impairing reception on any of the TV channels.

In TV fringe areas where it is desirable to keep the signal-to-noise ratio as high as possible, it may be advantageous to use series-resonant wavetraps. Such wavetraps are especially applicable when interference is weak.

The same components used in the previously described parallel wavetraps are used, but for this application they are connected in series with each other. If coaxial lead-in is used one series wavetrap is sufficient. Simply connect the wavetrap between the center conductor (at the antenna terminal on the chassis) and ground. Such a hookup may also be used with twin-lead but this results in an unbalanced line. These wavetraps should be connected directly between the antenna terminals on the receiver and ground.

In some cases it may be found that 21 mc. signals are entering the receiver through the power line. The interference entering in this manner may be eliminated by the use of the parallel wavetraps described in this article. For this usage however, use 30 turns of No. 22 enameled wire closewound on the ½-inch form. —30—

A PORTABLE P.A. SYSTEM

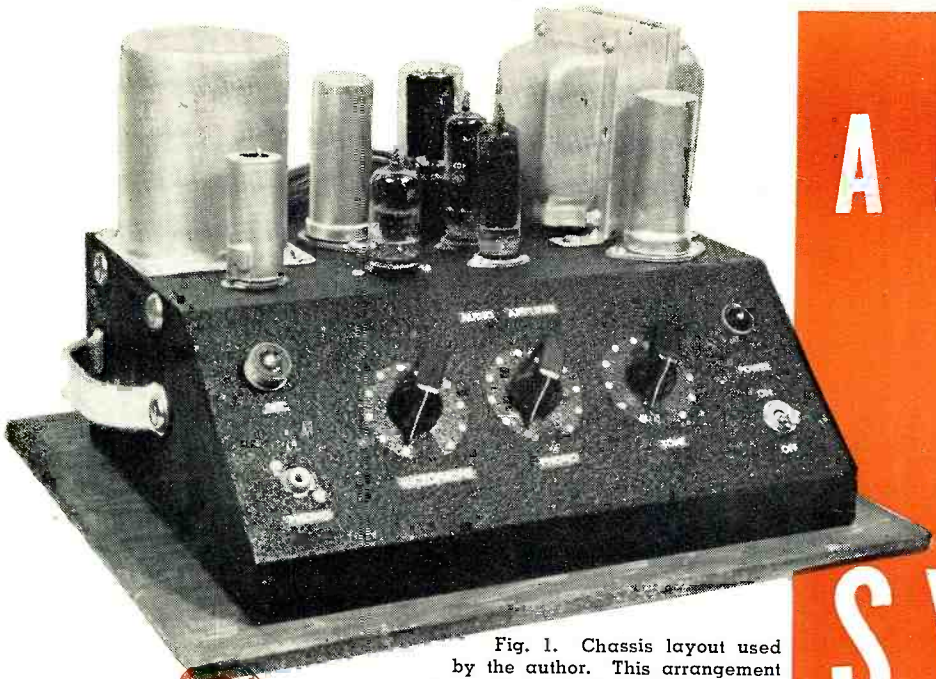


Fig. 1. Chassis layout used by the author. This arrangement may be varied to fit housing selected.

By
LOUIS E. GARNER, JR.

Construction details on a sturdy, lightweight unit that can be built in a few hours and pay for itself in months.

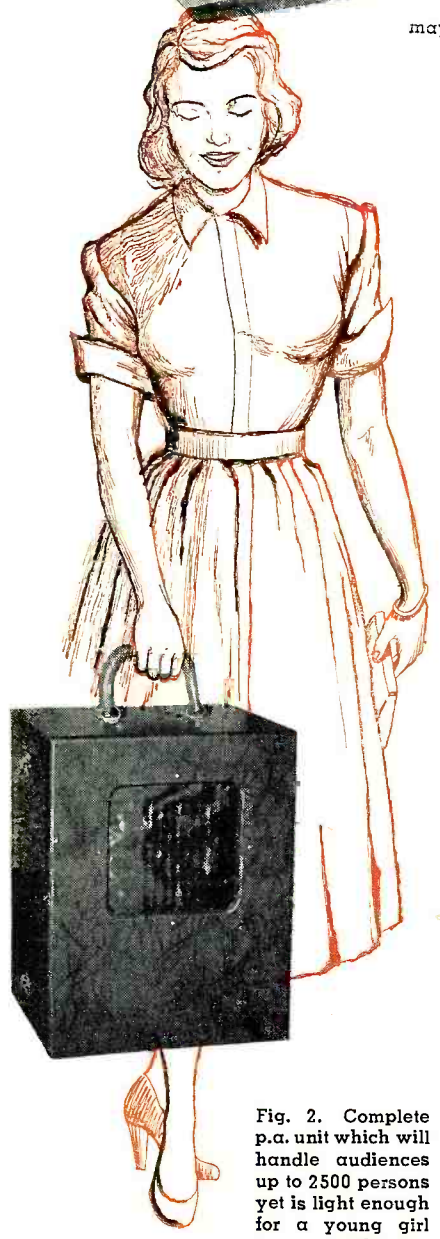


Fig. 2. Complete p.a. unit which will handle audiences up to 2500 persons yet is light enough for a young girl to carry with ease.

EVEN though TV has received considerable publicity since the lifting of the "freeze" and tends to dominate news in the electronic field, other branches of electronics are by no means "dead." Public address rentals, sales, and installations continue to offer an excellent market for the aggressive radio-TV service-dealer. One important market was discussed recently in RADIO & TELEVISION NEWS ("Public Address Systems Aid Barkers," July, 1952). Other important markets, especially for rental systems, include civic organizations (Rotary, Lions, Kiwanis, Soroptimist clubs, etc.), political groups (especially during an election year), churches, local clubs, schools, and similar organizations.

Not only is there good money to be made in direct sales and rentals, but many service shops, particularly those in small towns and in suburban areas, find that the business and good-will resulting from the "free" loan of a system far exceeds any immediate cash benefits obtained if a charge had been made. General practice is to charge for the rental of a p.a. system when used by money-making groups (carnivals, shows, etc.) or political organizations, but to either make a reduced charge or to permit "free loan" of a system to charitable or civic groups. This rule does not apply in the case of organizations specializing in p.a. rentals only, of course—in such cases, good business practice dictates that "free" work be kept to a minimum.

A p.a. system designed primarily for rental work must meet several important requirements. It must, above all, be easily portable. In addition, it should be completely self-contained—everything should be in "one package"; it should have reasonable power, permitting one system to be used in a variety of circumstances; it should be easily set up and easily disassembled; it should be rugged; and it should be inexpensive. The p.a. system shown in Fig. 4 meets these requirements admirably. Although it contains all the components necessary for the majority of installations, including two speakers and baffles, each with 50 feet of connecting cable, a 15-watt amplifier, a hand mike together with desk stand, and ample extra mike cable, it easily fits into one small package that is so compact and light that it may be carried by a young girl. The system shown in Fig. 2 will easily handle audiences up to 2500 persons, ample for all except the largest gatherings.

Circuit Description

The "heart" of any p.a. system is the amplifier. The schematic diagram of the amplifier used in this portable p.a. system is given in Fig. 3. As can be seen, the circuit is quite conventional. This design was deliberately chosen so that construction cost and time could be kept to a minimum.

V_1 serves as the microphone preamplifier stage, with R_1 as the grid input resistor. Bias is provided by

means of cathode resistor R_3, bypassed by C_1, while screen voltage is obtained through screen-grid dropping resistor R_4, bypassed by C_2. R_5 serves as the plate-load resistor for V_1, with plate decoupling provided by means of R_6 and C_4.

The amplified signal appearing across R_5 is applied to the *"Mike"* gain control R_7 through blocking condenser C_3, and then to the grid of one-half of the dual triode V_2 through isolating resistor R_8.

A signal obtained from a phonograph or radio tuner can be applied across the *"Phono"* gain control R_2 and thence through isolating resistor R_9 to the grid of the same tube, where the two signals are combined. R_9 serves to minimize changes in the level of the mike signal as R_2 is adjusted, while R_8 serves a similar function as far as R_7 is concerned. Thus, both controls may be adjusted independently.

The amplified signal appearing across plate load resistor R_{10} is applied to the grid of V_3 through blocking condenser C_7 with both R_{13} and R_{14} acting as the grid resistor for this tube. R_{13} and R_{14} form a simple resistive voltage divider, permitting part of the signal to be applied to the grid of the second-half of V_2. The ratio of these two resistors is chosen so that the signals applied to both halves of V_2 are of essentially equal amplitude.

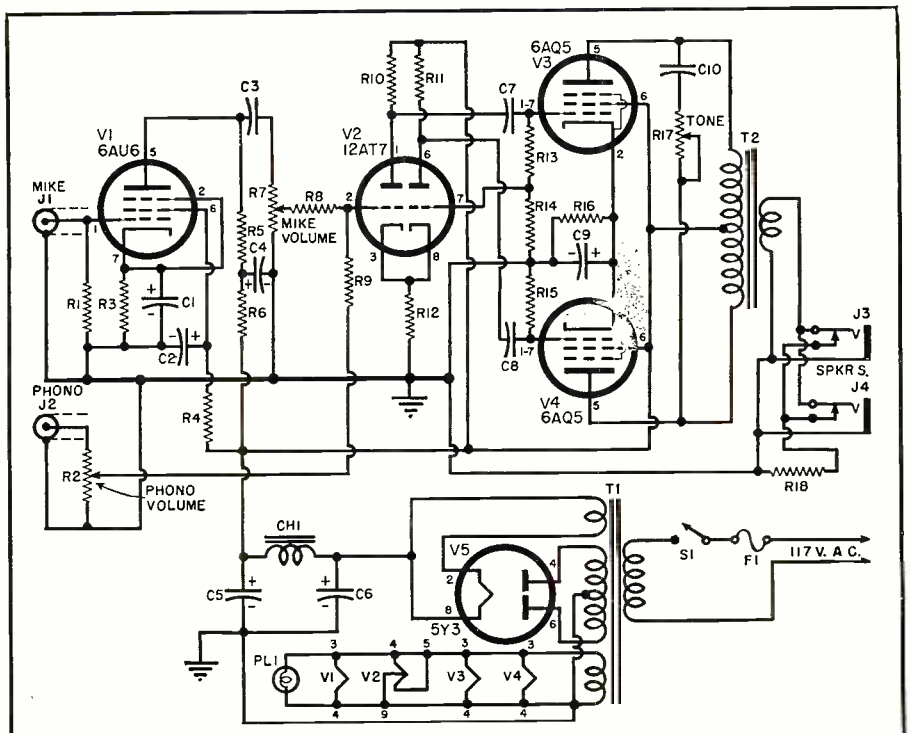
Thus, the signal across plate load resistor R_{11} is equal in amplitude to the signal appearing across R_{10}, although shifted in phase by 180°. It thus provides satisfactory drive for the other tube in the push-pull output amplifier and is applied to the grid of this tube V_4 through blocking condenser C_8, appearing across grid resistor R_{15}.

Bias for the phase-inverter stage, V_2, is obtained by means of a common cathode resistor, R_{12}. This resistor is not bypassed and the resulting degeneration helps insure proper balance in the output signal level.

Bias for the output stage is obtained by means of common cathode resistor R_{16}, bypassed by C_9. T_2 is the output transformer, used to match the output tubes to the speakers used.

"Tone" control is provided by a conventional "losser" type circuit, consisting of C_{10} and R_{17}, connected across the primary of the output transformer.

The output circuit is somewhat different from those usually encountered. Keeping in mind that the amplifier might often be used by inexperienced personnel, closed circuit jacks (J_3 and J_4) were provided for loudspeaker connections and a load resistor (R_{18}) so connected that it will always be in the circuit unless both speakers are plugged in. R_{18} thus serves two important functions. First, it makes it impossible to operate the amplifier without a load, even if the loudspeakers are not connected—this serves to protect the output transformer and output tubes against damage. In addition, since it parallels the output connections, it is still in the circuit if only one speaker is connected, and



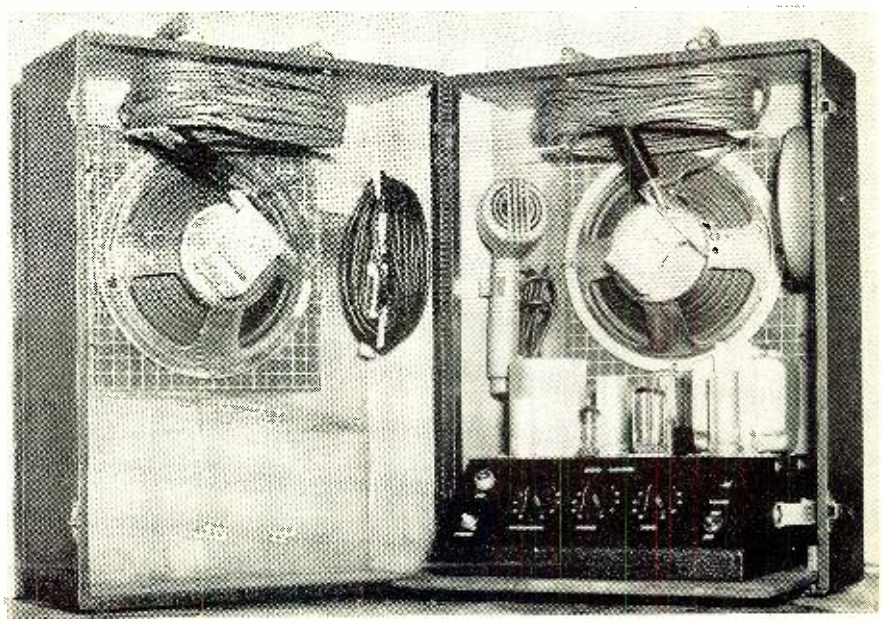
R_1—*5 megohm. ½ w. res.*
R_2, R_7—*1 megohm pot. ("Mike" and "Phono" gain)*
R_3—*2000 ohm, 1 w. res.*
R_4—*1 megohm, ½ w. res.*
R_5, R_{13}, R_{15}—*470,000 ohm, ½ w. res.*
R_6—*27,000 ohm, ½ w. res.*
R_8, R_9—*270,000 ohm, ½ w. res.*
R_{10}, R_{11}—*100,000 ohm, ½ w. res.*
R_{12}—*910 ohm, ½ w. res.*
R_{14}—*8200 ohm, ½ w. res.*
R_{16}—*200 ohm, 5 w. wirewound res.*
R_{17}—*50,000 ohm pot. ("Tone" control)*
R_{18}—*10 ohm, 2 w. wirewound res.*
C_1—*50 μfd., 25 v. elec. cond.*
C_2, C_4—*10/10 μfd., 450 v. elec. cond.*
C_3, C_7, C_8—*.1 μfd., 400 v. cond.*
C_5, C_6—*20/20 μfd., 450 v. elec. cond.*
C_9—*50 μfd., 50 v. elec. cond.*
C_{10}—*.05 μfd., 600 v. cond.*
CH_1—*10 hy., 90 ma. filter choke*
T_1—*Power trans. 350-0-350 v. @ 90 ma.; 5 v. @ 3 amps.; 6.3 v. @ 3.5 amps. (Thordarson Type TS-24R04-U or equiv.)*
T_2—*Audio output trans. (18 w. universal type), 10,000 ohms plate-to-plate to v.c. (Stancor A-3852 or equiv.)*
J_1—*Coaxial microphone connector (Amphenol)*
J_2—*Phono jack (RCA type)*
J_3, J_4—*Closed circuit phone jack*
S_1—*S.p.s.t. toggle sw.*
PL_1—*6.3 v. pilot lamp*
F_1—*2 amp. fuse (3AG type)*
V_1—*6AU6 tube*
V_2—*12AT7 tube*
V_3, V_4—*6AQ5 tube*
V_5—*5Y3 tube*

Misc. Parts Required

1—Portable amplifier case
2—8" PM speakers
2—Phone plugs
1—100-foot length lamp cord
1—Microphone (Astatic Model 200)
1—Chassis (from Bud CA-1980 unit)
1—Shielded miniature 7-pin socket

Fig. 3. Complete circuit diagram and parts list for the portable p.a. amplifier.

Fig. 4. Over-all view of p.a. "system." It includes two speakers and baffles, each with a 50 foot length of connecting cable; a 15-watt amplifier; a hand mike, together with a desk stand; and a generous amount of extra microphone cable.



thus serves to maintain a matched load. In other words, a form of "automatic" matching is provided in that *either one or both* speakers may be connected at will without changing transformer connections, and yet maintaining a proper impedance match.

The power supply circuit is conventional, utilizing a full-wave rectifier, V_5, and a "pi" filter consisting of CH_1, C_5 and C_6.

Construction Hints

Above and below chassis views of the amplifier are given in Figs. 1 and 5, respectively. Miniature tubes have been used to keep the entire unit as compact as possible, while maintaining a "clean" and easy-to-wire layout.

The general layout used by the author is readily apparent in Fig. 1, although this layout need not be followed exactly by the builder. However, care should be taken to keep the output and input stages well separated and interstage lead lengths should be kept to a minimum.

Hum pickup is minimized by using shielded input leads for both the *"Mike"* and *"Phono"* connections and by using a shielded socket for the *"Mike"* preamplifier tube (V_1).

In order to save above-chassis space, the output transformer has been mounted below the chassis on the rear "apron." It is clearly visible in the photograph below.

Often, when installing a rental system, it will be found that power is not readily available. To avoid the necessity for carrying one or more extension line cords, an exceptionally long line cord is provided (20 feet) and is wound on a standard clothesline cleat mounted on the back of the chassis (Fig. 5). Another clothesline cleat is mounted inside the carrying case and is used as a holder for an extension mike cable (Fig. 4).

The sloping front chassis is the lower part of a standard *Bud* CA-1980 amplifier foundation. With the small carrying case used in the model built by the author, it was found impossible to use the cover of the amplifier foundation. With a larger carrying case, the entire foundation could be used.

Any standard microphone is suitable for use with this p.a. system, although an inexpensive crystal "mike" is recommended, not only from the viewpoint of output, but also because of low cost, ruggedness, and general all-around usefulness.

A microphone stand is often a necessity, and it is advisable to provide one if at all possible. Many of the stands available may be disassembled into short lengths which may be fitted into the case. The ingenious builder may construct a stand if the cost of a commercial unit is not justified.

Lengths of telescoping tubing or small diameter pipe would serve this purpose well. Set screws or clamps are used to hold the sections together.

The portable carrying case was purchased as a stock item from one of the larger mail order radio supply houses. A check of mail order catalogues indicates that similar carrying cases are available from almost all supply houses. Some cases will come equipped with a mike clamp and brackets for the loudspeaker lines. In others, the case will be "stripped," and any desired brackets or clamps will have to be provided by the builder. The case used by the author was a "stripped" version, and it was even necessary to provide the plywood "base" for the amplifier. A 60 amp. standard fuse clip was used as the "mike" clamp, and clothesline cleats (obtained from a local hardware store) used as brackets for the extra microphone line and for the loudspeaker lines. The general arrangement of these clamps and brackets is visible in Fig. 4.

Decals are used for identifying controls and jacks.

Parts Substitutions

The circuit given in Fig. 3 is subject to wide modification, and quite a number of substitutions may be made without affecting the operation of the unit. In fact, the builder, by using parts available in the "junk box," and modifying the circuit slightly, may be able to make a substantial reduction in over-all cost. It is possible to assemble this entire system for under $40.00 (exclusive of labor) if care is taken in utilizing surplus and "junk box" parts.

A type 6SJ7 tube may be substituted for the type 6AU6 tube used by the author, a type 6SL7 or type 6SC7 for the 12AT7, type 6V6 for the 6AQ5, and, where less power can be tolerated, type 6K6. Where tube substitutions are made, appropriate socket changes will be necessary, of course. Almost any standard rectifier tube will be satisfactory for the type 5Y3GT used in the model—types 5Y4, 80, 5U4, 5Z3, etc.

If desired, the tone control may be omitted, and a .005 μfd., 600 v. paper condenser connected in place of C_{10} and R_{17}.

Although an upright-mounted transformer was used by the author, a shell-mounted transformer will do just as well. Voltages are not too critical, and a center-tapped secondary of from 600 to 750 volts will give satisfactory results.

Electrolytic condenser sizes are not critical, and somewhat smaller or appreciably larger electrolytics may be used throughout without difficulty.

Two 8" PM speakers are used in the model shown in the photographs, however, 10" or 12" speakers may be easily substituted, although a larger carrying case will become necessary. Care should be taken that the two speakers are connected in the same manner so that "phasing" will be proper, and sounds emanating from the speakers will tend to reinforce rather than to cancel. If desired by the builder, only one speaker need be provided.

The portable p.a. system described may be easily built by a skilled technician in from 12 to 15 hours, with the cost of parts well under fifty dollars. It is an ideal project to work on between servicing jobs. Once completed, it may either be sold outright, rented, or kept for lending to civic and church groups for "good-will."

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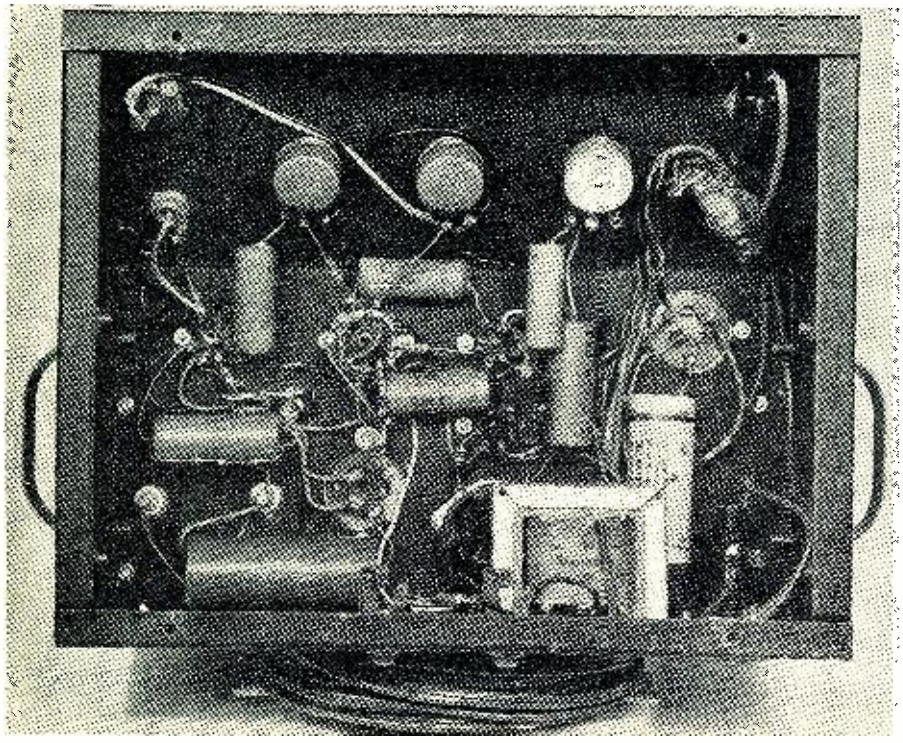
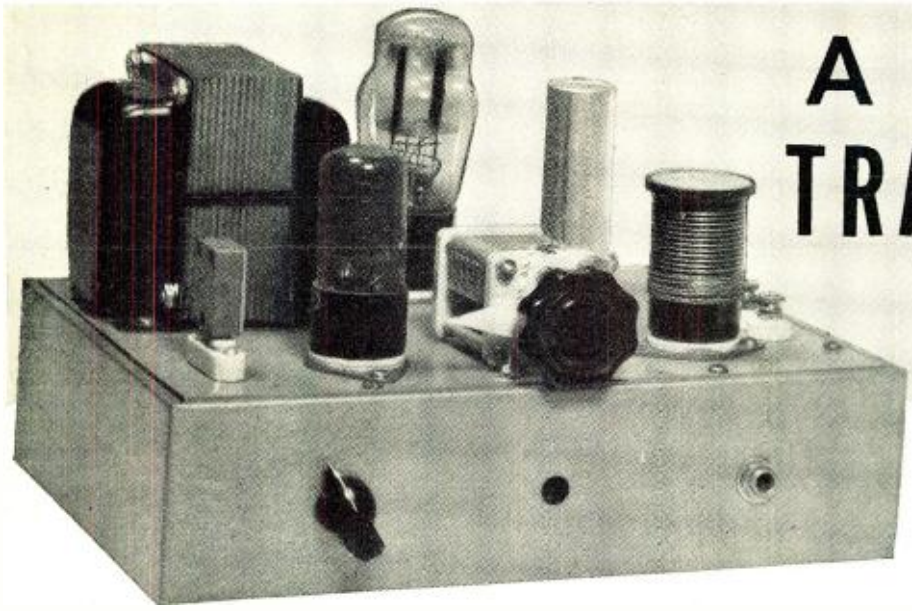
Fig. 5. Under chassis view of the portable 15-watt public address amplifier.





A NOVICE TRANSMITTER KIT

By

DAVE LAGENOUR, W9LEI

Engr., Thordarson-Meissner Mfg. Div.

Fig. 1. Front chassis view of the Novice transmitter. The design has been incorporated into a commercially-available kit which has been designated the "2-CW."

Although designed for the 80 m. band, this 20-watt unit can be adapted to operate on either 40 or 20 meters.

SINCE the authorization of the "Novice" class amateur license, there has been a growing demand for transmitter kits of low power which can be easily assembled in a short time by those with a limited knowledge of radio.

The newcomer to amateur radio needs a simple rig that can be put on the air in a short time, one that is low in cost, and is reliable. The "2-CW" kit meets these requirements inasmuch as it is extremely simple to operate and requires but a single adjustment when the frequency is shifted.

While this particular kit was designed primarily for operation on the 80 meter band, coil data has been included in the coil table to permit winding the proper coils for the other amateur bands.

The transmitter described in this article (Fig. 1) was designed and constructed by the author. It has been in service at his station for several months and has proved itself by giving consistent communication on 40 meters over distances up to 2000 miles —with excellent signal reports.

The circuit is a straightforward crystal oscillator operating at an input of 20 to 25 watts with the output designed to operate into a half-wave, center-fed folded dipole, using 300-ohm twin-lead for both the antenna and feeder.

The entire transmitter may be assembled on a chassis measuring 10¼ by 7¼ by 2⅝ inches.

Assembly

Although the entire transmitter is easy to assemble, a few special construction procedures are outlined to facilitate the work.

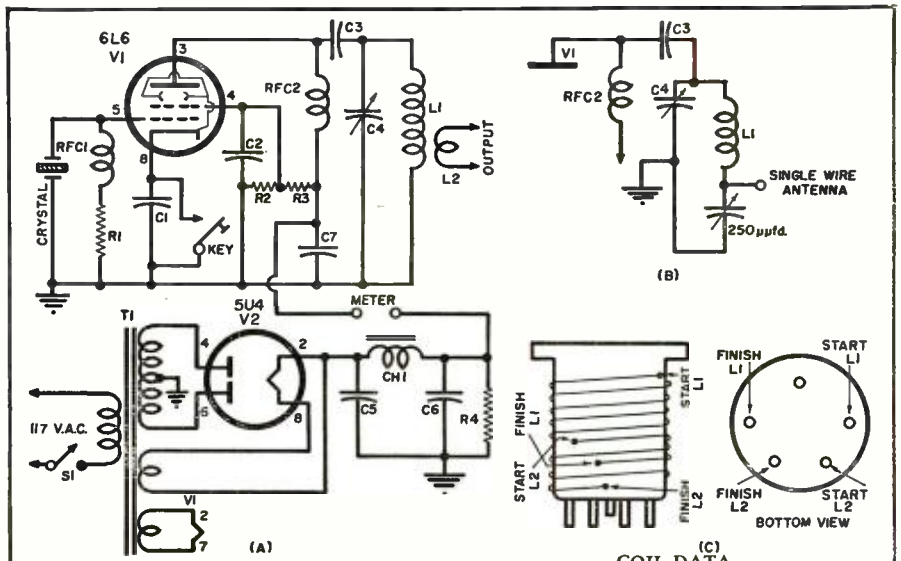
First mount all of the parts. Remember to "make haste slowly" in this operation as it is easier to avoid errors in the first place than to try to correct them after they are made.

Proceed with the wiring, hooking up the power transformer leads first. These leads should be kept close to the chassis and run direct. All of the other wiring as well as the components (condensers and resistors) should be kept about one-fourth inch away from the chassis. Use heavy wire—at least a No. 16—for all of the r.f. wiring.

After the construction has been

(*Continued on page* 105)

Fig. 2. (A) Complete circuit diagram of transmitter. (B) Circuit variation if a random length antenna is used. (C) Coil winding details. Data given below.



R_1—100,000 ohm, ½ w. res.
R_2—100,000 ohm, 1 w. res.
R_3—10,000 ohm, 2 w. res.
R_4—50,000 ohm, 10 w. wirewound res.
C_1—.05 μfd., 600 v. cond.
C_2, C_3, C_7—.01 μfd., 600 v. cond.
C_4—100 μμfd. var. cond.
C_5, C_6—15/15 μfd. 450 v. cond.
L_1, L_2—See coil table
RFC_1, RFC_2—2.5 mhy. r.f. choke (Meissner Part #19-1996)
CH_1—8 hy., 60 ma. choke (Thordarson #20C59)
T_1—Power trans. 300-0-300 v. @ 90 ma.; 5 v. @ 3 amps.; 6.3 v. @ 3 amps. (Thordarson #22R04)
S_1—s.p.s.t. rotary sw.
V_1—6L6 tube V_2—5U4 tube

COIL DATA

80 Meters
L_1*—35 t. #24 en. closewound
L_2*—8 t. #28 en. wound over bottom end of L_1 (Meissner No. 18-3914)

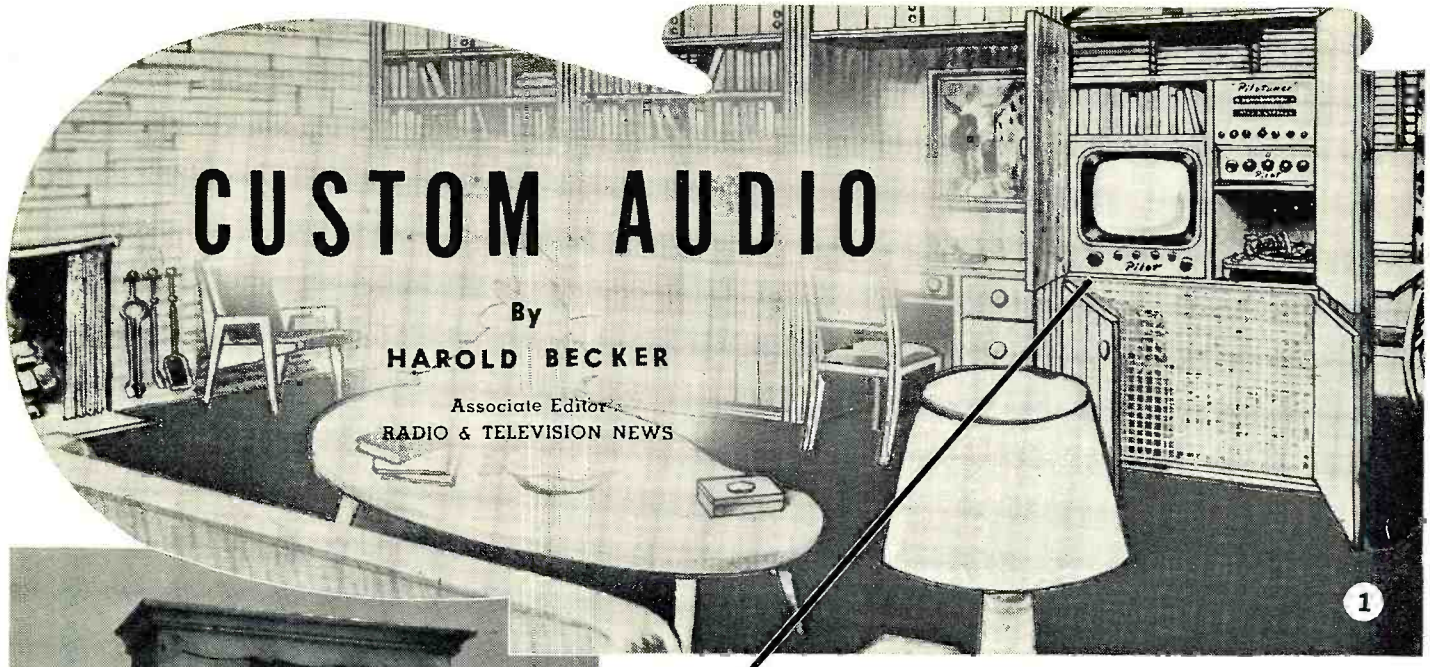
40 Meters
L_1*—19 t. #24 en., spaced to occupy 1¼"
L_2*—6 t. #28 en., 3 t. interwound with last 3 t. of L_1, wind remaining 3 t. at bottom of L_1 (Meissner No. 18-3913)

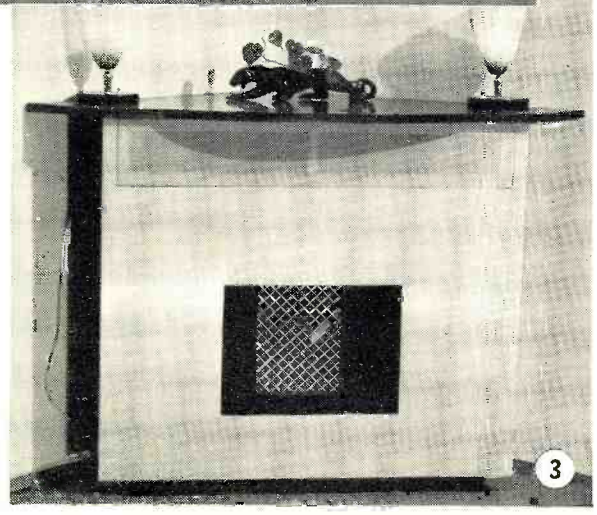
20 Meters
L_1*—12 t. #24 en., spaced to occupy 1¼"
L_2*—5 t. #28 en., 2 t. interwound with last 2 t. of L_1, wind remaining 3 t. at bottom of L_1 (Meissner No. 18-3913)

* All coils wound on 1¼", 5-prong plug-in forms.

CUSTOM AUDIO

By
HAROLD BECKER
Associate Editor
RADIO & TELEVISION NEWS





The growing popularity of custom equipment has opened a vast and profitable field for the audio technician. Here are some workable suggestions.

ONE of the principal reasons for the growth of high fidelity during the past few years has been the emphasis given to it by a select group of parts-jobbers and enterprising custom-builders. The public has been made aware of the multitude of audio products through the various audio "show places" set up around the country. Found primarily in larger metropolitan areas, the "Audio Center", "Hi-Fi Room", or "Sound Center", as it is variously known, displays and demonstrates the high fidelity merchandise in a salable environment. The success of this pattern of selling has led an increasing number of parts-jobbers to consider the establishment of "sound rooms."

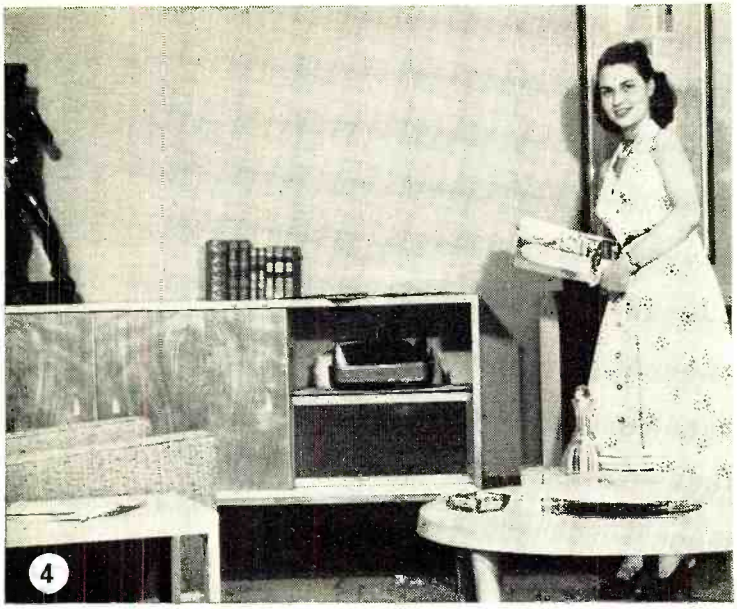
Thus, thanks to the far-sightedness of individual jobbers, audio has been properly promoted. The customer listens to his choice of equipment in relaxed surroundings in a room that's acoustically treated. After all, there is no better approach in selling living room pleasure than through a living room setting. However, the expensive requirements of "sound rooms" have limited their growth to parts-jobbers, with no means of audio display as yet devised for the local dealer.

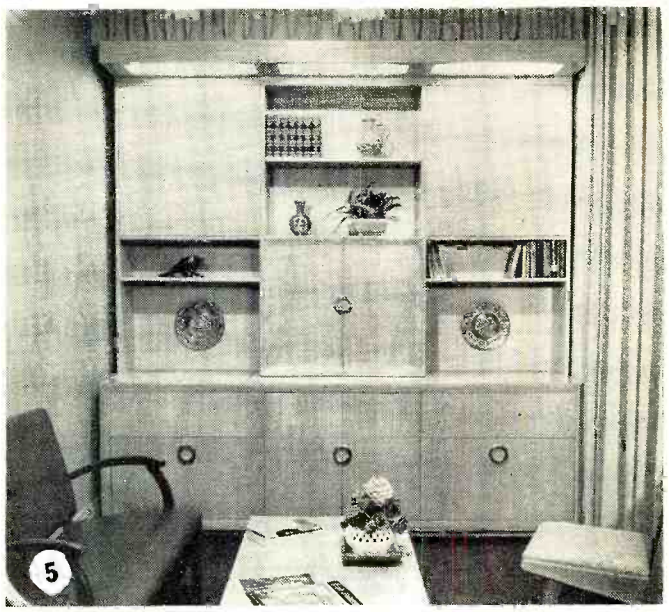
Many jobbers recognizing the inadvisability of leaving the dealer out of the audio picture have set up coordinated selling plans. The dealer is given the opportunity of using

1 Artist's sketch of the recently-introduced Nova wall units which provide room for a complete audio-TV system, storage space, and other facilities. The units will be available in all wood styles and can be purchased in any cabinet combination.

2 An Early American Hutch cabinet of pine. Space is provided for two 12" speakers behind the rattan panels placed diagonally across the top corners. This arrangement permits the proper diffusion of sound. The audio equipment is housed in the center drawer with all controls instantly available when the drawer is opened. Harrison Associates, 17 West 44th St., New York 36, N. Y., designed and built this installation on a custom basis.

3 A contemporary corner-style enclosure with a Micarta top. The Stevens 15" woofer is at the lower front opening (black portion), a Stevens tweeter (middle range) and crossover at the top and a Jensen "super-tweeter" and crossover also at the top. This unit was designed by Harrison Associates, NYC.





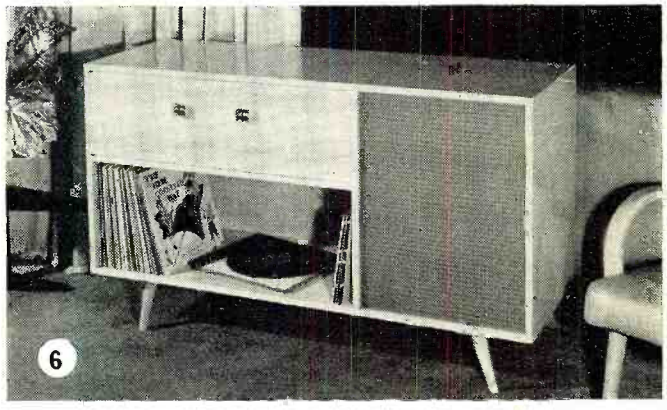
the jobber's showroom to exhibit audio products to his local customer. Should any sale result from this process, the dealer is cut in and given the opportunity of handling the installation.

Typical of the approach now being undertaken by many parts-jobbers is that of *Hudson Radio,* a New York City parts-jobber. They recently directed an audio campaign at their service customers. In simple terms the service operator was offered the opportunity of utilizing *Hudson's* sales and technical facilities to sell his local customer.

The reaction to date to *Hudson's* plan has been tremendously encouraging. It points up the latent desire of most service organizations to get involved in audio. They need the helping hand of those who know the business.

Meanwhile, more and more custom-builders are entering the expanding audio field. Equipped to provide the customer with individual styling and a choice of audio packaging, the custom-builder is on one hand an interior decorator and on the other a design engineer. He must have a complete knowledge of cabinetry, its craftsmanship, and its place in the home; as well as being able to technically appraise related audio equipment.

The general consumer reaction to custom audio has been so favorable that large radio and television dealers are promoting custom packages in a standard line of cabinets. In this way the customer is able to receive a better-than-average commercial sound system at moderate cost. *Goody's* and *Haynes-Griffin* of New York City have found increasing interest in a package of this nature. Indications are that the future will see a greater stimulation of audio packaging through the set dealer. —30—

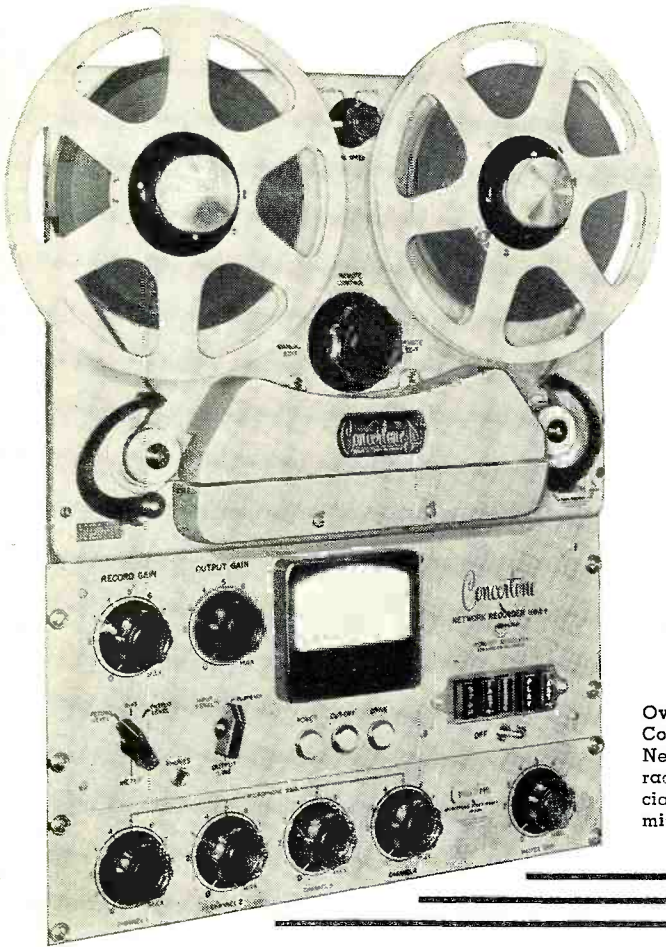


4 Part of Arrow Electronics' new "Audio Center." This "Center" is used to demonstrate how audio equipment can be fitted into the home unobtrusively, functionally, and at reasonable cost. The cabinet at the left contains a complete sound system. Sliding door panels are used to conceal the equipment.

5 A specially-designed home entertainment center which has been installed by Kierulff Sound Corporation at its "Audio Workshop" in Los Angeles. This blonde ash wood cabinet conceals a complete, custom-assembled audio entertainment unit.

6 The series 800, one of several new units in the line of packaged high fidelity radio-phonograph systems to be marketed by Sound Workshop of Brooklyn. The unit includes a Webster record changer, a Pilot AM-FM tuner, a 10-watt amplifier made by Precision Electronics, and a Jensen H-222 speaker unit.

7 A custom television installation combined with a high-quality sound system, is another version of the home entertainment center by Kierulff Sound Corp. All of the music and television equipment is located within the room divider-type cabinet. Components include a Conrac television tuner, an Altec 303A tuner with Altec amplifier, a 3-speed Markel changer which plays both sides of records, and a Jim Lansing speaker.



Over-all view of the new Concertone Model NWA-1 Network Recorder in its rack-mounted version. Special design technique permits its use in 19" rack.

New TAPE RECORDER HAS MANY FEATURES

By
E. BERLANT
Berlant Associates

Self-activating disc brakes and improved bias oscillator are among the many features of this new professional tape recorder unit.

WITH an ever-increasing number of uses being found for magnetic tape recording equipment, the design of the new *Concertone* "Network Recorder" was concentrated on the development of a basic mechanism that would combine versatility and maximum dependability.

Completely new engineering techniques have resulted in a relatively compact and simple unit which requires practically no maintenance or adjustment yet is capable of being adapted to any purpose since it will accommodate up to five magnetic heads and is activated by solenoids. The push-button control may be paralleled at any number of remote points.

The performance requirements of recording and broadcast studios necessitates the use of standard NARTB 10½" reels. Since space conservation is a big item in studio installations, the basic drive plate was designed to fit a standard 19" equipment rack and to be mounted in any position from horizontal to vertical. With proper component layout, it was found that a 19" rack panel would accommodate these reels side-by-side with reasonable overhang, yet leave adequate space for all the elements required in the design. This panel is a rigid aluminum casting, cross-ribbed for strength, which is studded with sturdy bosses onto which all assemblies are mounted. For ease of manufacture and maintenance, the mechanisms are constructed as complete subassemblies which are mounted to the main panel as separate units.

The first requirement of a tape drive mechanism is the ability to handle tape smoothly and dependably. On the basis of past experience, mechanical clutches were ruled out as requiring too precise adjustment and continual attention. Each reel is mounted directly on the shaft of an induction motor. During the high-speed rewind and in forward operation full voltage is applied to these motors. During the recording and playback operation these motors are operated in series with a ballast resistor. The supply motor is shunted with a second ballast resistor which decreases the voltage it receives and increases the voltage across the take-up motor to balance their relative torques. The revolving magnetic fields of these motors are allowed to slip, thus making provision for the varying rate of revolution of the reels.

In starting, a higher voltage is momentarily imposed on these motors to overcome inertia. This starting voltage is controlled by a time-delay relay. The housings of the motors are of cast aluminum and are equipped with radiant fins to insure adequate cooling. The torque between the supply and take-up reels is so well balanced that the entire drive system remains locked in synchronism at any reel relationship even if the line voltage is reduced to 100 volts.

As important as starting and moving the tape is stopping it effectively at any speed. Where the reels are mounted directly on the take-up and supply motors (eliminating the problems associated with mechanical clutches) the maintenance of proper brake tensions represents a major item of service. If the braking differential is too great, the tape is stretched or snapped; if it is too small, one reel will overrun the other, resulting in spilled, snarled, or torn tape.

In designing the new *Concertone* unit, it was considered of prime importance to develop a braking system that would operate indefinitely without wear or adjustment. The resulting design is a radical departure from standard practice. It is interesting to note that there is no provision for brake adjustment, even at the time of manufacture.

The brake design is, basically, a self-activating disc brake. Braking differential is established by the direction and inertia of rotation of the reels. Operating characteristics are similar to those obtained with electrodynamic braking. In addition, the brakes are automatically applied in the event of power failure.

Each brake consists of two toroid-shaped felts cemented to a three-inch steel disc. This disc floats between two steel discs, one of which rolls on three steel balls set into wedging cams. When the brake is released, a light spring rolls the activating disc upon the balls, compressing the felts between the discs and bringing the reels to a stop. There are over ten square inches of effective surface on each brake.

The heads are mounted in a copper-brazed head mount made of magnetic shielding metal. Provision is made for the proper positioning of the heads. Individual combination magnetic shields and wrap-around guides provide for correct tape-to-head contact.

The fact that space has been pro-

vided to accommodate five heads opens the way to a variety of applications. For example, an extra playback head may be placed ahead of the erase head. By connecting this head to a separate playback channel or switching connection, it is possible to play a recorded tape, erase it, and record another program. This permits the recorder to do double duty in delayed broadcast work. With one full-track erase head and four combination record-playback heads, the drive may be adapted for four-channel recording for instrumentation, etc.

Besides its normal application, the addition of two extra playback heads and a special playback preamplifier-mixer panel permits multiple echo and reverberation effects at nominal cost. Other possibilities will undoubtedly suggest themselves to those with special requirements.

In keeping with the design objective of maximum constructional simplicity and dependability, the main drive offers several interesting features. A dual-speed hysteresis synchronous motor is used, operating at 600 and 1200 rpm on 60-cycle current. The shaft is finish-ground on its own bearings. The flywheel is on the opposite end of the shaft and contains, as part of its construction, an axial blower that directs an airblast into the shroud over the motor. This serves to keep the motor cool under continuous operation and creates a damping effect on the flywheel.

The entire drive assembly, like the reel-handling motor and brake assemblies, is constructed as an integral subassembly and is removable or replaceable as a unit. The solenoids are shock mounted and their action is transmitted to the brake assemblies and pressure-roller assembly by direct linkage.

Examination of the operation of the recorder discloses a number of unusual solutions to some of the problems of loading and handling tape. The reel mount spindle and lock is designed to take either the small RTMA or the large NARTB reels without the use of adapters. Two plates with bayonet slots are mounted inside the lock mechanism. When the small reels are used, the lower plate locks with a partial turn in either direction. When the NARTB reels are used, the lock mechanism fits inside the reel hub, acting as a centering device, and the upper plate locks in the same manner.

The tape is loaded by drawing the tape around a guide roller, through a slot in the cover casting, and around a second guide roller, after which it is connected to the takeup reel in the usual manner. The spring-loaded filter arms and cut-off switch control are then swung out, automatically lifting the tape, then spring back into the proper operating position. Failure to set these arms correctly is indicated by a red pilot light at the remote control stations and at the main amplifier.

The problem of editing tape has been solved by the addition of a control knob with three positions: "Remote Control" for normal operation; "Remote Edit," which brings the tape into contact with the heads at all times and permits the location of the desired material by running the machine at fast or normal speed while listening; and "Manual Edit" which disconnects the remote control and releases the brakes while bringing the tape into contact with the heads. In this position the reels may be manipulated manually for the precise location of a cutting point. When this spot is located, the tape is marked, drawn out, and cut.

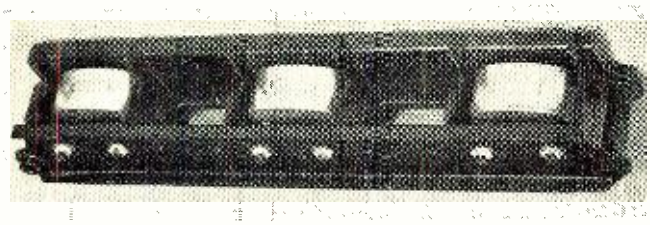
The associated electronic amplifiers are divided into two sections. The transport chassis amplifier contains the erase and bias stages, the first stage of playback preamplification, the last stages of push-pull record, and the motor and solenoid control circuits. This amplifier is mounted on a sliding track and is connected to the drive mechanism by a plug. It may be slid out on its track to permit full access to the drive mechanism during operation.

The control amplifier is mounted on a 19" x 7" rack panel and contains the record preamplification, the line amplifier, power supply, and interlocking push-buttons for operational control. Connection is made to the drive mechanism amplifier chassis by means of *Jones* connector cables.

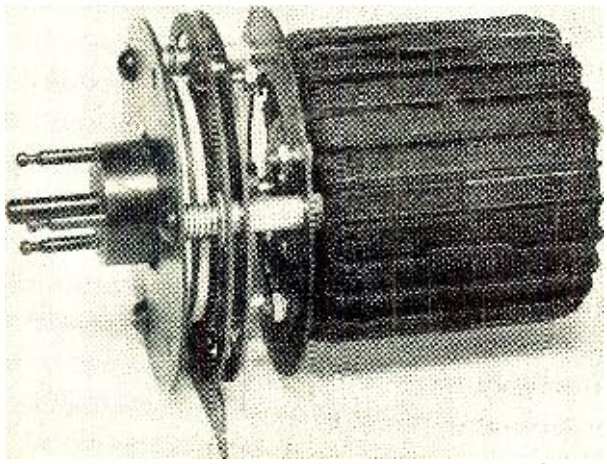
The erase and bias amplifiers are of interest in that they represent push-pull triode amplifiers operating at two different frequencies. This is a departure from general practice. The erase oscillator is a modified *Colpitts* type operating at 40 kc. An 80 kc. signal appears across the cathode resistor. This signal is tapped off through a potentiometer to the primary of an air-core transformer. The secondary of the transformer feeds the push-pull

(*Continued on page* 147)

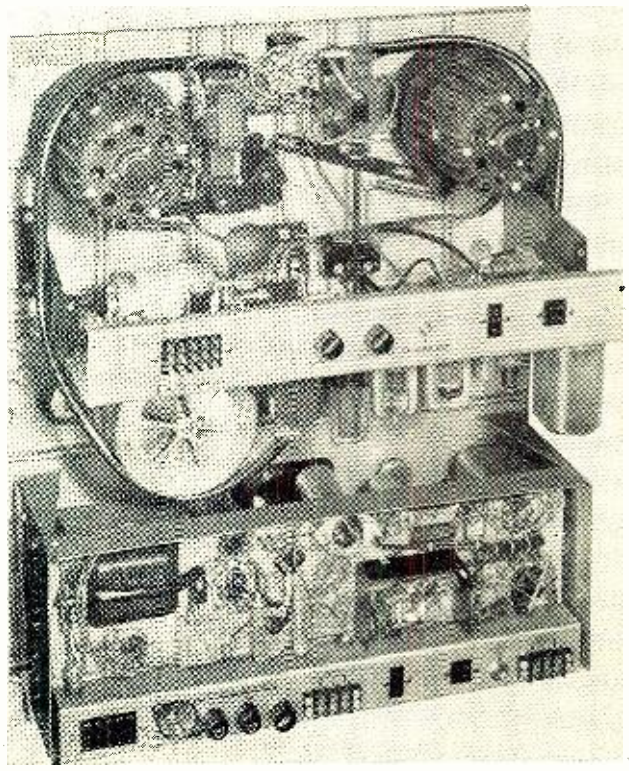
Head mount assembly. Note space is provided for additional heads. Magnetic shielding material is employed.



Take-up or supply motor and brake assembly. The disc on steel balls rides up on cam slots to actuate unit.



Rear view of the Model NWA-1 Network Recorder. The entire unit has been designed for quick and easy service.



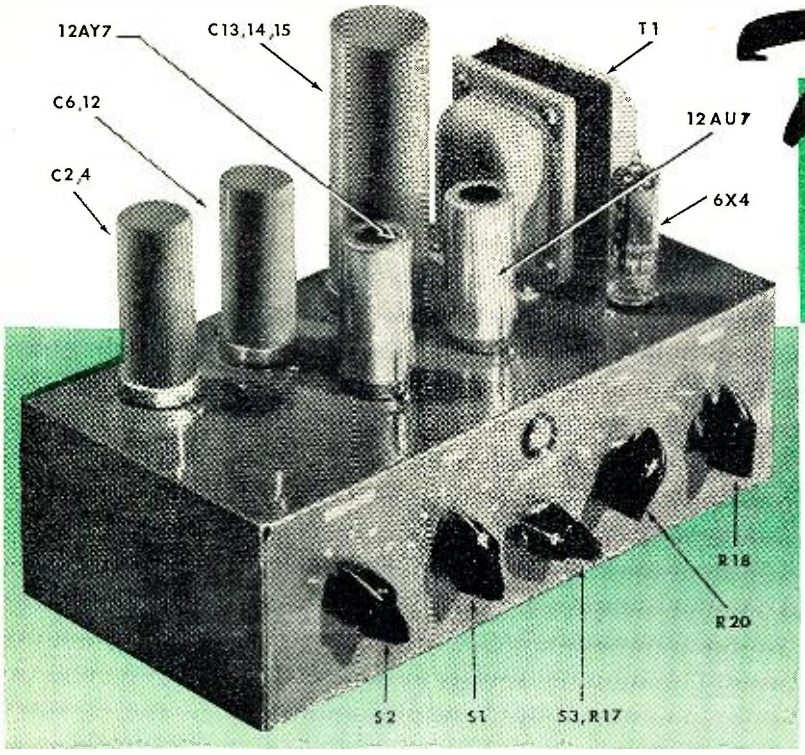


Fig. 1. Front panel view of the RADIO & TELEVISION NEWS equalizer-preamplifier. The most important above-chassis components are labeled. See the circuit diagram, Fig. 3, for identification of these components.

The RADIO & TELEVISION NEWS Preamp

Design and construction data on a complete "front end" to be used with any high-fidelity audio amplifier.

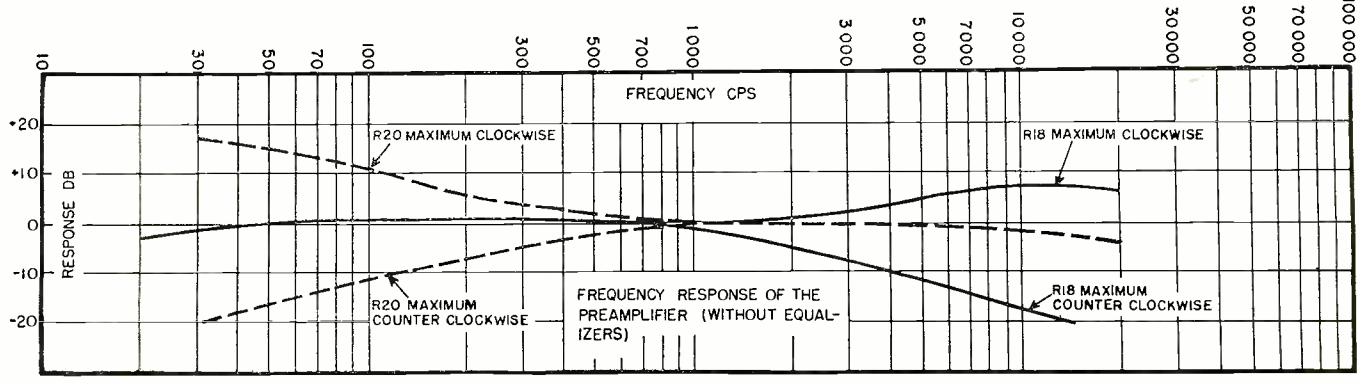
A SMALL equalizer-preamplifier, intended for use with an amplifier incorporating its own gain and tone controls, has been described in previous issues of RADIO & TELEVISION NEWS. Judging from reader response, the performance of this unit has been more than satisfactory. There have, however, been a number of requests for a preamplifier to be used with the sort of amplifier, typified by the *Williamson,* which has recently attained a good deal of popularity but which has no signal-modification controls of its own. With such an amplifier, the preamplifier must include not only proper equalization for the various types of discs, but also the volume control, tone controls, and any other signal-modification stages that may be desired. The design of a preamplifier which fulfills the requirements of most users was the object of the work described here. The resultant unit is shown on this month's cover.

The previously-designed unit has been chosen as the basis for the new preamplifier because of its generally adequate performance. With a 10-mv. input that unit could deliver a maximum of .36 volt, but by accepting an output of only .20 volt, improved bass response might be obtained. The additional stages must thus be able to increase this .20-volt signal to 1 to 2 volts, required for most commercial power amplifiers, as well as modify it by tone and volume controls.

Because the tone control is required to handle signal voltages of relatively small magnitude without introducing noise, the degenerative circuit previously described[4] is not especially suitable. Instead, an excellent circuit of the type described by Fidelman[5], which appears to be derived from previously-published circuits, has been chosen. The range of bass and treble boost and cut obtainable with this arrangement can be seen from the frequency-response curves appearing in graph below. With this control, the total amount of variation between full cut and full boost at a given frequency (rather than the amount of boost or cut from the "flat" position) is determined by the circuit constants. This means that the midposition of the control rotation does not necessarily correspond to flat response. Thus, in the original amplifier it will be noted that the amount of treble boost is quite limited whereas the treble cut is perhaps unnecessarily great. This may be caused by inaccuracy in the taper of the treble control or in the values of the condensers used in the treble-control circuit. This points up the greatest shortcoming of the circuit, namely, that the position of the controls for "flat" response is quite sensitive to errors in component values.

The reason for this sensitivity is that in the "flat" position the condensers and the control form two complementary non-frequency-discriminating voltage dividers; since the resistance of the lower section of the control is ⅛th the resistance of the upper section

Fig. 2. Frequency response of the preamplifier without equalizers in the circuit. The response will vary somewhat with these incorporated.



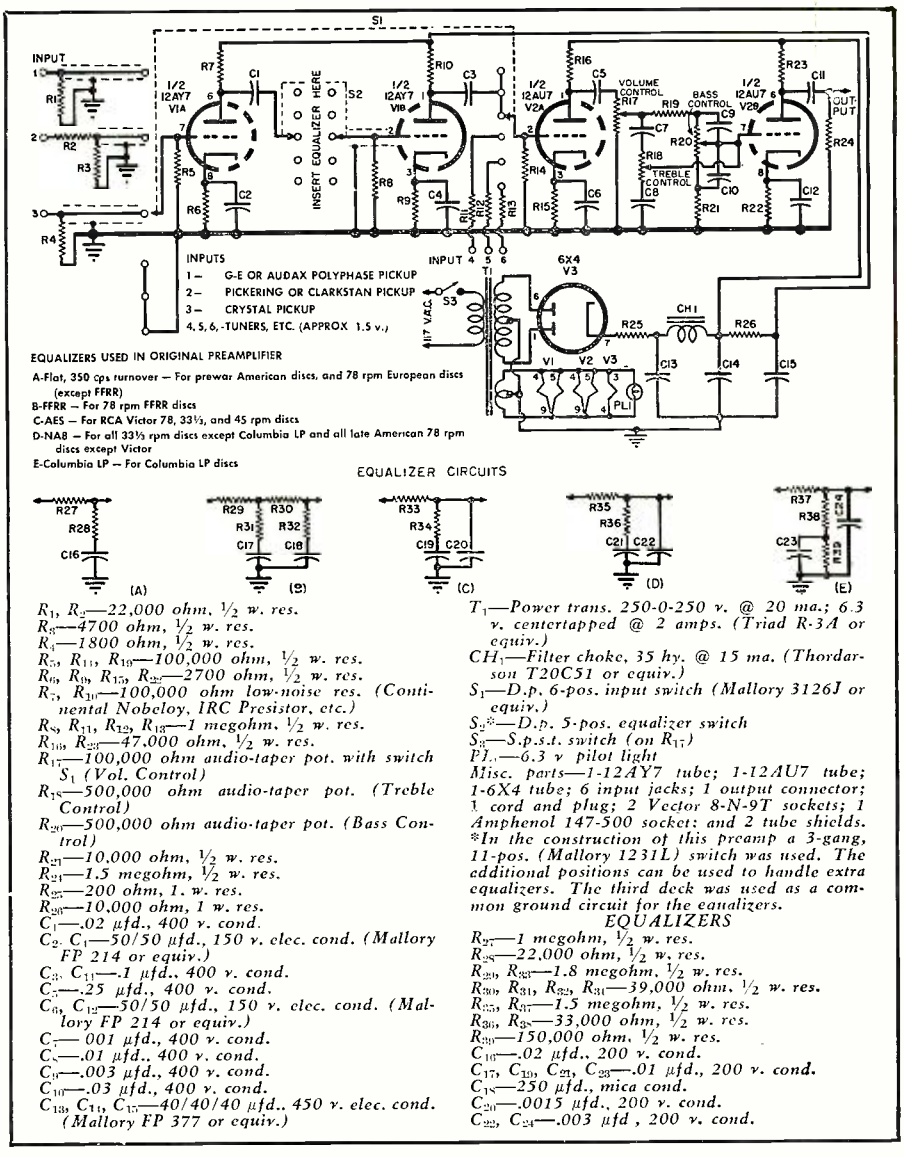
when the slider is in midposition, presumably the reactance associated with the lower part should be 1/9th of that connected to the upper part. Commercial limitations make necessary a ratio of 10 to 1 instead of 9 to 1 which initially causes some departure from the control midposition for flat response. Inaccuracy in the condenser value and control taper can, however, aggravate this error, as well as accidentally compensate for it. We may obtain an idea of the relation between midposition error and condenser error by using an approximate equation for the audio-taper control resistance: $R = \alpha^{3.3}$ where R is the fraction of total resistance and α is the fraction of total rotation. By differentiating the expression we obtain another for $d\alpha$ in terms of dR:

$$d\alpha = \frac{dR}{3.3\ \alpha^{2.3}}$$

and we find that an error of 20% in the value of the large condenser, requiring a compensating rotation amounting to almost 20% of the resistance of the control, is equivalent to a movement of 0.3 revolution from the midpoint of the control. For this reason it is desirable, when using this type of control, to set the "flat" position with the aid of any of the customary means of measuring frequency response. Naturally, any deviation from center position for flat response affects the maximum boost and cut available.

The circuit diagram of the unit and its parts list is given in Fig. 3. The volume control is quite conventional, and is located in conjunction with the tone controls in such a manner that the signal level through the preamplifier is always maintained at a relatively high level. In this way, hum and noise are held to a minimum relative to the signal and excessive precautions against hum pickup in the wiring are largely obviated. It will be noted that the resistance of the control is rather low, which is necessary to permit the tone controls to function properly.

There has been a recent tendency to replace three controls, namely, bass, treble, and volume, with a single so-called "loudness" control in which the frequency response is varied with the signal level in such a manner as to compensate approximately for the variation in the ear's sensitivity with changing volume. This is not a desirable substitution for several reasons: In the first place, no provision is made for adjustment of the frequency response to compensate for recording- and playback-room acoustics. In addition to this, the effect of playing two recordings of the same performance, identical in every respect except the recording level, should be considered; the playback from both discs should sound identical but this will certainly not be the case with a "loudness" control. Such a loudness control may, of course, be used in conjunction with the customary bass and treble controls but this seems to be needless duplication; a brief consideration also shows that the standard volume control is still necessary when a "loudness" control is used. In the unit under consid-



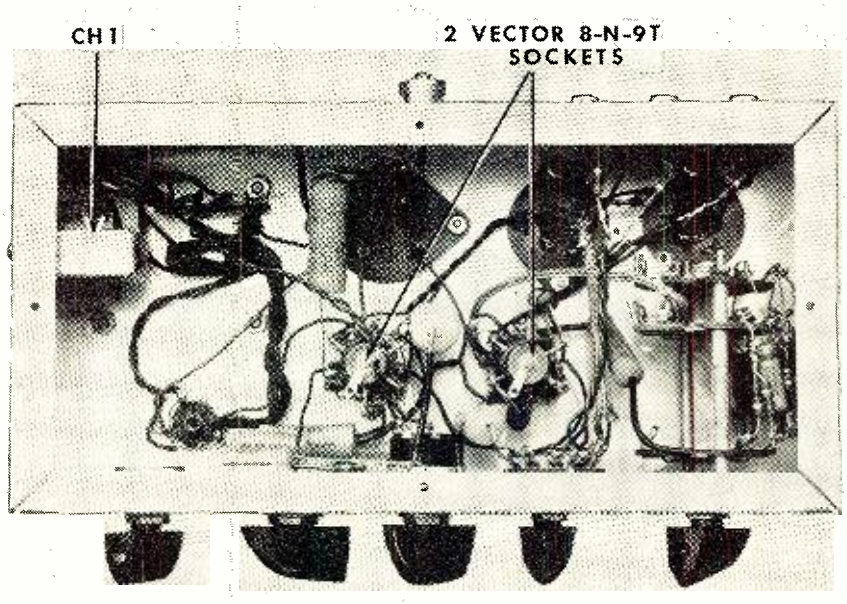
R_1, R_2—22,000 ohm, ½ w. res.
R_3—4700 ohm, ½ w. res.
R_4—1800 ohm, ½ w. res.
R_5, R_{11}, R_{19}—100,000 ohm, ½ w. res.
R_6, R_9, R_{15}, R_{22}—2700 ohm, ½ w. res.
R_7, R_{10}—100,000 ohm low-noise res. (Continental Nobeloy, IRC Preistor, etc.)
R_8, R_{11}, R_{12}, R_{13}—1 megohm, ½ w. res.
R_{16}, R_{23}—47,000 ohm, ½ w. res.
R_{17}—100,000 ohm audio-taper pot. with switch S_1 (Vol. Control)
R_{18}—500,000 ohm audio-taper pot. (Treble Control)
R_{20}—500,000 ohm audio-taper pot. (Bass Control)
R_{21}—10,000 ohm, ½ w. res.
R_{24}—1.5 megohm, ½ w. res.
R_{25}—200 ohm, 1. w. res.
R_{26}—10,000 ohm, 1 w. res.
C_1—.02 μfd., 400 v. cond.
C_2, C_{14}—50/50 μfd., 150 v. elec. cond. (Mallory FP 214 or equiv.)
C_3, C_{11}—.1 μfd., 400 v. cond.
C_5—.25 μfd., 400 v. cond.
C_6, C_{12}—50/50 μfd., 150 v. elec. cond. (Mallory FP 214 or equiv.)
C_7—.001 μfd., 400 v. cond.
C_8—.01 μfd., 400 v. cond.
C_9—.003 μfd., 400 v. cond.
C_{10}—.03 μfd., 400 v. cond.
C_{13}, C_{15}, C_{16}—40/40/40 μfd., 450 v. elec. cond. (Mallory FP 377 or equiv.)
T_1—Power trans. 250-0-250 v. @ 20 ma.; 6.3 v. centertapped @ 2 amps. (Triad R-3A or equiv.)
CH_1—Filter choke, 35 hy. @ 15 ma. (Thordarson T20C51 or equiv.)
S_1—D.p. 6-pos. input switch (Mallory 3126J or equiv.)
S_2*—D.p. 5-pos. equalizer switch
S_3—S.p.s.t. switch (on R_{17})
PL_1—6.3 v pilot light
Misc. parts—1-12AY7 tube; 1-12AU7 tube; 1-6X4 tube; 6 input jacks; 1 output connector; 1 cord and plug; 2 Vector 8-N-9T sockets; 1 Amphenol 147-500 socket; and 2 tube shields.
*In the construction of this preamp a 3-gang, 11-pos. (Mallory 1231L) switch was used. The additional positions can be used to handle extra equalizers. The third deck was used as a common ground circuit for the equalizers.

EQUALIZERS

R_{27}—1 megohm, ½ w. res.
R_{28}—22,000 ohm, ½ w. res.
R_{29}, R_{33}—1.8 megohm, ½ w. res.
R_{30}, R_{31}, R_{32}, R_{34}—39,000 ohm, ½ w. res.
R_{35}, R_{37}—1.5 megohm, ½ w. res.
R_{36}, R_{38}—33,000 ohm, ½ w. res.
R_{39}—150,000 ohm, ½ w. res.
C_{16}—.02 μfd., 200 v. cond.
C_{17}, C_{19}, C_{21}, C_{23}—.01 μfd., 200 v. cond.
C_{18}—250 μfd., mica cond.
C_{20}—.0015 μfd., 200 v. cond.
C_{22}, C_{24}—.003 μfd , 200 v. cond.

Fig. 3. Circuit diagram of preamp and the associated equalizer circuits.

Fig. 4. Under chassis view. By spacing parts, hum difficulties are eliminated.



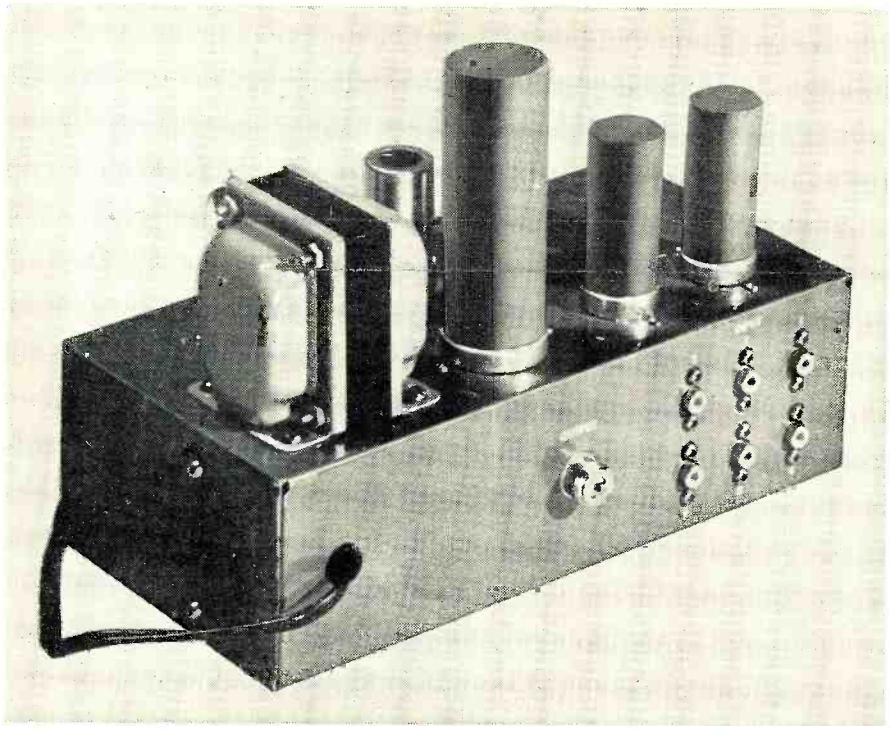


Fig. 5. Rear view of preamp. See parts list, Fig. 3, for identification of input jacks.

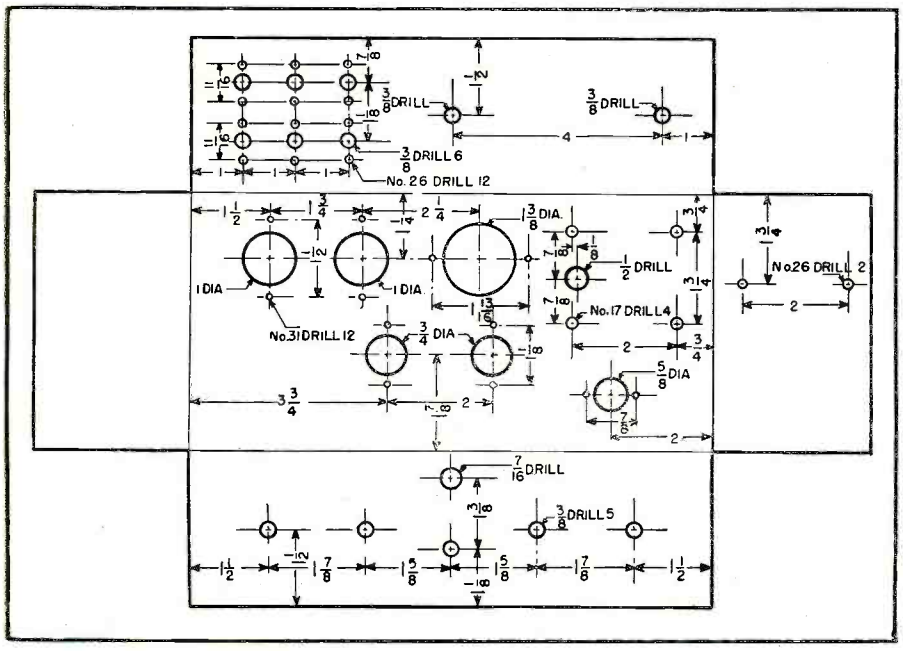
eration, a single audio-taper volume control is consequently employed.

The two final stages of the preamplifier use a 12AU7 twin-triode with cathode bias and relatively small grid resistors; the grid resistors of all stages throughout the unit are kept at low values to minimize hum pickup. The plate resistance of this tube is approximately 7000 ohms and because of the circuit arrangement, this is the output resistance of the preamplifier unit. The length of connecting cable that can be used between the preamplifier and the main amplifier depends upon the input capacitance of the latter unit, but no trouble should be experienced with lines up to 8 feet long. As a matter of fact, the danger in the use of long lines lies in the possibility of hum pickup rather than in detriment to the frequency response. For long lines, a good plate-to-line transformer can be used to reduce the output impedance of the preamplifier. Cathode followers should generally be avoided in low-level audio stages because they introduce relatively large amounts of hum unless d.c. is used on the heaters, which introduces other complications.

The unit described employs five equalizers chosen from the previously-published table[3] and for which details are given in Fig. 3. These equalizers cover 90% of the needs of most record collectors. While the selector switch shown in the diagram of Fig. 3 incorporates the minimum number of positions, should additional ones be required a switch with the desired number of contacts can be substituted. In the original circuit an 11-position switch was used and is the one shown in the photographs of the preamp.

This circuit is also equipped with six inputs, three of which are for phonograph and three for high-level signals such as tuners or preamplified tape recorder input. Of the three phonograph inputs, one has been designed for a *General Electric* or *Audax* cartridge, another for a *Pickering* or *Clarkstan* pickup, and the third for crystal pickups of the types commonly encountered. These inputs should be altered by the individual constructor to suit his own equipment. It should be noted that the crystal cartridge is loaded by a resistor of very low value, which makes the cartridge velocity-responsive (as is required for the subsequent equalizers) and greatly improves the bass response and overall distortion as compared to constant-amplitude arrangements.

Fig. 6. Scale drawing of the chassis cutouts for use with the specified parts.



Construction

The entire preamplifier may be compactly mounted on a 5" x 10" x 3" chassis. Fig. 6 shows sizes and possible locations of the holes required if the specified parts are used. If other arrangements are employed it is well, in the interest of hum reduction, to space the power transformer as far as possible from input stages, particularly from the equalizer switch. The greatest difficulty to be encountered in the construction of a preamplifier with integral power supply is the pickup of hum from stray a.c. fields.

Hum is minimized by shielding low-level grid leads. The lead from the equalizer switch output to the second-stage grid is particularly critical in this respect and should be as short and well-shielded as possible. Heater wires should be twisted and kept away from the chassis and from grid leads. The point at which the 6.3 volt winding centertap is grounded will have some effect on the hum level. In the original unit this tap is grounded very near the power transformer. The power transformer specified in the parts list (*Triad*) is designed especially for preamplifier service and has a low flux-density core. It is important to space the 117-volt leads going to the switch on the volume control well away from the tone controls. It may prove desirable to shield these 117-volt leads.

The preamplifier must be located sufficiently far from the phono pickup to prevent hum. In general, hum having the character of 120-cps buzz will be found to be caused by improper lead placement or shielding with respect to a.c. lines; inductive hum pickup from the power transformer is a relatively pure 60-cps note.

The hum level can be markedly reduced by locating the power supply

(*Continued on page* 96)

MOBILE RADIO

By

LEO G. SANDS

Bogue Railway Equipment Division

Motorola's "Uni-channel Sensicon Dispatcher," being tested, is operated at the company's Phoenix Radio Service on a 20 kc. channel spacing instead of usual 60 kc.

Part 3. A discussion of some of the unusual installation problems encountered and practical ways of solving them.

THE planning of mobile radio systems has evolved into a relatively simple matter because the installation technician or engineer can draw on the great backlog of experience of his predecessors. Naturally, new problems still arise which require ingenuity.

The first step in planning a mobile radio system is the determination of the necessary communications range. It is desirable to provide adequate coverage but it is often detrimental to others to install the equipment in such a manner as to radiate signals to areas beyond the required range, causing unnecessary interference. A topographic map of the area is a great aid in preliminary planning. The range of a v.h.f. mobile radio system is governed mostly by the height of the base station antenna above surrounding terrain. The range is also governed by transmitter power but to a far lesser degree than by antenna height and receiver sensitivity.

For example, if it is determined that communication within a radius of 10 miles from the base station is necessary, a convenient horseback estimate of required base station antenna height is 90 feet. Often this height is more than adequate although under some conditions, greater antenna height is necessary to obtain solid communication to all points within the 10 mile radius.

At v.h.f, it is generally considered that somewhat greater than line-of-sight conditions prevail. However, solid objects reflect the signals into such areas as under bridges, between buildings, canyons, etc. In the 152 to 162 megacycle band, reflections aid greatly but at 450 megacycles even greater benefit is derived from reflections. It has been demonstrated that communication has been extended to areas when operating in the 450 megacycle band where 152 megacycle signals could not be received.

Fig. 1. The transmitting conditions which prevail when community is located in valley and coverage over a bowl-shaped area is desired. See text for location details.

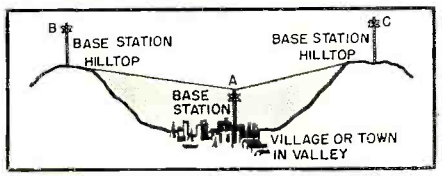
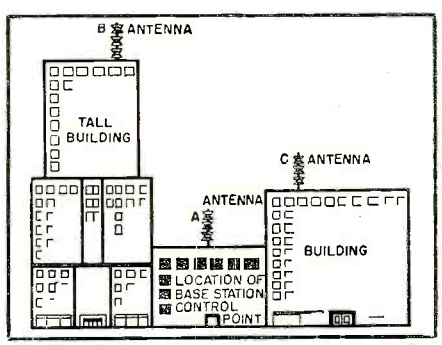


Fig. 2. Optional locations for the base station antenna. Text covers alternatives.



The maximum attainable range is greater in the 25 to 50 megacycle band than in the 152 to 162 megacycle band and the maximum range in the 450 megacycle band is still less. However, the improved reflection characteristics of the higher frequencies generally provide more solid communications within a shorter radius. Likewise, as less noise and static are encountered at the higher frequencies, weaker signals may be tolerated.

The base station generally utilizes a more powerful transmitter than the mobile units. The power output of the mobile unit is limited by space, weight, and the capacity of the vehicle's electric power system. The base station receiver often provides greater effective sensitivity than the mobile receiver because of the greater antenna height and relatively constant electrical noise conditions. The mobile units, on the other hand, move about in and out of high noise areas, therefore, the differences in power and antenna heights provide approximately the same range when talking out from the base station as when talking in from a mobile unit.

Fig. 1 illustrates a condition where the community to be covered is located at point "A"; communication can be expected within the bowl formed by the surrounding hills. If located at points "B" or "C", the community will be covered and the range will be extended to areas far beyond the desired limits. Although greater coverage is obtained, it is possible that the base station receiver will pick up unwanted signals on the same frequencies as mobile systems operating in other communities.

If the control point is to be located at point "A" and the need for extended coverage dictates that the base station be located at point "B" or "C", it will be necessary to provide a remote control line between points "A" and "B." In established communities it is

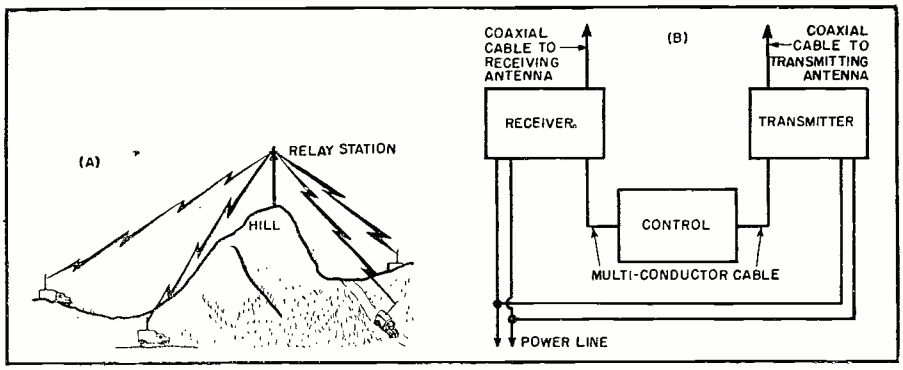
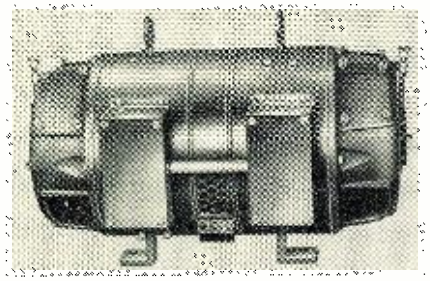


Fig. 3. (A) Using a mobile relay station to provide extended communications range between mobile units. (B) Conventional hook-up for a mobile radio relay installation.



A d.c. to a.c. motor generator set for use as emergency power supply or for converting d.c. to a.c. in areas where normally only direct current service is available.

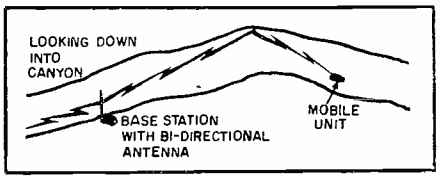


Fig. 4. How canyon walls are utilized to extend the range of mobile radio equipment. This is the type of transmission used by the Milwaukee Road for its two-way system when trains are passing through mountains.

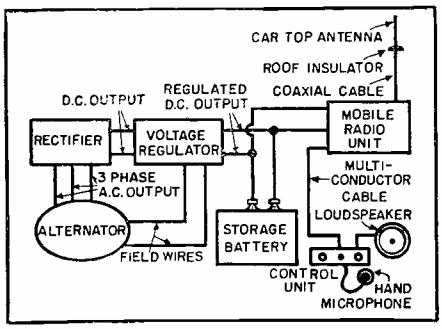


Fig. 5. Mobile unit hook-up using alternator-rectifier generating system. See text.

generally not feasible to run private wire lines across thoroughfares so it will be necessary to lease wire facilities from the local telephone company to join points "A" and "B" or "A" and "C." Although one pair of wires simplexed to ground will provide the required facility, it may be necessary, because of tariff regulations, to lease two circuits, one for carrying the audio signal and the other for control purposes.

If the base station is to be located near the control point as illustrated in Fig. 2, the antenna may be installed at points "A," "B," or "C." Because of the greater height, point "B" will probably provide the greatest range. If the base station equipment is located at point "A," it will be necessary to run coaxial cable or hollow transmission line from the base station to the antenna at location "B." If the distance between the antenna and the base station equipment runs as much as 200 feet, it may be preferable to install the base station equipment adjacent to the antenna and make use of a remote control line between the base station unit and the control apparatus.

In some areas, it is necessary to provide communications between a base station and mobile units behind large obstructions or inside curving canyons definitely not in line-of-sight or a reasonable facsimile thereof.

This problem was encountered by the *Chicago, Milwaukee, St. Paul & Pacific Railroad* while testing radio in the Cascade Mountains in the State of Washington. Huge mountains projected into the signal path between the base station and radio equipped trains. Irley Morrison, *Bendix Radio* field engineer, and Elmer Muckerheide, *Milwaukee Road* telephone engineer, solved the problem by using directional antenna arrays aimed at a wall of the canyon. The radio signals were literally bounced off the mountain wall down the canyon to the mobile units.

Normally, direct communication between mobile units is limited to a few miles because both antennas are close to the ground. Where considerable mobile unit-to-mobile unit range is required and in services where permitted by FCC rules, a relay station may be used to pick up and relay signals from one mobile unit to another. Two radio channels are required. By installing the automatic relay station at a high location and by employing a tall antenna support, ranges of 30 or more miles between mobile units can be attained.

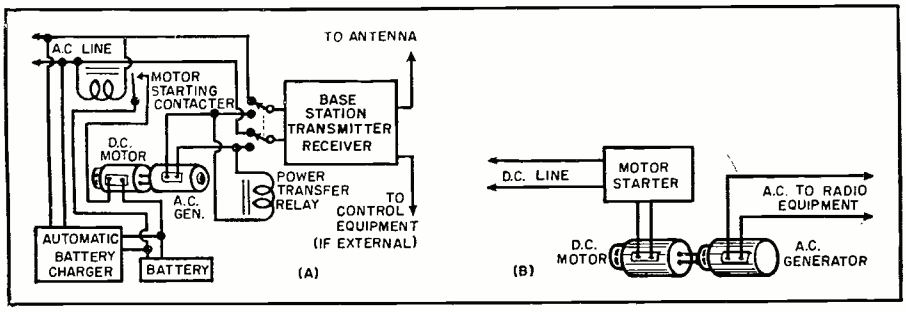
Reliable electric power is of course required at base stations to provide maximum service. In cities and towns, the source of electric power is generally very reliable and does not present a serious problem. However, if the mobile radio system could be of value in emergencies or disasters, an emergency power source is worth considering.

The most common type of emergency power supply is the engine driven generator with or without automatic starting and load transfer facilities. Another type of emergency power supply system developed by the engineers of the *Bogue Railway Equipment Division* for microwave applications provides an uninterrupted flow of power to the radio apparatus. It makes use of two motors, one a.c. and one d.c., direct connected to an a.c. generator. The radio apparatus always receives its power from the generator, never direct from the line. The a.c. motor is powered from the line and rotates both the generator and the floating d.c. motor. In event of power line failure, the d.c. motor is automatically connected to a standby battery and takes over as driver of the generator. When power is restored, the a.c. motor is again connected to the line and the d.c. motor is disconnected from the battery.

In mobile radio services where momentary interruptions of power can be tolerated, the simple emergency power system shown in Fig. 6 will suffice. Power for the radio apparatus is normally supplied from the line. When utility power fails, the motor contactor starts a d.c. motor which is direct connected to an a.c. generator. When the generator voltage has reached normal, the power transfer relay transfers the load from the line to the generator output. Restoration of power causes automatic disconnection of the d.c. motor from the standby battery and transfer of the load back to the line.

In some localities where the available power is unreliable or poorly regulated, a motor generator set may be utilized to provide continuous and regulated power. As shown in Fig. 7, the line provides power to an automatic

Fig. 6. (A) Emergency power supply system for base station with automatic cut-in and cut-off. (B) Power supply system for base station installed in a d.c. power area.



battery charger which, in turn, operates a d.c. motor. A storage battery is floated across the charger-to-motor feed line. The d.c. motor drives an a.c. generator which provides power for the radio apparatus. In case of power failure, the motor generator continues to run in a normal fashion, deriving power from the battery until the battery is exhausted or power has been restored.

Power for a mobile radio unit installed in a motor vehicle is generally derived from the electrical system of the vehicle which consists of a storage battery, voltage regulator, and a generator coupled to the engine. In most vehicles, 6 volts d.c. is available while in many trucks and buses, 12 volts is available.

The original generator provided with the vehicle is designed to take care of the normal load consisting of lights, ignition, and radio receiver. When mobile radio is added, the original generator may or may not be adequate. If the vehicle is operated at fairly high speeds most of the time, the generator may provide sufficient power to keep the battery charged.

In services where the mobile unit is left on for long periods with the vehicle standing still or traveling at very low speeds, a larger generator and battery may be required. A d.c. generator of greater capacity or an alternator-rectifier type charging generator system may be installed in place of the original generator. In some cases, replacement of the generator pulley with one of smaller diameter might do the trick by providing higher charging current at lower engine speeds.

In some installations it may be desirable to install an additional battery, either in parallel with the regular battery, or connected through a cut-out to the generator.

The radio equipment in the latter case is powered from the additional battery, leaving the regular battery for its normal service of furnishing headlights, starter, and standard accessories.

In this manner, there is little likelihood of battery failure due to too great a drain from the radio equipment. The additional battery should be of large capacity.

Complete instructions for installation of the radio equipment in a vehicle are nearly always provided by the manufacturer in printed form or through personal supervision. Unusual vehicles sometimes present problems and in many cases it is necessary to provide a protective covering for the radio equipment if it cannot be installed in the trunk of the vehicle or if no trunk exists.

Many types of antennas are available for base station applications and there are many opinions as to which is best. Much depends upon the requirements of the specific application. Most mobile radio manufacturers either manufacture or distribute antennas designed to provide excellent performance with their equipment. This is not to say that good performance cannot be obtained when using an antenna not specifically recommended by the mobile radio equipment manufacturer.

Antennas are being offered which provide effective power gain. This is the cheapest way to increase effective transmitter power and receiver sensitivity because the antenna requires no maintenance. An antenna with a gain of 3 db over a half-wave dipole doubles the effective radiated power of the transmitter.

Base station antennas are designed to be fed through solid dielectric coaxial cable or hollow transmission line, either air or gas filled. Most antennas are designed to match 52 or 72 ohm lines, depending on the type of antenna. The choice between coaxial cable and hollow line depends largely on personal preference, length of run, installation conditions, and operating frequency. Both types have strong adherents.

The flexible type coaxial cable has the advantage of flexibility and requires no maintenance and, consequently, is to be preferred in the majority of cases.

The hollow type of transmission line must be air and gas tight, with a constant gas pressure maintained. Gauges must be installed, and moisture carefully removed to prevent arc-over within the cable. In view of these additional requirements and precautions, the use of this type of cable is normally limited to installations having a relatively high transmitted power output.

Mobile antennas are generally designed for installation on the roof of the vehicle, on a rear fender, or on the bumper. Most are vertical whips, approximately one-quarter of a wavelength in height, utilizing the vehicle roof or body as a ground plane. Coaxial cable is used to interconnect the mobile antenna with the mobile transmitter-receiver unit.

Mobile radio system antennas are designed for vertical polarization as contrasted with horizontal polarization employed in FM and TV broadcasting. Experiments conducted with horizontal as well as circular polarization, a combination of vertical and horizontal, in mobile applications produced interesting results. Because of several factors, including convenient antenna design, vertical polarization has remained standard.

(To be continued)

Mobile radio installation on railway caboose. Communications unit containing the transmitter, receiver, and power supply in a single package is mounted on lower shelf, junction box on top shelf, and regulator for axle-driven generator on locker wall.

Base station control unit. Loudspeaker is built into the telephone base. On receipt of a call, the operator picks up handset and uses radio in the same manner as a regular telephone except that a press-to-talk button on the handset is actuated when talking and then released when listening.

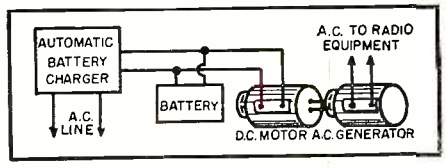
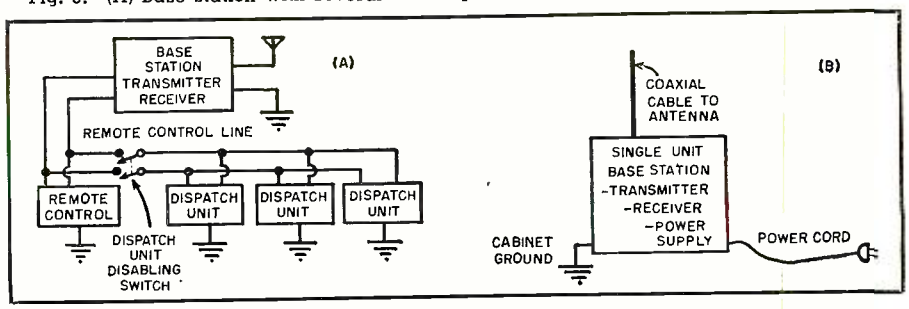


Fig. 7. Power supply for a base station installed in an area where available power is unreliable or else poorly regulated.

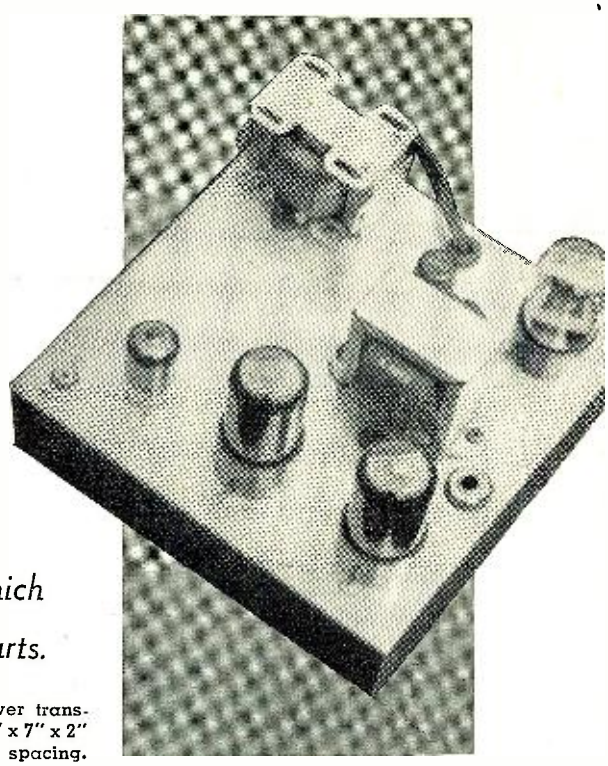
Fig. 8. (A) Base station with several control points. (B) Packaged base station hook-up.



AN ECONOMY AUDIO AMPLIFIER

By
GEORGE PHILACTOS

Details on a simplified "Williamson"-type unit which can be built from inexpensive and non-critical parts.



Top chassis view of the "power transformerless" amplifier. The 7" x 7" x 2" chassis permits correct parts spacing.

HERE is a compact, low-cost amplifier that will give surprisingly good results. As the total power input is approximately 30 watts, this amplifier can be operated for hours with a minimum of wasteful heat dissipation and at low operating cost.

Sufficient gain is available to operate from a crystal-type phono pickup or from an AM or FM tuner. The amplifier was designed and built by the author for use with a crystal-type pickup to enable the junior member of the household to play children's records.

It was decided to build the "best" little amplifier that the "state of the art" would permit at minimum initial cost and minimum operating expense. It was assumed at the outset that the young operator would, at times, leave the player on for long periods of time.

A power transformer was deemed unnecessary and it was decided to design around the "a.c.-d.c." or "power transformerless" type of hookup. Since good quality was a prime requisite (along with low cost), the Williamson amplifier circuit was studied and compared with typical a.c.-d.c. audio amplifier circuits. Several tube combinations were checked in the tube manuals with the final product being built as shown in the circuit diagram of Fig. 1.

This amplifier was based upon the use of a 35L6 beam power tube as a triode-connected, class A operated amplifier. Power output for triodes in push-pull can be calculated by using the formula:

$$Power\ output = (I_{max} \times E_o)/5$$

For an operating plate potential (E_o) of 200 volts, I_{max} equals 125 ma. Substituting 200 for E_o and .125 for I_{max}, a power output of 5 watts is obtained.

The proper plate-to-plate load resistance for triodes in push-pull can be determined from the formula:

$$Plate\text{-}to\text{-}plate\ load = 4(E_o - .6\ E_o)/I_{max}$$

Substituting 200 for E_o and .125 for I_{max}, a plate-to-plate load resistance of 2560 ohms is obtained.

The grid bias for class A operation is equal to one-half the grid bias for plate current cut-off with a plate potential equal to 1.4 times E_o. For a 35L6 triode-connected at a plate potential of 280 volts ($1.4 \times E_o$) cut-off bias equals minus 50 volts. One-half this value equals minus 25 volts. Under operating conditions of a plate potential of 200 volts positive and a grid bias of 25 volts negative, a triode 35L6 will draw a plate current of approximately 25 ma. The plate dssipation (grid #2 connected to plate) will be equal to $200 \times .025$ or approximately 5 watts for each tube. This value of plate dissipation is well under the maximum rated plate dissipation for this type of tube which indicates that long tube life may be expected.

The plate dissipation for the two output tubes will be approximately 10 watts. With a calculated power output of 5 watts, it can be seen that the plate circuit efficiency of beam power tubes triode-connected and operating in class A at comparatively high plate voltage is surprisingly high. This may be an important consideration in the design of the new commercial amplifiers using beam power tubes in the output stages as triode-connected class A power amplifiers (807, KT66, etc.).

A d.c. supply of 225 volts will be necessary to obtain the 200 volts of plate potential and the 25 volts of cathode bias. A voltage doubler is used with a half-wave vacuum rectifier type 35Z5GT and a 100 ma. selenium rectifier. One side of the a.c. supply is common to the negative side of the d.c. supply. This is desirable in order to minimize hum difficulties in high gain audio amplifiers. In this amplifier the 12AU7 heater is on the side of the a.c. supply which is common to the d.c. supply negative. The two 35L6GT electron tubes are next, in series with the half-wave rectifier 35Z5GT at the other end of the a.c. supply. The heaters of the four tubes in series equal 117.6 volts at .15 ampere; an efficient transformerless heater hookup.

At this point it should be noted that the half-wave vacuum rectifier has a potential difference of approximately 120 volts d.c. between the heater and cathode. This type of tube is rated at a maximum peak heater-to-cathode voltage of 350 volts and should idle along with a heater-to-cathode potential difference of 120 volts d.c. The resistor, R_s, functions as a voltage dropping resistor so that a "B" and "C" supply voltage of 225 volts is obtained with a load current of approximately 55 ma. R_s also functions as a surge-limiting resistor for the selenium rectifier.

The potential across C_7 builds up gradually as the cathode in the half-wave vacuum tube rectifier comes up to operating temperature. In this manner the full operating plate voltage is applied to the amplifier tubes when they have reached operating heater temperature. This will insure maximum useful cathode emission life.

Negative feedback is employed from the voice coil back to the cathode circuit of the input section of the 12AU7. Approximately 60 per-cent of the input-stage cathode resistor is bypassed by condenser C_1. The negative feedback voltage is developed across the unbypassed section of the first-stage cathode resistor. This was done in order to obtain maximum gain in the input

stage with maximum negative feedback in the three-stage feedback loop. The feedback resistor, R_{13}, has a value of 2700 ohms and has been determined on a basis of negative feedback over the three stages, resulting in a gain reduction of 9 db at 400 cycles when the output is terminated in an 8-ohm load. The unbypassed section of the input amplifier cathode resistor provides a gain reduction of 1 db at 400 cycles. This results in a total of 10 db of negative feedback, 9 db over a three-stage loop (including the output transformer) and 1 db over a one-stage loop.

The output transformer should have an impedance ratio of 3000: 8. The primary winding should have a centertap for push-pull operation. A *Stancor* Type A-3852 universal output transformer or its equivalent will be adequate. When using the A-3852 transformer observe the connections as shown on the circuit diagram. When using other audio output transformers positive feedback may be obtained if the feedback voltage differs by 180 degrees. When turning the amplifier on for the first time, if oscillation is experienced reverse the two plate leads to the 35L6GT tubes.

Although this transformer is rated at 4000 ohms primary impedance, the performance was entirely satisfactory as used. It is possible that the constructor can find a stock transformer to give the exact match if a more accurate match is desired.

In the event that a speaker with other than an 8-ohm impedance is used, the eight ohm tap should still be used for the feedback. The proper taps to match the speaker used should still be connected to the speaker.

The phase inverter is of the split-load type, R_6 and R_9 being matched resistors. Out-of-phase drive voltage for the push-pull grids is obtained from the plate and cathode of the driver stage.

The amplifier was built on a 7" x 7" aluminum chassis which measured 2" high. The input stage is at one corner of the chassis away from the rectifier tube in order to minimize hum pickup. Shielding the 12AU7 was found to be unnecessary. An *RCA* type of phono jack is mounted close to the 12AU7 input grid. This jack is mounted in such a way that it is insulated from the chassis. As one side of the a.c. supply is common to the input grid-return circuit and d.c. negative, a.c.-d.c. precautions should be observed.

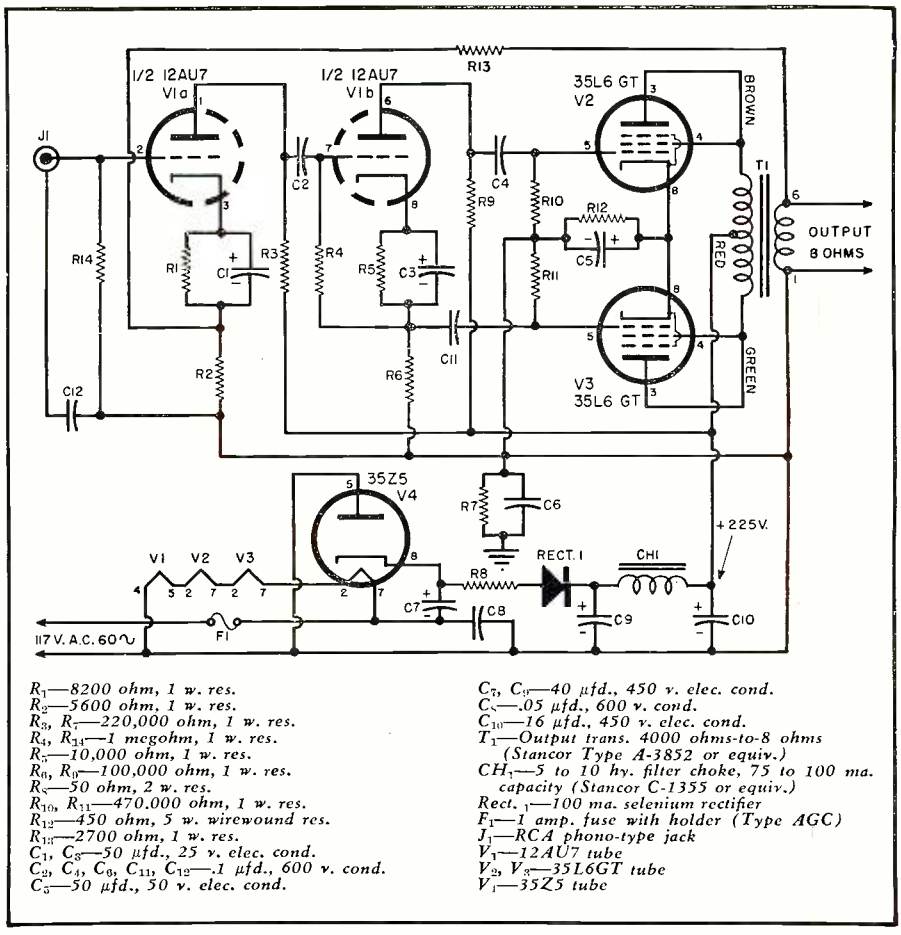
The ground side of the input jack is isolated from the a.c. line by means of condenser C_{12} but there is still enough voltage present at the jack to cause a slight shock when the line plug is inserted incorrectly.

If the amplifier is enclosed in a wooden or other non-conducting cabinet, there is little possibility of shock regardless of which way the line plug is inserted.

A 12" PM speaker having an 8-ohm voice coil impedance is used with the amplifier. No volume control was incorporated in the amplifier as this control is adjacent to the pickup arm, or is in the tuner. Likewise, no "on-off" switch was incorporated in the amplifier.

In the event that a volume control is wanted at the amplifier itself, R_4 may be made the control by substituting a one megohm pot. The arm of the pot. should go to the grid of V_{1b}.

An "on-off" switch can be inserted in the a.c. line, just to the left of the heater string.



R_1—8200 ohm, 1 w. res.
R_2—5600 ohm, 1 w. res.
R_3, R_7—220,000 ohm, 1 w. res.
R_4, R_{14}—1 megohm, 1 w. res.
R_5—10,000 ohm, 1 w. res.
R_6, R_9—100,000 ohm, 1 w. res.
R_8—50 ohm, 2 w. res.
R_{10}, R_{11}—470,000 ohm, 1 w. res.
R_{12}—450 ohm, 5 w. wirewound res.
R_{13}—2700 ohm, 1 w. res.
C_1, C_8—50 µfd., 25 v. elec. cond.
C_2, C_4, C_6, C_{11}, C_{12}—.1 µfd., 600 v. cond.
C_3—50 µfd., 50 v. elec. cond.
C_7, C_9—40 µfd., 450 v. elec. cond.
C_5—.05 µfd., 600 v. cond.
C_{10}—16 µfd., 450 v. elec. cond.
T_1—Output trans. 4000 ohms-to-8 ohms (Stancor Type A-3852 or equiv.)
CH_1—5 to 10 hy. filter choke, 75 to 100 ma. capacity (Stancor C-1355 or equiv.)
Rect. $_1$—100 ma. selenium rectifier
F_1—1 amp. fuse with holder (Type AGC)
J_1—RCA phono-type jack
V_1—12AU7 tube
V_2, V_3—35L6GT tube
V_4—35Z5 tube

Fig. 1. Circuit diagram of the "economy" amplifier. No power transformer is required.

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RCA Tube Manuals
Fleming, Lawrence: "Quality Amplifier for TV Sound," Radio & Television News. May, 1951
Fidelman, David: "Audio Simplified" (Part 6), Radio & Television News, February, 1952

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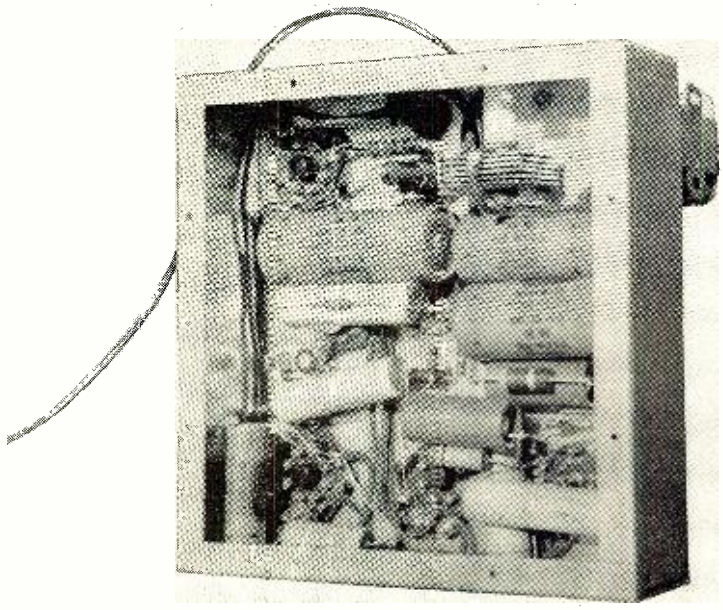
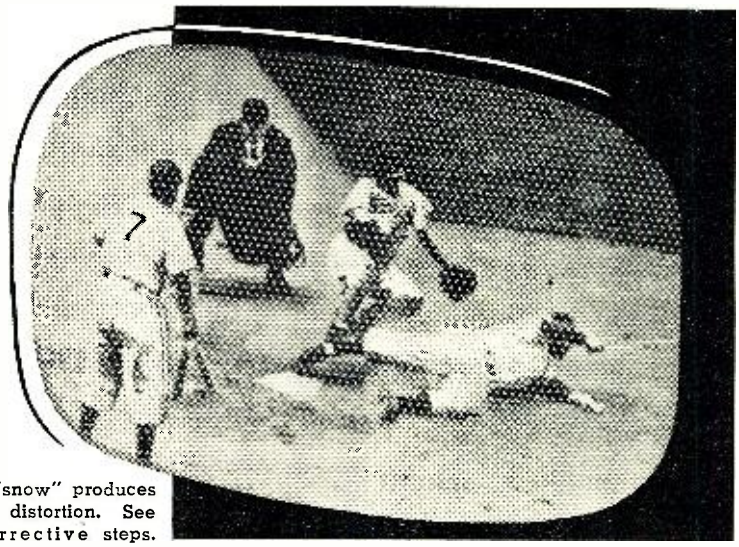
Under chassis view of the amplifier. A 7" x 7" x 2" chassis houses all parts.



TELEVISION "SNOW"

By
WALTER H. BUCHSBAUM
Television Consultant
RADIO & TELEVISION NEWS



Television "snow" produces this type of distortion. See text for corrective steps.

A review of sources of noise in TV receivers, circuits designed to reduce noise, and correct service procedures.

ONE of the most frequent topics mentioned in letters from readers concerns "snow" in the TV picture. It is mostly this phenomenon that limits the usefulness of TV sets in the fringe area and technicians fight a never-ending battle to reduce or eliminate "snow." This article, then, is designed to explain the sources and the nature of this trouble and show some means of alleviating it.

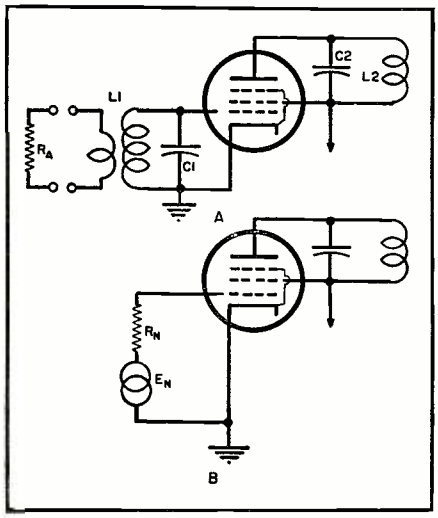
"Snow" appears when the picture signal is very weak and the signal-to-noise ratio becomes small. On broadcast radios it was "static" with its hiss and crackle that interfered with long distance reception. The same causes now appear as small white blobs on the TV screen. When the picture signal is only twice as strong as the static noise a signal-to-noise ratio of 2:1 is said to exist and the noise as well as the picture will be visible on the screen. This noise comes from two different sources: the atmospheric or static noise and the internal noise due to the circuits in the TV set. While we have no control over the atmospheric noise, its influence can be reduced by using an antenna which will pick up much more signal than noise. Matching the impedances of the antenna and the transmission line also helps to obtain more signal than noise. Once the signal reaches the receiver, however, nothing can be done to change the signal-to-noise ratio as it relates to external noise. The receiver itself adds some noise to the signal that is received from the antenna, making the final picture worse than the one actually received. In order to evaluate these different factors, engineers have agreed on a system for rating the signal at the receiver input and also for rating the noise contribution of the set itself.

Signal-to-Noise Ratio

Signal-to-noise ratio and other noise factors depend on the bandwidth and the gain of the antenna and receiver. This becomes apparent when we consider any tuned circuit and its selectivity. If the bandwidth is narrow, the gain at the resonant frequency will be many times higher than at the off-frequencies. Such a circuit will provide much more of the desired signal and less of the noise which comes in at different frequencies. As the bandwidth is increased, gain is reduced and more and more noise is accepted together with the signal. The gain of the signal itself becomes less and therefore its ratio to the noise also dwindles. In TV receivers a certain minimum bandwidth is necessary to get good resolution or picture detail.

As mentioned earlier, signal-to-noise ratio is measured by taking the average value of the signal and dividing it by the average value of the noise. This figure is often expressed in db and is applied mostly to antennas and matching networks rather than to the receiver itself. To find the noise contribution of the receiver the "noise factor" is used and this is always expressed in db. The noise factor is defined as the ratio of the noise due to the antenna radiation resistance to the noise due to the receiver alone. It may not be apparent, but any antenna has a radiation resistance which is reflected in the impedance of the antenna at the terminals. Any resistance causes noise due to the electron movement through it and the larger the resistance, the greater will be the noise. A 1 megohm carbon resistor, for example, produces quite an appreciable noise when as little as 1 ma. flows through it. Assuming that the antenna is fixed, the noise contributed by the receiver will depend on a number of factors. Grid resistors, mixer circuits, tubes, joints, and many other sources add up in the TV receiver to make the noise factor considerable. Tube noise depends, among other things, upon the plate voltage since much of it is due to the shot effect of electrons hitting the plate. To make matters worse, all of the i.f. and video amplifiers amplify the noise of the previous tubes along with their own contribution.

Fig. 1. (A) Basic television r.f. amplifier circuit, and (B) its equivalent circuit.



For purposes of calculation it is assumed that the i.f. and video sections are operated to contribute minimum noise and that the critical point is the r.f. amplifier with all the noise considered to have originated there. This is merely a convenient assumption which is good enough in most cases but does not preclude the other sections of the receiver as noise sources.

Fig. 1A shows the basic circuit of a typical r.f. amplifier as used in TV tuners. Fig. 1B is its equivalent circuit showing the noise generator E_N and its resistance R_N. Based on this equivalence, noise measurements are made. The simplest method of measuring noise factor utilizes a diode whose noise emission is regulated by the filament temperature which is controlled by the filament voltage. The receiver r.f. input is connected to the diode and the receiver output is measured first with the diode off. Then the diode is adjusted to double the measured noise output. Thus the noise output of the diode alone is equal to

that of the r.f. amplifier and can either be calculated from the diode temperature or measured directly on a properly calibrated meter. This, then, equals the noise contribution of the receiver. The noise due to resistance can be calculated and by setting up a ratio between the receiver noise and that due to a resistor of the input impedance, usually 300 ohms in TV sets, the noise factor is obtained.

For most commercial TV receivers the noise factor varies from 10 to 20 db with the higher value always occurring at the high end of the band where the r.f. amplifier is less efficient. It is interesting to note that in order to have ten times as much signal as noise at the picture tube the receiver noise factor must be 3 db if the TV signal is about 100 microvolts at the receiver input. If the noise factor is 15 db, an average figure, the signal must be 430 microvolts to give ten times as much signal as noise at the picture tube. One way of getting an approximate idea of the relation between signal and noise at the screen is to connect an oscilloscope to the output of the video amplifier and observe the amplitude of the noise and the signal. A typical scope pattern for a weak signal is shown in Fig. 3.

External Improvements

The best place to remove "snow" is at the antenna. What we said about tuned circuits and their bandwidth-gain relation to noise goes for the antenna as well. A broadband antenna cannot produce as good a signal-to-noise ratio as a narrow-band type. The gain of an antenna in db is usually a close approximation of the signal-to-noise ratio it will produce in an area where the TV signal is almost as weak as the noise. Where the signal is much stronger than noise, the "snow" problem rarely exists, so it is quite important in fringe installations to use narrow-band antennas, usually of the type designed for a single channel. To mention a few common antennas—the yagi (simple or stacked), rhombic, and double-V types give fairly good signal-to-noise ratios. Impedance matching is important since mismatch causes a much greater loss of the desired signal than of the noise. Details of transmission line and impedance matching appeared in the author's article, "Television Transmission Lines," in the May, 1952 issue of RADIO & TELEVISION NEWS.

The transmission lines themselves act as antennas for unwanted noise signals. In the May issue the possibilities of shielding and twisting lines were considered. All of these techniques help somewhat in keeping the noise at the receiver input to a minimum.

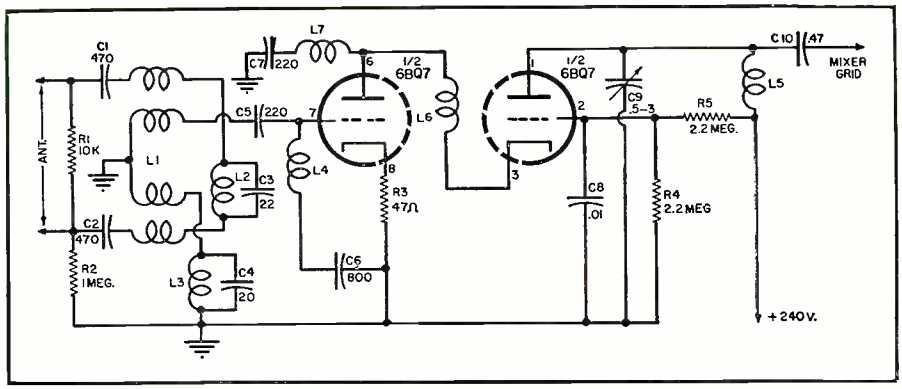


Fig. 2. Elaborate balanced input circuit which also provides FM interference rejection.

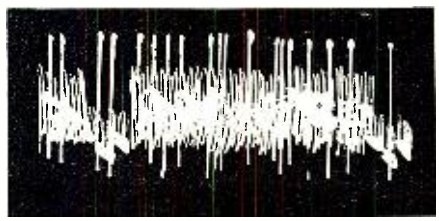


Fig. 3. Typical scope pattern of weak signal.

Receiver Improvements

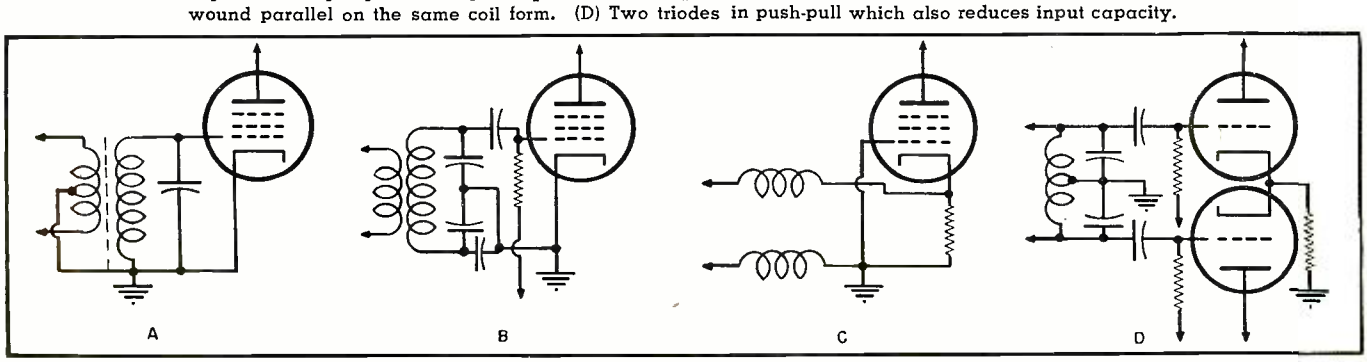
Since the most critical spot in the receiver is the r.f. amplifier, it seems the logical place to start when attempting to reduce noise. To keep noise due to the transmission lines down, balanced input is used in most TV tuners. Fig. 4 shows four common circuits used to provide balanced input. The theory behind these circuits is that noise picked up by the line will arrive at both ends of the line at the same instant but with opposite polarity and therefore cancel out when balance to ground exists. In Fig. 4A, an electrostatic shield (a conductor) is used to reduce capacitive coupling between primary and secondary, which would cause some unbalance. In Fig. 4C, the two input coils are wound parallel on the same coil form.

A more complicated version of this is the input circuit of Fig. 2, which also provides balanced input together with good FM interference rejection. Fig. 4D uses two triodes in push-pull which permits good balance and also reduces the input capacity.

Next to balance, the gain and input impedance of the r.f. amplifier are most important. Most pentodes have fair gain but require a rather high grid impedance to obtain that gain. This is equivalent to having a high value resistor in the grid and such a resistor generates a lot of noise. Putting the r.f. signal in at the cathode has some advantages since the impedance is low, but resonant circuits are broadly tuned, thus impairing the noise factor. Despite this, many manufacturers have used grounded-grid amplifiers where the signal was introduced at the cathode with good results. Of all practically applicable circuits the lowest noise factor is obtained from a cascode circuit, as shown in Fig. 2. To use this circuit in the TV band two new double triodes, the 6BK7 and the 6BQ7, have been developed and are now in general use. This circuit combines the advantages of grounded grid and grid input by using two triode sections in series. The first has conventional grid and cathode connections, but the plate is connected to the cathode of the second stage. The grid of the second stage is grounded for r.f. signals through C_8 and maintained at a fixed d.c. voltage through R_4 and R_5. The network, L_6, L_7, C_7, provides neutralization and some increase in gain on the high channels. Only coils L_4 (the grid) and L_5 (the output plate) are switched for

(*Continued on page* 145)

Fig. 4. Four common circuits used to provide balanced input. (A) Electrostatic shield used to reduce capacitive coupling between primary and secondary. (B) A balanced tank circuit. (C) Two input coils wound parallel on the same coil form. (D) Two triodes in push-pull which also reduces input capacity.



4 PROBLEM PREAMPS

By
GEORGE L. AUGSPURGER
Design Eng., Audio Research Laboratories

Construction details on four simple yet effective preamps which were designed to handle four fairly common problems.

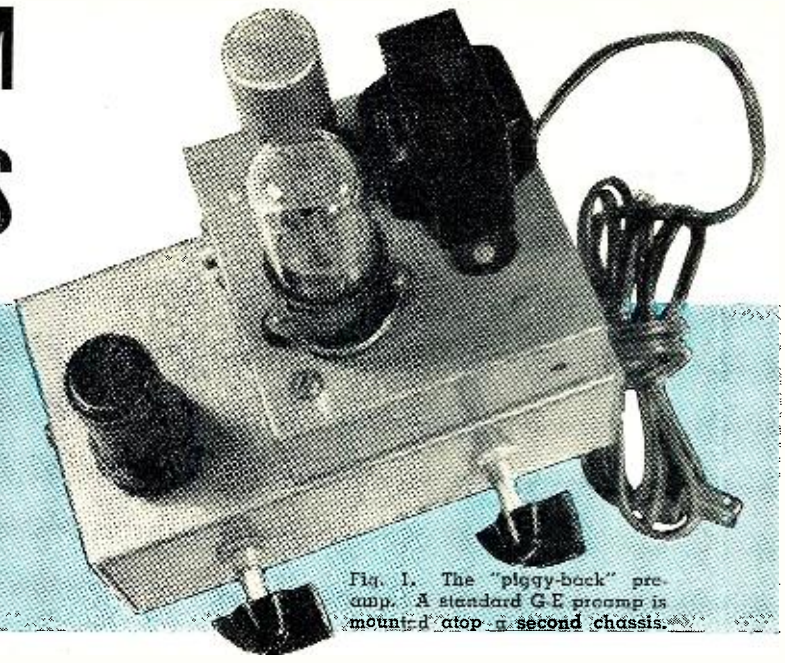


Fig. 1. The "piggy-back" preamp. A standard G-E preamp is mounted atop a second chassis.

SINCE the advent of the inexpensive reluctance pickup there has been a corresponding flood of circuitry for the necessary preamplification and equalization of the little gadgets. We have tried various brands of magnetic cartridges and numerous preamp circuits suggested by engineers and audiophiles. It didn't take long to discover that some of the designers had been listening through their slide-rules again. In the long search for circuits that *sounded* good, four designs were developed to fit specific situations. There is nothing in any one of these little devices to push the industry ahead ten years, but each one is simple and practical. And, darn it, they all sound good!

First Problem: A customer, maybe a friend of yours, has a pretty decent radio-phonograph. He has become interested in high fidelity but doesn't have a high-fidelity income. You have sold him a better speaker for his set and showed him how to enclose and acoustically treat the speaker chamber. When he'd scraped a little more money together, he had you install a reluctance cartridge and preamp for the record player. It sounds reasonably good now, but the radio has only a single tone control that doesn't do anything very worthwhile for his recordings. He wonders if you can't install separate bass and treble controls with the fifteen bucks he saved on last month's grocery bill.

When you get into a situation like this (and it happens again and again) you are usually under what is known as a moral obligation to try to make the guy happy with the money he's got. Your first impulse is to tear into the radio chassis and hope that you haven't lost too much money by the time you get done. Well, a little practice taught us that the moment you begin playing with a manufacturer's product, you run into all sorts of headaches—the chassis is in three sections, all interconnected, and it takes a half a day just to get it out of the cabinet; the present tone control is part of a complicated feedback loop and there isn't enough gain to install conventional equalizers without an extra stage—where are you going to find room for another control, and will the knob balance the rest of the knobs on the cabinet, and where are you going to find a knob to match those walnut, brass, and lucite monstrosities? As we said, little problems along the line are apt to arise, and the whole project develops into an exponential increase of time and work.

Now time is worth money, even in the sound business, and work is something to be avoided whenever possible, so it seems as if that first impulse had better be checked and a few other impulses thought out before the job is started. (Don't laugh—we went through all this more than once before we learned.) We finally worked out a simple little modification of the commercial *G-E* preamplifier which uses only about five dollars' worth of parts and takes only a couple hours to put together.

The circuit diagram is shown in Fig. 3 while the photograph of the finished unit is shown in Fig. 1. In order to get space for the two controls and the extra tube, the *G-E* chassis is mounted piggy-back on a second, slightly larger chassis. The final device can be mounted in record storage space or flexible shafts can be used for the controls and the chassis hidden away in the rear recesses of the radio cabinet.

As to the circuit, there's not much to it. The easiest way in the world to vary the high frequency response of a reluctance pickup is to change the load across it. The three components shown give a smooth treble roll-off that just fits the bill. The starred components are those which were added to the *General Electric* circuit. The commercial unit was left intact. All that we've done is tack on a little more equalization after the output of the standard unit.

At this point, things get a little more complicated. Nine extra parts and a tube to be exact. The extra stage is necessary to make up for equalization loss, but it took a long time to convince us that the little *G-E* thimble transformer and postage stamp rectifier would handle the added load. They certainly were never meant to, but one of these double-decker preamps has been in use for over a year now and it still performs every day, so our power supply fears never materialized. The bass control gives bass boost only, since the *G-E* circuit supplies little enough. With the bass control full on, the additional boost starts at 1000 cycles and runs down to about sixty. We will have more to say about the low frequency limit of equalization in a moment, but for now it seems reasonable to set sixty cycles as the low frequency limit of an inexpensive system such as this.

Originally, this was all we planned, but when we tried this modified preamp on a variety of records, we found that some of the 78 rpm pressings needed more highs. A 50 $\mu\mu$fd. condenser bridged across the series leg of the bass boost network solved this last difficulty. The audio amplifier of our friend's radio has a slight droop in the upper range and our additional boost compensates for this. Also, since the treble control affords a great deal of attenuation due to the parallel capacitance/inductance of the network and pickup, the high frequency boost of the last stage simply shifts the range of the treble control upward so that it now gives both boost and cut. If this composite effect is plotted, it is not as pretty as the mathematically designed curves which wander all over the page and intersect in one point. But the performance—well, it was

better than anything our customer had hoped for, and, by golly, it even sounded good to us.

Second Problem: Another hi-fi bug comes in lugging a good quality phonograph amplifier which he has just bought. He has only two complaints; he has already had to replace the 6SC7 preamplifier tube twice to get rid of pops and crackles, and he wishes he had a variable bass turnover switch like the really expensive amplifiers. Just when he invites some friends in and starts to show off his fancy new music system, the 6SC7 is apt to start sputtering again. Other than that, his installation sounds good, but the fellow down the street insists that at least three separate bass turnover points are necessary to equalize for various recording curves. Is there anything that you can do about these two difficulties?

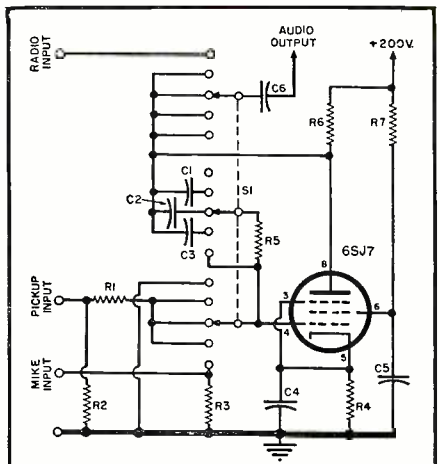
This time you haven't any choice but to tear into a nice looking commercially engineered and built product. Fortunately, the pickup preamplifier is sufficiently divorced from the main amplifier circuit that you don't have much to worry about. The big difficulty here is not in trying to figure out something—there are dozens of circuits available that don't use nasty little 6SC7's, and any of them can be fitted with two or three turnover points. The problem here is *how* and *where*. The amplifier controls are all neatly arranged with no space for one more. Perhaps you can use the input selector switch for bass turnover. Maybe you can even use one switch for both an input selector and a bass turnover switch.

This last idea could be worked out in a number of ways with a number of standard preamplifier designs. However, when we ran across Lawrence Fleming's article in the March, 1950 issue of *Audio Engineering*, we just couldn't resist trying a single-stage feedback preamp circuit such as the one he described. So we took Fleming's circuit and played with it until we had worked out a simple little schematic that uses only a 6SJ7 and a dozen assorted resistors and condensers. With this handful of parts, it not only works as a reluctance pickup preamplifier with three bass turnover frequencies, but as a microphone input stage (with the feedback equalizer cut out), and a fifth position on the selector switch disconnects the preamp and feeds the tuner input directly into the amplifier.

The circuit of this all-purpose preamp is shown in Fig. 2. A five-position, three-pole rotary switch is used to replace the original input selector switch. This switch had better be of the shorting type unless you like loud clicks. In the first (bottom) position, the 6SJ7 grid is connected to the microphone input and disconnected from the plate feedback circuit. The tube therefore functions as a standard microphone input stage. The next three switch positions connect the grid to the reluctance pickup and also through one of three resistance-capacitance combinations to the plate of the same tube. This single-stage feedback equalization is certainly about the simplest possible, yet it performs at least as well as any of the well-known preamplifier circuits. Its only drawback is that the gain is slightly less than that of a twin-triode, but with any of the medium output magnetic cartridges, it gives plenty of output to drive a standard amplifier.

The three phonograph positions provide three turnover frequencies. The values indicated give bass equalization starting at 300, 500, and 800 cycles respectively. In this circuit, the bass boost is good down to about 30 cycles. The 100,000 ohm isolating resistor in series with the pickup is necessary because of the relatively low impedance at the grid of the 6SJ7 due to the plate-to-grid feedback circuit. The resistor R_2 is simply the recommended load of the particular pickup being used. The last position on the new selector switch grounds the grid of the tube and connects the following stage directly to the radio tuner input.

An even more elaborate version of this novel circuit could be arranged with another switch section for the cathode and an extra switch position for grounded-grid (low impedance microphone) input. As it stands, most of the components can be mounted right on the switch sections so that the whole affair takes up no more space than the straight 6SC7 preamp which it replaces. This circuit has low noise level, low hum because of its bypassed cathode, and remarkable economy of parts for all its functions. It works extremely well and it sounds good.

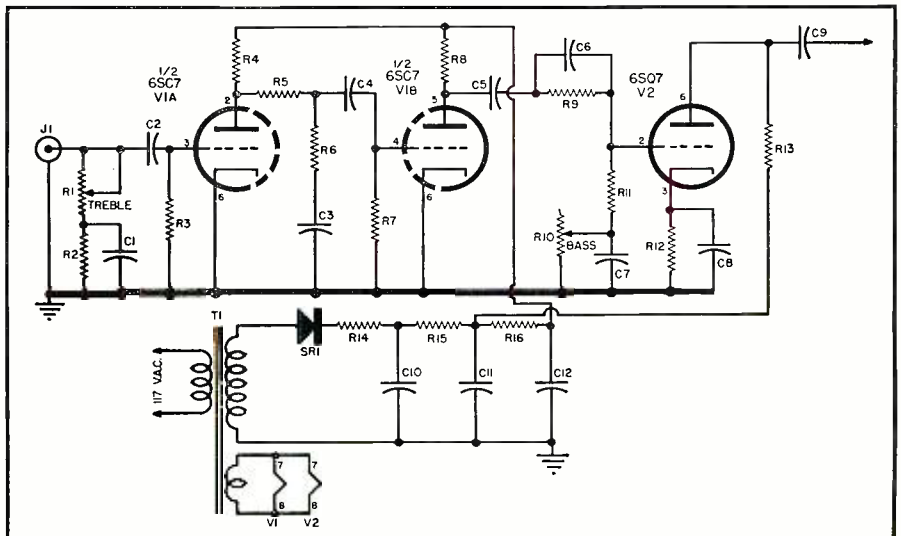


R_1—*100,000 ohm, ½ w. res.*
R_2—*See text*
R_3, R_4—*1 megohm, ½ w. res.*
R_5—*2200 ohm, ½ w. res.*
R_6—*470,000 ohm, ½ w. res.*
R_7—*2.2 megohm, ½ w. res.*
C_1—*200 μμfd. mica cond.*
C_2—*350 μμfd. mica cond.*
C_3—*500 μμfd. mica cond.*
C_4—*40 μfd., 25 v. elec. cond.*
C_5—*.5 μfd., 400 v. cond.*
C_6—*.1 μfd., 400 v. cond.*
S_1—*3-pole, 5-pos. sw.*

Fig. 2. A single-stage equalizer-preamplifier.

In arranging and wiring the preamp, just try to keep input and feedback components away from a.c. leads and magnetic fields. And please don't scatter grounds. There must be *only one ground point* for the whole stage and it must not be a lump of solder on the chassis. It should be an isolated terminal which is then connected to whichever amplifier ground point gives the least hum. If you follow these precautions, the circuit should perform

Fig. 3. Schematic of G-E preamp as modified by author. See text for complete details.



R_1*—*250,000 ohm pot*
R_2*, R_5, R_{11}*—*33,000 ohm, ½ w. res.*
R_3, R_7—*3.3 megohm, ½ w. res.*
R_4—*68,000 ohm, ½ w. res.*
R_5—*200,000 ohm, ½ w. res.*
R_6—*27,000 ohm, ½ w. res.*
R_9*—*330,000 ohm, ½ w. res.*
R_{10}*—*500,000 ohm pot.*
R_{12}*—*5600 ohm, ½ w. res.*
R_{13}*—*100,000 ohm, ½ w. res.*
R_{14}—*100 ohm, ½ w. res.*
R_{15}, R_{16}—*22,000 ohm, ½ w. res.*
C_1*, C_2, C_4, C_9*—*.05 μfd., 400 v. cond.*
C_3—*.01 μfd., 400 v. cond.*
C_5—*.02 μfd., 400 v. cond.*
C_6*—*50 μμfd. mica cond.*
C_7*—*.005 μfd., 400 v. cond.*
C_8*—*25 μfd., 25 v. elec. cond.*
C_{10}, C_{11}, C_{12}—*30/15/15 μfd., 150 v. elec. cond.*
SR_1—*50 ma. selenium rectifier*
J_1—*Input jack*
T_1—*Power trans. 125 v. a.c. secondary @ 15 ma.; 6.3 v @ .6 amp. (Stancor PS8415 or equiv.)*
V_1—*6SC7 tube*
V_2—*6SQ7 tube*
**Indicates parts added to conventional G-E preamp.*

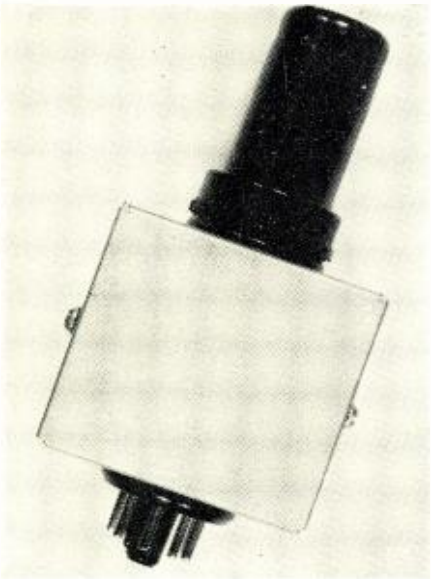


Fig. 4. Plug-in converter preamp. It plugs into one of the 6SJ7 mike-stage tube sockets.

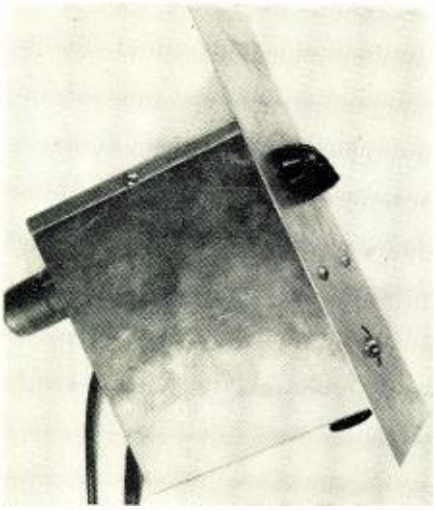
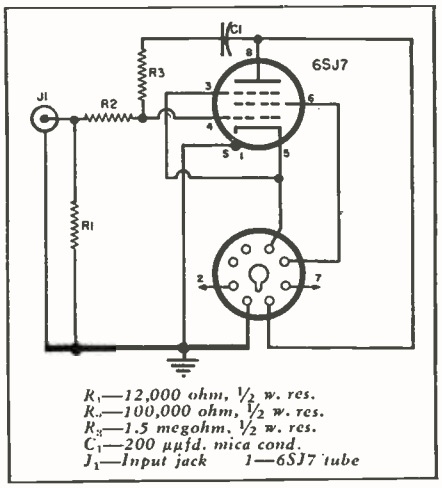


Fig. 6. The preamp designed by the author for his Audak "Polyphase" pickup. Unit slides into the author's unitized console.



R_1—12,000 ohm, ½ w. res.
R_2—100,000 ohm, ½ w. res.
R_3—1.5 megohm, ½ w. res.
C_1—200 μμfd. mica cond.
J_1—Input jack 1—6SJ7 tube

Fig. 5. Mike stage adapter preamp circuit.

and you should be happy. Our customer was. He is no longer annoyed by squeaks and crackles and he found that adjustable bass turnover is a big help in making various recordings sound as natural as possible.

Third Problem: Like most people involved in audio work you prefer to use reluctance pickups whenever possible because of their clean tonal quality, ruggedness, and immunity to excessive heat and humidity. Again and again you have had to supply music distribution systems, public address equipment, and rental amplifiers with crystal phonograph pickups because it was too cumbersome and expensive to fiddle around with separate preamplifiers. You would like to see a cheap little unit that would simply plug into any standard amplifier and automatically adapt it for use with magnetic pickups with no additional wiring or modification necessary.

We had this idea in the back of our mind for some time before we found the answer. Of course, there is always the simple bass boost network which can be inserted in the pickup line, but this always boosts the hum level of the system way up, and magnetic pickups have enough hum problems as it is without asking for more. After we had designed the elaborated Fleming circuit described in Problem Two, we suddenly saw that this was also the answer to our universal magnetic adapter project. We used the Fleming circuit again and designed the simple little widget shown in Fig. 5. This is certainly the simplest magnetic preamplifier we have ever seen. Three resistors, a condenser, and a couple of connectors are mounted in a tiny L.M.B. box. The box plugs into any standard amplifier in place of one of the 6SJ7 microphone stage tubes. The tube plugs into the top of the box, and the pickup plugs into a jack on the side. "Push-pull—click-click" and it's all ready to go.

The adapter as shown can be used with any amplifier using 6SJ7's in the microphone stages. By consulting Mr. Fleming's article, similar preamps can be built for amplifiers using high-mu triodes in the first stage. The feedback resistor and condenser combination can, of course, be altered to any turnover and bass cut-off frequencies desired.

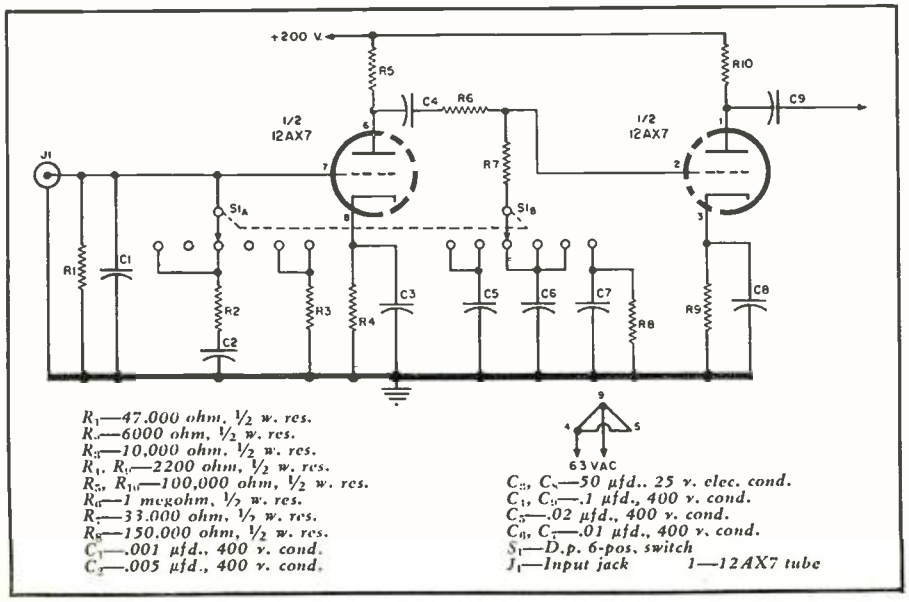
Fourth Problem: You have bought a brand-new pickup and turntable for your own hi-fi system and now you want to build a preamplifier unit that will give the most realistic performance possible from your records. You want the circuit that will give the best performance and the most versatility, but at the same time you are a little wary about getting involved in low impedance tuned-circuit equalizers such as those which gently color the expensive *Pickering's* beautiful reproduction. What you want is a nice trouble-free, two-stage equalizing preamp with variable compensation to match the various types of recordings. You don't want a lot of knobs to play with, but you do want something that will make any record sound as good as it can. You have read all your old copies of RADIO & TELEVISION NEWS, but each published design has several graphs and curves which prove conclusively its superiority over all other mere pretenses of preamps. What circuit will you use? Which one should you build?

Well, we tried them and listened to them and listened some more and tried something else. This procedure is necessary because of the difference in over-all performance of different reproducing systems. Our listening room happens to have an unpleasant resonance at about 70 cycles. Any speakers, pickups, or equalizers which hump the bass response at this frequency have no part in our installation. Comparative listening tests have shown us that our system is very near the average of the "really-good-but-not-quite-price-is-no-object" systems. Our final preamp design sounds just as good on most comparative systems.

Since we happened to choose the *Audak* "Polyphase" pickup for our own

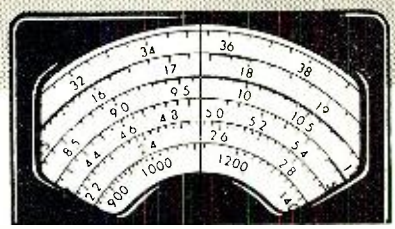
(*Continued on page* 120)

Fig. 7. Schematic diagram of the Audak "Polyphase" preamplifier circuit.



R_1—47,000 ohm, ½ w. res.
R_2—6000 ohm, ½ w. res.
R_3—10,000 ohm, ½ w. res.
R_4, R_6—2200 ohm, ½ w. res.
R_5, R_{10}—100,000 ohm, ½ w. res.
R_7—1 megohm, ½ w. res.
R_8—33,000 ohm, ½ w. res.
R_9—150,000 ohm, ½ w. res.
C_1—.001 μfd., 400 v. cond.
C_2—.005 μfd., 400 v. cond.
C_3, C_8—50 μfd., 25 v. elec. cond.
C_4, C_9—.1 μfd., 400 v. cond.
C_5—.02 μfd., 400 v. cond.
C_6, C_7—.01 μfd., 400 v. cond.
S_1—D.p. 6-pos. switch
J_1—Input jack 1—12AX7 tube

International SHORT-WAVE



Compiled by KENNETH R. BOORD

IT IS a pleasure to dedicate the November *ISW DEPARTMENT* to 4VEH, Box 1, Cap Haitien, Haiti, owned by the East and West Indies Bible Mission, which recently returned to the airwaves after an absence of several months.

We are grateful to M. E. Picazo, technical director of 4VEH, who, in the absence of Director G. T. Bustin, has furnished this interesting data. (Mr. Picazo, ex-chief engineer of WMTC, Vancleve, Kentucky, USA, is well-known on the 75- and 20-meter amateur bands as "Mardy," W4MVL. He hopes to get an "HH" call soon.) To readers of the *ISW DEPARTMENT,* Mr. Picazo writes:

"As our station grows in power, length of airtime, and coverage, we will endeavor to keep our standards high, and to provide the best quality programs possible for our friends of the short-wave bands. We hope the music and programs will be of cheer and comfort to those in need of it, as well as instructive and inspirational, for we would like to have you as a personal friend of 4VEH, and we want the best for our friends. We hope to see 4VEH fill its place on the airwaves as another herald of 'peace and goodwill towards men' from the only Author and Prince of Peace.

"Radio Station 4VEH first went on the air June 2, 1950, in the 31-meter band. The station radiated regularly until November 25, 1951, when a breakdown in the modulation transformer and main power transformer caused a shutdown. Scarcity of components and delay in shipping extended the period of closedown to July 20, 1952.

"Engineer Paul Shirk (who recently had to return to California due to ill health) went about building an entirely 'new' transmitter, incorporating some original ideas with the *Terman-Woodyard* system of modulation. The result was a trim, compact, efficient 3-kw. output transmitter using a pair of *Eimac* 4-1000A's driven by 807's. The rest of the tubes are all miniature types. In this system of high-efficiency, low-level modulation, the principles of the well-known *Doherty* circuit apply, but at a higher operating bias on the final, which gives Class C operation with an efficiency approaching 80 per-cent.

"The use of low-drive tetrodes, plus the incorporation of low-level modulation, made possible the installation of the complete transmitter with all associated power supplies, electronically-controlled overload and time delay circuits and relays, and the antenna-tuning network—the whole thing is in one 6-foot standard-type rack, with much room to spare!

"The studio control console, also built here, is immediately adjoining, but separate from, the transmitter. In the present setup, we have one main studio using the dissimilar-curved section-type of walls. It is here that our electric organ programs originate. In our studio and transmitter building, we will have two large main studios, two minor studios, and two control rooms.

"A 10-kw. transmitter, now under construction, and our present 3-kw. transmitter will be used to transmit in the 49-, 31-, and, possibly, in the 19-m. bands.

"Due to unavoidable circumstances, the present staff of 4VEH is quite limited and, therefore, programming is also limited. Most of our Spanish and *English* programs are produced in the United States and are sent to us in the form of disc or tape recordings. Owing to our extended shutdown, however, some of our programs have not been reinstated. Hence, unfortunately, it is impossible even now to give a *bona fide* program schedule which we could guarantee to hold. Nonetheless, the following schedule will hold for this fall:

"Weekdays—0630-0700 organ concert; 0700-0900 Spanish programs; 0800-0830 *English* broadcast. Sundays —0630-0700 organ concert; 0700-0730 Spanish program ("Las Buenas Nuevas"); 0730-0830 *English* program ("The Evangelistic Hour," studio production); 1730-1800 organ concert; 1800-1830 Spanish program ("Las Buenas Nuevas"); 1830-1900 sacred music in Spanish, *English,* French, Creole; 1900-1915 *English* program; 1915-2000 local church services in French and Creole; 2000-2015 music; 2015-2030 "Lutheran Hour" in Spanish; 2030-2100 "Light and Life Hour" in *English.*

"If contracts are enacted, in time we may sign on at 0545 *daily* to carry the additional broadcasts. But this is so tentative, listeners will have to depend on announcements during our broadcasts for any definite changes (which will be announced).

"So far, our present channel—9.625 —seems to be about the best, although it is wedged between two other (powerful) signals (in this area); I am hoping to be able to settle on this frequency permanently, however.

"Paul Shirk, the designer and operating engineer of 4VEH since its inception, was forced by ill health to leave this work before he saw his 'dream' 10-kw. transmitter constructed. I have taken over his duties.

"Reception reports are appreciated and will be answered promptly if accompanied by an International Reply Coupon.

"4VEH is a missionary radio station, unendowed, and at the present unaffiliated with any denominational group. It is supported by donations and gifts from its friends and listeners from all over the world. Its staff is non-salaried, and the entire station operates on a non-profit, non-commercial basis."

Best wishes go to 4VEH and its staff for a successful future!

* * *

Radio Club Notes

Sweden—Arne Skoog, DX editor, Radio Sweden, reports: "Teknikens Varlds Radio Club, Sweden, now has about 9900 members and we expect Member Number 10,000 within a few weeks. This is the biggest club of its kind in the world, I believe. ORU, Brussels, Belgium, is now taking over our fortnightly DX programs in Swedish, formerly carried by OTC, Leopoldville, Belgian Congo. I compile and record these programs here at home on my own *Ekotape* 'Announcer'; these sessions are presented as special features arranged by ORU and Teknikens Varlds Radio Club. Radio Diamang, Dundo, Angola, listed 7.070 but heard here in Sweden on 6.870, dedicated a special program to our club in August."

* * *

This Month's Schedules

(*Note*: Many stations will be reverting to *winter* schedules soon. In such cases, you may find some schedules will be *one hour later* than listed herein—K.R.B.)

(*Continued on page* 134)

(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.

REMOTE VOLUME CONTROL

By **C. RICHARD ELLIS**
Government Engineering
General Electric Company

Mechanical and electrical methods for controlling volume remotely. Suitable for home or commercial installations.

A LONG-DISTANCE "handle" on the volume control of an audio amplifier can often greatly increase the convenience and usefulness of the audio system. In public-address work, it is disconcerting to adjust the gain of the audio system at the amplifier to what seems the proper volume and then walk out into the audience in front of the speaker horns and find that the program is not being heard. Without an accomplice with signal flags, a good deal of trotting back and forth becomes necessary to maintain a desired sound level over the audience as the program content changes.

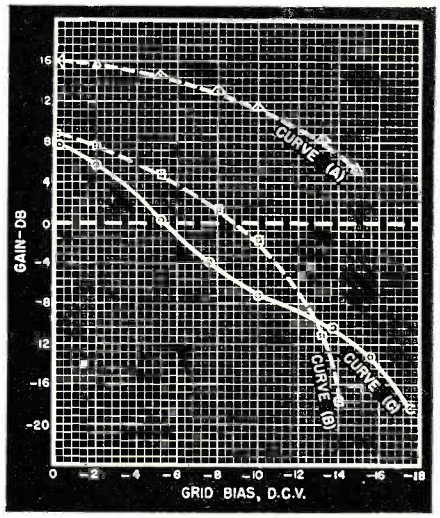
In the realm of custom installation of high quality audio equipment in the home, a long "handle" on audio gain can again be used to advantage. It is often true that a good speaker installation alone takes up all of the living-room space that the owner is willing to devote to the entire system. If the gain of the audio amplifier can be controlled remotely, then the amplifier and its power supplies can be located in some otherwise unused space outside the living room, a strong selling point in the average apartment or small home.

Several methods of remotely controlling audio gain were investigated by the author for the previously-mentioned reasons and are reported here. The simplest solution, that of putting a pad in the speaker line, is ruled out if the input audio level is to vary over an appreciable range. If the input does vary, then the control must be accomplished at a low-level stage to prevent large inputs from overloading the following stages.

A second solution, that of running the low-level audio from the record player or tuner to the control potentiometer and back to the audio amplifier through shielded cable, has several disadvantages; hum and noise may be picked up by the long audio line, and frequency-sensitive attenuation may occur if the lines are not properly terminated. In addition, shielded audio cable is bulky and difficult to conceal when used in the home.

If the audio is not to be piped around, there are at least two alternatives: the control may be exercised by mechanical means, or a special stage may be added to the remote amplifier and control obtained by varying the bias on this special stage. Both methods have advantages. If the audio amplifier gain of 60 to 80 db is to be completely controlled, a mechanical system is much simpler. On the other hand, if a range in gain of 20 to 25 db is enough, then a single-stage circuit will effect this control. A simple, one-stage electronic control cannot vary the gain from zero to maximum without excessive distortion. However, all that is required is that the audio output vary from the lowest desired listening level to the maximum desired level with little distortion, and if this range in a particular case is 20 to 25 db, then the electronic system will fill the bill.

Fig. 1. Variation in gain obtained with circuits of Fig. 2 as grid bias is changed by remote gain control. (A) Curve for triode, (B) Curve for cathode-coupled dual-triode, and (C) Curve for pentagrid tube circuit.



Considering the mechanical methods first, Figs. 3A and 3B show two methods of obtaining complete gain control by mechanical means. In Fig. 3A, two relays and a ratchet wheel are used to step the volume control to any desired position. A gear from an old clock can be soldered to a shaft which is connected to the volume control to form the ratchet system. The relays can be of almost any type, depending on availability. About all that is required is around ⅛ inch movement of the relay armature when the relay operates. The ratchet arms are fastened to the relay armature and their length is determined by the movement necessary to step the ratchet wheel one notch. The longer the arms, the greater the final motion. Two systems are shown for operating the relays from the remote position. The push-button system is the simpler. To increase the volume one step, one button is pushed. To decrease the volume one step, the other button is pushed. In the rotary control system, an eleven-position rotary switch of the "break-before-make" type is used to control the relays. All of the contacts are tied together to the common wire between relays. As the switch is rotated, the circuit is broken between each contact, allowing the relay to drop out and then operate again. The vane on the switch shaft is soldered to a sleeve which is a tight friction fit on the shaft. When the switch is turned in one direction, the vane holds up against one relay lead, and the increase volume relay is stepped around. When the switch is turned in the other direction, the vane holds up against the other relay lead, and the decrease volume relay operates. No limit switches are needed in this system, since the relays do not exert enough force to damage the volume control when the end of rotation is reached.

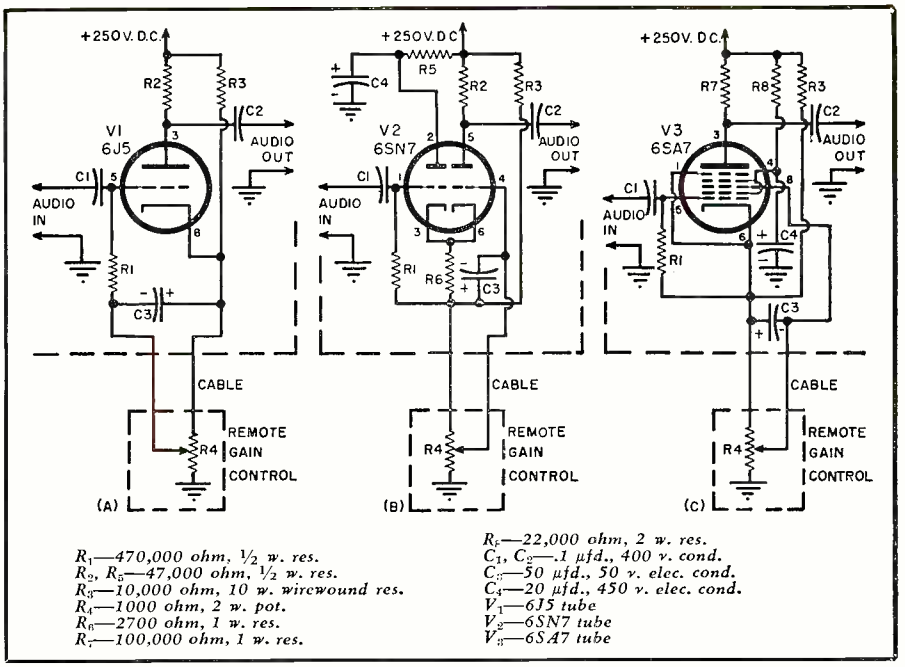
Fig. 3B shows a second means of obtaining mechanical control. Here, a surplus 28 volt d.c. series motor, designed for use in aircraft electronic equipment, is used. The worm gear and wheel are from an old variable condenser, also surplus: the T-23/-ARC-5 has several. Originally, the motor was intended for rotation in one

direction only, and for d.c. operation. By removing the end bell covering the brushes, it was possible to solder separate leads to the armature brush contacts and bring them out along with the leads to the motor field. The motor operates very well on 12.6 volts a.c., obtained by placing two 6.3 volt filament transformer windings in series, and with both the armature and field windings available, they can be wired as shown to obtain either-direction rotation. It is necessary in this case to use limit switches, as the torque of the motor is sufficient to damage the volume control if the motor is not shut off when the ends of rotation are reached. These switches are of the type which snap open when pressure is applied to them.

Fig. 2 shows three simple circuits for obtaining electronic remote gain control, and in Fig. 1, the control achieved by these circuits. The curves of Fig. 1 show the maximum gain variation obtained for 1% or less distortion Near cut-off, the tubes will pass only the positive portion of the input signal, and at the other end of the grid voltage range, positive grid swings will cause the tubes to draw grid current. Either condition means distortion, and thus the range of gain control is limited. Fig. 2A is a simple triode amplifier. The range of control obtained here by varying the bias is only about 12 db, and the input signal cannot be much greater than 100 millivolts or excessive distortion will occur. The only advantage of this circuit over the others is simplicity. Fig. 2B is a cathode-coupled, dual-triode amplifier with remote bias control. The effective control range for less than 1% distortion is shown in Fig. 1B and is seen to be 26 db. A maximum of one-half volt can be applied to the first grid of this circuit without exceeding the 1% distortion limit. Smooth control is obtained over the entire range by varying the grid d.c. voltage about 14 volts, as shown in Fig. 1B.

The most complicated circuit, Fig. 2C, employs a pentagrid mixer tube. The same range of control is obtained as for the cathode-coupled dual triode, but a maximum input of one volt can be used before distortion reaches 1%. As can be seen from Fig. 1C, however, the audio gain is not as smooth a function of grid bias as in the case of the dual triode.

The effectiveness of these various remote volume controls can be summarized as follows: If complete control of the gain of the amplifier from zero to maximum is desired, a mechanical system is much the simplest and the choice here depends on the parts available. If a range of only 10 or 12 db in gain is required, and the maximum grid signal is less than one tenth volt, a single triode such as the 6J5 can be used. (This small signal condition would be fulfilled directly at the output of a pickup such as the *G-E* variable reluctance type.) If a range of 26 db or so in audio gain is required, either the dual triode or the pentagrid converter will do the job. The dual triode can only handle an input of about one-half volt, while the pentagrid can be driven twice as hard, but the triode has a more linear output *vs* bias characteristic than the pentagrid, giving a more conventional control.



R_1—470,000 ohm, ½ w. res.
R_2, R_5—47,000 ohm, ½ w. res.
R_3—10,000 ohm, 10 w. wirewound res.
R_4—1000 ohm, 2 w. pot.
R_6—2700 ohm, 1 w. res.
R_7—100,000 ohm, 1 w. res.
R_8—22,000 ohm, 2 w. res.
C_1, C_2—.1 µfd., 400 v. cond.
C_3—50 µfd., 50 v. elec. cond.
C_4—20 µfd., 450 v. elec. cond.
V_1—6J5 tube
V_2—6SN7 tube
V_3—6SA7 tube

Fig. 2. Three circuits for obtaining remote control of audio gain electronically. (A) Triode gain control. (B) Cathode-coupled gain control, and (C) Pentagrid gain control. Only d.c. is run from the audio chassis to the remote gain control pot, thus eliminating long audio cables which would otherwise be required.

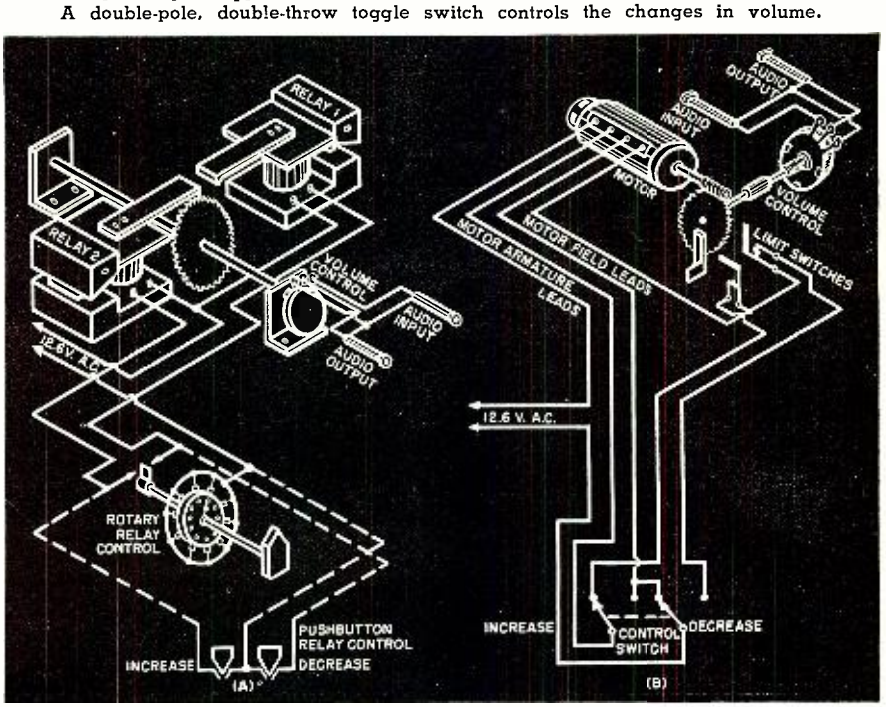
The wiring from the amplifier to the remote position may be ordinary line cord as only low voltage d.c. flows in this wiring. Lengths of this line cord may be fitted with male and female connectors, and in this manner extensions of various lengths can be used.

It is recommended that the connectors used be of the polarized type to avoid confusion with line cords.

A correctly chosen remote gain control can add much to the utility of a public address system by allowing the operator of the system to hear the program as the audience hears it. When applied to the home custom audio installation, the remote gain control will increase its sales appeal by conserving space in the living area, permitting the apartment dweller or small home owner to utilize the best in audio equipment.

—30—

Fig. 3. (A) Stepping-relay remote volume control system. Two methods are shown for operating this type of remote control. (B) Motor driven volume control system. A double-pole, double-throw toggle switch controls the changes in volume.



A MULTI STATION INTERCOM

Front view of the master station. Only two simple operating controls are required.

By **RICHARD J. SANDRETTO**

Construction details on a simple, battery-operated system which can drive as many as three separate slave stations.

INTERCOM systems are indispensable in many industries and business offices, yet the use of intercoms in homes is not as widespread as it could be. This is primarily due to the inherent disadvantages of the usual a.c.-d.c. type of intercom. Many people do not want a system which must be allowed to warm up or else be left on all the time.

Battery powered and instant heating, this versatile, low-cost, simply constructed intercom gives economical operation in average home use. Only two miniature tubes are used, yet excellent performance is achieved with plenty of power and sensitivity.

The disadvantages of a.c.-d.c. intercoms are eliminated. There is no long warm-up time, hum, shock hazard, component damaging heat, rectifier tube, or filter condenser. It is easy to install, independent of power failures, and portable, if desired.

A housewife can answer the doorbell without stepping out of the kitchen, check up on nursery activities, call her husband when he is in the garage or workshop, etc.

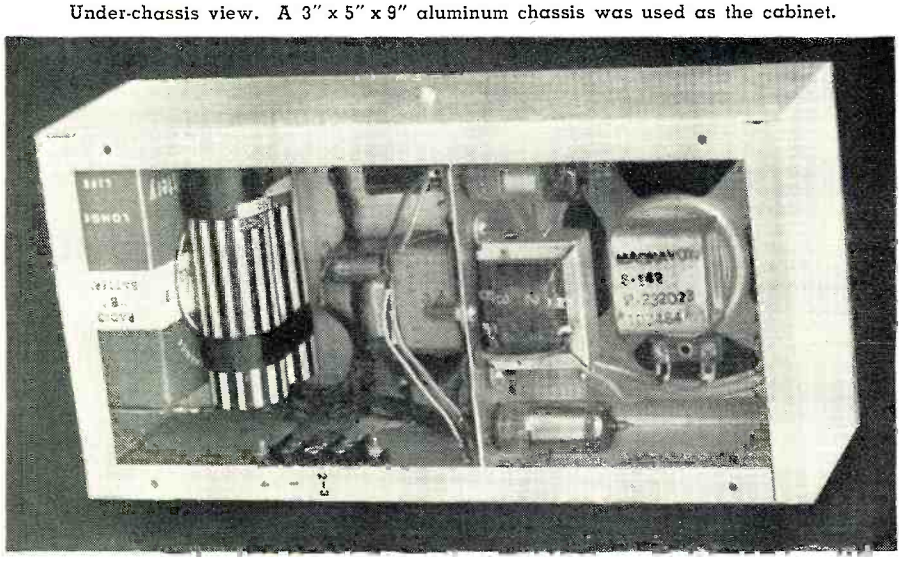
The author has a substation at the front door and the master station in the shop. This saves walking back and forth to answer peddlers and impresses callers.

The basic master station may be used with the variety of station hookups to suit specific individual requirements. The amplifier gives high gain with a 1U5 tube as a pentode voltage amplifier and a 3V4 tube as the power amplifier.

A 67½ volt battery, commonly used in portable receivers, serves as the "B" supply. Filament voltage is provided by two 1½-volt "A" cells connected in parallel. These batteries last longer than they would in portable receiver use. This is due not only to the lower current consumption of the intercom, but also because these batteries recover some of their strength between their brief periods of use.

Maintenance on this type of intercom consists almost entirely of infrequent battery and tube replacements.

Under-chassis view. A 3" x 5" x 9" aluminum chassis was used as the cabinet.



Construction

In Fig. 1, the amplifier schematic diagram, four numbered, unterminated wires are shown. These correspond to the numbered wires shown in the station hookup diagram. In practice the junction of these four wires is made on a terminal strip.

A *Centralab* PC-91 "Pentode Couplate" printed circuit was used to take the place of three resistors and three condensers in the circuit. From the photo it can be seen how it was conveniently mounted, held in place by sufficient friction obtained by pushing it in gently between the transformer mounting bolt and the tape-covered end of the same transformer. The bolt was covered with a piece of spaghetti. Besides taking the place of the six above-mentioned components, the printed circuit is easier to install, since there are only six wires to connect instead of twelve. It also takes up less space and costs less than the individual parts would cost. Of course, if the constructor wishes, he may obtain the same results by using conventional components in place of those contained in the printed circuit. For this reason, in the diagram, the parts that are contained in the PC-91 are enclosed within dotted lines. Connection points to the printed circuit are numbered to correspond with the unit's lead numbering.

The input transformer is one sold for this specific purpose. It should have a primary of about 4 ohms, and a secondary impedance of 25,000 ohms or more. An output transformer may be pressed into this type of service, but results will be inferior and will depend on the impedance of the windings. Higher impedance windings will work best in the grid circuit.

The pilot light may be omitted, if desired, with resultant increase in "A" battery life. The author has found the best pilot lights for this purpose are

the types #48 and #49, miniature screw and bayonet base respectively. These lights draw .06 ampere at 2 volts, or less than .05 ampere at 1½ volts. If a brighter light is desired, one-cell flashlight lamps work well.

A switch in series with the "B" battery is not necessary because there is no drain on this battery when the tube filaments are off.

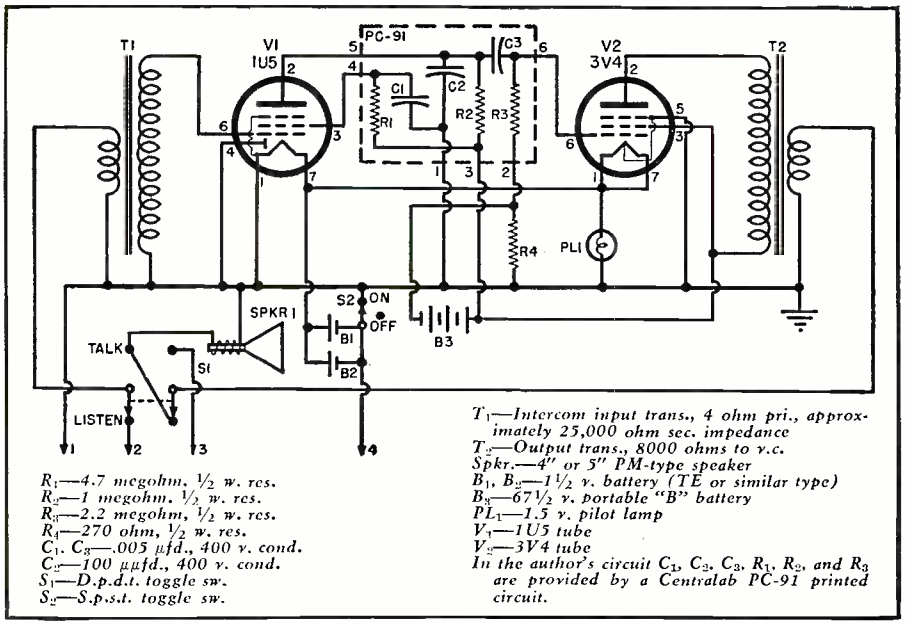
Aluminum chassis have been found to make very attractive small cabinets for purposes such as this. One measuring 3"x5"x9" was used for the master station. The speaker is mounted in the top half and the batteries rest in the bottom. If the master station is to be fastened to a wall, a back plate will not be necessary.

A piece of sheet metal, 3"x5", serves as the chassis, and is held in place by two right-angle brackets. The tube sockets are mounted on this shelf, and the input transformer is mounted on the underside, between the sockets. In this way it is close to the 1U5 tube socket, so that the connections can be very short. The shelf acts as a shield between the input and output transformers. The output transformer is mounted either on the speaker and its leads brought down below the chassis, or on top of the shelf and turned at right angles to the input transformer below.

Speakers for intercom applications are usually of the 4" or 5" PM types. Of course, other sizes may be used if desired. Although costing more, a heavier Alnico magnet in the same size speaker will give better results than a lighter one.

The use of barrier-type terminal strips greatly simplifies the hooking up of the stations as well as allowing for future changes in station arrangement.

The following construction procedure was found to be best: Drill necessary holes in cabinet; mount the speaker, switches, and pilot light socket, and attach leads; mount the tube sockets, and the transformers on the chassis, and wire the chassis, attaching battery leads with plugs. Besides these battery leads, there will be three other wires coming from the wired chassis. These will be the ground wire and the ungrounded low impedance input and output wires from the transformers. Before going any further, the operation of the amplifier should be checked. Connect an extension speaker between a grounded point and the input lead. Connect another speaker between a grounded point and the output lead. Keep the speakers far enough apart to avoid acoustical feedback. Plug in the batteries and ground the free end of the "A" supply (negative terminal), causing the tube filaments to heat. If the wiring has been properly done, the intercom amplifier may now work correctly or it may oscillate. If oscillation occurs this is due to the fact that the input and output transformers or their leads are in proximity. To correct this, either move the wires farther apart or try reversing the lead connections of the primary and secondary windings of either or both of the transformers. After the amplifier has been checked, disconnect the batteries and speakers. Now, fasten the chassis to the cabinet, and solder the two leads coming from the transformers to the proper lugs of the d.p.d.t. switch. All other connections to switch, pilot light, and speaker leads are made on the barrier-type terminal strip, which is mounted in any accessible location. Plug in the batteries and the master station is ready to operate as soon as the stations have been connected.



R_1—4.7 megohm, ½ w. res.
R_2—1 megohm, ½ w. res.
R_3—2.2 megohm, ½ w. res.
R_4—270 ohm, ½ w. res.
C_1, C_3—.005 μfd., 400 v. cond.
C_2—100 μμfd., 400 v. cond.
S_1—D.p.d.t. toggle sw.
S_2—S.p.s.t. toggle sw.

T_1—Intercom input trans., 4 ohm pri., approximately 25,000 ohm sec. impedance
T_2—Output trans., 8000 ohms to v.c.
Spkr.—4" or 5" PM-type speaker
B_1, B_2—1½ v. battery (TE or similar type)
B_3—67½ v. portable "B" battery
PL_1—1.5 v. pilot lamp
V_1—1U5 tube
V_2—3V4 tube
In the author's circuit C_1, C_2, C_3, R_1, R_2, and R_3 are provided by a Centralab PC-91 printed circuit.

Fig. 1. Complete schematic diagram and parts list covering the "master" station.

A volume control is generally not needed on these units. If it seems desirable to reduce the volume after the unit has been completed, the easiest way is to put a resistance of low value, under 4 ohms, in series with the master station speaker.

Fig. 3A shows a simple substation hookup, Fig. 3B a substation that may originate call, and Fig. 3C a substation with privacy and call-originating provisions. With the last circuit the person at the substation must turn on his switch whenever conversation begins, and turn the same switch off at the end.

The novel switching circuit shown in Fig. 3D was designed by the author for the purpose of eliminating one of the four conductors between the two stations, and yet obtain exactly the same results as are obtained with the circuit of Fig. 3C. One will understand the operation of this circuit by visualizing the switches in their different positions. The d.p.d.t. switch shown in this diagram is put in in place of the s.p.s.t. "on-off" switch shown in the amplifier schematic diagram. A s.p.d.t. switch with the "off" position in the center, or two s.p.s.t. switches, must be used on the substation. The three-wire arrangement in Fig. 3D is especially useful for rela-

(*Continued on page* 101)

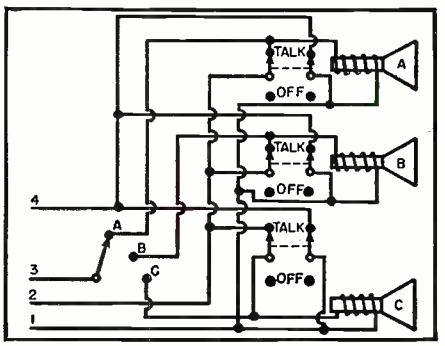
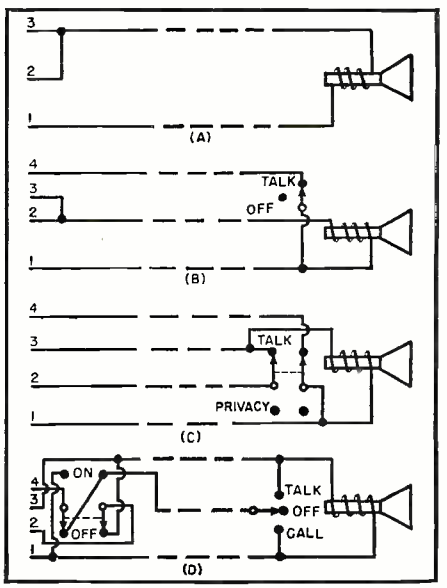
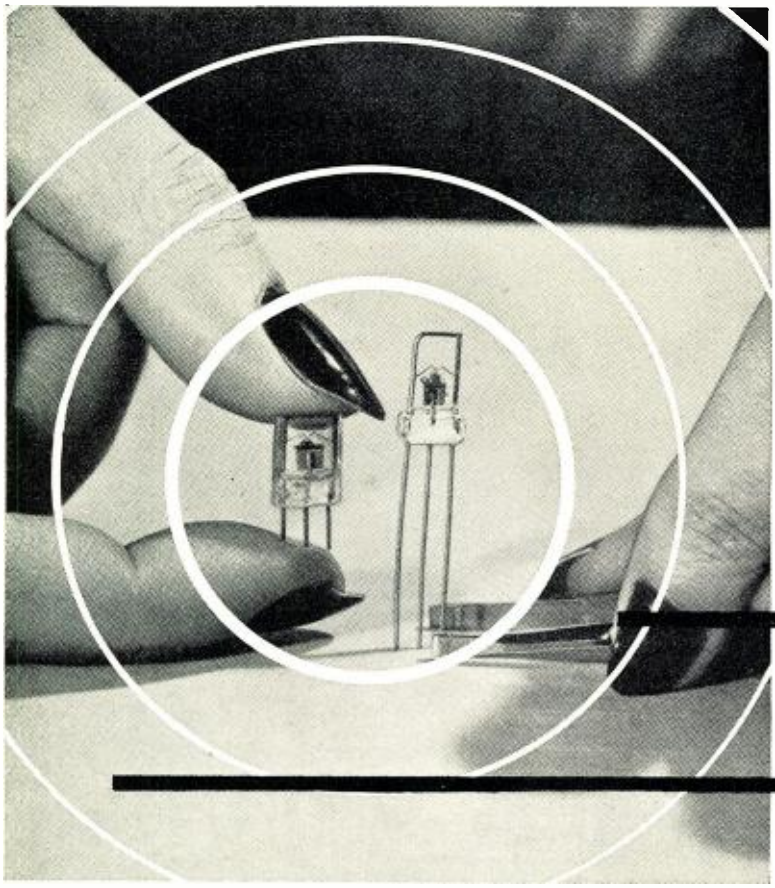


Fig. 2. Hook-up for multi-station installation. Since the author used a single slave station the "selector switch" was not required and the master and slave units were connected directly. If more than one slave station is to be used, the selector switch is incorporated, and installed on the master-amplifier chassis.

Fig. 3. (A) Simple slave station. (B) Slave station that can originate call. (C) Privacy feature added to the circuit of (B). (D) Circuit variation to eliminate the need for a fourth conductor. See text.





SURVEY OF TRANSISTOR DEVELOPMENT

By
B. N. SLADE
Tube Dept., Radio Corporation of America
Harrison, New Jersey

Part 3. Concluding article covers simple transistor amplifier circuits and designs for other applications.

Two views of an RCA transistor. The unit at the left is complete, with components embedded in plastic. Unit at right is still under construction.

IN THIS, the concluding article in this series, we will consider some simple transistor amplifier circuits, other transistor circuit applications, and several other types of germanium devices.

Transistor Amplifier Circuits

It is interesting to compare the amplifier circuit properties of the point-contact transistor and the junction transistor. A number of amplifier circuit connections are possible to obtain several combinations of input and output impedances. In the case of the point-contact transistor, however, special consideration must be given to the circuitry. If the internal feedback resistance is too large, and if the current amplification factor is greater than unity, the circuit may become unstable and oscillations will occur. It can be seen in the curves in Fig. 3, Part 2 (September issue, page 64) that the internal feedback resistance varies with the operating point. The current amplification factor may also vary somewhat with collector voltage, thus making the circuit stability dependent upon the d.c. biases. Resistance placed in series with the emitter and collector leads helps to suppress these oscillations, but may decrease the power gain of the circuit. For example, the input impedance to the grounded-base amplifier circuit shown in Fig. 1 is approximately 500 ohms and the output impedance is approximately 10,000 ohms. If the internal feedback resistance is too large, additional resistance necessary to stabilize the circuit will exceed these impedance values and, therefore, reduce the gain of the circuit. Point-contact transistors which have a very low value of internal feedback resistance, less than 100 ohms, for example, usually have such low feedback that amplifier circuits require no special stabilization. It is desirable in some r.f. circuits, particularly, that the transistor be stable under low impedance conditions such as off-resonance of a parallel-tuned circuit.

In the case of the simple junction transistor, the current amplification factor is always less than unity, and oscillations cannot occur. Ryder and Kircher[1] have pointed out that the grounded-base circuit is analogous to an electron-tube grounded-grid circuit if the emitter, base, and collector of the transistor are compared to the cathode, grid, and plate of the electron tube, respectively. The grounded-grid electron-tube circuit also has a low input and high output impedance. The comparison is particularly appropriate in the case of the junction transistor, which, like the tube circuit, is stable even under extreme short-circuit conditions.

If the emitter is grounded, as in Fig. 2, higher input impedances and lower output impedances may be obtained. Higher power gains may be obtained with this circuit configuration than with the grounded-base circuit, but in point-contact transistors the feedback may become large and lead to instability. If junction transistors are used, this type of circuit is similar to an electron-tube grounded-cathode circuit.

Higher input impedances and lower output impedances may also be obtained if the collector is grounded, as in Fig. 3. This circuit can become unstable if a point-contact transistor is used, and the power gain which may be obtained is low. However, the junction transistor can be used to good advantage in this circuit, because power gains ranging from 10 to 20 db may be obtained with input impedances and output impedances on the order of 200,000 and 50,000 ohms, respectively. In fact, appreciable gain may be obtained using equal input and output matching impedance, thus making cascading of several stages of amplification feasible. This circuit is similar to the electron-tube grounded-plate or conventional cathode-follower circuit.

Table 1 shows typical values of input and output impedances and power gains for all three types of circuits for both junction-type and point-contact transistors. It will be noted that in the grounded-emitter and grounded-base circuits the input and output impedances of the point-contact transistor may actually become negative values, a condition which indicates that these circuits are potentially unstable. These characteristics of the point-contact types, which lead to potential instability in amplifiers, are of

1. *Ryder, R. M. and Kircher, R. J.; "Some Circuit Aspects of the Transistor" Bell System Technical Journal, Vol. XXVIII, pages 367-401, July, 1949*

great advantage in oscillators and trigger devices.

Other Circuit Applications

When considering the possible circuit applications for the two types of transistors, one must be aware of the advantages and limitations of both types.

At the present time, the advantages of high gain, low noise, and greater stability of the simple junction transistor can be utilized at frequencies up to several megacycles in applications such as r.f. and i.f. amplifiers of standard broadcasting receivers. In addition, power outputs greater than one watt appear to be possible in oscillator and amplifier applications in the audio frequency and low frequency ranges. Another feature of the junction transistor is its ability to amplify and oscillate with microwatt power inputs.

The frequency response of the point-contact transistors, on the other hand, is somewhat higher than that of junction types. As with junction types, point-contact types which are currently available can be made to oscillate and amplify over the broadcast-frequency band. When used as an amplifier, point-contact transistors have a relatively flat response over the entire broadcast band and beyond. Types now under development will operate at considerably higher frequencies. Feedback in these units has been reduced to values which make stable operation at radio frequencies practical. The point-contact transistor, therefore, may also have considerable application in radio circuits and may be used in intermediate-frequency amplifiers, radio-frequency oscillators, and other circuits not associated with the high-power stages of r.f. systems. Point-contact transistors have been developed which are capable of oscillating at frequencies well over 100 mc. Oscillations at frequencies higher than 200 mc. have been obtained; one developmental unit has oscillated at a frequency over 300 mc.

One of the most important uses of the point-contact transistor probably will be in counter circuits. A number of recent publications[2] describe some basic circuits which utilize the negative resistance properties of one or more transistors. These circuits generate pulses of various waveforms, store information for varying periods of time, add, subtract, multiply, and divide. Up to the present time these functions, and many others, have been performed in electronic computers by large numbers of electron tubes for which the heater-power supplies alone have been considerable. Use of the transistor would obviously alleviate this situation since no heater power is required. Furthermore, little d.c. power is necessary for operation. The adverse characteristics of transistors with regard to frequency response, noise, and power output are relatively unimportant factors in computer circuits. Computers which employ germanium devices would have the advantages of small size, ruggedness, and economy of operation and maintenance.

Other Germanium Devices

The progress in the field of germanium devices is not limited to the field of transistors. While the point-contact germanium diode has already attained commercial acceptance, new types of diodes utilizing the "p-n" junction rectification characteristics are being developed. One diode power rectifier which utilizes a p-type or acceptor impurity metal diffused onto a pellet of germanium has already been described.[3] Peak inverse voltages of 400 volts are permissible with these devices which have very low resistances in the forward direction and current-carrying capabilities as high as 350 milliamperes. When the relative infancy of the germanium power rectifier is considered, it is difficult to estimate the ultimate importance of these devices. Because of improved efficiency, however, they appear to be suitable both as a replacement for the selenium rectifier and as an advantageous substitute for certain types of rectifier tubes.

Another germanium device of considerable significance is the phototransistor.[4] This photocell is a photo-conductive device and operates on the principle that light absorbed by germanium changes its conductivity. In the phototransistor, a point contact acts as the collector and draws a small amount of current. Light in the vicinity of the collector increases the conductivity of the germanium and the current through the collector.

The first transistor was announced only three and one-half years ago. Great strides have been made in learning the fundamental theory of operation of transistor devices, and much progress has been made in the knowledge of the control of transistor characteristics and manufacturing processes. There appear to be a number of fields in which transistors will be used widely and to great advantage. Further improvements in their characteristics may be expected as research and development continue.

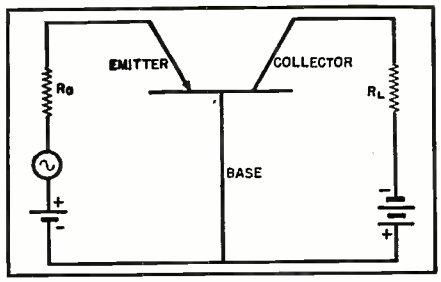


Fig. 1. Layout whereby the transistor is used in grounded-base amplifier circuit.

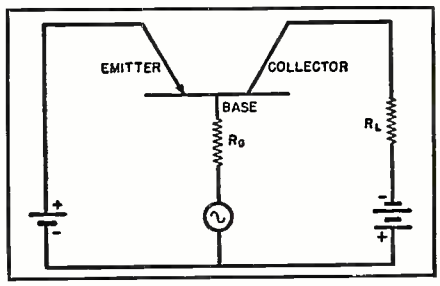


Fig. 2. A transistor grounded-emitter amplifier circuit, as discussed in the text.

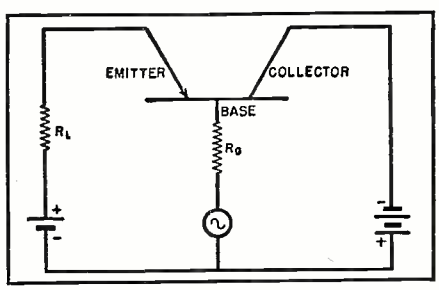


Fig. 3. The transistor grounded-collector amplifier circuit. See text for details.

Acknowledgment

The author wishes to acknowledge the advice and contributions of Mr. E. W. Herold and Dr. J. Kurshan of the *RCA Laboratories Division,* Princeton, N. J., and of Mr. R. M. Cohen and Mr. H. Nelson of the *RCA Tube Department,* Harrison, N. J.

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2. *Eberhard, E., Endrey, R. O., and Moore, R. P.; "Counter Circuits Using Transistors." RCA Review, Vol. X, No. 4, page 459, December, 1949.*
3. *Saby, J. S.; "Recent Developments in Transistors and Related Devices." Tele-Tech, Vol. 10, No. 12, December, 1951.*
4. *Shive, J. N.; "The Phototransistors," Bell Laboratories Record," Vol. XXVIII, No. 8, pages 337-342, August, 1950.*

Table 1. Input and output impedances and power gains for three circuit applications.

	Junction Transistors	Point-Contact Transistors
GROUNDED-BASE AMPLIFIER CIRCUIT		
Input Impedance	90 ohms	180 ohms
Output Impedance	0.4 megohm	14,000 ohms
Power Gain	37 decibels	20 decibels
GROUNDED-EMITTER AMPLIFIER CIRCUIT		
Input Impedance	620 ohms	1800 ohms
Output Impedance	54,000 ohms	—8000 ohms
Power Gain	41 decibels	28 decibels
GROUNDED-COLLECTOR AMPLIFIER CIRCUIT		
Input Impedance	40,000 ohms	—37,000 ohms
Output Impedance	1000 ohms	—10,000 ohms
Power Gain	17 decibels	14 decibels

A VERSATILE WAVEMETER

By

JACK ROBERSON

Construction details on a simple unit which can be used as a wavemeter and field strength meter, a modulation quality monitor, a d.c. meter, alignment indicator for voice coil connections, a grid-dip adapter, and an absorption meter.

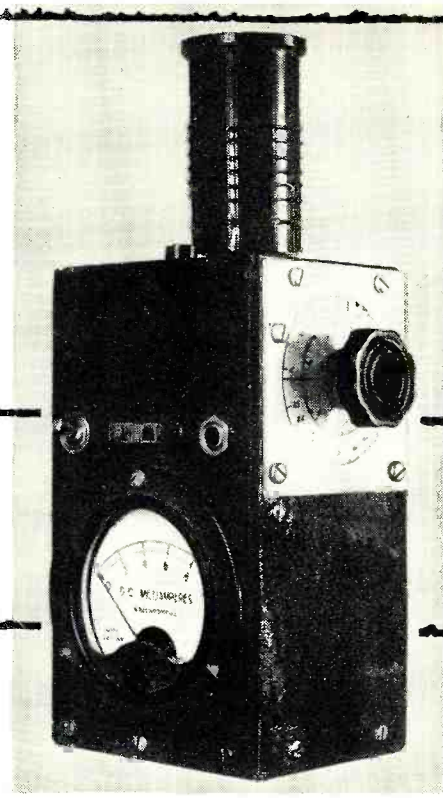


Fig. 1. Over-all view of home-built wavemeter. It will measure frequencies from 2 to 70 mc. in four overlapping bands.

PERHAPS one of the biggest problems confronting the beginning amateur is the construction of coil-condenser combinations that will tune to the right frequency—this is especially true in the building of oscillator circuits. That first transmitter is usually only an oscillator circuit with perhaps an added amplifier stage. Building that first transmitter is lots of fun, but getting it to work can be quite another matter, especially if no test equipment is available. Usually, the beginning amateur checks frequency with his receiver since a receiver is nearly always present, but difficulty is sometimes experienced, especially if the receiver happens to be a superheterodyne. Unless the set has excellent image rejection, a strong signal will be received at at least two points on the dial—one at the proper point and one on the other side of the receiver's local oscillator. The receiver will also respond to the various i.f. frequencies produced between the harmonics of the test oscillator and the receiver's oscillator; all of these responses are present in the superhet and can cause a lot of grief during that first tune-up. Unless the receiver has an "S" meter, relative signal strengths are also difficult to determine.

Another commonly used tuning device is the closed loop of wire connected to a low current flashlight bulb. By holding this loop near the coil of the oscillator or the amplifier and watching the brilliance of the bulb, you can tell when a circuit is putting out the maximum amount of energy —of course a bulb that indicates frequency is quite a rarity indeed. The loop of wire must be held very close to the circuit under test in order to obtain sufficient energy to light the bulb, and this is sometimes a little dangerous when you consider that your hand may come in contact with high r.f. voltages.

One of the simplest frequency indicating devices is the absorption meter which has no meter at all but is merely a coil and calibrated variable condenser. The absorption meter operates by absorbing a small amount of energy from the circuit under observation which causes the meter in the circuit to either dip or rise, depending on whether it is the grid circuit or plate circuit. The absorption meter at resonance absorbs the largest amount of energy, and by calibrating the variable condenser you can readily determine the frequency of the circuit. This basic absorption meter circuit is shown in Fig. 2A. Although reasonably accurate, the absorption meter is not able to indicate signal intensity—it is limited to frequency indications only. By adding an indicator to the absorption meter, the relative signal strength may be observed. This results in a device known as a wavemeter, the circuit of which is shown in Fig. 2B. As C_1 is tuned to resonance with the frequency under test, the circulating current in the tank composed of C_1 and L_1 increases to maximum. Maximum current is induced in the coil L_2, and is rectified by the crystal rectifier causing M to indicate a maximum reading. The tuning of the oscillator or amplifier for more output will cause the meter to swing further upscale. The wavemeter, although simple in its construction, can overcome many of the objections encountered in using the receiver or the flashlight bulb methods of frequency and resonance indication.

The accuracy of the wavemeter depends primarily upon the care taken in the calibration of the variable condenser. The lower-priced commercial models are roughly calibrated for the amateur bands and cost around $15. One company manufactures a wavemeter that is a precision instrument complete with detailed calibration charts and costs many times more than the lower-priced models. The accuracy of the wavemeter described in this article will depend mainly on your needs as well as the care you exercise and your skill. The wavemeter will measure frequencies from 2 mc. to 70 mc. and has a dial divided into four bands: 2 to 6 mc., 5 to 15 mc., 11 to 35 mc., and 23 to 70 mc. No special test equipment is needed to calibrate the wavemeter other than a signal generator or a receiver. If the instrument is to be used by a radio technician, a range covering the broadcast band would be very desirable. The construction of the wavemeter requires no special tools or gimmicks; precision resistors are eliminated; coil forms may be any reasonable size if allowance is made for removing or adding turns; and the variable condenser is of the small variety commonly found in surplus stocks. In order to increase the versatility of the instrument some refinements have been added which make it possible to use the wavemeter for a number of other things such as a grid-dip adapter, tuning meter for d.c. currents (three ranges), field strength meter, audio tuning device for connection to the voice coil leads of a receiver during alignment, phone quality monitor, and of course an absorption meter. Many of the various functions utilize parts that are in common with some of the other functions. The various functions are easily omitted to meet the needs of the builder.

Construction

The wavemeter case was constructed from scrap aluminum sheet and meas-

ures 7" high x 4" wide x 3" deep. Suitable factory-made boxes are obtainable at low cost. The condenser, C_1, is mounted directly below the coil form (Fig. 4) to permit short connections, and directly in front of the coil form socket is located the pin jack, J_1. Above the meter in Fig. 1 from left to right will be seen the "wavemeter-current" switch, S_1, the meter shunt switch, S_2, and the headphone jack, J_2. The crystal rectifier is soldered to the pin jack, J_1, and the switch, S_1. Nearly any of the surplus crystals are suitable if their limitations are kept in mind—mainly their current carrying capabilities. The original model uses a 1N23 type, but a type 1N34 would have been more satisfactory. If meter shunts appear to be precision-wound resistors, and you are slightly leery of their construction, the following procedure will simplify the selection of those used in this instrument. R_2, the meter shunt for the 10 ma. range, is a 10-ohm resistor. This resistor can either be constructed or purchased depending on the number of resistors on hand. The purpose of R_2 is to decrease the meter reading when testing strong r.f. energy or when measuring more than 1 ma. of current. R_2 is the proper size when it causes the meter reading to decrease to 1/10 its normal reading, *i.e.,* if a meter is hooked up as shown in Fig. 3A, and the potentiometer is adjusted for full-scale reading, the addition of R_2 in shunt with the meter should cause the meter to read 1/10 of full scale. R_1 is the resistor which makes it possible to measure currents up to 100 ma., and is easily made from a length of nichrome wire. Once again the potentiometer of Fig. 3A is set for full scale meter reading; connect one end of the nichrome wire to a meter terminal and vary the length of wire which touches the other meter terminal until the meter reading decreases to 1/100th of its former reading without the shunt. The length of nichrome wire can be wound around a strip of lucite or plastic and is secured at the ends with small machine screws. Convenient pigtails can also be connected to the machine screws to enable solder connections since nichrome wire isn't easily soldered.

The coils are wound on 4-prong, 1½" diameter coil forms although other sizes may be used if allowances are made. No special precautions are necessary although the wire on the coils should be cemented with coil dope at various points to keep the calibration from changing once the wavemeter is completed.

Calibration

Calibration may be accomplished in a number of ways. Perhaps the easiest way is to generate known frequencies with a signal generator and to mark the wavemeter dial at convenient points. If a receiver is available with an "S" meter, calibration is possible without using a signal generator. Connect an antenna to J_1 on the wavemeter and connect the chassis ground of the wavemeter to the antenna input on the receiver. Tune in a signal on the receiver at a desired calibration point—even a noise frequency is permissible. When the wavemeter is tuned to the incoming frequency, a dip will be noticed in the "S" meter reading. If the receiver has no "S" meter, it is possible to use the receiver's local oscillator as a signal generator, providing, of course, that you know whether or not the receiver's local oscillator operates above or below the incoming frequency, and the receiver's i.f. frequency is known. The two most commonly used bands are put on the outer edge of the dial card to make the reading of these ranges easier.

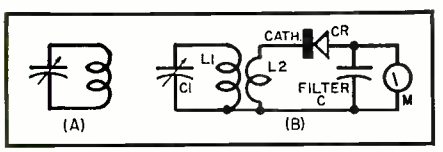
Various Uses and Hints

Wavemeter and Field Strength Meter—The "wavemeter-current" switch, S_1, is put in position "A" or the "up" position. The proper coil is inserted, and the variable condenser, C_1, is rotated until the meter indicates that maximum circulating current is present in the tank circuit of the wavemeter. Frequency is then indicated directly on the dial. S_2 reduces the meter reading if the meter "pins" when measuring strong r.f. fields. For very weak r.f. signals the signal may be connected directly to J_1 and ground on the wavemeter which causes the meter to read upscale. When C_1 is tuned to the frequency of the signal, the meter will dip, indicating that the wavemeter is absorbing maximum energy from the source. The calibration for this latter method will be slightly different from the previous method due to the loading effect on L_2.

Modulation Quality Monitor—A pair of headphones inserted in the headphone jack when the instrument is used as a wavemeter will disconnect the meter and allow modulation quality of the signal to be heard. For extremely sensitive readings connect a 50 microampere meter to the headphone jack when using the instrument as a wavemeter.

Direct-Current Meter—For the 1 ma. and the 10 ma. ranges S_1 should be in position "A", with the coil form removed. The phone plug to which the current connections are made should be loosely inserted into the headphone jack so that it does not cause the closed-circuit phone jack to open since this would disconnect the meter. The sliding switch, S_2, changes the range from 1 to 10 ma. For the 100 ma. scale S_1 must be in position "B." The current to be measured is connected to the headphone plug, and the plug is completely inserted into the phone jack. S_2 should be opened for accurate measurements.

Fig. 2. (A) Basic absorption meter circuit. (B) Circuit diagram of a simple wavemeter.



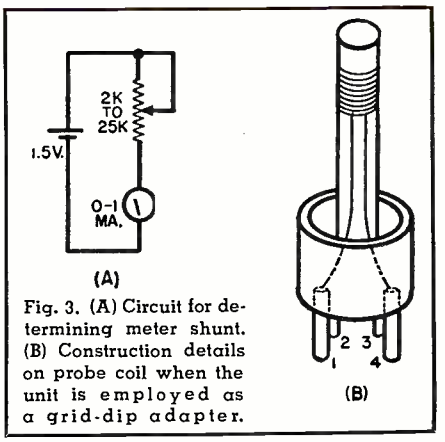
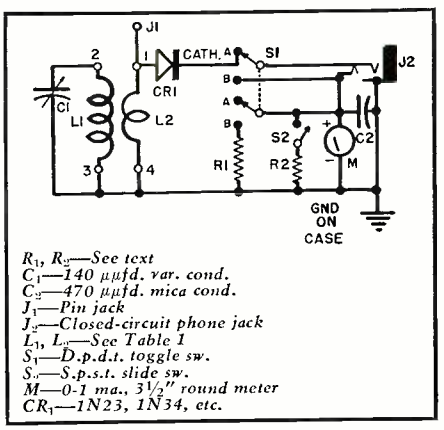


Fig. 3. (A) Circuit for determining meter shunt. (B) Construction details on probe coil when the unit is employed as a grid-dip adapter.



R_1, R_2—See text
C_1—140 μμfd. var. cond.
C_2—470 μμfd. mica cond.
J_1—Pin jack
J_2—Closed-circuit phone jack
L_1, L_2—See Table 1
S_1—D.p.d.t. toggle sw.
S_2—S.p.s.t. slide sw.
M—0-1 ma., 3½" round meter
CR_1—1N23, 1N34, etc.

Fig. 4. Complete schematic diagram covering the simple absorption-type wavemeter.

L_1—2-6 mc.—42 t. #24 en., spaced 1⅝"
5-15 mc—16 t. #18 en., spaced 1½"
11-35 mc.—6 t. #18 en., spaced 1⅛"
23-70 mc.—2 t. #18 en., spaced 1"
L_2—2-6 mc.—13 t. #26 en., closewound
5-15 mc.—6 t. #26 en., closewound
11-35 mc.—4 t. #26 en., closewound
23-70 mc.—2 t. #26 en., closewound
Note: L_1 and L_2 are separated by ¼" spacing.

Table 1. Coil winding data for wavemeter.

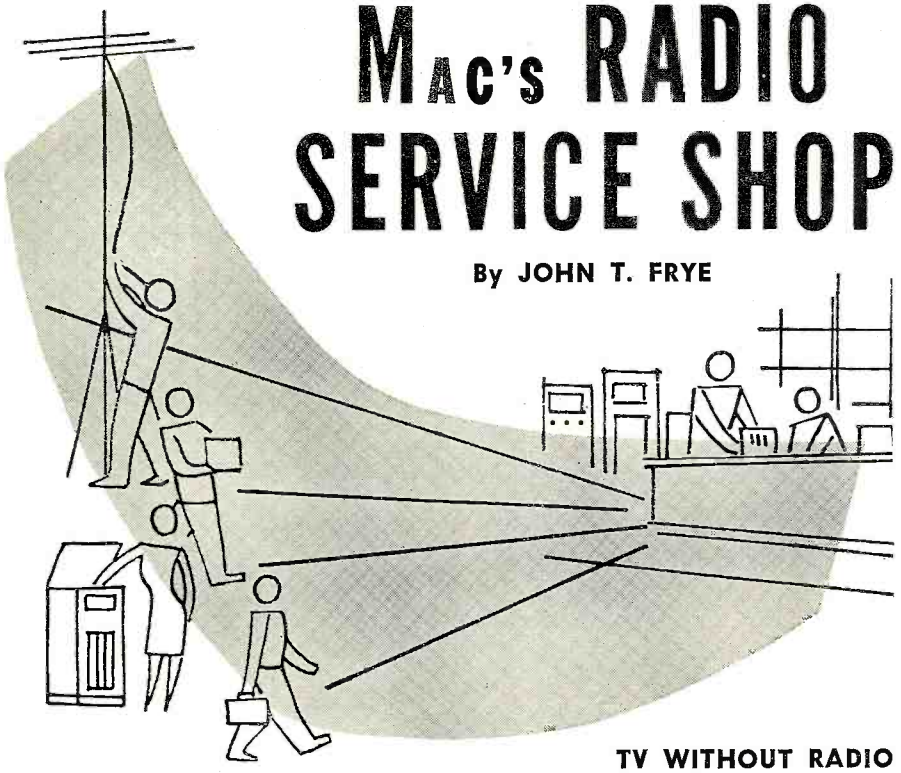
Alignment Indicator for Voice Coil Connections—Set S_1 to position "A," with the coil form removed. Connect the voice coil leads to J_1 and ground on the wavemeter. If the volume is so great that the meter "pins," connect a resistor in series with one of the voice coil leads to the wavemeter.

Grid-Dip Adapter—The wavemeter can be used as an adapter in a couple of ways. A few turns of wire from the "hot" lead of the signal generator are wrapped around the tank circuit under test, and another lead is closely coupled to the tank circuit and is plugged into J_1. When the signal generator is tuned to the frequency of the coil-condenser combination under test, the tank circuit will reradiate the maximum amount of energy into the wavemeter. The coil for the lowest frequency band on the wavemeter should be used in the preceding test. Another method which is a little more satisfactory consists of making a special probe coil on the end of a piece of round lucite or plastic. This coil is about 100 turns of #28 enameled wire, and the ends of the wires are soldered

(*Continued on page* 110)

MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE



TV WITHOUT RADIO

MAC was regarding his assistant, Barney, with a frown of strong disapproval. That worthy young man, blissfully oblivious of his boss's stern gaze, was attempting to align the miniature i.f. transformers of an AM-FM set by thrusting the metal bit of a tiny screwdriver into the hexagonal openings in the top of the tuning slugs and trying to turn them with this makeshift. Now and then the screwdriver bit would wedge in the opening enough to allow the slug to be turned a little, but most of the time it just slipped around inside the hole.

Suddenly Mac reached over with the duck-bill pliers he held in his hand and took a firm grip on the lobe of Barney's ear.

"Hey! Lookout! Leggo! What are you trying to do?" the boy exclaimed as he squirmed ineffectively to free his ear from the bite of the pliers.

Without saying a word Mac led the struggling youth to a wall cupboard and pulled out a drawer with his free hand.

"Now there," he said, "as you well know, is every kind of an alignment screwdriver, wrench, and wand that we have been able to find on the market. This little white job is specifically made to fit the openings in the slugs of those i.f. transformers. Don't ever, *EVER* let me catch you using anything but it on those transformers again."

Barney rubbed the ear that Mac finally released and mumbled, "The i.f.'s just needed a little touching up, and I didn't want to take the time to get the alignment tool. I was doing all right with that screwdriver."

"You were not!" Mac denied categorically. "All you were doing was reaming out the holes in those slugs until pretty soon nothing would turn them, and on top of that you were taking a strong chance of breaking the slug and making it necessary for us to install a new transformer at our expense. Worse yet, the presence of the metal screwdriver bit in the fields of the windings made proper adjustment of the transformers impossible. A guy who would do a thing like that is capable of committing the unpardonable sin of mechanics: using a screwdriver as a chisel by hammering on the end of the handle.

"I'm serious about this, Barney," Mac went on. "A good mechanic or a good technician is one who has and *uses* the proper tool for doing every job he ordinarily encounters. Using makeshift tools is a sign of laziness and incompetence and invariably results in slovenly work. Once you start using straight screwdrivers on *Phillips* screws, corner-rounding monkey wrenches on hex nuts, and so on, these bad habits grow on you and become harder and harder to break. In a way it is too bad that radio men are called upon to use a lot of hand tools without ever having had the training of working in a garage or machine shop. If we had served an apprenticeship in one of those places, our bad mechanical practices would have been nipped in the bud right in the beginning in no uncertain or easily forgotten fashion."

"I'm sorry, Mac, that I slipped up that time," Barney said as he picked up the tuning wrench and started readjusting the i.f. transformers. "It won't happen again. But now, without seeming to want to change the subject, there's something else I'd like to talk to you about. Yesterday I got a letter from my cousin who lives in Chicago, and he asked me a couple of questions that I think you can answer better than I can. He has been thinking about starting to study television with the idea of going into service work, but he says his friends discourage the idea. They tell him it will take too long to learn television because first he will have to master the theory and practice of radio servicing, even though he does not intend to do radio service. How about that? Do you think it is possible to start right in studying television without having a radio background? How much help do you think a good knowledge of radio really is when it comes to mastering television?"

"What do *you* think," Mac asked.

"Well, I don't really know. Working here with you, I have sort of picked up what knowledge I have in both fields in a pretty well-scrambled form, and I have never made any attempt to separate them in my mind. I do know this, though: we don't go at running down TV troubles the way we do radio troubles. Even the instruments we use in each case are different."

"That's about the story," Mac said. "It is pretty difficult for us old timers to have to admit that several years of experience in radio repairing is not an absolute essential to becoming a good TV technician, but that is the fact. Some of the crackerjack television technicians of today never worked at repairing radios at all. Their entire schooling and experience has been with video sets."

"Wouldn't they have been still better technicians if they had been exposed to a few years of fixing radios?"

"I'm not at all sure about that. It depends a lot on how flexible or set in his ways the individual technician is and also on how much of his radio knowledge is held in the form of sound and clearly-understood theory and how much in the form of mere experience.

"The bull-headed type of radio technician insists on using exactly the same technique in TV servicing that he uses in radio repairing. He can hardly wait until he gets an ailing TV chassis upside down so that he can start probing with his meters, looking for shorted condensers, incorrect voltages, etc. The fellow with an adaptable mind, on the contrary, will soon realize that you can learn a lot more about what is wrong with a television set by studying the face of the tube than you can by prodding around in the bottom of the chassis. He will start concentrating on test pattern symptoms. The cathode-ray oscilloscope, that was used only on very rare occasions in radio service, will become his right hand in running down TV ailments."

"But won't his knowledge of radio help him *any?*"

"Certainly it will, for no knowledge is entirely wasted. His radio background will be particularly helpful if he has thoroughly mastered the

(*Continued on page* 104)

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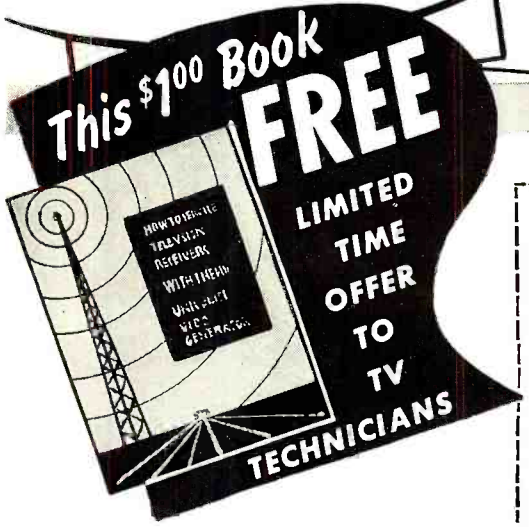
— Ray S. Guichard,
Mgr. Service Training



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SINUSOIDAL SWEEP EXPANSION

By
STANLEY E. LEHNERT, W9NDK

Add this simple circuit to your scope and increase its usefulness for television receiver servicing.

PROBABLY one of the most difficult television waveforms to examine with the conventional oscilloscope is the vertical synchronizing pulse interval and the successive steps of integration as it is shaped for vertical synchronization. The inadequacy of horizontal gain and the natural sync point for the sweep oscillator normally force one to resort to an expanded sweep with accurate phasing. Oscilloscopes incorporating these refinements are available but due to the increase in cost normally fall beyond the reach of the average technician. It is the purpose of this article to present a circuit which, in most cases, can be constructed from available used parts; that will add versatility to the conventional oscilloscope; and enable one to investigate problems of poor interlace.

Since most television stations phase their synchronizing generators with the power line, the use of a 60-cycle sinusoidal sweep for horizontal deflection in the oscilloscope becomes feasible. Examination of a sinusoidal wave, however, will reveal that linearity of sweep can be obtained over rather small portions of the complete cycle. This offers no difficulty since the interval of the vertical synchronizing pulse also represents a small interval of field scanning time.

In Fig. 2, it can be seen that linear representation of the synchronizing pulse interval will be produced if the sinusoidal sweep voltage is phased so that the pulse interval occurs during the sweep voltage interval from *A* to *B*.

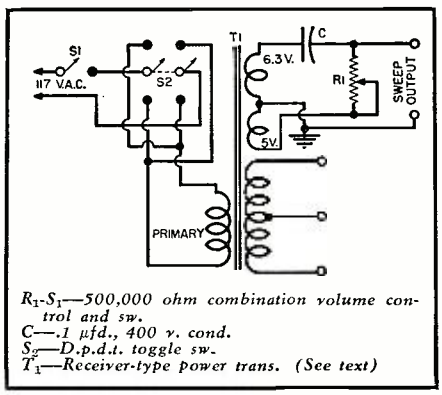
Since the rate of change of deflecting voltage is greatest during this interval, considerable expansion will take place. This expansion, coupled with full gain capabilities of the horizontal amplifier, will result in complete coverage of the cathode-ray tube by the vertical synchronizing interval, and provide a very stable waveform analysis.

The circuit necessary for such a sweep is shown in Fig. 1, and will be recognized as a 180-degree phase-shifting network. The transformer used in this illustration is a small receiver type power transformer having only two heater windings, a 5 volt winding and a 6.3 volt winding, respectively. In order to produce sufficient drive for the horizontal amplifier in the average oscilloscope, it was found necessary to phase the two heater windings.

Slight changes in sweep amplitude are apparent as the phase is shifted, because of this unbalance, but this presents no difficulty. Since two television stations may be phased with the same power line and still be separated by 180 degrees, the use of a double-pole, double-throw switch in the primary side of the power transformer will eliminate the necessity for reversing the power plug. Placing the switch in the opposite position automatically shifts the phase of the sweep voltage by 180 degrees and insures that the scanning sequence will be from left to right, in order to give natural reproduction of the viewed wave.

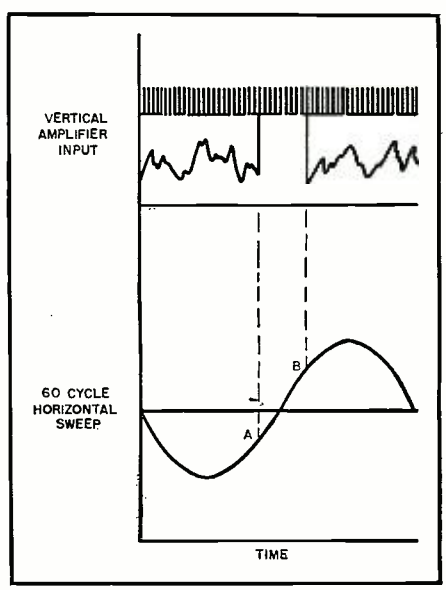
If an intensity modulation terminal

Fig. 1. Circuit to be added to scope to provide sinusoidal sweep expansion.



R_1-S_1—500,000 ohm combination volume control and sw.
C—.1 μfd., 400 v. cond.
S_2—D.p.d.t. toggle sw.
T_1—Receiver-type power trans. (See text)

Fig. 2. Linear representation of the synchronizing pulse interval produced when sweep voltage is phased so that the pulse interval occurs during the sweep voltage interval from points "A" to "B" on display.



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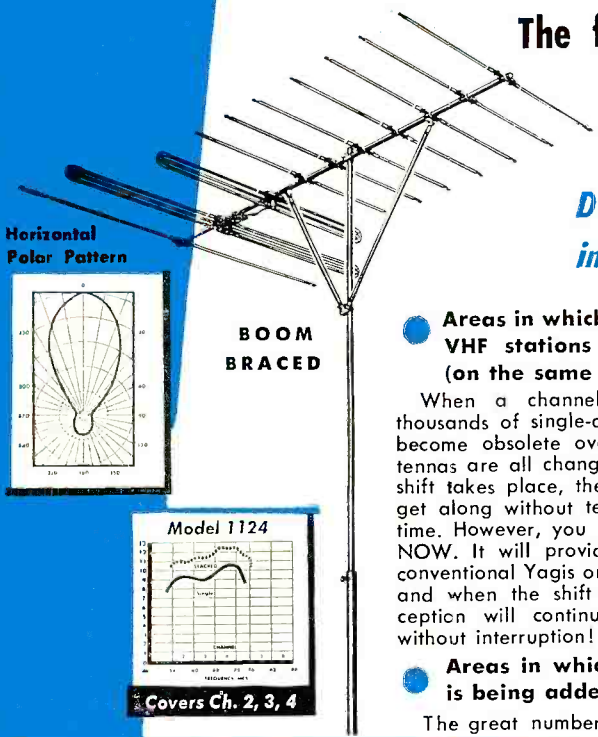

Horizontal Polar Pattern

Model 1124

Covers Ch. 2, 3, 4

Designed for service TODAY and TOMORROW — in these 3 booming VHF markets:

● **Areas in which the FCC has ordered VHF stations to change channels (on the same band).**

When a channel-shift takes place, the thousands of single-channel Yagis in use will become obsolete overnight. Unless such antennas are all changed on the same day the shift takes place, the set owner will have to get along without television for a period of time. However, you can install the Futuramic NOW. It will provide better reception than conventional Yagis on the present channels — and when the shift occurs, this superior reception will continue on the new channel without interruption!

● **Areas in which a new VHF station is being added to the present one.**

The great number of single-channel Yagis now in use will not bring in the new channel. If an additional Yagi is installed, it will have to be tied into the present installation with separate leads and a switching system. However, ONE Futuramic will do the job of BOTH antennas — at lower cost — with better results on *both* channels.

● **Areas served at present by two or more VHF stations (on the same band).**

In such areas, the installation man has had to compromise between conventional broad band antennas, and separate Yagis for each channel. Only the Futuramic will give you the full advantages of both. It combines highest gain and sharpest directivity with simple, economical installation.

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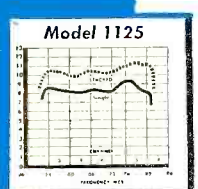
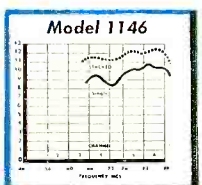


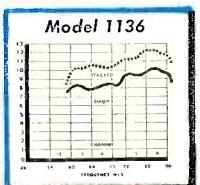
Covers Ch. 2, 3, 4, 5

Model 1146



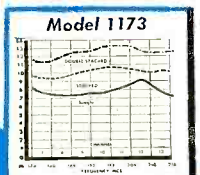
Covers Ch. 4, 5, 6

Model 1136



Covers Ch. 3, 4, 5, 6

Model 1173



Covers Ch. 7, 8, 9, 10, 11, 12, 13

Model No.	Channels Covered	List Price
1173	7, 8, 9, 10, 11, 12, and 13	$20.83
1124	2, 3, and 4	$40.97
1125	2, 3, 4, and 5	
1136	3, 4, 5, and 6	
1146	4, 5, and 6	

SHATTERS all performance records!

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- On each of its specified channels, one single Low Band Futuramic will outperform any 4-bay conical or fan array.
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- A high-low Futuramic combination is the most sensitive array ever devised for all-channel VHF reception.
- And the Futuramic uses Channel Master's famous Z-Match system for maximum stacking gain.

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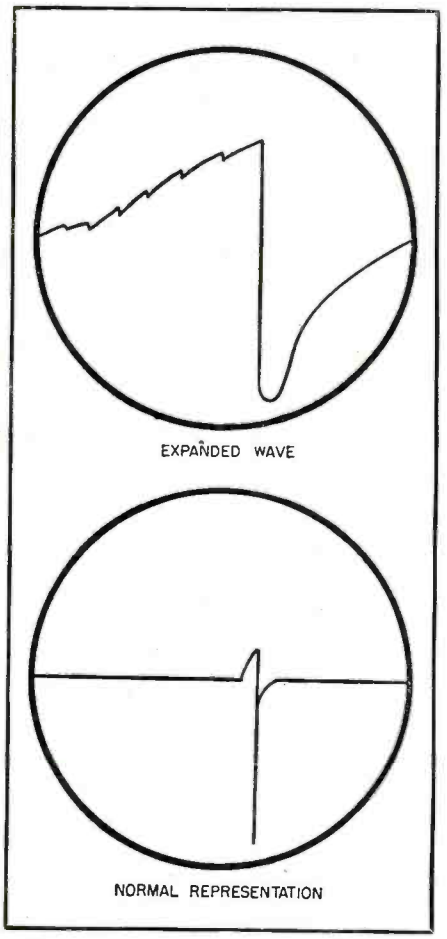

Fig. 3. Expanded wave taken between first and second sections of a triple section integrator. The sharp swing in the negative direction is produced by the vertical oscillator grid waveform and indicates the sync point of the oscillator.

is provided on the oscilloscope satisfactory blanking of the return trace can be accomplished with a sinusoidal voltage displaced 90 degrees with respect to the sweep voltage.

Operation of the circuit is quite simple and consists merely of the proper adjustment of R_1 which centers the vertical synchronizing pulse interval in the sweep period, from whence horizontal gain is increased to give the proper amount of expansion on the face of the cathode-ray tube.

If the scanning sequence appears to be from right to left, switching S_2 to the opposite position will give normal representation. Since the sweep rate is 60 cycles, each successive field can be checked for its point of synchronization. If interlace is poor and a pairing of lines results in the picture, each field will be seen to accept separate points on the integrator charge curve for synchronization.

In Fig. 3 the expanded wave taken between the first and second sections of a triple section integrator is shown. The sharp swing in the negative direction is produced by the vertical oscillator grid waveform and indicates the sync point of the oscillator.

Technicians will find this circuit well worth the slight effort needed to add it to their scopes. —30—

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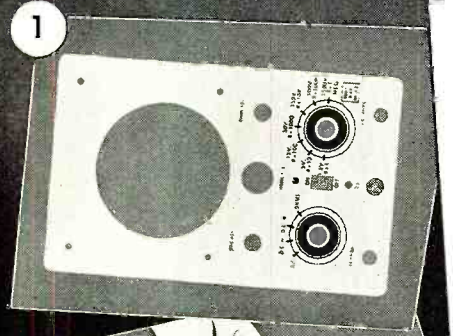

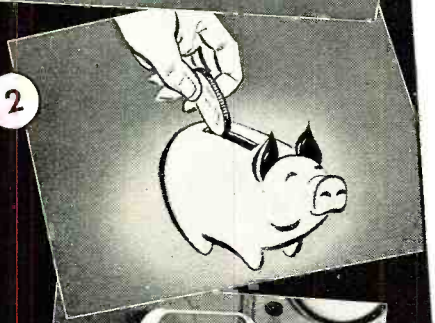

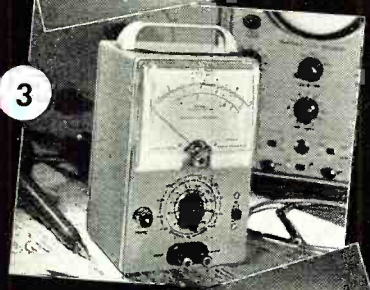

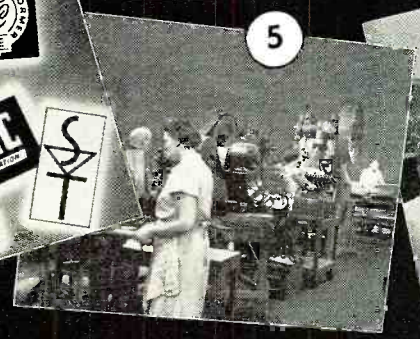

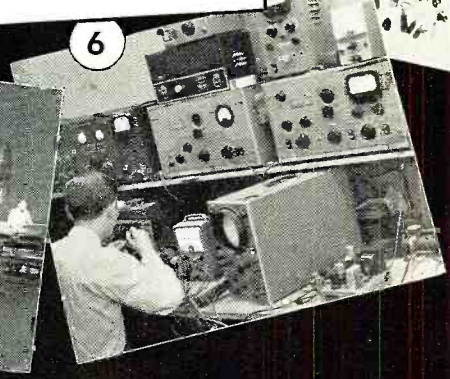

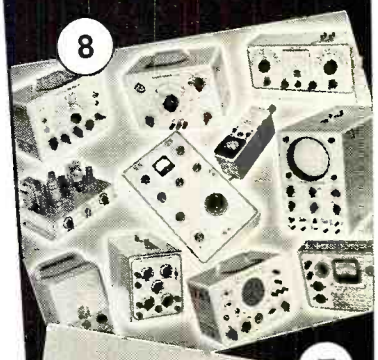

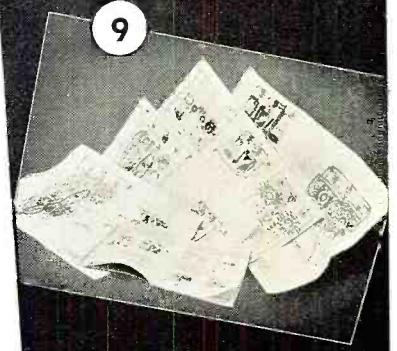

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NEW *Heathkit* "Q" METER KIT

• A HIGH QUALITY Q METER AT LOW COST.

MODEL QM-1
SHIPPING WT. 12 LBS.
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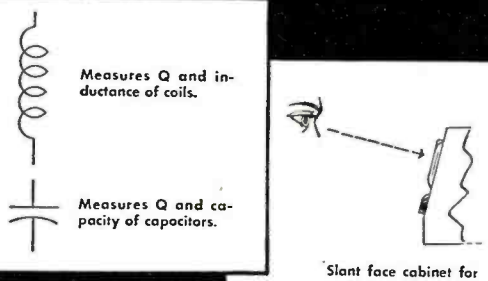

Slant face cabinet for ease in reading the meter.

- First Q METER within the price range of all.
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- Can be used to measure small inductances or capacitors.
- Measures Q of condensers, RF resistance and distributed capacity of coils.
- Measures capacity by substitution, capacity by resonance, inductance by resonance.
- Slanted panel for convenient operation.

Another outstanding example of progressive HEATHKIT engineering. Now a highly desirable Q METER within the price range of all laboratories, schools and experimenters. No longer is it necessary to deny yourself the many measurement advantages offered by this instrument.

Use the new HEATHKIT Q METER for the following simple basic measurements: capacity by substitution, capacity by resonance, inductance by resonance and Q at the OPERATING frequency all can be read on the calibrated scales. The method used to obtain information regarding the Q of condensers, RF resistance, distributed capacity in coils, etc., is only slightly more involved. In the HEATHKIT Q METER, the generated RF signal is coupled through a cathode follower and injected across a low impedance condenser which is included in the resonant circuit under test. Large 4½" 50 microampere Simpson meter reads Q directly. The resonating condenser and vernier condenser are calibrated in mmf for substitution method capacity tests. The resonating condenser is also calibrated in effective capacity for resonance tests. The inductance calibration serves for rapid determination of the approximate inductance of a coil. The HEATHKIT Q METER has a generator frequency range of 150 kc to 18 megacycles. Vernier capacity covers ± 3 mmf and the resonating condenser is calibrated from 40 mmf to 450 mmf actual capacity or 40 mmf to 350 mmf effective capacity. Meter reads Q directly up to 250. Higher and lower full scale readings can be obtained by varying the injection voltage levels.

The entire kit consists of 12AT7, 6AL5, 6C4, OD3 and 6X5 tubes, 50 microampere Simpson meter, power transformer, cabinet and all other parts necessary for construction as well as instructions for assembling, testing and operation of the completed instrument.

Heathkit DECADE RESISTANCE KIT

The HEATHKIT DECADE RESISTANCE KIT is widely used by schools, experimenters and laboratories because of the extremely wide resistance range offered and the useful, dependable service provided. The DECADE consists of 5 rotary 2 deck ceramic wafer switches with silver plated contacts and twenty 1% precision resistors in a circuit which provides the resistance range of 1 ohm to 99,999 ohms in 1 ohm steps. The HEATHKIT DECADE RESISTANCE KIT is simple to construct and is housed in a beautiful polished birch cabinet with an attractive panel. The DECADE will furnish years of accurate trouble-free service.

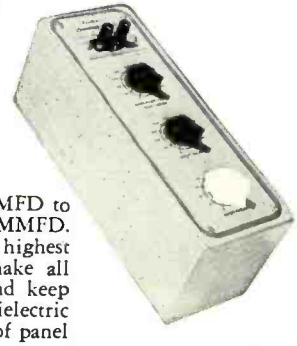
Individual decade sections of above can be purchased separately for special applications.

MODEL DR-1
SHIPPING WT. 4 LBS.
$19.50

NEW *Heathkit* DECADE CONDENSER KIT

Extremely useful in all experimental and design work such as determination of condenser values for: compensating networks, filters, bridge impedances, tuned circuits, etc. *Uses all precision silver mica condensers within ±1% accuracy.* Values run in three decades from 100 MMFD to 0.111 MFD in steps of 100 MMFD. Smooth acting, positive detent, highest quality ceramic wafer switches make all capacitor values easy to set up and keep losses to a minimum. Low loss dielectric terminal board mounts on outside of panel for easy cleaning. Heathkit binding posts accommodate a wide variety of test leads. Comes complete with all parts, including polished birch cabinet.

Individual decade sections of above can be purchased separately.



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NEW *Heathkit* OSCILLOSCOPE KIT

• NEW WIDE BAND VERTICAL AMPLIFIER ± 2 DB 10 CYCLES TO 1 MC.

Direct plate connections for modulation tests.

Displays TV sync pulses correctly.

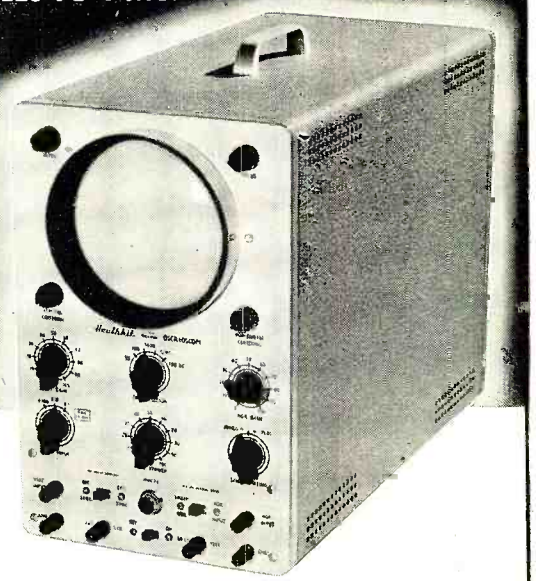
Useful to 5 mc.

Good square wave response at 100 kc.

MODEL O-8

SHIPPING WT. 29 LBS.

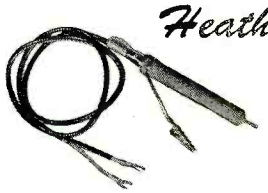
$43.50



- New wider band vertical amplifier ± 2 db from 10 cycles to 1 megacycle useful to over 5 megacycles.
- High sensitivity in vertical amplifier. .025 volts RMS per inch deflection.
- New 3 step input attenuator input ranges X1, X10, X100.
- New 5CP1 intensifier type tube for greater brilliance.
- Terminal board and rear cabinet opening provisions for direct connections to deflecting plates.
- Newly styled formed and ventilated aluminum cabinet.
- Wide band sweep generator, 15 cycles to over 100 kc. Will synchronize with 5 megacycle signal.
- 10 tube circuit featuring push pull operation of vertical and horizontal amplifiers.
- Internal synchronization on either positive or negative peaks.
- Reproduces faithfully the front and back porches of TV sync pulses. Excellent square wave reproduction to over 100 kc.
- Optional Intensifier kit available for 2200 volt operation.

Proudly announcing the new 1953 HEATHKIT Model O-8 OSCILLOSCOPE featuring the finest performance ever offered in this extremely popular kit instrument. Improved wider band vertical amplifier featuring a new 3-step input attenuator affording smooth control of the excellent .025 volts per inch vertical sensitivity. Possibility of overloading the vertical input circuit is minimized. Greater band width in the vertical channel is a decided advantage to TV service men. Permits clear observation of all TV sync pulse detail and excellent square wave reproduction over 100 kc. 5CP1 intensifier type CR tube provides a brilliant trace with normal accelerating voltages. A handsome, ventilated cabinet with smooth rounded corners and a snug fitting drawn panel adds to the smartly styled professional appearance. Longer life is assured through cooler instrument operation. Push pull output stages in both vertical and horizontal amplifiers for balanced deflection of the spot. All of the many fine features of the previous model have been retained. Rear cabinet access to terminal board for direct connection to CR plates. The entire kit of all 10 tubes, parts, cabinet and panel as well as detailed construction manual for assembly and operation of the instrument included.

INTENSIFIER KIT: For extreme trace brilliance in special applications such as photography, group demonstrations or operation in brightly lighted areas an optional Intensifier kit providing 2200 volt operation of the CR tube is available. Kit includes high voltage filter condenser, high voltage selenium rectifier, etc. $7.50.



Heathkit SCOPE DEMODULATOR PROBE KIT

Trouble shooting or aligning TV, RF, IF and video stages requires demodulation of high frequency signals before Oscilloscope observation. The HEATHKIT SCOPE DEMODULATOR PROBE KIT was specifically developed for this application. Kit consists of a probe housing, crystal diode detector circuit, shielded cable and spade lugs. Assembly is simple and the probe will quickly prove its usefulness as an Oscilloscope accessory.

No. 337
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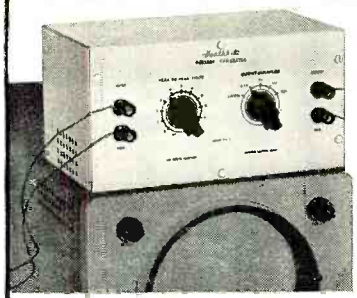
$4.50

NEW *Heathkit* VOLTAGE CALIBRATOR KIT



MODEL VC-1
SHIPPING WT. 5 LBS.
$9.50

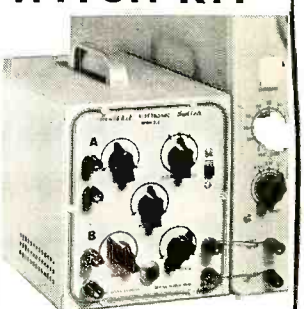
Use the Heathkit Voltage Calibrator with your oscilloscope to measure peak-to-peak TV complex waveshapes. TV manufacturer's specifications indicate correct peak-to-peak voltages and this kit will permit making these important measurements.

A big help to engineers in circuit work. Makes peak-to-peak voltage measurements of complex waveshapes of all kinds. Flat topped semi-square wave output of calibrator assures fast and easy measurement of any voltage between .01 and 100V peak-to-peak.

The Voltage Calibrator can remain connected to your oscilloscope at all times for instant use. "Signal" position connects signal under study directly through calibrator and into scope input circuit for direct observation. Eliminates transfering leads from calibrator *A wonderful scope accessory.*

Heathkit ELECTRONIC SWITCH KIT

A few dollars spent for this accessory will increase the usefulness of a scope immeasurably. An electronic switch will open up a whole new field of scope applications for you. The S-2 allows TWO SIGNALS to be observed at the SAME TIME — this important feature allows you to immediately spot phase shift, clipping, distortion, etc. The two signals under observation can be superimposed or separated for individual study. Each signal input has an individual gain control for properly adjusting scope trace patterns. Has both coarse and fine frequency controls for adjusting switching time. Multivibrator switching frequency is from less than 10 cps to over 2000 cps in three overlapping ranges. Kit comes complete including 5 tubes, power transformer, all controls, instruction manual, etc. *Every scope owner should have one!*



MODEL S-2
SHIPPING WT. 11 LBS.
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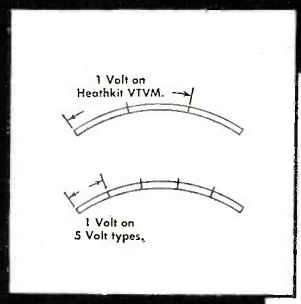
Heathkit VACUUM TUBE VOLTMETER KIT

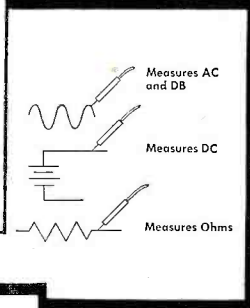
• NEW 1½ VOLT RANGE ON 1953 VTVM

MODEL V-6

SHIPPING WT., 7 LBS.

$24.50





- New 1½ volt low range gives over 2" of scale per volt instead of less than ¾" found on 5 volt range type.
- Increased accuracy due to expanded scales.
- New 1500 volt DC high range gives 50% greater coverage.
- Seven ranges in all. 1½, 5, 15, 50, 150, 500 and 1500 volts DC (1000 volts maximum AC only).
- Provides proper service ranges 150 volts for AC DC work and 500 volts for AC type service.
- High input impedance, 11 megohms minimizes circuit loading.
- Variety of accessory probe kits available.
- 1% precision resistors in multiplier circuits.
- 200 microampere Simpson meter.
- Center scale zero adjust.
- Transformer operated.
- Test leads included.
- New cabinet styling.
- Large, clearly marked meter scales indicate ohms, AC volts, DC volts and DB.

The 1953 Heathkit V-6 VTVM has improved ranges! The lowest range has been moved way down to 1.5V full scale. This gives 3½" of actual scale length for the 1.5V covered — *that's 2⅓ inches per volt!!* Now you can make your low level measurements faster and with greater accuracy.

And the upper range has been moved up. *Readings up to 1500V DC* can be readily made with new, improved VTVM — plus readings up to 1000V on AC. Higher ranges for extended use.

New vertical chassis mounting gives added chassis space for really easy wiring — no tight corners to worry about. Uses only highest quality components throughout. Simpson 200 microampere meter movement combined with 1% precision resistors in multiplier circuit insure highly accurate and dependable readings.

AC and DC voltage ranges are 0-1.5V-5V-15V-50V-150V-500V-1500V. (1000V max. reading on AC) — a total of seven ranges for convenient, accurate readings. Instrument also measures resistance from .1 ohm to over 1 billion ohms in seven handy ranges of RX1, X10, X100, X1000, X10K, X1 Meg., — all convenient multiples of 10 with no skips. Has Db scale in red for easy indentification.

New panel has tough *baked on enamel finish* for freedom from scratches and maximum durability. Modern styled, formed, compact cabinet with rounded edges and crackle finish is truly handsome.

Comprehensive, detailed instruction manual with step-by-step instructions, figures, pictorials, etc. makes assembly a cinch.

Be sure and look over the special accessory VTVM probes below — for added usefulness.

Heathkit R. F. PROBE KIT

SHIP. WT. 1 LBS. **$5.50**

No. 309

Extends RF range of HEATHKIT 11 megohm VTVM to 250 megacycles ± 10%.

Heathkit 30,000 V. D.C. PROBE KIT

SHIP. WT. 2 LBS. **$5.50**

No. 336

Provides DC multiplication factor of 100 for any 11 megohm VTVM.

Heathkit PEAK TO PEAK VOLTAGE PROBE KIT

SHIP. WT. 2 LBS. **$6.50**

No. 338

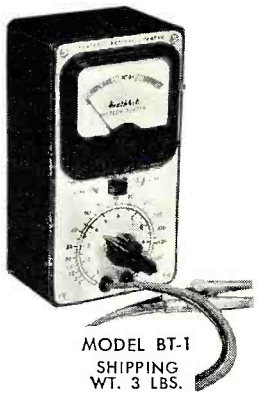
Reads on DC scale of any 11 megohm VTVM 5 kc to 5 megacycle range.

NEW Heathkit BATTERY TESTER KIT

The new Heathkit Battery Tester measures all types of dry batteries between 1½ volts and 150 volts under actual load conditions. Readings are made directly on a three-color GOOD-WEAK-REPLACE scale that your customers can readily understand. Operation is extremely simple and merely requires that the leads be connected to the battery under test. Only one control to adjust in addition to a panel switch for A or B battery types.

The Heathkit Battery Tester features compact assembly. An accurate meter movement and wire wound control mount in the portable, rugged plastic case.

Use the BT-1 to check portable radio batteries, hearing aid batteries, lantern batteries and photo flash gun batteries.



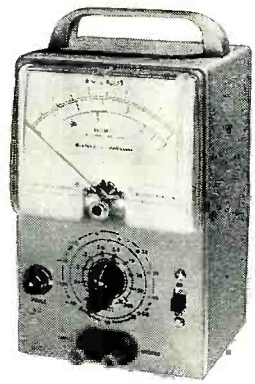
MODEL BT-1

SHIPPING WT. 3 LBS.

$7.50

Heathkit AC VACUUM TUBE VOLTMETER KIT

A new AC VTVM that makes possible those sensitive AC measurements required by laboratories, audio enthusiasts and experimenters. Ten full scale ranges of .01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts RMS. 10 DB ranges from −52 to +52 DB. Frequency response within 1 DB from 20 cycles to 50 kc. Simpson 200 microampere meter with large plainly marked meter scales. Precision multiplier resistors. Two amplifier stages using miniature tubes. A unique bridge rectifier meter circuit and a clean layout of parts. Order the AV-2 today and become acquainted with the interesting possibilities offered by this instrument.



MODEL AV-2

SHIPPING WT. 5 LBS.

$29.50

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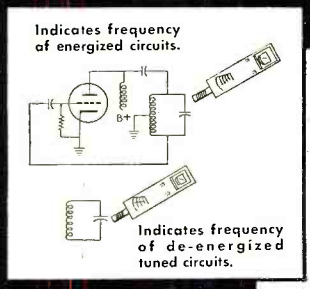
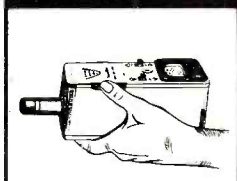
. . . BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* GRID DIP METER KIT

• CONVENIENT ONE HAND OPERATION.




Complete unit easily held and operated with one hand.

MODEL GD-1

SHIPPING WT. 4 LBS.

$19.50

- New GRID DIP METER with assembled calibrated coils.
- Uses quality Simpson 500 microampere meter.
- One hand operation, extremely compact. Only 2½" wide by 3" high by 7" long.
- Variable meter sensitivity control.
- Uses newest type 6AF4 high frequency triode in a Colpitts oscillator circuit.
- Continuous coverage from 2 megacycles to over 250 megacycles in 6 ranges.
- Head phone monitoring jack.
- AC power transformer operated for maximum safety.

Here is the GRID DIP METER KIT you have been asking for. This new HEATHKIT instrument is compact, highly sensitive and easy to use. Housed in a handsome formed aluminum cabinet—rounded corners—durable oven baked finish on panel and cabinet. The entire instrument can be easily held and operated in one hand, tuning accomplished with the thumb wheel drive. This excellent design feature leaves the other hand entirely free for making circuit adjustments. The instrument with many applications — with oscillator energized, use it for finding the resonant frequency of tuned circuits, locating parasitics, determining characteristics of filter circuits, roughly tuning transmitter stages with power off, and neutralizing transmitters. Useful in TV and radio repair work for alignment of traps, filters, IF stages, peaking and compensation networks within the 2 to 250 megacycle range. With the oscillator not energized, the instrument acts as an absorption wave meter and indicates the frequency of radiating power sources. Locates spurious oscillations, as a relative indication of power in various transmitter stages, etc. Phone jack permits monitoring of AM transmitter for determination of radiated hum, audio quality, etc. (Head phones not included). Complete kit includes plug-in coils, tube, all necessary parts and detailed assembly and instruction manual.

Heathkit IMPEDANCE BRIDGE KIT

MODEL IB-1B

SHIPPING WT. 15 LBS.

$69.50

The HEATHKIT IMPEDANCE BRIDGE is especially useful in educational training programs, industrial laboratories and for experimental work. Use it for measuring AC and DC resistance value of resistors, determination of condenser capacitance and dissipation factor, finding coil inductance and storage factor, electrical measurements work, etc. Quality components: GR 1000 cycle hummer, GR main control, Mallory ceramic wafer silver plated contact switches, ½% precision resistors, etc. The basic circuit is a self powered, 4 arm bridge. Choice of Wheatstone, Capacitance comparison, Maxwell or Hay bridge circuits. Resistance from 10 milliohm to 10 megohm. Capacitance 10 mmf to 100 mfd. Inductance 10 microhenry to 100 henries. Dissipation factor .002 to 1. Storage factor (Q) 1 to 1000. The IMPEDANCE BRIDGE has provisions for external generator use for measurement at other than the 1000 cycle level. Take the guess work out of electrical measurements. The HEATHKIT IMPEDANCE BRIDGE mounted in a beautiful polished birch cabinet with large easy reading panel calibrations will furnish years of accurate, trouble free measurement service.

Heathkit HANDITESTER KIT

The HEATHKIT Model M-1 HANDITESTER fulfills requirements for a portable volt ohm milliammeter. This kit features precision 1% resistors, 3 deck switch for trouble free mounting of parts, specially designed battery bracket, smooth acting ohms adjust control, beautiful molded bakelite case and a 400 microampere meter movement. 5 convenient AC and DC voltage ranges as follows: 10 - 30 - 300 - 1000 - 5000 volts. Ohms ranges 0 - 3000 and 0 - 300,000. DC milliampere ranges 0 - 10 milliamperes and 0 - 100 milliamperes. The instrument is easily assembled from complete instructions and pictorial diagrams. Test leads are included. Carry the HEATHKIT M-1 HANDITESTER in your tool box at all times for those simple jobs and eliminate that extra trip for additional testing equipment.

MODEL M-1

SHIPPING WT. 3 LBS.

$13.50

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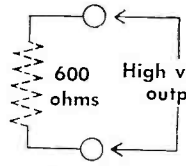
NEW Heathkit AUDIO GENERATOR KIT

• RANGE EXTENDED TO 1 MEGACYCLE

MODEL AG-8

SHIPPING WT. 16 LBS.

$29.50



Low impedance output
High voltage output

Sine wave output from 20 cycles to 1 megacycle.

- Improved design — new low price.
- Frequency coverage in five ranges from 20 cycles per second to 1 megacycle.
- Response flat 1 DB from 20 cycles to 400 kilocycles. Down 3 DB at 600 kilocycles. Down only 8 DB at 1 megacycle.
- Five calibrated output voltage ranges, continuously variable 1 mv, 10 mv, 100 mv, 1 v, 10 v.
- Low impedance output circuit. 600 ohms.
- Distortion less than .4 of 1% from 100 cycles per second through the audible range.
- New HEATHKIT universal type binding posts.
- Durable infra-red baked enamel panel.
- Transformer operated for safe operation.
- Sturdy, ventilated steel cabinet.

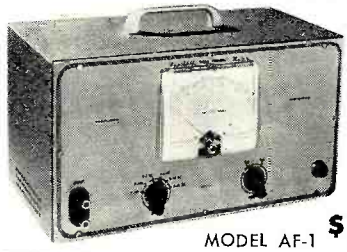
A new Audio Generator with features heretofore found in only the most expensive generators. Such features as complete coverage from 20 cycles to 1 Mc — response flat ±1 db from 20 cycles to 400 Kc, down 3 db at 600 Kc and down only 8 db at 1 Mc.

And it has calibrated output . . . Calibrated continuously variable and step attenuator output controls allow you to easily set calibrated output voltage. Moreover, distortion is less than .4 of 1% from 100 cps through the audible range.

Oscillator section consists of a two stage resistance coupled amplifier (6SJ7 and 6AK6) utilizing both positive and negative feedback for oscillator operation and reduction of distortion. Oscillator section drives a cathode follower output power amplifier (6AK6) which isolates the oscillator from variations in load and presents a low impedance output (600 Ohms). Power supply is transformer operated and utilizes 6X5 rectifier with 2 sections of RC filtering.

An unbeatable dollar value — for here is an audio generator with wide frequency coverage, excellent frequency response, stepped and continuously variable calibrated output, high signal level, low impedance output, and low inherent distortion.

Heathkit AUDIO FREQUENCY METER KIT

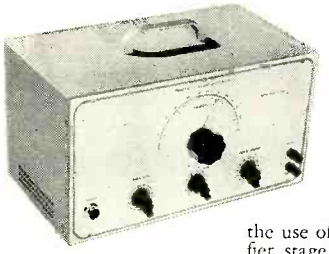


The HEATHKIT AUDIO FREQUENCY METER provides a simple and easy way to check unknown audio frequencies from 10 cycles to 100 kc between 3 and 300 volts RMS. The instrument features 7 ranges for accuracy and wide coverage. The meter itself has a quality 200 microampere Simpson movement and large clearly marked scales. The AUDIO FREQUENCY METER is transformer operated and features a voltage regulator tube to maintain constant plate voltage on the second stage. Kit supplied complete with all necessary construction material and a detailed construction manual.

SHIPPING WT. 15 LBS.

MODEL AF-1 $34.50

NEW Heathkit AUDIO OSCILLATOR KIT



A new Audio Oscillator with both sine and square wave coverage from 20 to 20,000 cycles . . . An instrument designed to completely fulfill the needs of the audio engineer and enthusiast — Has numerous advantages such as high level output (up to 10V obtainable across the entire range), distortion less than .6%, and low impedance output.

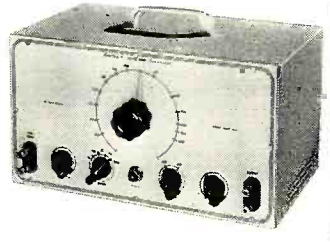
Special design features include the use of a thermistor in the second amplifier stage for keeping the output essentially flat across the entire range.

A cathode coupled clipper circuit produces good, clean, square waves with rise time of only 2 microseconds. Oscillator section uses 1% precision resistors in range multiplier circuit for greatest accuracy.

You'll like the operation of this fine new kit.

MODEL AO-1
SHIPPING WT. 14 LBS.
$24.50

Heathkit SQUARE WAVE GENERATOR KIT



The HEATHKIT SQUARE WAVE GENERATOR is an excellent square wave frequency source with wide range coverage from 10 cycles to 100 kc continuously variable. This feature makes it useful for TV and wide band amplifier work as well as audio experimentation. The output voltage is continuously variable between 0 and 20 volts. The circuitry consists of a multivibrator stage, a clipping and squaring stage and a cathode follower low impedance output stage. The power supply is transformer operated and utilizes a full wave rectifier circuit with two sections of filtering. Another excellent HEATHKIT value at this remarkable low price. Kit includes all necessary construction material as well as complete instruction manual for assembly and operation.

MODEL SQ-1
SHIPPING WT. 14 LBS.
$29.50

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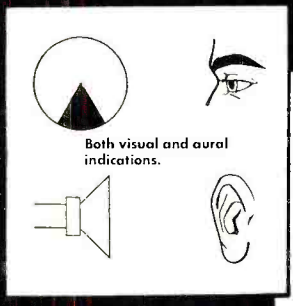
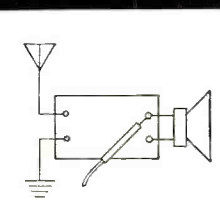
NEW *Heathkit* VISUAL-AURAL SIGNAL TRACER KIT

• NEW NOISE LOCATOR AND WATTMETER CIRCUITS.



Both visual and aural indications.



Traces signals from antenna clear through speaker.

MODEL T-3

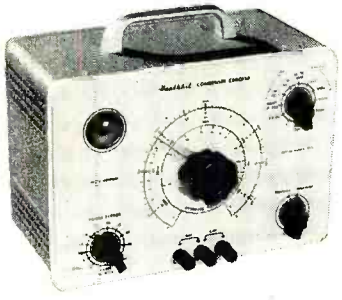
SHIPPING WT. 8 LBS.

$22.50

- Permits visual signal observation as well as aural operation.
- Two separate input channels.
- Tremendous RF channel sensitivity. Adequate for actual signal detection at receiver input.
- Separate high gain RF and low gain audio channels.
- A unique and useful noise locater circuit.
- Built-in calibrated wattmeter.
- Two separate shielded probes for RF and audio application.
- Additional test leads supplied.
- Substitution test speaker and output transformer eliminates necessity for speaker removal in service work.
- Utility amplifier. Check record changers, tuners, microphones, instrument pickups, etc.
- VTVM and Scope panel terminals.
- 5 tube transformer operated circuit.

The new HEATHKIT VISUAL AURAL SIGNAL TRACER represents one of the most convenient and useful instruments the service man can use in AM, FM and TV service work. The electron ray beam indicator constantly monitors both input channels for visual observation of the signal. Now, see and hear the signal level for easier estimation of signal strength and gain per stage in a receiver circuit. Separate high gain channel and special shielded demodulator probe for RF circuit work. Low gain channel for audio circuit investigation and for use as a noise locater. In this feature, approximately 200 volts DC is applied to a suspected circuit component and the action of the voltage in the component can be seen and heard to determine satisfactory operation. This feature alone will prove tremendously helpful in locating the source of objectionable noises in coils, transformers, resistors, condensers, cold solder joints, controls, etc. A convenient wattmeter permits rapid preliminary check for voltage distribution circuit breakdown as well as transformer failures. Use the T-3 as a universal test speaker and substitution transformer and save service time by eliminating the necessity for speaker removal on every service call. Additional service uses are: as a utility amplifier for checking the output of record changers, tuners, microphones, instrument pickups, etc. Separate panel terminals permit utilization of other shop equipment such as your Oscilloscope or VTVM. Entire kit supplied complete with 5 tubes, all necessary construction material along with a detailed step by step instruction manual for the assembly and operation of the instrument.

NEW *Heathkit* CONDENSER CHECKER KIT



MODEL C-3

SHIPPING WT. 7 LBS.

$19.50

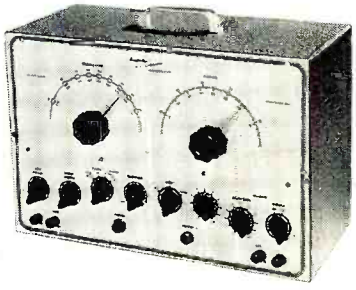
Announcing the new improved Model C-3 HEATHKIT CONDENSER housed in a new smartly styled professional appearing cabinet featuring rounded corners and snug fitting drawn panel. Adequate provisions for ventilation insures longer instrument life through cooler operation. Use the C-3 to accurately measure those unknown condenser and resistor values. All readings of condensers and resistors are read directly on the calibrated scales. Range of condenser measurements is from .00001 mfd to 1000 mfd. Calibrated resistance measurements can be made from 100 ohms to 5 megohms. A leakage test with a choice of 5 DC polarizing voltages will quickly indicate condenser operating quality under actual voltage load conditions. The spring return leakage test switch automatically discharges the condenser under test and eliminates shock hazard. An electron ray beam indicator tube is used in a new leakage test circuit for added sensitivity. The instrument is transformer operated for safety and will prove an extremely welcome addition to your shop equipment. The kit is furnished complete with all necessary parts, test leads and includes a step by step detailed construction manual for assembly and operation.

Heathkit TV ALIGNMENT GENERATOR KIT

MODEL TS-2

SHIPPING WT. 20 LBS.

$39.50



Here is an excellent TV ALIGNMENT GENERATOR designed to do TV service work quickly, easily and properly. The Model TS-2 when used in conjunction with an Oscilloscope provides a means of correctly aligning TV receivers. The instrument furnishes a frequency modulated signal covering in 2 bands the range of 10 to 90 megacycles and 150 to 230 megacycles. An absorption type frequency marker covers from 20 to 75 megacycles in 2 ranges: therefore you have a simple, convenient means of checking IF's independent of oscillator calibration. Sweep width is variable from 0 to 12 megacycles. Other excellent features are horizontal sweep voltage controlled with a phasing control — both step and continuously variable attentuation for setting the output signal to the desired level — a convenient stand by switch — and blanking for establishing a single trace with a base reference level. Make your work easier, save time and repair with confidence. Order your HEATHKIT TV ALIGNMENT GENERATOR now.

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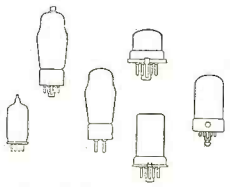
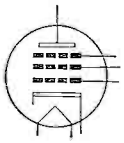
Heathkit TUBE CHECKER KIT

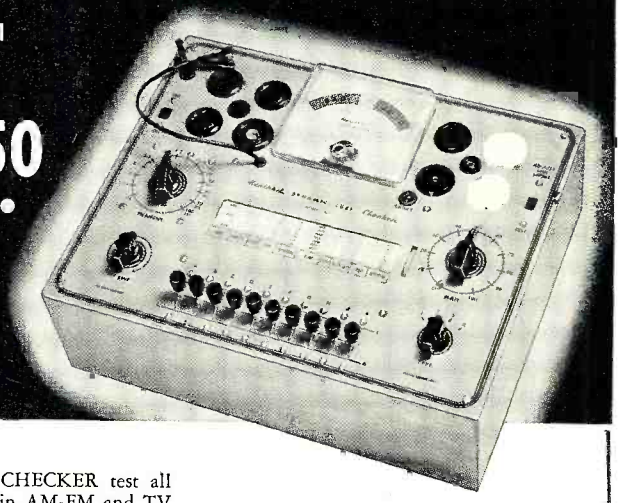


Checks 7, 8, 9 prong tubes, octals, loctals, 7 and 9 prong miniatures, 5 prong Hytrons, pilot lights.



Checks for opens, shorts, emission, filament and filament tap continuity.

MODEL TC-1
SHIPPING WT. 12 LBS.
$29.50



- Beautiful counter type birch cabinet.
- 4½" Simpson 3 color meter.
- Simplified setup procedure.
- Built-in gear driven roll chart.
- Checks emission, shorted elements, open elements and continuity.
- Complete protection against obsolescence.
- Sockets for every modern tube.
- Blank for new types.
- Individual element switches.
- Contact type pilot light test socket.
- Line adjust control.

PORTABLE TUBE CHECKER KIT MODEL TC-1P

Same as TC-1 except supplied with polished birch cabinet (with removable lid) instead of counter type cabinet. Shipping weight 14 lbs..... **$34.50**

No. 365 Polished Birch Tube Checker Cabinet only. Shipping Weight 7 lbs..... **$7.50**

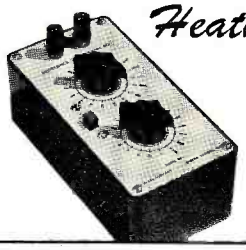
With the HEATHKIT TC-1 TUBE CHECKER test all types of tubes commonly encountered in AM-FM and TV receiver circuits. Test setup procedure is simplified, rapid and flexible. Tube quality is read directly on a beautiful 4½" Simpson three color BAD - ? - GOOD scale that your customers can readily understand. Panel sockets accommodate 4, 5, 6 and 7 prong tubes, octals, loctals, 7 and 9 prong miniatures, 5 prong Hytrons, a blank socket for new tubes and a contact type socket for quick checking of pilot lights. Built-in gear driven roll chart for instant reference. Neon short indicator, individual three position lever switch for each tube element, spring return test switch, line set control to compensate for supply voltage variations. At this low price, no service man need be without the advantages offered by the HEATHKIT TUBE CHECKER.

Heathkit TV PICTURE TUBE TEST ADAPTER

Use your HEATHKIT TUBE CHECKER with this new TV TEST ADAPTER to determine picture tube quality. Check for emission and shorts, independent of TV power supply. Consists of standard 12 pin TV tube socket, 4 feet of cable, octal socket connector and data sheet. Quickly prove TV picture tube condition to yourself and your customer.

No. 355 Ship. Wt. 1 lb. **$4.50**

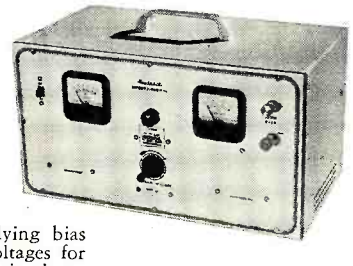
Heathkit RESISTANCE SUBSTITUTION BOX KIT



MODEL RS-1
SHIPPING WT. 3 LBS.
$5.50

NEW HEATHKIT RESISTANCE SUBSTITUTION BOX KIT provides switch selection of any single one of 36 RTMA 1 watt 10% standard value resistors, ranging from 15 ohms to 10 megohms. This coverage available in 2 ranges in decades of 15, 22, 33, 47, 68 and 100. Housed in rugged plastic cabinet featuring new HEATHKIT universal type binding posts. The entire kit priced less than the retail value of the resistors alone.

Heathkit BATTERY ELIMINATOR KIT



A clean 6 volt d-c supply source is definitely required for successful automobile radio servicing. Has a continuously variable d-c output from 0 to 8 volts. It can be safely operated at a steady 10 ampere level and will deliver up to 15 amperes for intermittent periods. The voltage output terminals are completely isolated from the chassis to accommodate additional service applications such as supplying bias voltages or d-c substitution voltages for battery operated tube filament circuits.

The output of the Battery Eliminator is constantly monitored by a d-c voltmeter and a d-c ammeter. The circuit features an automatic overload relay of self resetting type. For additional protection, a panel mounting fuse is provided. Build this kit in a few hours and pocket a substantial savings.

MODEL BE-3
SHIPPING WT. 20 LBS.
$24.50

Heathkit VIBRATOR TESTER KIT

Repair time is valuable, and the Heathkit Vibrator Tester will save you hours of work. Instantly tells the condition of the vibrator under test — and the check is thorough and complete. Checks vibrator for proper starting, and the easy-to-read meter indicates the quality of output on large BAD-GOOD scales. Tests both interrupter and selfrectifier types of vibrators. Five different sockets for checking hundreds of vibrators.

Operates from any battery eliminator capable of delivering continuously variable voltage from 4 - 6V at 4 amps. The Heathkit BE-3 Battery Eliminator is ideal for operating this kit.

Faulty vibrators can be spotted within seconds and you're free to go on to other service jobs.

MODEL VT-1
SHIPPING WT. 7 LBS.
$14.50

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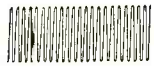
Heathkit SIGNAL GENERATOR KIT

MODEL SG-7

SHIPPING WT. 7 LBS.

$19.50

Modulated or unmodulated RF output.



400 cycle sine wave output.

- Step attenuated RF ouput.
- 6 to 1 vernier dial ratio.
- Turret mounted coil subassembly.
- Pre-calibrated and adjusted coils.
- Hartley RF oscillator circuit.
- Colpitts oscillator 400 cycle sine wave output.
- Modulated or unmodulated RF output.
- Frequency coverage on fundamentals 160 kc to 50 megacycles in five ranges. 51 megacycles to 150 megacycles on calibrated harmonics.
- RF output in excess of 100,000 microvolts.
- Audio output 1½ to 2 volts.
- AC transformer operated.
- Professionally styled cabinet.
- Infra red baked enamel panel.

The new HEATHKIT Model SG-7 SIGNAL GENERATOR easily fulfills requirements for a controllable, modulated or unmodulated source of variable frequency. A convenient 400 cycle sine wave output is available for audio work. All RF oscillator coils are precision wound and adjusted to calibration before shipment thereby assuring maximum accuracy. The coils, band switch and tuning condenser all mount as a turret assembly so as to offer the advantage of short wiring leads and easy mounting of parts. The RF output circuit is of the low impedance type obtained by the use of cathode coupling to the output jacks. The level of RF output is varied by means of the RF step and RF output control. Use the HEATHKIT SG-7 as an RF signal source modulated or unmodulated for radio repair, laboratory work, experimental testing, 400 cycle sine wave audio testing, checking RF stages, alignment of both AM and FM IF stages, marker generator for TV alignment, etc. The kit is transformer operated and utilizes miniature tubes for ease in handling high frequency. Panel jacks and a convenient switching system permit either external or internal modulation. The entire kit is supplied complete with tubes and all necessary material as well as a detailed step by step instruction manual for the assembly and operation of the instrument.

Heathkit INTERMODULATION ANALYZER KIT

MODEL IM-1

SHIPPING WT. 18 LBS.

$39.50

The HEATHKIT MODEL IM-1 is an extremely versatile instrument specifically designed for measuring the degree of interaction between two signals caused by a specific piece of apparatus, or a chain of equipment. It is primarily intended for tests of audio equipment but may be used in other applications such as making tests of microphones, records, recording equipment, phonograph pickups and loud speakers. Use it for checking tape or disc recordings, as a sensitive AC voltmeter, as a high pass noise meter for adjusting tape bias, cutting needle pitch or other applications. High and low test frequency source, intermodulation section, power supply and AC voltmeter all in one complete unit. Percent intermodulation is directly read on three calibrated ranges, 30%, 10% and 3% full scale. Both 4 to 1 and 1 to 1 ratios of low to high frequencies easily set up. At this low kit price YOU can enjoy the benefits of Intermodulation analysis for accurate audio interpretations.

Heathkit LABORATORY REGULATED POWER SUPPLY KIT

MODEL PS-2

SHIPPING WT. 20 LBS.

$29.50

New HEATHKIT LABORATORY POWER SUPPLY provides continuously variable regulated DC voltage output from 160 volts to 400 volts depending on load. Panel terminals supply separate 6.3 V. AC supply at 4 amperes for filament circuits. A 3½" plastic cased panel mounted meter provides accurate metered output for either voltage of current measurements. Exceptionally low ripple content of .012% admirably qualifies the HEATHKIT LABORATORY POWER SUPPLY for high gain audio applications. Ideal for laboratory work requiring a reference voltage for meter calibration or for plotting tube characteristics. In service work, it can be used as a separate variable voltage supply to determine the desirable operating voltage in a specific circuit. Use it as a DC substitution voltage in trouble shooting TV circuits exhibiting symptoms of extraneous undesirable components in plate supply circuits. Entire kit, including all 5 tubes now available at this low price.

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE ARLAB-N Y.

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

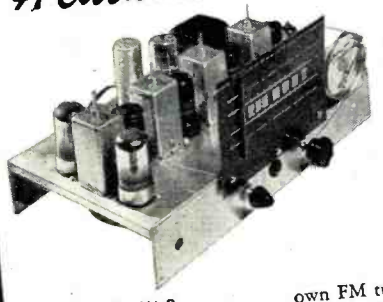
Heathkit WILLIAMSON TYPE AMPLIFIER KIT

The new HEATHKIT WILLIAMSON TYPE AMPLIFIER- incorporates the latest improvements described in Audio Engineering's "Gilding the Lily." 5881 output tubes and a new Peerless output transformer with additional primary taps afford peak power output of well over 20 watts. Frequency response ±1 db from 10 cycles to 100 kc. allows reproduction of highs and lows with equal crispness and clarity. Harmonic and intermodulation distortion have been reduced to less than ½ of 1% at 5 watts. This eliminates the harsh unpleasant qualities which contribute to listening fatigue. Make this amplifier the heart of your radio system to achieve the fine reproduction that is the goal of all music lovers.

The HEATHKIT PREAMPLIFIER (available separately or in combination with the amplifier kit) features inputs for magnetic or low level cartridges, crystal pickups and tuners, turnover control for LP or 78 type records, individual bass and treble tone controls each providing up to 15 DB of boost or attenuation. Special notched shafts on preamplifier controls and switches adaptable to custom installation. The preamplifier can be mounted in any position and a liberal length of connecting cable is supplied. No radio experience is required to construct this amplifier. All punching, forming, or drilling has already been done. The complete kit includes all necessary parts as well as a detailed step by step construction manual with pictorial diagrams to greatly simplify the construction.

ACROSOUND TRANSFORMER OPTION. If desired, the output transformer with the kit will be the Acrosound output transformer, type TO-300. The use of this transformer permits ultra-linear operation as described in Audio Engineering's "Ultra-Linear Operation of the Williamson Amplifier."

Heathkit FM TUNER KIT



MODEL FM-2

SHIPPING WT. 9 LBS.

$22.50

The HEATHKIT MODEL FM-2 TUNER specifically designed for simplified kit construction features a preassembled and adjusted tuning unit. Three double tuned IF transformers and a discriminator transformer are used in an 8 tube circuit. Smooth tuning is obtained through a 9 to 1 ratio vernier drive using a calibrated six inch slide rule type dial. The usual frequency coverage of 88 to 108 megacycles is provided. Experience the thrill of building your own FM tuner. Operate it through your amplifier or radio and enjoy all the advantages of true FM reception. Transformer operated power supply to simplify connections to all types of audio systems. The kit is supplied complete with all 8 tubes and necessary material required for construction. A complete instruction manual simplifies assembly and operation.

PRICES OF VARIOUS COMBINATIONS

W-2 Amplifier Kit (Incl. Main Amplifier with Peerless Output Transformer, Power Supply and WA-P1 Preamplifier Kit) Shipping Weight 39 lbs. **$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 39 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**

WA-P1 Preamplifier Kit only. Shipping Weight 7 lbs. Shipped express or parcel post. **$19.75**

Heathkit ECONOMY 6 WATT AMPLIFIER KIT

MODEL A-7

SHIPPING WT. 10 LBS.

$14.50

The HEATHKIT Model A-7 amplifier features beam power, push pull output with frequency response flat ±1½DB from 20 to 20,000 cycles. Separate volume, bass and treble controls. Two input circuits, output impedances of 4, 8, and 15 ohms. Peak power output rated at full 6 watts. High quality components, simplified layout, attractive gray finished chassis, break off type adjustable length control shafts and attractive lettered control panel.

THE MODEL A7A amplifier incorporates a preamplifier stage with special compensated network to provide the necessary voltage gain for operation with variable reluctance or low output level phono cartridges. Excellent gain for microphone operation in a moderate powered sound system.....**$16.50**

Heathkit HIGH FIDELITY 20 WATT AMPLIFIER KIT

The HEATHKIT MODEL A-8 amplifier kit was designed to deliver high fidelity performance with adequate power output at moderate cost. The frequency response is within ± 1 DB from 20 to 20,000 cycles. Distortion at 3 DB below maximum power output at 1000 cycles is only .8%. The amplifier features a Chicago power transformer in a drawn steel case and a Peerless output transformer with output impedances of 4, 8, and 16 ohms available. Separate bass and treble tone controls permit wide range of tonal adjustment to meet the requirements of the most discerning listener. The amplifier uses a 6SJ7 voltage amplifier, a 6SN7 amplifier and phase splitter and two 6L6's in push pull output and a 5U4G rectifier. Two input jacks for either crystal or tuner operation. The kit includes all necessary material as well as a detailed step by step construction manual.

MODEL A-8

SHIPPING WT. 19 LBS.

$33.50

MODEL A8-A features an added 6SJ7 stage (preamplifier) for operating from a variable reluctance cartridge or other low output level phono pickups. Can also be used with a microphone. A 3 position panel switch affords the desired input service. **$35.50**

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE ARLAB-N.Y.

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

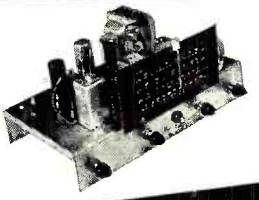
Heathkit SUPERHETERODYNE RECEIVER KITS

- High gain dual iron core tuned type IF transformers
- AC transformer operation for safety
- Continuously variable tone control
- Sturdy punched and plated steel chassis
- Ideal for custom installation
- Full AVC action
- Inverse feedback for improved frequency response
- Kit supplied with all necessary construction material except speaker and cabinet. (Available separately if desired).

6 tube all wave circuit. 3 ranges, continuous coverage 550 kc to over 20 megacycles, shipping wt. 11 lbs.

Model AR-1

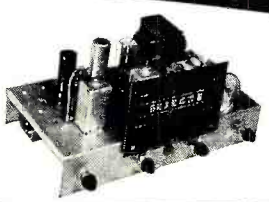
$23.50



5 tube broadcast band 550 to 1600 kc coverage, shipping wt. 11 lbs.

Model BR-1

$19.50



Two excellent radio receiver kits featuring clean design and open layout for simplified construction. Satisfy that urge to build your own radio receiver and select the model which meets your requirements. Both receivers feature continuously variable tone control, a radio phono switch and phono input and an AC receptacle for the phono motor. A six inch calibrated slide rule type dial with a 9 to 1 ratio vernier dial drive insures easy tuning.

SHIPPING INFORMATION

ON PARCEL POST ORDERS include postage for weight shown and insurance. (We insure all shipments.) Don't worry about sending more than the correct amount — if you send us too much, every extra cent will be promptly returned.

ON EXPRESS ORDERS do not include transportation charges. They will be collected by Express Agency on delivery.

ORDERS FROM CANADA must include full remittance for merchandise.

Orders processed on the same day received. Customers notified of unavoidable delay.

U. S. postal or express money orders, bank drafts or checks are acceptable. Do not send loose coins or stamps.

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

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NEW YORK CITY (16)
CABLE ARLAB-N Y

The HEATH COMPANY

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- ☐ Express
- ☐ Freight
- ☐ Best Way

QUANTITY	ITEM	PRICE	QUANTITY	ITEM	PRICE
	Heathkit Oscilloscope Kit—Model O-8 (29 lbs.)	$43.50		Heathkit Square Wave Gen. Kit—Model SQ-1 (14 lbs.)	$29.50
	Heathkit Intensifier Kit (O-8 only) No. 339 (1 lb.)	7.50		Heathkit AC VTVM Kit—Model AV-2 (5 lbs.)	29.50
	Heathkit Voltage Calibrator Kit—Model VC-1 (5 lbs.)	9.50		Heathkit Intermodulation Analyzer Kit—Model IM-1 (18 lbs.)	39.50
	Heathkit Electronic Switch Kit—Model S-2 (11 lbs.)	19.50		Heathkit Regulated Power Supply Kit—Model PS-2 (20 lbs.)	29.50
	Heathkit Scope Demodulator Probe Kit No. 337 (1 lb.)	4.50		Heathkit Handitester Kit—Model M-1 (3 lbs.)	13.50
	Heathkit T.V. Alignment Generator Kit—Model TS-2 (20 lbs.)	39.50		Heathkit Decade Resistance Kit—Model DR-1 (4 lbs.)	19.50
	Heathkit Q Meter Kit—Model QM-1 (12 lbs.)	39.50		Heathkit Decade Condenser Kit—Model DC-1 (4 lbs.)	16.50
	Heathkit Grid Dip Meter Kit—Model GD-1 (4 lbs.)	19.50		Heathkit Impedance Bridge Kit—Model IB-1B (15 lbs.)	69.50
	Heathkit VTVM Kit—Model V-6 (7 lbs.)	24.50		Heathkit Battery Tester Kit—Model BT-1 (3 lbs.)	7.50
	Heathkit RF Probe Kit No. 309 (1 lb.)	5.50		Heathkit Resistance Substitution Box Kit—Model RS-1 (3 lbs.)	5.50
	Heathkit HV Probe Kit No. 336 (2 lbs.)	5.50		Heathkit F.M. Tuner Kit—Model FM-2 (9 lbs.)	22.50
	Heathkit Peak-to-Peak Volt. Probe Kit No. 338 (2 lbs.)	6.50		Heathkit Broadcast Receiver Kit—Model BR-1 (11 lbs.)	19.50
	Heathkit Visual-Aural Signal Tracer Kit—Model T-3 (8 lbs.)	22.50		Heathkit Three Band Receiver Kit—Model AR-1 (11 lbs.)	23.50
	Heathkit Condenser Checker Kit—Model C-3 (7 lbs.)	19.50		Heathkit Amplifier Kit—Model A-7 (10 lbs.)	14.50
	Heathkit RF Signal Generator Kit—Model SG-7 (7 lbs.)	19.50		Heathkit Amplifier Kit—Model A-7A (10 lbs.)	16.50
	Heathkit Tube Checker Kit—Model TC-1 (12 lbs.)	29.50		Heathkit Amplifier Kit—Model A-8 (19 lbs.)	33.50
	Heathkit T.V. Tube Adapter No. 355 (1 lb.)	4.50		Heathkit Amplifier Kit—Model A-8A (19 lbs.)	35.50
	Heathkit Battery Eliminator Kit—Model BE-3 (20 lbs.)	24.50		Williamson Type Amplifier Kit (Type.) Shipped express only	
	Heathkit Vibrator Tester Kit—Model VT-1 (7 lbs.)	14.50		WA-P1 Preamplifier Kit (7 lbs.) (Shipped exp. or p.p.)	19.75
	Heathkit Audio Generator Kit—Model AG-8 (16 lbs.)	29.50			
	Heathkit Audio Oscillator Kit—Model AO-1 (14 lbs.)	24.50			
	Heathkit Audio Frequency Meter Kit—Model AF-1 (15 lbs.)	34.50			

*Please ship C.O.D. ☐ Postage enclosed for_____lbs. Enclosed find ☐ Check ☐ Money Order for_____

Bretz, who resigned his post at *Aerovox Corp.* after seven years' service, is the executive vice-president in charge of sales.

Officers of the new company include: Joseph P. Sewack, president; Paul Machiesky, secretary, Mr. Mitchell, and Mr. Bretz.

* * *

CHARLES A. RICE has been elected president of *United Electronics Company* of Newark, New Jersey, succeeding Rudolph H. Amberg who passed away June 29th.

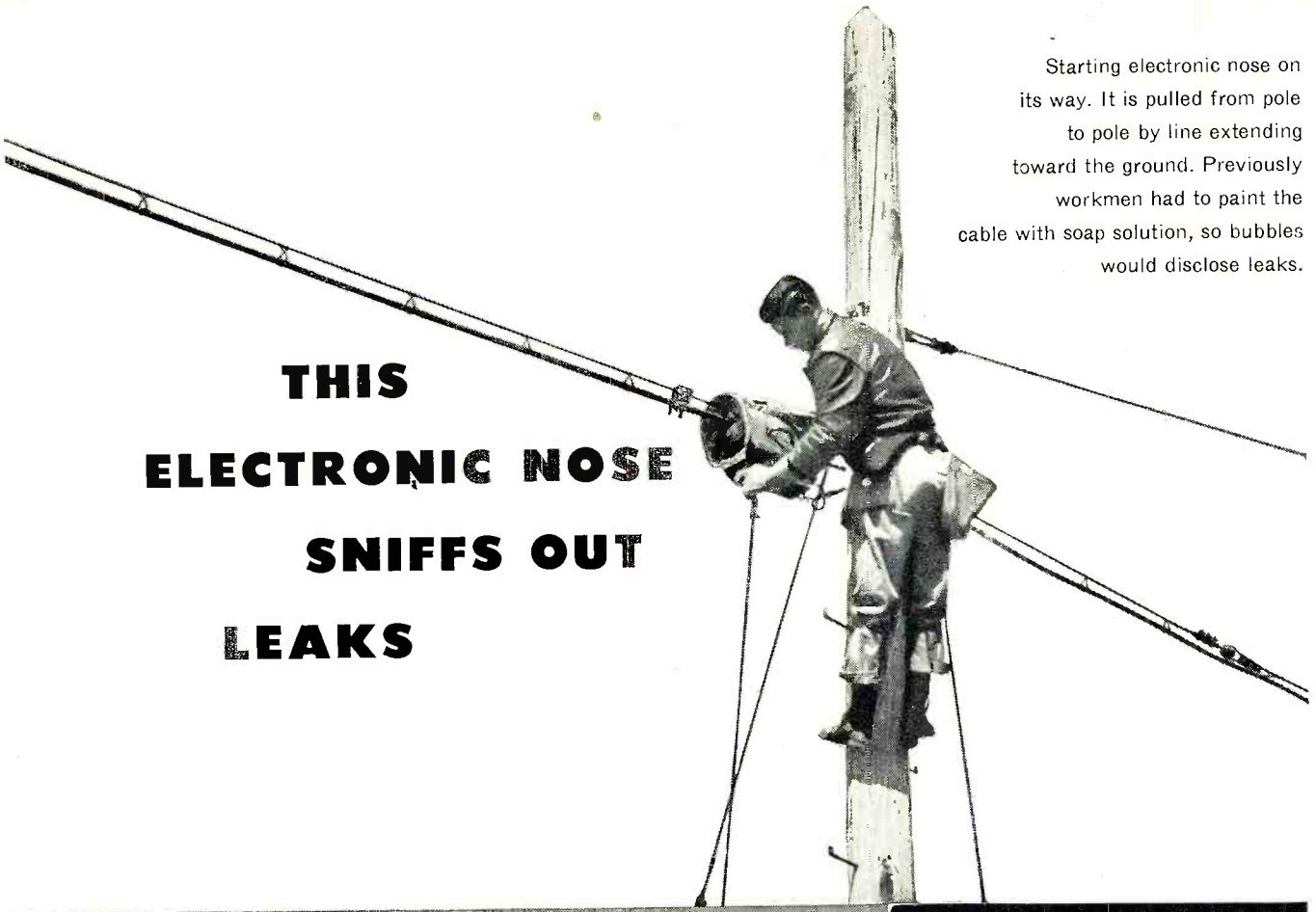
Mr. Rice served as executive vice-president of the corporation for more than 10 years and is a veteran of the radio-electronics industry. Prior to joining *United Electronics*, he was sales manager of the original electronics department of *Sylvania Electric*. Prior to that he was sales manager of the *DeForest Radio Company* of Passaic and Jersey City.

The company manufactures a wide range of special-purpose electron tubes for radio, electromedical and scientific applications, in addition to military type tubes for the Armed Forces.

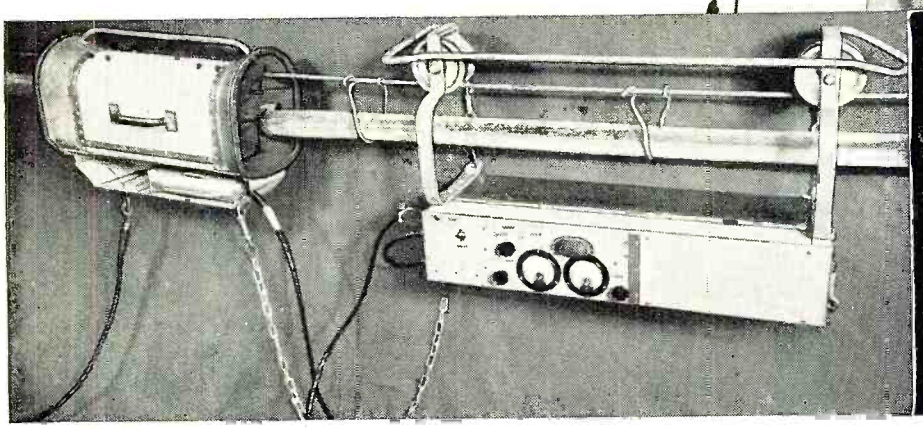
* * *

ROBERT G. HAMILTON has been named manager of radio sales for the radio and television division of *Sylvania Electric Products Inc.* He was formerly assistant to the advertising manager of the division . . . **S. F. ZELINSKY** is the new industrial relations director for the *Raytheon Television and Radio Corporation*, formerly *Belmont Radio Corporation*. He has been in personnel administration for 25 years . . . The *Bendix Radio Division* has appointed **ARTHUR C. OMBERG** to the post of director of engineering and research . . . **CARL F. HOLDEN** has been elected president of *Federal Telecommunication Laboratories, Inc.* He succeeds **HAROLD H. BUTTNER** who will assume duties as vice-president of *International Telephone and Telegraph Corporation*, the parent company . . . **KENNETH B. BOOTHE** is the new vice-president of *Audio & Video Products Corporation*. He was formerly manager of the company's instrumentation division . . . **GEORGE KARL** has been appointed manager of the research and market analysis department of *Stewart-Warner Electric*. He will be responsible for all distributor quotas, market analysis, sales statistics, and analysis for all distributor territories . . . **HARRY W. BURKE** has been appointed special merchandising representative for *Zenith Radio Corporation*. He will work out of the company's Chicago headquarters on special merchandising assignments involving distributors of the company's

THIS ELECTRONIC NOSE SNIFFS OUT LEAKS



Starting electronic nose on its way. It is pulled from pole to pole by line extending toward the ground. Previously workmen had to paint the cable with soap solution, so bubbles would disclose leaks.



For test, the cable is cleared of protective nitrogen or air, and filled with Freon gas. Case at left collects escaping gas which operates Freon-sensitive detector underneath. At points where Freon escapes through sheath cracks, the box at right—a combined control unit and power supply—rings a bell. Workmen mark the point of leak for later repair.

After years of buffeting by the wind, even tough telephone cable sometimes shows its age. Here and there the lead sheath may crack from fatigue or wear through at support points. Before moisture can enter to damage vital insulation, leaks must be located and sealed.

To speed detection, Bell Laboratories scientists constructed an electronic nose which *sniffs* out the leaks. Using an electrically operated element developed by the General Electric Company, the device detects leaks of as little as 1/100 cubic foot per day. Sheath inspection can be stepped up to 120 feet per minute.

Thus Bell scientists add findings in other fields to their own original research in ways to make your telephone system serve you better. On the other hand their discoveries are often used by other industries. Sharing of scientific information adds greatly to the over-all scientific and technological strength of America.

products . . . **HOWARD S. MONCTON** has been named administrative engineer of the radio and television division of *Sylvania Electric Products Inc.* He will be responsible for the coordination of the administrative functions of the division's engineering department including personnel, project planning, general services to the operating groups, and accounting . . . **B. V. K. FRENCH** is now associated with the *F. W. Sickles Division* of the *General Instrument Corporation* as a member of the company's field engineering staff . . . **JAMES G. FRANKLIN** has been appointed division manager to handle the "Fidelitone" phonograph needle line for *Permo, Inc.* He will make his headquarters in Indianapolis . . . **DR. HENRY F. IVEY** is the new director of research and development for *Skiatron Electronics & Television Corporation.* He was formerly associated with *Westinghouse* . . . **RAYMOND T. LEARY** is the new sales manager of *Cornell-Dubilier's* jobber division. He has been with the company since 1947 . . . **EDWARD M. CAPPUCCI** has been made general manager of *Radio Merchandise Sales,* New York antenna and electronic manufacturing concern. He joined the company several years ago as plant superintendent of the antenna division . . . **JOHN L. LYONS** has been promoted to the post of national director of sales for *Kaye-Halbert Corporation,* West Coast television concern . . . **PAUL M. CORNELL,** formerly a radio communication engineer with *Motorola, Inc.,* has joined *Electronic Engineering Company* of Akron, Ohio, as a sales engineer.

* * *

DR. YUEN T. LO has been appointed project engineer at the Antenna Development Laboratory of the *Channel Master Corp.,* Ellenville, New York.

A graduate of the National Southwest Associate University of China, Dr. Lo taught at the Radio Research Institute of Tsing Hua University, where he also was engaged in ionosphere research. An honor student at the University of Illinois, he received his doctor's degree earlier this year. His thesis was on the subject of electromagnetic wave propagation.

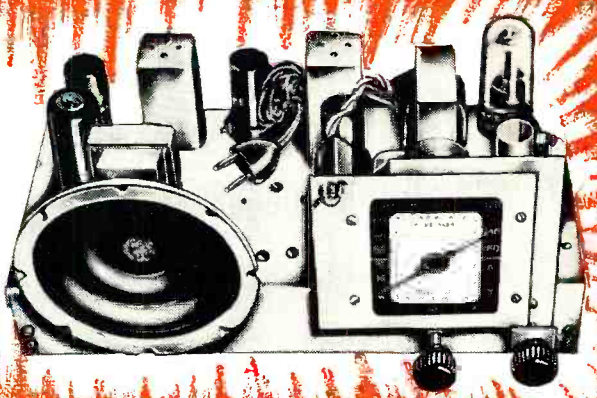
In his new position, he will carry on advanced development in electronics and antennas, including u.h.f.

* * *

MARS, the Military Amateur Radio System, will henceforth be known as the Military Affiliate Radio System, according to word received from the Department of Defense. The familiar designation MARS will, however, be continued.

The name was changed as the term "military affiliate" more clearly defines the relationship between the Armed Forces and individual members of the system.

-30-



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
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NEW! NO OBLIGATION PLAN

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.

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

SPRAYBERRY ACADEMY OF RADIO
111 NORTH CANAL ST.
Dept. 25-P 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!

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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.

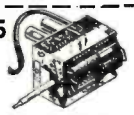
Name..... Age.....

Address.....

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

TELEVISION FRONT ENDS on SALE at McGEE—STANDARD COIL, RCA, SARKES-TARZIAN

STANDARD COIL CASCODE TUNER $19.95



The Cascode Circuit of the Standard Tuner offers a new development of this famous TV front end assembly which affords a 2-to-1 improvement in gain and a 35% to 50% reduction of noise over the pentode tuner. Other advances include: easy conversion to UHF reception by interchange of channel inductors: increased sensitivity for TV sets in fringe areas: elimination of booster use: and a high profit item for the serviceman as a replacement unit sale. Brand new factory cartoned. Series TV-2000 TV tuner, compl. with tubes 6BK7 or 6BQ7 and a 6J6. Scoop price. $19.95 ea.

THE ORIGINAL STANDARD COIL TV TUNER ANOTHER McGEE SCOOP $12.95

Five millions of this 12-channel Standard Coil tuner now in use. The popular model with clip-in channel inductors and concentric fine tuning shaft. You save over 50%. Price includes tubes. Stock No. SC-947. $12.95 each: 2 for $25.00. Choice of 2⅞" or 3¼" length insulated shaft. Used on Emerson Model 650D, 655, etc. Filaments connected in series (12 volts) and shunted .6 amp drain for AC-DC TV sets. Priced with tubes 6AG5 or 6BC5 and 6J6. Stock No. SC-948, $13.95 each; 2 for $27.00. Available with either 2", 3½", or 5" shaft length. Filaments are in parallel for 6.3 volts AC operation. Price includes tubes 6AG5 or 6BC5 and 6J6. Note: Both tuners have IF coil attached for intercarrier sets. For sets with separate sound we suggest using the convertor coil on the following stage. (Diagram furnished with each tuner.) Bakelite channel selector knob with embossed channel markings. 59c extra.

STANDARD COIL TUNERS FOR ADMIRAL SETS $13.95

2 tube Standard Coil tuners for Admiral TV sets. Price includes tubes: 6AG5 or 6BC5 and 6J6. Brand new. For intercarrier models: No. 94C8-1, 5¼" shaft. No. 94C21-2, 2⅞" shaft. For separate sound models: No. 94C8-1, 5¼" shaft. No. 94C18-2 and -3 5½" shaft. No. 94C18-4, 5" shaft. (Numbers listed are Admiral part numbers.)

3-TUBE SARKES-TARZIAN T.V. TUNER $9.95

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 convertor coil, built in fine frequency control. Sarkes-Tarzian TV tuner, 3 tubes. Net price, $9.95 each. Specify shaft length, either 2⅞" or 4¾".

RCA 201E1 T.V. TUNER $7.95

Terrific buy on this RCA tuner. We have a limited quantity of the famous original 201E1, 13 channel completely wired and tested TV front end tuners. Ready to connect to your TV video I.F. strip. Offered at a sacrifice. Price was $44.00. Now only $7.95 each, with tubes. Each tuner in good condition but has been repaired. Stock No. RCA-13P. TV front end tuner. Convertor coil type for separate sound as used in the famous 630 chassis. Complete with 3—6J6 tubes. $7.95. Specify shaft length desired, either 2" or 4".

BRUSH CRYSTAL EAR PHONE $5.49 With Control

Simply clip on to the speaker voice coil of any radio or TV set or to an audio amplifier. No soldering necessary. Listen in privately to your favorite programs. The tiny Brush crystal ear phone fits your ear just like a regular hearing aid ear piece. A small remote control box enables using 20 ft. from the radio or TV set. Has its own separate volume control and small matching transformer built-in to operate the crystal from any speaker voice coil. Ideal for hospitals, homes, hundreds of other uses. 10 times more comfortable to wear than conventional earphones. Stock No. BH-500 includes Brush crystal ear piece, remote control box, 20 ft. of cable and instructions. Sale price, $5.49 complete. Brush crystal ear phone with 36" cord, Stock No. BR-51, $2.95. (You connect it like any crystal earphone, diagram furnished.) Accessory kit includes volume control with switch plus coupling capacity and instructions, 99c extra.

CROSLEY RADIO WITH 45 RPM CHANGER $29.95

5 tube superhet radio (540 to 1600 kc Broadcast) using 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5 tubes) Automatic changer for up to 8 45 RPM records (6⅞" only). Brand new in original factory cartons. Only 600 to sell at the terrific low price of $29.95. Shipped Express only. Shipping weight 23 lbs. Mahogany cabinet 13" x 16" x 8½" high. Lid covers 45 RPM changer (will not play 78 or 33⅓ RPM records). Ideal for children and grown-ups alike. Model No. 10-145M. $29.95.

T.V.-RADIO NEWS SPECIAL $9.95

3 Flybacks and 3 Deflection Yokes for $9.95. You get 3 deflection yokes, 2—70° yokes, and 1—55° yoke, and 3 horizontal flyback transformers. 2 General Electric 14,000 volt ceramic core 70° and 1 early model Philco. The G.E. flyback cost regularly more than our price for the complete deal. Stock No. 33YK. ship. weight, 5 lbs. Radio News Special, only $9.95.

T.V. COMPONENT DEAL #CGE $12.95

Here is a terrific TV parts deal for those who repair TV or for the builder and experimenter. You get a Meissner 12-channel TV tuner, a Crosley 5-tube video IF strip, a 14KV G.E. horizontal output transformer, plus a standard 4-wire vertical output transformer, plus a 70° cosine deflection yoke (no tubes included). It's worth $20.00. Our sale price, only $12.95.

GENUINE STANDARD COIL T.V. BOOSTER $11.95

Not Surplus, But Right From the Factory

Latest Model B-51 Standard Coil Television Booster. McGee makes another lucky purchase and as usual, passes the saving on to you. The famous Model B-51, 12 Channel Standard Coil TV booster, which lists for $35.00, is offered to you for only $11.95 each. Brand new, factory cartoned and fully guaranteed by McGee. This top quality single stage booster utilizes printed high frequency circuits, for improved performance on all channels. Uses 6AK5 tube. Average gain, 6 to 7 volts on low channels and 5 or 6 on high channels. No distorting of picture or sound. Has extremely low noise factor. Continuous one-knob tuning and channel selector control switch for off-on and by-passing 300 ohm lead-in to set. Modern design, dark brown plastic cabinet, 8"x4¼"x4½". Made for 110 volt, 60 cycle AC operation. Shipping weight 5 lbs. Model B-51. Sale price, $11.95 each, or buy 2 for only $22.00.

McMURDO SILVER BOOSTER $10.95

Sensational value. Continuously variable inductance type tuner, from channel 2, including the FM band, through channel 13. This booster is self powered for 110 volts AC operation. Incorporates a 6J6 tube. Input for 300 ohm TV line and 300 ohm output to the TV set. Single knob tuning. Attractive plastic case. McMurdo-Silver Super Sonic TV-FM booster. Stock No. GB-6B. Shipping weight 5 lbs. McGee's terrific sale price, $10.95 each, two for $20.00.

1952 MODEL ASTATIC $19.10

New Astatic "Seanafar" TV booster with improvements to match the newer model TV receivers. Minimum noise with maximum gain. Balanced cascaded circuit with 6J6 and 6BQ7. Input and output for both 72 and 300 ohm. Mahogany finished metal cabinet 6¼"x4⅞"x4¾" high. Model CT-1. Net price $19.10.

1952 MODEL REGENCY $19.10

New Regency DB-520 TV booster with exclusive circuit stabilizer and newly designed cabinet only 4½"x6x4½". Improved circuit with push-pull 6J6 is equal to the best cascode circuits and has higher gain. Matches 72 or 300 ohm. Net price $19.10.

20 IN. CONV. 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.

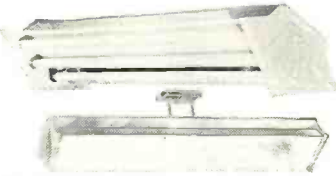
14-INCH CONVERSION KIT $19.95

Our 14" conversion kit includes an RCA 14CP4, 14" rectangular blackface tube, plus a 14,000 volt G.E. built flyback, plus a 70° cosine yoke, plus a 14" plexiglas gold trimmed mask. Offered at the very low price of only $19.95. Suggested diagram furnished. Ship. weight, 20 lbs. Via express or truck only. Stock No. RC-14X, net price, $19.95.

17-INCH CONVERSION KIT $24.95

Our 17" conversion kit includes a 6-month guaranteed 17HP4 blackface rectangular picture tube, plus a G.E. built 14,000 volt flyback, plus a matched 70° cosine yoke, plus a gold trimmed 17" plexiglas mask, and suggested diagram. The 17HP4 is the latest electro-static focus tube that requires no focus coil. Shipped via express or truck only. Stock No. 17-TP4. Net price, $24.95.

TERRIFIC FLUORESCENT FIXTURE SALE



IS YOUR SERVICE DEPT. PROPERLY LIGHTED? SAVE 50% ON THIS 4-LIGHT FIXTURE

$12.95, TWO FOR $25.00 WITH LAMPS

TOP ILLUSTRATION—This is the finest value in a fluorescent fixture that we have ever offered. Constructed of heavy gauge metal with lustre white enamel finish. All General Electric high power factor ballasts. Furnished with General Electric 36", 30 watt white fluorescent lamps. Fixture may be mounted next to the ceiling or suspended on chains. These fixtures are beautifully constructed. Use them over your service bench, in your display room or in your office. Brand new in factory cartons properly packed for shipment. These fixtures sold for up to $30.00. We bought 6 truck loads and are passing our bargain on to you. Why pay more than this to modernize your shop. Shipping weight 26 lbs. each. Shipped via Express, Rail Freight or Truck only. Stock No. MK-430 fixture complete. Net $12.95; 2 for $25.00.

DELUXE MODEL WITH GLASS, $14.95; CEILING CANOPY, $1.95

Bottom Illustration

Deluxe Model No. MK-430X, same as No. MK-430 described above with the exception that it has translucent glass over the lamps to diffuse the light. CEILING CANOPY that is shown. $1.95 extra. Shipping weight 33 lbs. Net price $14.95; 2 for $28.00.

Canopy for suspending either of the above fluorescent fixtures 30" from the ceiling. For use where it isn't advisable to mount fixture flush or suspend it on chains. Canopy kit is complete with stamped metal box cover with hardware for mounting to any outlet box and 2—30" lengths of ⅜" white enameled tubing. Ship. wt. 6 lbs. Fixture canopy kit, No. I-30. $1.95.

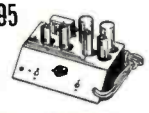
COMPLETE RADIO, TELEVISION AND AMPLIFIER KITS AT McGEE

3-WAY PORTABLE KIT $15.95

A NEW '52 MODEL

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, 5½"x5¾"x8". Receives broadcast 550 to 1650 KC, 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; 1½ V. 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, 2-7F7, 2-6A3, 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.

10-Watt Hi-Fi Amplifier Kit $14.95

A complete kit of parts including tubes 12AX7, 12AU7, 2-50L6, plus rectifier, diagram and instructions to build a high fidelity twin tone control audio amplifier with bass and treble boost. Inputs for radio tuner, crystal mike and crystal phono pickup. Output matches 8 ohms. Response from 50 to 15,000 cps. Chassis ready punched. Ventilated cover. Straight forward circuit with twin triode gain stages and 2-50L6 tubes in push-pull. Size, 5¼" x 10" x 5¾" high. Model AP-10R. ship. wt. 8 lbs. Sale price $14.95.

10-TUBE RADIO KIT $29.95

10 tube broadcast radio chassis kit, complete with tubes; 2-6SK7, 6SA7, 6H6, 6SQ7, 2-12AX7, 2-6V6 plus 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. Input 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. 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 2 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12SK7, 12SK8, 12SK7, 12SQ7, 35L6 and 35Z5, diagram and instructions. Factory quality. Cabinet size 13"x6¾"x6¼". Shipping weight 12 lbs. Model ME6-2. Net $14.95.

5-TUBE AC-DC KIT $12.95

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.

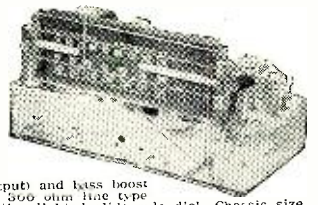
AC POWERED BROADCAST TUNER KIT $12.95

A self-powered, 3-gang superhet tuner kit with R.F. stage. This complete kit is furnished with diagram, photos and tubes, 6AU6 R.F., 6BE6 oscillator R.F., 6AU6 I.F. detector, 6AL5 diode. AVC, plus rectifier. Connect to any audio amplifier. Ideal for use with our S-2020, TM-16 or 7x5 amplifier kits. Chassis size, 9¼"x4x4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, $12.95.

BUY YOUR FM-AM CHASSIS—CHANGERS—SPEAKERS AT McGEE

ESPEY 12-TUBE FM-AM CHASSIS, $64.50

★ BUILT-IN PRE-AMP FOR G.E. VARIABLE RELUCTANCE PICK-UP
★ WIDE RANGE AUDIO
★ WHY NOT ORDER WITH A COAXIAL SPEAKER AND A RECORD CHANGER? SEE OUR SPECIAL OFFERING



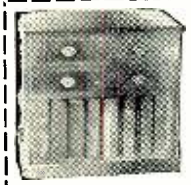
McGee's new 1952 model 12-tube FM-AM chassis. Latest design with phono inputs for all types of record players, crystal or G.E. variable reluctance. Receives standard broadcast 550 to 1700 kc and FM 88 to 108 mc. Wide range audio response (push-pull 6V6 output) and bass boost tone control. Loop antenna for broadcast and 300 ohm line type FM antenna may be stapled in cabinet. Attractive lighted slide rule dial. Chassis size, 13½" x 9" high and 9" deep. Complete with tubes: 6BE6, 6BA6, 6BA6, 12AT7, 6SH7, 6AL5, 6SQ7, 6SQ7, 12AT7, 2—6V6GT and 5Y3GT rectifier. Shipping weight 20 lbs. Stock No. 7C-X Espey 12-tube FM-AM chassis. Sale price, **$64.50**, less speaker. Output matches voice coil of our 12" or 15" coaxial speakers.

ESPEY DEAL (1), $104.95
Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and VM-950 G.E. 3-speed changer equipped with a G.E. turnabout variable reluctance cartridge. A better home music system than ordinarily available. Espey Deal #1. Sale price **$104.95.** With 15" coaxial PM speaker P15-CR instead of CU-14Y, **$10.00** extra.

ESPEY DEAL (2), $118.95
Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and the English Garrard 3-speed changer equipped with a G.E. variable reluctance turnabout cartridge. Our best home music system. Espey Deal #2. Sale price **$118.95.** With 15" coaxial PM speaker P15-CR instead of CU-14Y, **$10.00** extra.

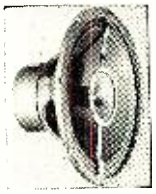
ESPEY DEAL (3) $138.95
Espey 7-C chassis complete with THREE 12" coaxial PM speakers CU-14Y (these three 12" coaxial speakers give a cone area equal to an 18" speaker) and a Garrard 3-speed changer with G.E. variable reluctance turnabout cartridge, Espey Deal #3, Sale price **$138.95.**

CAPEHART CABINET, $79.95
BLANK OR CUT TO FIT ESPEY CHASSIS



Buy this cabinet with Espey chassis and the VM changer listed above and have a fine radio-phono combination for less than the value of the cabinet alone. This beautiful cabinet was intended for a Capehart $800.00 combination. It is the finest possible furniture quality cabinet workmanship. 37" high, 40" wide and 21" front to back. Hinged top lifts in two sections. 25½" lid covers the changer compartment and 14½" is the width of the radio compartment. Changer mounting panel is furnished blank. Radio panel is shipped ready cut to fit the 7-C Espey chassis. Baffle is cut to hold 2—12" speakers. Made of top quality walnut veneer, ⅞" material used throughout. Shipped via truck, rail or express only. Shipping wt., 160 lbs. Stock No. C-175, with panel cut to fit Espey 7-C, **$79.95.** Stock No. B-175B, with blank changer and radio panel, **$79.95.** Buy 2—12" 32 oz. Alnico PM speakers for use in this cabinet for only **$15.00 ($7.50** each).

McGEE'S $62.50 LIST 15" COAXIAL SPEAKER, $21.95
21 OZ. ALNICO V MAGNET—5" TWEETER



This is the finest 15" coaxial PM speaker value that we have ever offered. New 1952 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. P15-CR, shipping weight 13 lbs. Net price **$21.95.**

12" COAXIAL SPEAKER, $12.95

McGee offers the new 1952 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.**

12" JENSEN PM, $15.95

Another McGee Scoop! Jensen Concert 12", 14¼ 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.**

3-SPEED CHANGERS ON SALE AT McGEE

WEBSTER CHICAGO MODEL 100-2 ONLY $26.95

For the first time we offer the world famous Webster-Chicago, model 100-2. Features a newly designed spindle, that drops the records flat; air-cushioned to the turntable. Pickup arm sets down automatically after the last record plays. Plays all records automatically 33⅓, 78 and 45 rpm. New balanced tone arm with Electro-Voice Tilt-A-Matic cartridge with dual needles. Ordinarily cost over **$37.00.** McGee offers them for only **$26.95** each. Base size 12"x12¾". Shipping weight 14 lbs.

V.M. 3-SPEED MODEL 406 $22.95

VM model 406, deluxe 3 speed automatic record changer. Plays them all. Intermixes records of the same speed. Equipped with a flip over crystal pickup with twin needles. Base size, 12¼x13". Shipping weight 12 lbs. VM-406. Net price **$22.95.**

TERRIFIC COMBINATION CABINET SALE

29.95

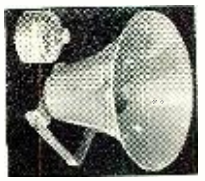
Originally intended for an Admiral 14" TV combination. Made of mahogany veneer, 32" wide, 35½" high and 20" deep. Offered at less than the factory production cost. Upper left door is made to swing down, opening record changer compartment, 14½" x 12¾" x 20" deep. Upper right door swings open for the TV compartment. (Note: the TV chassis area is only 14½" wide and 15½" high, 20" deep, limiting the size of TV chassis to a 14" set.) Panel is cut for the 14" Admiral. Up to a 32" speaker may be mounted in the lower right section. Lower left section has hinged door and is for record storage. Brass hardware and matching grill cloth. Shipping weight 60 lbs. Stock No. A-330 mahogany TV combination cabinet. Special Price, **$29.95.** Blank panel overlay for cut out TV panel, **$3.95** extra.

CAPEHART CABINET FOR 1000 SET—ONLY $99.95
EITHER WALNUT OR MAHOGANY

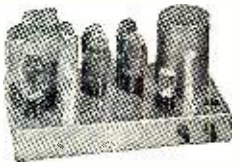
99.95

Beautiful, finest quality walnut combination radio-phono cabinet, 42" high, 42" wide and 22" deep. Made for Capehart's finest combination, selling for $900 and more. Cabinet set manufacturer over $200.00. Has highly polished matched walnut panels. Made of ¾" material. Top 1⅛" solid stock. This cabinet weighs approximately 175 lbs. The changer radio and speaker grill all have hinged doors. Radio compartment on right hand side is 14" high and 11½" wide. Made to mount chassis vertically. Changer compartment is 14" high by 26½" wide. Large enough to hold any record changer or recorder mechanism. Front ½" of top over the changer compartment is hinged to fold back for easy access to the changer. Both radio and changer compartments come with uncut blank panels. Speaker baffle is cut for a 12" speaker and the speaker compartment is completely enclosed. Shipping weight, 275 lbs. Stock No. K-275 Capehart combination cabinet. Net price **$99.95.** SPECIFY, when ordering, whether you want **Walnut** or **Mahogany.**
Note: This cabinet has a very large record changer compartment. It is suggested that you obtain a selective record changer from a Juke box operator and make a selective radio-phono combination.

50-WATT BOOSTER AMPLIFIER—$39.95



25-Watt Horn $28.95



50-Watt Booster $39.95

2-Mike Pre-Amp. $12.95 Extra.

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 ideality output transformer, matches speaker with 4-8-16 ohm voice coil, also 60 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 base boost tone control. Size 8 x 6½ x 14½. Stock No. PA-55N. Shipping weight 26 lbs. Sale price **$39.95** ea.

2-MIKE PRE-AMP. Pre-amplifier plugs in directly to the PA-55N Booster amplifier. It enables use of 2, Crystal or Dynamic Mikes plus one low level input. Furnished with 4 foot cables and plugs for remote control of the 55 watt Booster Amplifier. Small chassis size 5 x 3¼ x 4". Stock No. PR-2X, with tubes 7F7 and 7N7. Net price **$12.95** ea.

25-WATT HORN 25-Watt Driver and 3½-foot air column re-entrant Trumpet. The standard type trumpet and driver you see the most. Drivers are 100% weatherproof, horn is spun aluminum, offered to you at a considerable savings. Stock No. MA-33. Shipping weight 20 lbs. Net price **$28.95.**

3-SPEED PORTABLE ELECTRIC PLAYERS
TWO NEW MODELS

$21.95 **$18.95**
$21.50—LOTS OF 3—$18.50
PLAYS ALL 3 SPEEDS ALL 3 SIZES

New 1952 model 7843-X electric portable player has crystal pickup with all-purpose, 3-speed needle and brown reptile grain leatherette cover. Ship. wt. 10 lbs. Sale price, $18.95 each, lots of 3, **$18.50** each.
Deluxe model 8532-X electric portable player has tone control and flip-over crystal cartridge with two needles for playing LP and standard records. Tan leatherette cover. Ship. wt. 11 lbs. Sale price, **$21.95** each. lots of 3, **$21.50** each.
Both models are housed in sturdy wood cases covered with durable leatherette material. They have powerful 3-tube amplifiers with full-size Alnico V dynamic speakers and volume controls. Plays all 3 speeds, 78, 45 and 33⅓ RPM and all 3 sizes, 7", 10" and 12" records.

TERRIFIC VALUES IN SPEAKERS AND BAFFLES

8" PM AND LEATHERETTE BAFFLE, $4.95
LOTS OF 10, $4.75

The finest Leatherette Baffle we have ever offered. New seif-supporting plastic grill material, baffle is covered tan with matching grill. Offered with a good heavy duty 8" Alnico V PM speaker with 3.2 ohm voice coil. Stock No. 818. Speaker and Baffle, **$4.95** ea.; lots of 10, **$4.75.**
8". Baffle only. Stock No. NV-8. **$2.29** ea.; 10 for **$19.95.**

12" PM AND WALNUT BAFFLE, $9.95
LOTS OF 3, $8.95

The finest built 12" Walnut plywood wall baffle we know of. Factory cost of the famous juke box manufacturer exceeds $7.00, we offer with a 12" PM for little more. You pay only **$9.95** in single lots, or **$8.95** in 3 lots for both a 12" Quam Alnico V PM with 3.2 ohm voice coil and the beautiful wall baffle, 12" Speaker Baffle combination. Stock No. BS-1203 **$9.95** ea.; lots of 3, **$8.95** ea. 12" Baffle only, #SEG-12, **$4.95** each.

MIKES AND STANOS

4D-T, high impedance dynamic mike with 12 feet of cable. Sale price, **$10.95.** 35" to 64" chrome floor stand for mike, **$5.88.**

3-STATION INTERCOM MASTER, $14.95
USE UP TO 3-SUB STATIONS, $4.49 EACH

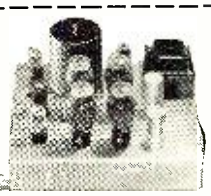
A red-hot intercom master value. A full 3 tube, 110 volt AC-DC master, with 3 station selector switch and easy accessible volume control. Small compact size, 5"x 6"x6¼" high. Makes an attractive intercom installation. May be used with from one to three of our G-4T substations described below. Intercom master is quiet at all times, except when press-to-talk switch is pressed at either the master, or one of the subs. Shipping wt, 5 lbs. Stock No. KA-3, master station, less subs. Net **$14.95.** Stock No. G-4T, brown plastic substation, with Alnico V PM speaker and press-to-talk switch. May be purchased with or without master station. Shipping weight 2 lbs. Net, **$4.49** ea.
3 wire plastic intercom cable, 100 ft. **$1.95;** 500 ft. **$8.95.**

4 General Electric Diodes for $1.95
Reg. $7.20 Net

You receive 2-1N48, 1-1N52, 1-1N63. All genuine General Electric Germanium crystal diodes. The total dealers net is $7.20. A special purchase enables a saving of over $5.00 to you on this kit of 4 diodes. G.E. Germanium crystal diodes are growing in popularity every day. Every radio and TV service department will do well to have a few of these kits on hand. Stock No. GED-4, kit of 4 diodes. (2-1N48, 1-1N52 and 1-1N63) only **$1.95** or 2 kits for **$3.75.**

38-WATT WIDE RANGE AMPLIFIER
WITH PUSH PULL PARALLEL 6L6'S—FOR USE WITH RADIO TUNER OR RECORD CHANGER

★ TWIN TONE CONTROLS FOR REMOTE OPERATION



38 watt amplifier for use with phono pick-up or radio tuner. 1 volt input produces full audio output. Features: 4-6L6 tubes in push-pull parallel. Heavy potted 50 watt capacity output transformer with taps at 4-8-16-60 and 250 ohms. Wide range audio response 20 to 15,000 cps. Twin electronic continuously variable bass and treble tone controls and gain control on a remote control with 3-foot cable so that the amplifier can be conveniently located. One half of the dual triode input is left unwired, so that you can add enough gain for a microphone or a G.E. variable reluctance phono pickup if desired. Chassis size 12"x18". Remote control 2¾" x7½". Shipping weight, 30 lbs. Model No. RA-938, complete with 4—6L6, 3—6SN7, and 2—6W4GT tubes. Sale price, **$49.95.**

G.I. 3-SPEED CHANGER WITH G.E. $22.95
VARIABLE RELUCTANCE TURN-ABOUT CARTRIDGE

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.

FOURTH ANNUAL A.E.S. CONVENTION

The following program of technical papers will be presented during the combined Audio Engineering Society Convention and 1952 Audio Fair to be held October 29-November 1 in New York

Wednesday, October 29 (Morning Session)

RECORDING—W. Oliver Summerlin, Audio & Video Products Corp., Chairman

"Binaural Disc Recording"—Emory Cook, Cook Laboratories

"Methods of Measuring Surface Induction of Magnetic Tape"—J. D. Bick, RCA Victor Division

* "A New Magnetic Recording Tape"—Edward Schmidt, Reeves Soundcraft Corp.

Wednesday, October 29 (Afternoon Session)

NEW DEVELOPMENTS—Bernard Osbahr, Tele-Tech Magazine, Chairman

* "A New Pocket Wire Recorder"—Oliver Read, Radio & Television News Magazine

"Constant Current Operation of Power Amplifiers"—Howard T. Sterling, Waveforms, Inc.

"Musical Therapy"—R. L. Cardinell, Magnetic Programs, Inc.

"Gun Shot Reinforcers and Synthesizers"—J. L. Hathway & R. E. Lafferty, National Broadcasting Company

Thursday, October 30 (Morning Session)

COMPONENTS—Charles Fowler, High-Fidelity Magazine, Chairman

"The Deposited Carbon Resistor"—Llewellyn B. Keim, Consulting Engineer

"Application of Electrolytic Capacitors in DC Power Supplies"—John Maxwell, P. R. Mallory & Company, Inc.

"Choice of Tubes for Audio Circuits"—W. R. Ayres, RCA Victor Division

"Review of New Printed Circuit Development and Audio Frequency Applications"—Arthur W. Kelly, Jr., Photocircuits Corp.

Thursday, October 30 (Afternoon Session)

INTERMODULATION DISTORTION SYMPOSIUM—Norman C. Pickering, Pickering & Company, Inc., Chairman

"Measurement of Non-Linear Distortion"—Alan Bloch, Audio Instruments Co., Inc.

"Distortion in Phonograph Reproduction"—H. E. Roys, RCA Victor Division

Friday, October 31 (Morning Session)

SPEECH INPUT SYSTEMS—John D. Colvin, Commercial Radio-Sound Corp., Chairman

"Basic Problems in Audio Systems Practice"—W. E. Stewart, RCA Victor Division

"Audio Frequency Input Circuits"—W. B. Snow, Vitro Corp. of America

"The Design of Speech Input Consoles for Television"—Robert H. Tanner, Northern Electric Company, Ltd.

Friday, October 31 (Afternoon Session)

DESIGN DATA—C. J. LeBel, Audio Instrument Company, Chairman

"Consideration of Some Factors Concerning the Use of Audio Transformers"—W. E. Lehnert, Audio Development Co.

"Bypass and Decoupling Circuits in Audio Design"—Lewis S. Goodfriend, Audio Instrument Company, Inc.

* "RC Networks"—Edward D. Sisson, Bell Sound Systems

"Attenuation Equalizers"—R. F. Bies, Bell Telephone Laboratories, Inc.

Saturday, November 1 (Morning Session)

HOME MUSIC SYSTEMS—C. G. McProud, Audio Engineering Magazine, Chairman

"Analyzing the LP Pickup Problem"—Theodore Lindenberg, Pickering & Company, Inc.

* "A New System of Variable Frequency Compensation"—H. J. Leak, H. J. Leak & Co., Ltd.

"Concert Hall Realism Through the Use of Dynamic Level Control"—John Nigro & Jerry Minter, Measurements Corp.

"Testing and Adjusting Speaker Installations with The Sound Survey Meter"—William R. Thurston, General Radio Co.

* Titles of papers marked with an asterisk are temporary titles subject to change upon receipt from the author.

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TIME PAYMENT PLAN

NO INTEREST!! - NO CARRYING CHARGES!!

USE CONVENIENT TIME PAYMENT ORDER BLANK BELOW

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JUNIOR SUPER-METER

MOST COMPLETE AND COMPACT MULTI-SERVICE INSTRUMENT EVER DESIGNED

Measures: * Voltage * Capacity * Current * Reactance * Decibels * Resistance * Inductance

Specifications: D.C. Volts: 0-7.5/75/150/750/1500 Volts. A.C. Volts: 0.15/150/300/1500/3000 Volts. Resistance: 0-10,000/100,000 ohms. 0-10 Megohms. D.C. Current: 0-7.5/75 Ma. 0-7.5 amps. Capacity: .001 Mfd.—.2 Mfd. .1 Mfd.—20 Mfd. Electrolytic Leakage: Reads quality of electrolytics at 150 Volt test potential. Decibels: —10 Db to +18 Db. + 10 Db. to + 38 Db. + 38 Db. to + 58 Db. Reactance: 15 ohms—25 K ohms 15 K ohms—2.5 Megohms. Inductance: .5 Henry—50 Henries 30 Henries—10 K Henries. Plus Good-Bad scale for checking the quality of electrolytic condensers.

Handsome round cornered molded bakelite case 3⅛" x 5⅞" x 2¼" complete with all test leads and instructions .....

$21.40 NET

Superior's New Model TV-11

TUBE TESTER

• 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 .....

$47.50 NET

Superior's New Model 670-A

SUPER-METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts.
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
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)
REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to +18 +14 +38 +34 to +58

The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 6¼"x9½" x4½".

$28.40

ADDED FEATURE:
The Model 670-A includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

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TV BAR GENERATOR

Throws an Actual Bar Pattern on Any TV Receiver Screen!!

Two Simple Steps:

1. Connect Bar Generator to Antenna Post of any TV Receiver.
2. Plug Line Cord into A.C. Outlet and Throw Switch.

RESULT: A stable never-shifting vertical or horizontal pattern projected on the screen of the TV receiver under test.

Power Supply: 105-125 Volt 60 Cycles. Power Consumption: 20 Watts. Channels: 2-5 on panel, 7-13 by harmonics. Horizontal lines: 4 to 12 (Variable). Vertical lines: 12 (Fixed). Vertical sweep output: 60 cycles. Horizontal sweep output: 15,750 Cycles.

TV Bar Generator comes complete with shielded leads and detailed operating instructions. Only NET $39.95

New Model 200 AM and FM

SIGNAL GENERATOR

Provides complete coverage for A.M.-F.M. and TV alignment

• R.F. Frequency Ranges: 100 Kilocycles to 150 Megacycles. • Modulating Frequency: 400 Cycles. May be used for modulating the R.F. signal. Also available separately. • Attenuation: The constant impedance attenuator is isolated from the oscillating circuit by the buffer tube. Output impedance of this model is only 100 ohms. This low impedance reduces losses in the output cable. • Oscillatory circuit: Hartley oscillator with cathode follower buffer-tube. Frequency stability is assured by modulating the buffer tube. • Accuracy: Use of high-Q permeability tuned coils adjusted against 1/10th of 1% standards assures an accuracy of 1% on all ranges from 100 Kilocycles to 10 Megacycles and an accuracy of 2% on the higher frequencies.

*** Tubes used: One 954 as oscillator; one 954 as modulated buffer amplifier; T-2 as modulator; 7193 as rectifier.**

The Model 200 comes complete with output cable and operating instructions .....

$21.85 NET

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Please send me the units checked below. I am enclosing the down payment with order and agree to pay the monthly balance as shown. It is understood there will be no carrying, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

☐ **JUNIOR SUPER METER**.....Total Price $21.40
$5.40 down payment. Balance $4.00 monthly for 4 months.

☐ **MODEL TV-11** .....Total Price $47.50
$11.50 down payment. Balance $6.00 monthly for 6 months.

☐ **MODEL 670-A** .....Total Price $28.40
$7.40 down payment. Balance $3.50 monthly for 6 months.

☐ **TELEVISION BAR GENERATOR**.....Total Price $39.95
$9.95 down payment. Balance $5.00 monthly for 6 months.

☐ **MODEL 200** .....Total Price $21.85
$5.85 down payment. Balance $4.00 monthly for 4 months.

☐ I enclose $..... as down payment.

☐ Ship C.O.D. for the down payment.

Signature.....

Name .....

Address .....

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

(*Continued from page 52*)

remotely or by obtaining power from the main amplifier; this practice is recommended wherever feasible. The power requirements are quite low and the additional drain should cause no trouble with any except "borderline" amplifiers.

Perhaps the reader has noticed that, although frequency response curves for various high-quality power amplifiers are widely published, similar curves for preamplifiers to be used with them are seldom to be found. This is true, of course, because the response of most preamplifiers does not extend over nearly the range of presently available power amplifiers. In addition, the presence of equalizers deliberately introduces frequency-response variation in order to compensate for various recording characteristics, so the response curves would be somewhat difficult to interpret correctly.

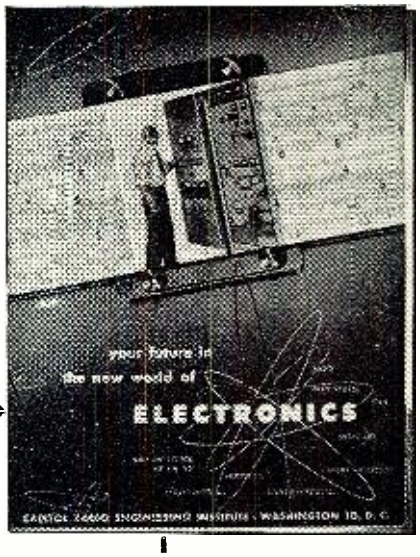
If a non-frequency-discriminating network of the same attenuation at 1000 cps and the same impedance at 20 cps as those of the equalizers used in the preamp is substituted for one of the equalizers (and the tone controls are set in flat-response position) the measured frequency response of the preamplifier will be that shown in Fig. 2. The equalizers themselves cause a departure from the ideal response at very low frequencies; this varies with the equalizer in question but always amounts to less than 1 db drop at 20 cps. Assuming the unit is connected to an amplifier requiring a maximum of 1.5 volts input, the tubes handle signals of very low voltage, so distortion is negligible.

As mentioned before, because of the location of the volume control, hum and noise (mostly introduced in the first stages) tend to be a constant proportion of the output signal rather than a fixed voltage independent of output level. In the original unit the noise level was unobjectionable compared to the output regardless of the volume control setting. A long interconnecting cable between the preamplifier and main amplifier may result in an increased noise level; the noise introduced by such a line is usually a buzz.

The use of the preamplifier is simplicity itself; the single equalizer switch needs only to be turned to the proper position for the disc being played—a pleasant contrast to circuits having independent control of bass turnover, and treble de-emphasis. The proper use of the tone controls is in compensation for playback level, room acoustics, and to a lesser extent, to correct for minor variations in recording practice. They are not intended as an auxiliary equalizer. If desired, the controls can be calibrated so that once a satisfactory setting of equalizer, tone, and volume controls is found

Where Are You Headed in TV-ELECTRONICS

and how soon will you get there?



Free CREI booklet lists opportunities and shows how to grasp them

DO YOU HAVE a career time-table? Do you know how much you should or could be earning two years from now? Five years? Many men are plodders without a plan. They wander through life never doing what they want to do, never receiving enough pay, never achieving true career satisfaction. Because they never knew ahead of time where they should or could be at a given date, they never planned ahead. When an opening arises, somebody else is promoted. When January 1st rolls around, they're just where they were a year before. Their *error*, failure to plan, can be the lesson which shows you the *secret* of future success. In this expanding, bustling TV-Electronics world, there is a whole lifetime of happiness and high earnings waiting for you, if you name your goals, and take steps to reach them. Thousands of ambitious young men have found success in TV-Electronics through the aid of the CREI booklet, "Your Future in the New World of Electronics." The newest edition tells of electronics' golden opportunities. 110 TV stations are now on the air. 2,000 more are made possible by the recent freeze lifting. There are over 18,300,000 TV sets and over 100 million radios in use.

This is the era of Communication: aeronautical, marine, police and fire, industrial, land transportation communications; this is the era of defense orders and a manufacturing industry which last year alone sold 3.8 billion dollars worth of electronic equipment, and is expected to do no less than 10 billion dollars worth excluding military orders. All these developments mean positions: in development, research, design, production, testing, inspection, manufacture, broadcasting, telecasting and servicing. Who will get these positions? You—if you have a career time-table; if you can foresee your future in electronics; if you are willing to advance your knowledge; if you spend 2 minutes to write for your copy of "Your Future in the New World of Electronics," and follow the plan it describes.

This is the booklet that shows you how CREI home study leads the way to greater earnings. However, being an accredited technical school, CREI promises you no short-cuts. You must translate your willingness to learn into salable technical knowledge via study. CREI knows what it means to grow along with a booming industry. This year CREI is celebrating its 25th Anniversary, having started in 1927 in the early days of radio. Since then CREI has provided thousands of professional radiomen with technical educations. During World War II, CREI trained thousands for the Armed Services. Leading firms use CREI courses for group training in electronics at company expense; among them are United Air Lines, Canadian Broadcasting Corporation, Trans-Canada Airlines, Sears Roebuck & Co., Bendix Products Division, All-American Cables and Radio, Inc., RCA-Victor Division and Machlett Laboratories. CREI courses, prepared by recognized experts, are constantly revised to keep them up-to-date. Student work is under the personal supervision of a CREI Staff Instructor who knows and teaches what industry needs.

You choose your own hours when you study at home. Upon completion you join the many CREI graduates who have found their diplomas keys-to-success in Radio, TV and Electronics. CREI alumni hold many top positions in America's leading firms.

At your service is the CREI Placement Bureau which helps find positions for students and graduates. Although CREI does not guarantee jobs, the bureau now has many more requests for personnel than can be filled. Talk to men in the field and check up on CREI's high standing in electronics instruction. Determine for yourself right now that your earnings are going to rise with your knowledge—and that you will rise with this booming industry. All this CREI offers you, provided you sincerely want to learn. Fill out the coupon and mail it today. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest—your future—is up to you.

CREI resident instruction (day or night) is offered in Washington, D. C. New classes start once a month.

VETERANS: If you were discharged after June 27, 1950—check the coupon for full information about the new G.I. Bill of Rights.

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

CHECK FIELD OF GREATEST INTEREST
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for any recording, the data can be entered on the record envelope. The user soon learns to compensate for major changes in playback level by a small adjustment of the bass control and an even smaller one of the treble response. The principal objects in the design of the unit have been to make it simple enough for any member of the audio enthusiast's family to operate without a course of special training, and secondarily to avoid all unnecessary complications in the circuit design.

The editors of RADIO & TELEVISION NEWS *wish to thank Mr. Charles P. Boegli of Cincinnati Research Company for his help in developing the unit described in this article.*

REFERENCES

1. Boegli, Charles; "A Preamp for Magnetic and Crystal Pickups," Radio & Television News, July, 1950.
2. Boegli, Charles; "An Improved Equalizer-Preamp," Radio & Television News, April, 1951.
3. Boegli, Charles; "Phono-Equalizer Chart," Radio & Television News, April, 1952.
4. Boegli, Charles; "The Degenerative Tone Control," Radio & Television News, June, 1951.
5. Fidelman, David; "Audio Simplified" (Part 7), Radio & Television News, March, 1952.

-30-

HAM VISITOR

MOSHIE Baal-Korch of Tel Aviv, in Milwaukee on a purchasing mission for his government, dropped in on members of the Milwaukee Radio Amateurs' Club recently to exchange experiences with his fellow hams.

Mr. Baal-Korch reported that a scarcity of equipment for radio amateurs was retarding the expansion of the hobby in Israel.

-30-

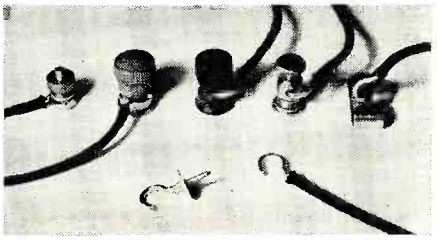
TERMINAL CONNECTORS

By ARTHUR TRAUFFER

I FIND that small brass cup hooks when soldered to the ends of connecting wires, provide me with handy and rugged connectors that can be quickly secured to all types of binding posts, as shown in the photo. Especially handy for experimental work, these hooks do away with unraveling strands of wire and sharp wire ends that often stick the fingers when making rapid connections.

These small brass hooks are 1" long over-all, and sell for about 10c a dozen at dime stores and hardware stores. The metal discs on the hooks are slipped off and the ends of the wires are soldered to the threads on the hooks. Either slip insulating tubing over the wires and shanks of the hooks, or wrap tape around the soldered connections on the hooks. -30-

Cup hooks make handy terminal connectors.



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for Good Pay Jobs, Success in
RADIO-TELEVISION

YOU LEARN SERVICING
by practicing with equipment I furnish

You build valuable Multitester (at left) as part of my Servicing Course. You use it to make many tests, get practical experience, make EXTRA money fixing neighbors' radios in spare time. Many of my students earn $5, $10 a week extra while learning. I send you many other kits too. You build a modern Radio. You build many circuits common to Radio and Television. All equipment is yours to keep. Read about and see other equipment in my free book. Mail card below.

YOU LEARN COMMUNICATIONS
by practicing with equipment I furnish

As part of my Communications Course I send you kits of parts to build the low power broadcasting transmitter shown at right and many other circuits common to Radio and Television. You use this equipment to get practical experience putting a station "on the air," performing procedures demanded of Broadcast Station operators. I train you for FCC Commercial Operator's License. Mail Card for Sample Lesson and 64-Page Book. FREE!

There are Good Jobs, Good Pay, Success in Radio-TV! *SEE OTHER SIDE*

TELEVISION *is Today's Good Job Maker*

In 1951 over 15,000,000 homes had Television sets, more are being sold every day. 108 TV stations are already operating, over 1800 are now authorized and many hundreds are expected to be on the air in 1953. This means new jobs, more jobs and better pay for trained men. The time to act is NOW! Start learning Radio-Television servicing or communications. Want to get ahead? America's fast growing industry offers good pay, a bright future and security. Cut out and mail card now. J. E. Smith, President, National Radio Institute, Washington, D.C.

CUT OUT AND MAIL THIS CARD NOW

Sample Lesson & 64-Page Book

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This card entitles you to Actual Lesson on Servicing, shows how you learn Radio-Television at home. You'll also receive my 64-Page Book, "How to Be a Success in Radio-Television." Mail card now!

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Mail me Lesson and Book, "How to Be a Success in Radio-Television." (No Salesman will call. Please write plainly.)

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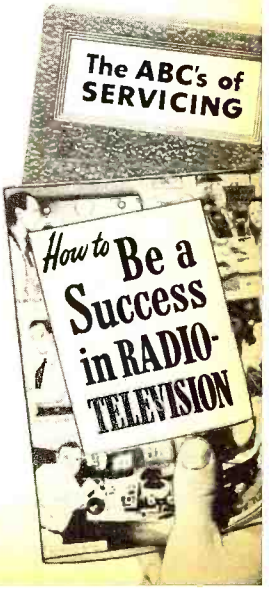

Train at Home to Jump Your Pay as a RADIO-TV Technician

J. E. Smith, *President*
National Radio Institute

The men whose letters are published below were not born successful. At one time they were doing exactly as you are doing now . . . reading my ad! But they acted. They decided they would know more . . . so they could earn more! They acted! Mail the card now for my 2 books FREE.

There's a Bright Future for You in America's Fast Growing Industry

Do you want good pay, a job with a bright future, security? Would you like to have a profitable business of your own? If so, find out how you can realize your ambition in the fast growing RADIO-TELEVISION industry. 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., are making opportunities for Servicing and Communications Technicians and FCC Licensed Operators.

NRI Training Can Lead to Jobs Like These in RADIO-TELEVISION

BROADCASTING
Chief Technician
Chief Operator
Power Monitor
Recording Operator
Remote Control Operator

SERVICING
Home and Auto Radios
P.A. Systems
Television Receivers
Electronic Controls
FM Radios

IN RADIO PLANTS
Design Assistant
Transmitter Design Technician
Service Manager
Tester
Serviceman
Research Assistant

SHIP AND HARBOR RADIO
Chief Operator
Assistant Operator
Radiotelephone Operator

GOVERNMENT RADIO
Operator in Army, Navy, Marine Corps, Coast Guard
Forestry Service Dispatcher
Airways Radio Operator

AVIATION RADIO
Plane Radio Operator
Transmitter Technician
Receiver Technician
Airport Transmitter Operator

TELEVISION
Pick-up Operator
Voice Transmitter Operator
Television Technician
Remote Control Operator
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You Learn by Practicing with Kits I Furnish

With both my Servicing Course and my NEW Communications Course I send you many Valuable Kits of Parts. They "bring to life" theory you learn in my illustrated texts. Mail card for my big 64-page book. It shows photos of equipment you build from kits I send.

My Training Includes Television

Both my Servicing and Communications Courses include lessons on TV principles. You get practical experience by working on circuits common to both Radio and Television. 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.

Send NOW for 2 Books FREE
Mail the Postage-Free Card NOW!

What will YOU be doing one year from today . . . will you be on your way toward a good job of your own in a Radio and Television service shop or business? Decide now that you are going to know more and earn more! ACT NOW! Take the important first step to a career and security. Send the postage-free card now for my FREE DOUBLE OFFER. You get Actual Servicing Lesson. Also my 64-page book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning; see equipment you practice with at home. Mail card now. J. E. SMITH, President, National Radio Institute, Washington 9, D.C. Our 39th year.

I TRAINED THESE EN

Handicapped but Successful

"I am now Chief Engineer at WHAW. My left hand is off at the wrist. A man can do . . . if he wants to." R. J. Bailey, Weston, W. Va.

$10 a Week In Spare Time

"Before finishing, I earned as much as $10 a week in Radio servicing, in my spare time. I recommend NRI". S. J. Petruff, Miami, Fla.

Control Operator, Station WEAN

"I received my license and worked on ships. Now with WEAN as control operator, NRI course is complete." R. Arnold, Rumford, R. I.

Trained Men Make Money In TV

"I am now servicing Television. Your course enabled me to repair TV receivers without any trouble." R. Currier, Fair Haven, Vt.

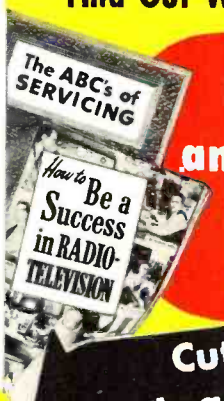
Has Growing Business

"Am becoming expert Teletrician as well as Radiotrician. Without your course this would be impossible." P. Brogan, Louisville, Ky.

Got First Job Thru NRI

"My first job was with KDLR. Now Chief Engr. of Radio Equipment for Police and Fire Dept." T. Norton, Hamilton, Ohio.

Find Out What RADIO-TV Offers You



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Make Extra Money While Learning

Keep your job while training. Many NRI students make $5, $10 and more a week extra fixing neighbors' Radios in spare time while learning. I start sending you special booklets that show you how to service sets the day you enroll. Multi-tester you build with parts I furnish helps discover and correct Radio troubles.

Want Your Own Business?

Many N.R.I. trained men start their own business with capital earned in spare time. Let me show you how you can be your own boss . . . Robert Dohmen, New Prague, Minn., (whose store is shown at right) says, "Am now tied in with two television outfits and do warranty work for dealers. Often fall back to N.R.I. textbooks for information on installing Television sets."

Multi-Station Intercom

(*Continued from page 67*)

tively long distances. It is intended for use with one master and one substation only.

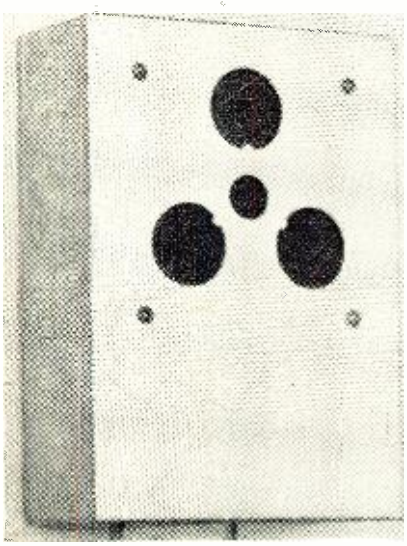
Fig. 2 shows how to properly connect more than one substation to the master station. Here, substations calling must identify themselves.

Some installations may be susceptible to slight acoustical feedback. If, after the intercom is installed, a low frequency oscillation is heard when the "talk-listen" switch is in "talk" position, touch the cone of the master station speaker gently with a fingertip. If the oscillation stops, it was caused by a slight amount of acoustical feedback. In this case, simply use a little sound absorbing material behind the input speaker.

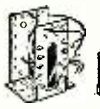
To see what the limits of distance between the master and a substation might be, the following test was made: A 47-ohm resistor was placed in series with the substation speaker. The volume, although much lower, was still acceptable in quiet areas. This lower volume was to be expected, of course, since the 47-ohm resistor was equivalent, in resistance, to about 3000 feet of #22 wire, or a distance of 1500 feet between stations. Because of hum and other interference pick-up of long lines, the practical limit is about 150 feet. It should be noted that the intercom used for this test had an input transformer with a 50,000-ohm secondary. Naturally, one would never encounter anywhere near the abovementioned practical distance limit in an average home installation. Such information is included for those who might want to use the intercom for purposes involving longer distances. Better results over relatively long distances will be obtained by the use of line transformers and booster cells in series with substation "call" switches.

—30—

Over-all view of a slave station unit.



YOU DON'T NEED 20-20 VISION TO SEE OLSON'S BUYS IN TELEVISION



14,000 VOLT FLYBACK AND 70° YOKE

OLSON COMBINATION DEAL!

BOTH FOR $4.88

Stock No. X-273

Now change over small picture TV sets to large Kinescopes for very little money. Here Olson offers you the two main parts for less than you normally pay for one. You get a high efficiency 14,000 volt Ferrite horizontal flyback Transformer like the General Electric RTO-085 (77J1) and you get one 70° yoke. This combination can be used to convert sets to use picture tubes up to 19" and larger. Buy several of these kits now. No more when these are gone. Shpg. wt. 3 lbs.

FINEST QUALITY

300 OHM TWIN LINE LEAD-IN

AVAILABLE IN 3 LENGTHS

100 Ft. COIL	500 Ft. SPOOL	1000 Ft. SPOOL
Lots of 10... $1.99 EACH	Lots of 2.. $6.75 EACH	Lots of 2. $12.50 EACH
Single, ea. $2.99	Single, ea. $6.95	Single, ea. $12.95
Stock No. W-73	Stock No. W-102	Stock No. W-99
Shpg. wt. ea. 2 lbs.	Shpg. wt. ea. 6 lbs.	Shpg. wt. ea. 12 lbs.

FREE!

With new TV stations near completion and more in the offing since the lifting of the ban on TV construction—now is the time to stock up on lead-in wire. Our purchase price was low and we're passing the savings on to you. This genuine low-loss polyethylene twin line is the nice heavy type with stranded copper conductors. Weather-resistant, for all TV sets.

AND YOU GET FREE—WITHOUT CHARGE—a box of 50 JFD 3" screw-eye insulators for 300 ohm line with every 500 ft. you order. Get 2 boxes with 1000 ft., etc. Regular retail price is $9.00 per 100 insulators.

YOU GET MORE! with ALLIANCE TENNA-ROTOR

The Alliance Tenna-Rotor makes it possible for you to "beam" or turn your antenna in the direction best suited to pick up any TV station within range. When so turned the signal delivered by the antenna to the TV set is increased by giving you a better, clearer picture. The rotator unit is fully enclosed in a moisture-proof housing, factory lubricated for life. Bearings are stainless steel. Works in any weather. Guaranteed for a full year. Approved by Underwriters' Laboratories. Can be used on all masts up to 1⅜" diameter. Takes up to a 20 lb. antenna. For heavier antennas also order the Thrust Bearing Bracket shown below. Operates on 115 V. 60 cycle AC 30 watts. Rotates clockwise full 360° at 1 RPM. Shpg. wt. 15 lbs.

NOW AVAILABLE IN 3 MODELS

STOCK NO. AU-15 MODEL ATR $20.53 Each	STOCK NO. AU-12 MODEL DIR $26.43 Each	STOCK NO. AU-21 MODEL HIR $26.43 Each
This model includes a control box which does not show direction but indicates end of 360° rotation by means of a panel lamp.	This model includes a control box which shows compass point direction of antenna at all times.	Deluxe Automatic Tenna-Rotor. Latest model. Simply set pointer at desired position. Antenna turns and stops automatically.

4 CONDUCTOR CABLE

For use with all Alliance Tenna-Rotors. 100 ft. Coil.

STOCK NO. W-62, EACH..... $2.95

THRUST BEARING BRACKET

For all Alliance Tenna-Rotors where extra heavy antenna is used. Supports up to 200 lbs.

STOCK NO. AU-13, EACH..... $2.91

OLSON SMASHES KINESCOPE PRICES

GUARANTEED!

Here are real bargains in Picture Tubes. Prices that would be impossible except for the fact that Olson made a cash deal on THREE SOLID RAILROAD CARS full of PICTURE TUBES. This is one of the biggest deals that we have ever made and we pass the savings on to you. We promised not to advertise the manufacturer's name, however, every tube is guaranteed, is in the original factory-sealed carton and bears the manufacturer's name. Express only. Shpg. wts.: 12LP4A—18 lbs., 16GP4A—16 lbs., 16KP4—20 lbs., 17BP4A—22 lbs., 19AP4B—23 lbs., 20CP4—31 lbs.

12LP4A	Round, Dark Face, Glass Envelope. Retail Price $31.00	$17.95
16GP4A	Round, Dark Face, Metal Envelope. Retail Price $51.00	$24.95
16KP4	Or 16RP4. Rectangular Glass Envelope, Dark Face. Retail Price $37.50	$20.95
17BP4A	Rectangular Dark Face, Glass Envelope. Retail Price $37.50	$20.95
19AP4B	Round, Etched Dark Face, Metal Envelope. Retail Price $65.00	$29.95
20CP4	Rectangular Dark Face, Glass Envelope. Retail Price $59.00	$29.95

BIG VALUE STANDARD COIL TV BOOSTER

★ Latest Model ★ Brand New
★ Reg. List Price $30.00
★ While they last. Model No. B-S1.

$10.95 Ea.

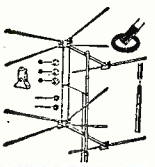
Just connect one of these Standard TV Boosters to your receiver and get brighter, snappier pictures and less "snow" and interference. Easy to attach. Works on all TV sets. An amazing deal—you can cash in—save money—Order Today. Tunes all 12 channels. Uses a 6AK5 tube and a selenium rectifier. Complete. Operates on 115 V. A.C. Shpg. wt. 6 lbs.

COMPLETE TV ANTENNA

A complete stacked array. Made by a famous manufacturer whose name and brand is on every factory sealed carton. Look what you get: 2 Six-element conical bays, 1 pair "Q" bars, 2 Five-foot mast sections, 60 ft. 300 ohm twin line, 5 Standoff insulators, 1 mounting base, 1 guy ring, 1 clamp, hardware. Elements are highest quality aluminum. Reg. list price is $31.95. Shpg. wt. 15 lbs. Express only.

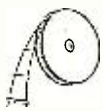
Stock No. AU-24

$11.99 Complete Set



OPEN WIRE TV LINE ★ Use in Place of 300 Ohm Line

Ideal for fringe area installations. Not affected by moisture or sun. Made of #18 copperweld wire with genuine polystyrene insulators spaced 6" apart. Tensile strength 400 lbs.



Stock No. W-78. 100 ft. coil. Shpg. wt. 4 lbs... $4.66

Stock No. W-79. 250 ft. coil. Shpg. wt. 9 lbs... $10.95

807 TUBES

A chance to stock up. Popular Power Tube. Shpg. wt. 1 lb. Stock No. X-288 ..... $1.49 Each

COMBINATION DEAL!

10 WATT HI-FI PUSH-PULL AMPLIFIER COMPLETE WITH 12" CO-AXIAL SPEAKER

STOCK NO. AS-67

BOTH FOR ONLY $39.95 WITH TUBES

COMPLETELY WIRED NOT A KIT

Order this matched outfit today. You get the 10-Watt Hi-Fi Amplifier PLUS the 12" Co-Axial Speaker both as described below. Can be built into any cabinet or bookcase—giving you a complete Amplifier System of which you can be proud.

Amplifier is completely assembled and ready to play. Built-in PRE-AMP for G.E. and similar types of magnetic pickups. 4 Inputs: 1 crystal phono, 1 magnetic phono, 1 radio, 1 mike. 4 Controls: 1 Bass, 1 Treble, 1 Volume, 1 Phono-radio Switch. Output Impedances: 4, 8, 16 ohms. Peak power output 17 watts. Order this amplifier today and see what brilliant, realistic tone it will deliver. Supply is limited. Every one in factory-sealed carton, You couldn't buy the parts alone for this price. Remember this is a full size amplifier, transformer operated, not an AC-DC job. Frequency response 20 to 20,000 cps at less than 1% of 1% distortion. 5 Tubes: 1—6SL7, 1—6SC7, 2—6V6, 1—5Y3. Complete with tubes. Size 12" x 6½" x 5½".

Speaker is our new 1952 Co-axial Model. Guaranteed to outperform any speaker in its price class. Equipped with two "high concentration" Alnico 5 magnets and a high frequency diffuser. The 12" section delivers the bass while the inner 3" tweeter speaker section delivers the treble tones. Together they give you "living tone." This speaker is unconditionally guaranteed to satisfy even the most critical user or Olson promises to refund your money. Only two wires to connect to amplifier. Voice coil impedance 8 ohms. Frequency response 30 to 17,500 cps. Shpg. wt. 25 lbs.

LATEST DESIGN 30 WATT AMPLIFIER

STOCK NO. RA-23

$34.95 Less Tubes

This commercial amplifier performs and looks better than most higher priced models. Not a kit. Gain: Mike-136DB, Phono-80DB. Dual tone controls for bass and treble. Output impedances 4, 8, 15 and 500 ohms. Input for two mikes and one crystal pickup. Tubes required. 3—6SQ7, 1—6SC7, 2—6L6g, 1—5V4g. Shpg. wt. 20 lbs.

FAMOUS MAKE CUSTOM-MADE AUTO RADIOS

CHECK THESE FEATURES

- ✓ Priced Low—They sell Fast.
- ✓ Every set is 6 tubes—3 gang.
- ✓ No cables, no brackets, no holes to drill, Installs in 3 to 4 minutes.
- ✓ Custom-Built, especially designed for the individual Auto.

OUTSTANDING BARGAIN! $41.97 CHOICE OF ANY MODEL

Superheterodyne. Six tubes including rectifier. Six volt storage battery operation. Two dual purpose tubes. Eight tube performance. Simple one or two unit construction depending upon the car. Three gang tuning condenser and tuned R.F. stage for extreme sensitivity. Automatic volume control. Permanent magnet, dynamic speaker with powerful Alnico 5 magnet. Easy vision slide-rule dial. Low battery drain. Beautiful hammertone finish. Shpg. wt. 12 lbs.

ORDER AUTO SETS FROM THIS LIST

Stk. No.	Make of Car	Year Model	Price
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RA-351	Chevrolet	1951-52	41.97
RA-200	Dodge	1949-1950	41.97
RA-251	Dodge	1951-52	41.97
RA-100	Ford	1949-1950	41.97
RA-151	Ford	1951	41.97
RA-152	Ford	1952	41.97
RA-451	Hudson	'48-49-50-51-52	41.97
RA-751	Henry J.	1951-52	41.97
RA-200	Plymouth	1949-1950	41.97
RA-651	Plymouth	1951-52	41.97
RA-551	Studebaker	1950-1951-1952	41.97

FREE!

Famous manufacturer's triple-chrome-plated auto antenna given FREE OF CHARGE with each auto set ordered during this special sale.

DON'T GET CAUGHT WITH YOUR BATTERY DOWN!

6-Amp. Overnight Battery Charger

Stock No. RA-58

$12.95

Put Power, Pep, Long Life into your car battery the modern, easy, inexpensive way. With long, hard winter months ahead you'll need Power, plenty of it, for heaters, lights and quick starts. Olson solves your problems with this safe, dependable, easy-to-operate Battery Charger that charges battery while still in car. Pays for itself in one winter by eliminating tow-charge, rental and lost time expenses. Complete—Ready to Operate. AC Cord and Plug. Extra-Long Battery Lead with Clips. Simply clip battery lead to terminals and plug AC Cord into convenient light socket or outlet. Built-in Ammeter tells exactly what charging rate is going into battery. Exclusive "Charger-Guard" protects against short-circuits and overloads, automatically tapers down charging rate as battery becomes charged, no fuses to replace, no manual resets. Attractive, Sturdy, Heavy-Gauge, Ventilated Steel Case, 6¼" x 6" x 7¼". 110/115 V., 50/60 Cycles AC. For all 6 volt Storage Batteries. Underwriter's Laboratories, Inc. Approved. Shpg. Wt. 10 lbs.

USE HANDY ORDER BLANK ON NEXT PAGE ➡

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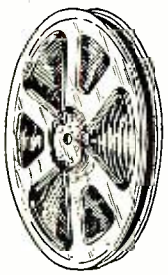
FREE! OLSON'S BIG BARGAIN CATALOG

Get Olson's LOWER-than-wholesale prices from this famous book. STANDARD BRANDS—FRESH STOCK. IMMEDIATE DELIVERY. Catalog is two colors—40 full pages of unbelievable bargains. A new catalog mailed Bi-Monthly—with new low bargains each mailing. Simply note on order blank or write today for your free copy from: OLSON RADIO WAREHOUSE, 275 E. MARKET ST., AKRON 8, OHIO.

RECORDING TAPE—FAMOUS MFR'S CLOSEOUT!



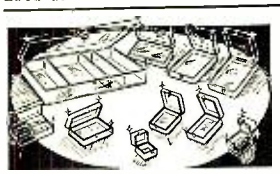
Get the buy of your life. Save up to 64% on high quality RECORDING TAPE. A large manufacturer had to sell his inventory and he unloaded the whole deal. Olson now offers you this high grade recording tape at prices which defy competition. Standard ¼" wide, 1200 ft. long. Frequency response 50 to 8,000 cy. Plastic Reel included with each.

PLASTIC BASE
1200 FT. REEL
Stock No. X-249
Single, each $2.19
Ship. wt. 1 lb.
Lots of 10, each..... **$1.99**

PRICES SLASHED ON EMPTY PLASTIC REELS

Finest clear plastic—will not warp.
5" Diameter—600' Size
No. X-250
Single, ea. 39c.
Shpg. wt. 8 oz.
LOTS OF TEN, EA..... **29¢**

7" Diameter—1200' Size
No. X-251
Single, ea. 49c.
Shpg. wt. 8 oz.
LOTS OF TEN, EA..... **39¢**



TRANSPARENT BOXES

Stock No. AS-65
Complete set of 10 assorted sizes..... **$1.95**

Made of Styron, the miracle plastic. Clear as glass but won't break with ordinary use. You get 10 different, all popular size boxes. All with hinged covers. Boxes range from 8"x3¾"x1½" to 1"x1"x ½". Handy for nuts, bolts, lugs, resistors, small parts, etc. Get several kits today. Shpg. wt. 2 lbs.

12" Magnavox Speaker and Baffle Close-Out

Stock No. AS-66
Get both for only ... **$7.95**
In lots of 4 sets. One set for $8.95.

You get Magnavox's fine 12" PM speaker with Alnico 5 magnet. (Same as you'll find in those expensive Magnavox Super-Radio-Phono Combinations.) Power output 8 watts. Voice coil fully dustproofed. Impedance 6-8 ohms. In addition you get a walnut Speaker Baffle to bring out the full rich, rounded tones of the Magnavox Speaker. Baffle may be mounted on a wall or it will stand on a table. Here's the ideal combination for extension speakers for porches or other rooms. Can be connected to any radio or amplifier. Order 4 or more sets and install them in restaurants, auditoriums, halls. Shpg. wt. 12 lbs.

MICROPHONE CABLE

50' COIL Stock No. W-74 **$2.95**
100' COIL Stock No. W-109 **$4.50**

Single tinned stranded conductor. Low loss insulation. Braided copper shield covered with smooth plastic. For all types of mikes. Shpg. wts.: 50'—3 lbs., 100'—5 lbs.

CRYSTAL MIKES

Astatic high output crystal mike for PA systems and recorders. Equipped with handle base and 7' shielded cable. Shpg. wt. 5 lbs.

M-67, each **$5.95**

M-66, same but with on-off switch built into handle .. **$6.95**

WANTED! $500,000.00 WORTH OF

Radio and TV Parts, Speakers, Transformers, Tubes, Picture Tubes, Condensers, Resistors, Switches, Wire, Knobs, Coils, Phono Cartridges, etc.

ALSO

Partially assembled or complete Radio, Amplifier and Television Chassis.

ALSO

Test Equipment, Record Players, Automatic Changers, Motors, Microphones, Tone Arms, Meters, Cable, Cabinets, Grille Cloth, Wire or Tape Recorders.

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FAIRCHILD GRINDER

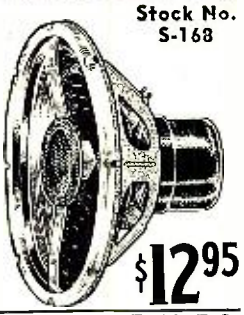
$9.98

Stock No TL-3

Service Shop Must! Made by Fairchild, famous maker of precision tools. Reg. nationally advertised price—$19.75. Includes 1—115V. high-speed, air-cooled grinder, 6 assorted grinding wheels, 1 circular saw blade, 1 hardened steel reamer, 1 buffing brush, 1 abrasion stone, all in a natural finish wooden case, size—10" x 5" x 3". Original factory sealed cartons. Shpg. wt. 6 lbs.

12" CO-AXIAL SPEAKER

Stock No. S-168

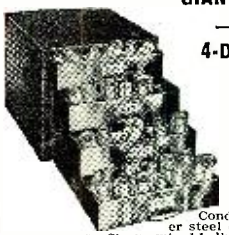


Our new 1952 Model. Guaranteed to outperform any speaker in its price class. Equipped with two "high concentration" Alnico 5 magnets and a high frequency diffuser. The 12" section delivers the bass while the inner 3" tweeter speaker section delivers the treble tones. Together they give you "living tone." This speaker is unconditionally guaranteed to satisfy even the most critical user or Olson promises to refund your money. Only two wires to connect to any radio or amplifier. Voice coil impedance 8 ohms. Frequency response 30 to 17,500 cps. Shpg. wt. 10 lbs.

$12.95

GIANT CONDENSER KIT

— 69 PIECES —
4-DRAWER CHEST
FREE
OF EXTRA COST



Olson's Price AS-20 **$16.95**

You get $51.60 list worth of "Akrad" Condensers plus the 4 drawer steel cabinet FREE, size 10"x 11½"x10". Shpg. wt. 11 lbs.

42 "AKRAD" By-Pass Condensers

Qty.	Cap.	Volts	List ea.	Total
2	.001	600	$.25	$.50
2	.002	600	.25	.50
2	.005	600	.25	.50
5	.01	600	.30	1.50
5	.02	600	.30	1.50
10	.05	600	.40	4.00
10	.1	600	.45	4.50
2	.005	1600	.55	1.10
2	.008	1600	.55	1.10
2	.01	1600	.60	1.20

Also 27 "AKRAD" Electrolytic Condensers

Qty.	Cap.	Volts	List ea.	Total
2	10	25	$1.00	$2.00
2	25	25	1.00	2.00
5	20	150	1.20	6.00
5	40	150	1.35	6.75
4	20-20	150	1.65	6.60
5	8	450	1.25	6.25
4	16	450	1.40	5.60

69 Pieces Valued at.... $51.60

VM 2-SPEED AUTOMATIC RECORD CHANGER

$19.99 EACH
Stock No. RA-99

★ Changes All 33⅓ and 78 RPM Discs
★ Intermixes 10" and 12" Discs
★ Stops After Last Record
★ Jam Proof ★ Hi-Fi Turn-Over Cartridge
★ 100% Guaranteed

Built for RCA. Factory sealed cartons. Worth $45.00 List.

Now you can take advantage of this deal that Olson ran across. Incorporates the latest design to play the records in most demand, 33⅓ and 78. Records may even be intermixed on the spindle. Will hold twelve 10" or ten 12" discs in one loading. Records slide down the center shaft with utmost precision. Low pressure tone arm is equipped with an RCA turn-over cartridge and two permanent needles. Shuts off after last record. Has reject button also. Size 12" x 13". Operates on 115 volts AC, 60 cycles. Shpg. wt. 15 lbs.

Stock No M-80

TELEPHONE PICKUP

$4.50

Record or amplify both sides of a telephone conversation. No connection to telephone necessary. Just lay pick-up under any cradle type phone and connect lead to hi-impedance input of any disc, wire or tape recorder or any amplifier. Operates by induction. Shpg. wt. 1 lb.

CONVERT 6V DC to 110V AC

Stock No. RA-104

$10.63

Now you can have all the advantages of a 110v AC power supply IN YOUR OWN CAR! Converts 6v DC to 110v AC 60 cycle with capacity to 45-50 watts. Fully filtered. Just plug in cigar lighter and operate portable phonos, radios, dictating machines, lights, electric shavers, etc. Only slightly larger than cigarette pack! Ideal for picnics, camping, summer traveling pleasure. Shpg. wt. 5 lbs.

HOWARD W. SAMS PHOTOFACT TELEVISION COURSE

FREE!

Thousands sold at $3.00. Olson gives you a copy free of charge. Bound in book form, 215 big pages 8½" x 11", crammed with valuable data and diagrams. Gives a complete understanding of TV operation and principles. Look at some of these chapter titles: Deflection Systems, Power Supplies, Intercarrier Systems, Video Amplifiers. 18 Chapters in all.

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How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MONEY BACK GUARANTEE:
Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.

Please Minimum Order $3.00

MAIL TO: OLSON RADIO WAREHOUSE
275 E. MARKET ST., AKRON 8, OHIO
WE SHIP SAME DAY WE GET YOUR ORDER

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL
			TOTAL	
			ADD POSTAGE	
			TOTAL AMOUNT	

NAME _____
ADDRESS _____
CITY _____ ZONE ____ STATE ____

RN-1152

OLSON RADIO WAREHOUSE • 275 E. Market St., Akron 8, Ohio

Mac's Service Shop

(*Continued from page 72*)

theory behind the functioning of the radio receiver. If he is completely familiar with the uses of resistors, condensers, transformers, coils, and tubes in radio circuits, it will be easier for him to grasp both the old and the new uses to which these components are put in television circuits. On the other hand, if his knowledge of radio has been acquired entirely through experience, and if he has only concerned himself with the *how* of radio repairing and has never been interested in the *why*, his radio background will be much less useful when he encounters the host of unfamiliar circuits in a television set."

"A big difference I notice between working on radios and working on TV sets is the frequencies used," Barney offered. "When I switch from a radio to a TV set, I have to sort of shift gears mentally and remind myself that when I start dealing with megacycles instead of kilocycles a lot of things change. For instance, inductance is no longer a matter of several turns of wire on a coil; it can be just a short length of straight wire. Capacities that could be ignored as trifling in a radio become low-reactance bypasses in the TV set. Lead dress in video sets is a lot more critical, too. I have to keep remembering that I can't go yanking the wires around willy-nilly the way I can in a radio set without seriously changing the alignment of the tuned circuits."

"All very true," Mac agreed, "and the situation is going to be doubled in spades now that we are moving into the u.h.f. region. The fact of the matter is that a good grounding in radar techniques will soon be of more value in television servicing than will a radio service background. 'Transit time,' 'cavity resonators,' and 'parabolic reflectors' will soon slip as easily from the technician's tongue as 'delayed a.v.c.' 'pentagrid converter,' and 'double-stacked yagi' do now. But I do not think this is any cause for dismay to the average radio and TV technician. If he were the sort who liked a staid and unchanging sort of work, he would never have gone into servicing in the first place, for radio itself has always been a growing and progressive thing. A fellow who has successfully hurdled from battery to a.c. sets, from t.r.f. to superheterodyne, and from AM to FM receivers is not going to balk at television, even though the TV set of the near future comes to look like a nearer relative of the bathroom plumbing than that of a radio receiver."

"Then you think I should tell my cousin to wade right into the study of television without worrying about not having radio training first?"

"By all means. If he goes to a good school, he will be given the basic theory that applies to both radio and television as a matter of course; but

instead of wasting time on circuits that are peculiar only to radio receivers, he will spend this time learning about the television receivers upon which he will actually work. While his knowledge of electronics will not be as broad as that of a technician who has served an apprenticeship in radio servicing, this will not be a handicap to him in the specialized work he will be doing. As a clincher, you might remind him that the first auto mechanics were blacksmiths, but being able to forge a good plowpoint is no longer a prerequisite to working on a hydramatic transmission!"

—30—

Novice Transmitter

(*Continued from page* 45)

completed in accordance with the schematic diagram (Fig. 2A), the unit is ready for testing.

Connect a d.c. milliammeter—one having a range of from 75 to 150 ma. full scale—to the terminals at the rear of the chassis. Install the correct coil and crystal for the band desired. Turn on the power switch and allow the transmitter to warm up for approximately one minute.

Now depress the key and observe the meter. Next rotate the tuning condenser slowly and note that at one point there is a decrease in the plate current as read on the meter. Note also that as this dip or decrease is approached from one side during the rotation of the condenser there is a sudden drop while on the other side the decrease is more gradual. The proper operating point is just past the point of lowest current on the side of the gradual change. See Fig. 3.

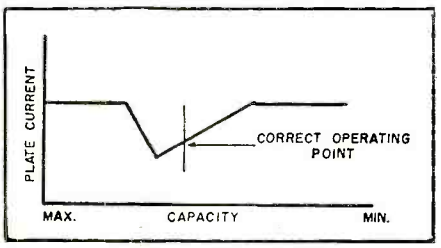
After the antenna is connected it will be necessary to tune the transmitter again following the procedure just outlined. The plate current, with the antenna connected, should be 55 to 60 ma. If the plate current exceeds this value it will be necessary to remove one or two turns from L_2 in order to reduce the antenna coupling.

The Antenna System

The *Meissner* "2-CW" kit was designed to operate into a folded dipole antenna of the type shown in Fig. 4. The antenna length may be computed from the formula $L = 468/f$ where L is the length in feet, and f is the desired operating frequency in megacycles.

If, however, the ham wishes to

Fig. 3. Proper operating point for transmitter. See text for complete tuning data.



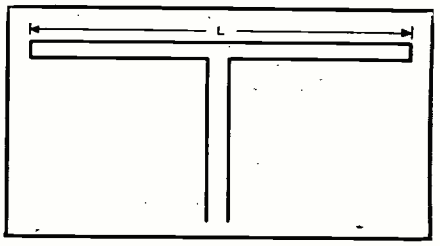


Fig. 4. Folded dipole for use with Novice transmitter. Formula for computing the vital dimensions is given in the text.

operate this transmitter with an antenna of random length, the unit may be converted by the addition of a 250 $\mu\mu$fd. antenna tuning condenser and the circuit altered as shown in the inset of Fig. 2B.

The procedure for tuning the transmitter with the random length antenna varies slightly from the procedure previously outlined. First the antenna condenser should be completely closed and the antenna connected. Next tune the plate condenser as previously described.

Now slowly open the antenna condenser a few degrees. Note that the plate current increases. It will now be necessary to re-tune the plate condenser. Again open the antenna condenser a few more degrees. Re-tune the plate condenser. Continue this operation until the plate current, with the plate condenser properly adjusted, reaches 55 to 65 ma. and you are ready to go on the air! —30—

HAM LICENSE PLATES

THE approximately 5000 hams living in Ohio will be receiving letters in the near future advising them that they may now apply for license plates with their amateur call letters.

The plates will be available upon payment of the regular license fee of $10.00 plus an additional service fee of $1.00.

R. E. Foley, state registrar, said that, "These special plates are being offered to Ohio's hams in recognition of their contribution to the safety of our citizens not only in times of natural disasters and emergencies, but in the field of Civil Defense, in which Ohio's Governor Frank J. Lausche has shown such a keen interest and concern."

Applications for the special plates must be made no later than December 31st. Letters to all known operators will explain the application procedure. —30—

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Executive Vice President

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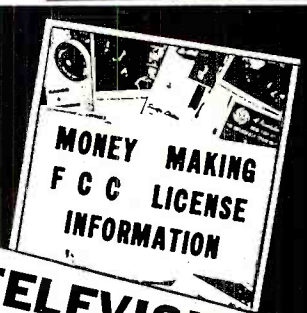

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Letter from Chief Engineer, Broadcast Station, Texas, "Please send list of latest licensed graduates."

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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

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GETS STATE POLICE JOB

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

GETS BROADCAST JOB

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

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

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FM BOOSTER IMPROVEMENT

By
CHARLES ERWIN COHN

A simple circuit change and substitution of a pentode for a triode give substantially improved performance.

AFTER building the untuned FM booster described on page 149 of the March 1952 issue (the author's "Booster for FM Sets"), I have made an improvement in the original circuit which consists of using a pentode instead of the triode amplifier originally specified.

Although the triode has a better noise figure than a pentode, the latter tube has far more gain, which is of primary importance since most FM sets without r.f. stages have only two i.f. stages. In addition to supplying the requisite gain, there is another advantage in that a pentode has a higher plate resistance than a triode. This permits more selectivity to be realized from the signal-tuned circuit, improving image rejection.

The antenna is connected directly to the grid and terminated with the usual 300-ohm resistor. Because of this low resistance the circuit cannot oscillate and thus is easy to install. Although the 300-ohm resistor is correct for folded dipole antennas, both of the indoor and outdoor types, other antennas may require other values for optimum operation. For example, a simple dipole requires 72 ohms. These resistor values are, of course, nominal, and are not so critical that the nearest commercial value cannot be used. Some types of TV indoor antennas, which are convenient to use with an FM set, may require higher or lower resistances for best operation. This value can only be determined by experiment.

Obviously, the antenna circuit is unbalanced. This is not troublesome for most antennas, especially indoor types, but may be objectionable for an outdoor antenna with a grounded mast. In such cases the 300-ohm resistor should be replaced by 150 ohms and the antenna lead previously grounded direct, as shown, should be grounded through another 150-ohm resistor. This gives a balanced connection but, unfortunately, causes a 6 db signal loss and thus should be used only where improved antenna performance cancels out that loss. This must also be determined by experiment. In the case of an antenna using some other impedance value, the two resistors should each be half the total impedance value instead of 150 ohms.

The choke, RFC_1, shown in the grid circuit, is incorporated to prevent i.f. pickup. Since this circuit has much less i.f. rejection than the usual inductive antenna coupling, signals at the i.f. frequency can be heard if the i.f. happens to be aligned at some frequency other than 10.7 mc. This could happen if the signal generator used for alignment is not correctly set or if the receiver were aligned without the use of a signal generator. (This latter practice is not condemned as it can give excellent results when properly done.)

This type of interference can be distinguished by the fact that it appears over the entire dial.

Construction of this choke is not at all critical, and it may be readily wound by wrapping ten turns or so of number 22 bare hookup wire around a pencil or similar size form, and then slipping it off the form.

There will be a slight spring to the wire, and it should be stretched slightly so the turns do not touch.

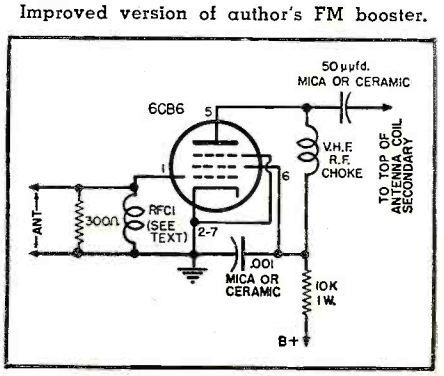
If ordinary cotton-covered wire in this approximate size is available, it may be used in place of the bare wire specified. If stock high-frequency r.f. chokes are on hand they may be tried in this position, connected from grid to ground.

The choke has no effect on reception, and of course need not be used if i.f. interference is not encountered during reception.

Any of the common television pentodes can be used in this circuit, although I used a 6CB6 because it has slightly higher transconductance than the others. The remainder of the circuit is fairly straightforward, the .001 μfd. mica condenser and the 10,000 ohm resistor serving the functions of decoupling and voltage dropping. The r.f. choke in the plate circuit is a v.h.f. type such as the *Ohmite* Z-O.

—30—

Improved version of author's FM booster.



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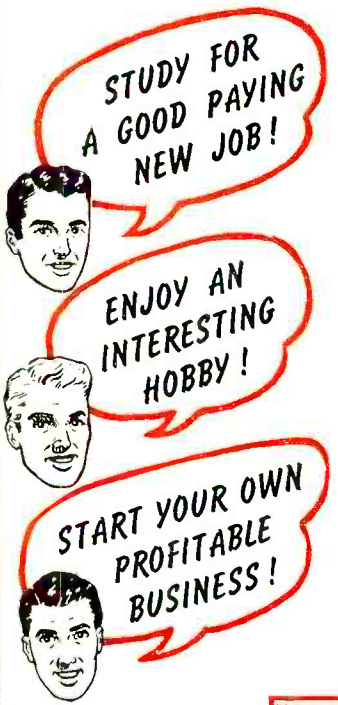

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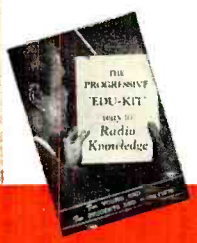

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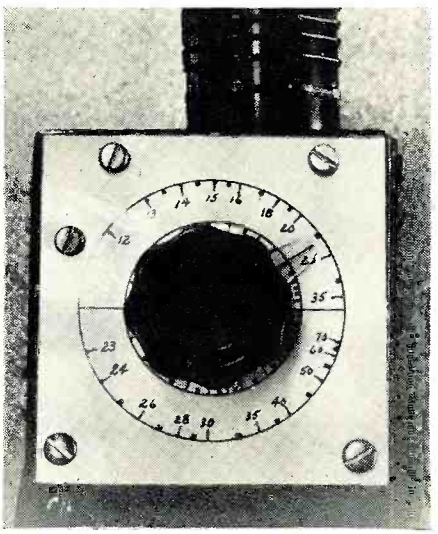
Versatile Wavemeter

(*Continued from page* 71)

to pins #1 and #4 of a 4-prong male socket (see Fig. 3B). The lucite can either be solid or hollow and should be about 4″ long. To use this device connect the signal generator to J_1 and ground, and adjust the output of the signal generator for a convenient meter deflection. Hold the probe coil close to the tank circuit under test; when the signal generator is tuned to the same frequency as the tank circuit, the meter will dip, showing that the tank circuit is absorbing maximum energy from the wavemeter. Frequency is then indicated directly from the reading on the signal generator.



Close-up view of the home-made dial scale used with the wavemeter. Instructions for setting up this dial are given in text.

Absorption Meter—Set S_1 to position "B". Insert the proper coil and hold the meter near to the coil under test in the transmitter. When the absorption meter is tuned to the same frequency as the tank circuit, the meter on the transmitter will either dip or rise depending on which circuit is being tested—grid or plate.

You will find that the wavemeter can save you many hours of guesswork around the ham shack or repair shop. It eliminates some of the unknown elements during construction: it creates confidence since you can see the results. For rapid frequency measurement, for coil and condenser work, for so many of those difficult measurements, let the wavemeter handle the job for you. —30—

BETTER SPLICING

By HENRY JOSEPHS

When splicing plastic television lead-in wire, particularly for outdoor installations, melt some of the plastic from another piece over the joints to make them more durable.

This type of insulation has proved to be more weatherproof than merely wrapping the splice with tape as is usually done. —30—

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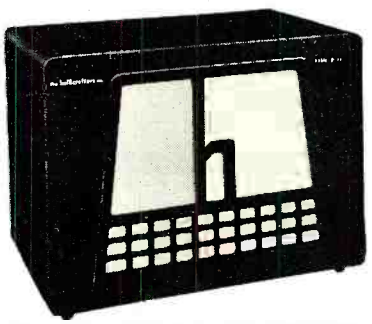

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A DEFLECTION AMPLIFIER covering range up to 100 kc.

By

R. G. VAUGHN, JR.

Replace the obsolete amplifier in your scope and increase the unit's sensitivity and voltage gain.

THAT important area of the oscilloscope's field of usefulness, the range below 100 kilocycles, has been somewhat neglected of late with the general preoccupation with video problems and techniques. Some of the large group of workers in this range may be interested in a high performance deflection amplifier of simple design, which is intended specifically for this range and may be used to replace an older amplifier.

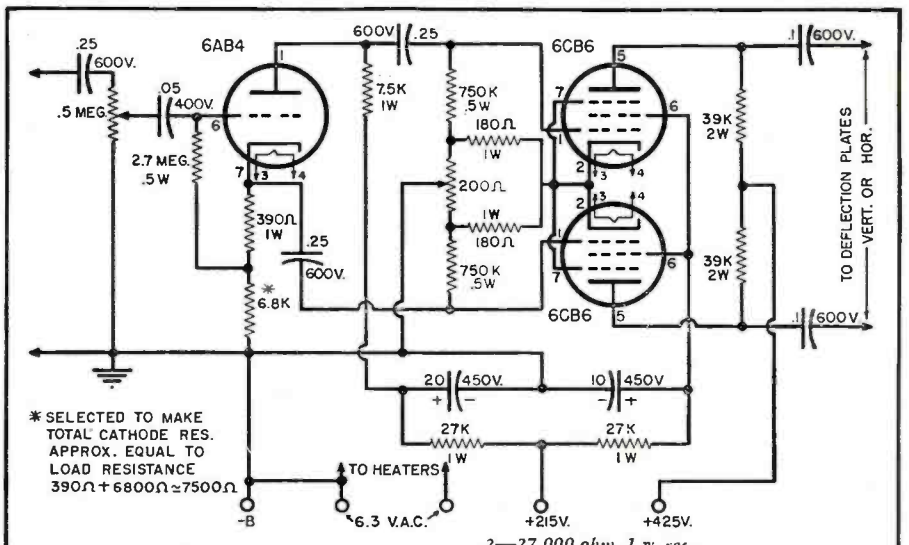
There are only three tubes in the amplifier proper, a single triode and two small r.f. pentodes, yet it provides a voltage gain of nearly 400 which is constant within about 5% or approximately one-half decibel over the range from 10 cycles-per-second to above 100 kilocycles. Peak output is more than 300 volts. There is an almost perfectly linear relationship between the gain control setting and voltage output over the entire audio spectrum although the control is a simple grid potentiometer. For example, with a half-gain setting at 20 kc. relative gain is down only about 1% or about one-tenth decibel compared to that at 1000 cycles.

For audio work these characteristics are virtually ideal yet are attained with simplicity and economy.

Since it has its own separate external power supply the unit may replace an older amplifier without disturbing the existing cathode-ray tube circuit. This arrangement has proved practical and convenient, and eliminates many installation problems which might otherwise exist.

The striking performance of the amplifier is due largely to the use of the high transconductance 6CB6 pentode with a relatively high plate supply voltage. This high voltage is obtained easily at no added expense. The small output capacitance of the 6CB6 permits the use of a relatively high plate load resistance without sacrificing any of the desired high frequency response. The 6AB4 triode in the split-load circuit provides a low capacitance, low admittance grid input which is comparable to the cathode follower—which circuit it resembles both physically and electrically. It is responsible for the relative absence of frequency discrimination by the gain control. It also permits the low im-

Complete circuit diagram and parts list covering the CR deflection amplifier.



1—.5 megohm pot.
1—2.7 megohm, ½ w. res.
1—390 ohm, 1 w. res.
1—6800 ohm, 1 w. res.
1—7500 ohm, 1 w. res.
2—750,000 ohm, ½ w. res.
1—200 ohm wirewound pot.
2—180 ohm, 1 w. res.
2—27,000 ohm, 1 w. res.
2—39,000 ohm, 2 w. res.
3—.25 µfd., 600 v. cond.
1—.05 µfd., 400 v. cond.
1—20 µfd., 450 v. elec. cond.
1—10 µfd., 450 v. elec. cond.
2—.1 µfd., 600 v. cond.
1—6AB4 tube
2—6CB6 tubes

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6CD6G ea. $1.49
6U8 ea. 89c
6V3 1.29
7N7 59c
12AU7 ea. 65c
807 ea. $1.55

0Z4	49c	6AL5	59c	6Q7GT	$ .49	7R7	$ .89	25AC5GT	$1.04
0Z4G		6AQ5		6R7GT	.69	7S7	1.07	25BQ6GT	1.15
1A5GT	.65	6AQ6	.81	6S4	.49	7V7	.69	25L6GT	.49
1A7	.59	6AR5	.74	6S7GT	1.15	7W7	1.07	25W4GT	.59
1B3GT	.69	6AT6	.49	6S8GT	.69	7X6	.89	25X5	1.04
1B5	29c	6AS5	.90	6SA7GT	.59	7X7	.69	25Z6GT	.59
1C7G		6AU5GT	.69	6SC7	.59	7Y4	73c	32L7GT	1.15
1E7		6AU6	49c	6SD7GT	.99	7Z4		35A5	.99
1H5GT	.49	6AV6		6SF5	.49	12A7	1.15	35B5	59c
1J6GT	.69	6B4G	1.44	6SF5GT	.49	12A8	.59	35C5	
1L4	.59	6B5		6SH7	.59	12AH7	1.45	35L6	.59
1LA4	1.19	6B6G	.79	6SH7GT	.59	12AL5	.54	35W4	.45
1LA6		6B8GT	1.15	6SJ7	49c	12AT6	.49	35Y4	99c
1LC5	.69	6BA6	.49	6SJ7GT		12AT7	.89	35Z3	
1LC6	1.19	6BA7	.69	6SK7GT		12AU6	.59	35Z4	.49
1LD5	.95	6BC5	.59	6SL7GT	.69	12AU7	.65	35Z5	.55
1LE5	1.19	6BC7	.79	6SN7GT	.59	12AV6	.49	35Z6G	.95
1LH4	1.19	6BD5GT	.89	6SQ7	49c	12AV7	.89	35/51	.79
1LN5	1.19	6BE6	.49	6SQ7GT		12AW6	.95	41	.72
1N5GT	.59	6BF5	.59	6SR7GT	.49	12AX7	.69	42	.59
1P5GT	69c	6BF6	.59	6SS7	.72	12BA6	.49	43	72c
1Q5GT		6BG6G	1.49	6T7G	1.15	12BA7	.69	45	
1R5	59c	6BH6	59c	6T8	.89	12BE6	49c	45Z5	.59
1S5		6BJ6		6U5	.59	12BF6		46	89c
1T4		6BK7	.98	6U6GT	59c	12BN7	.69	47	
1U4		6BL7	.79	6U7G		12C8	1.15	50A5	.89
1U5	.49	6BN6	.89	6V8	.89	12F5GT	65c	50B5	59c
1X2A	.69	6BQ6GT	.85	6V3	1.29	12H6		50C5	
2A3	1.15	6BQ7	1.19	6V6GT	.59	12J5GT	.54	50C6G	1.04
2A5	.79	6BZ7	1.29	6W4GT	49c	12K7GT	.59	50L6	.69
3LF4	1.19	6C4	.49	6X4		12Q7GT	.59	50X6	.79
3Q4	.59	6C5GT	59c	6X5GT		12SA7GT	.69	50Y6	.59
3Q5GT	1.08	6C6		6Y6G	.69	12SC7	.59	70L7	.89
3S4	59c	6C8G	1.15	7A4	.59	12SF5GT	59c	71A	.87
3V4		6CB6	.59	7A5	.89	12SF7		75	59c
5T4	1.40	6CD6G	1.49	7A6	73c	12SH7GT	.59	77	
5U4G	.49	6D6/78	1.10	7A7		16SJ7GT	.49	78/606	1.10
5V4G	.87	6D8G	1.15	7A8		12SK7GT	.69	80	.69
5W4	49c	6E5	.59	7B4		12SL7GT	.69	83	1.45
5W4GT		6F5GT	49c	7B5	.73	12SN7GT	.99	85	.79
5X4G	.65	6F6GT		7B6	.73	12SQ7	.49	117L7	1.40
5Y3GT	.45	6F8G	1.15	7B7	73	12SQ7GT	.59	117N7	.89
5Y4G	.54	6G6G	.95	7B8	.73	12SR7GT	.59	117P7	1.40
5X4G	81c	6H6GT	.49	7C4	1.30	12Z3	.95	117Z3	.49
5Z3		6J5GT	.49	7C5	73c	14A7	.89	117Z6	.69
6A3	1.15	6J6	1.04	7C6		14AF7	.93	807	1.55
6A7	1.21	6J7G	.59	7C7		14B6	89c	813	8.95
6A8GT	.59	6J8G	1.15	7E6	.59	14B8		1294	29c
6AB7	1.15	6K5GT	.69	7E7	.69	14C5	1.07	1299	
6AC5GT	89c	6K6GT	.49	7F7	.89	14C7	.98	1619	.45
6AC7		6K7GT	.59	7F8	1.47	14F7	.89	1629	.29
6AG5	.69	6K8GT	.69	7G7	.69	14F8	1.30	2050	2.00
6AG7	.89	6L5G	.95	7H7	.59	19BG6G	1.49	2051	1.15
6AH6	1.40	6L6G	95c	7J7	.69	19T8	.89	7193	.87
6AK5	.89	6L6GA		7K7	1.07	20	1.40	VT51	29c
6AK6	1.08	6L7	.69	7L7	.69	24A	.59	VT52	
		6N6G	1.40	7N7	59c				
		6N7GT	69c	7Q7					
		6P5GT							

TUBE KITS—BEST BRANDS AT BEST PRICES

3Q4, 1T4, 1R5, 1S5. List Value $8.00. Tube Kit only $1.98
3S4, 1T4, 1S5, 1R5. List Value $7.80. 4 Tube Kit $1.98
1U4, 3S4, 1S5, 1R5. List Value $7.80. All Four Tubes for $1.98
3V4, 1R5, 1S5, 1T4. List Value $7.80. All for $1.98
117Z3, 1U5, 3V4, 1R5, 1T4. AC-DC Portable Kit. All for $2.49
12AT6, 12BA6, 12BE6, 35W4, 50B5. 5 Tubes for $2.59
50L6GT, 35Z5GT, 12SQ7GT, 12SK7G, 12SA7G. 5 Tubes for $3.22

P. M. SPEAKERS
12" Coaxial PM Speakers $12.95 ea.
High fidelity with high pass filter attached. 20 watt; 40-17500 cps response; 8 ohm VC.
SPECIAL PRICE
6" P. M. Speakers ..... $1.29 ea.
Standard Replacement

TV PICTURE TUBES

ONE FULL YEAR GUARANTEE—All Types

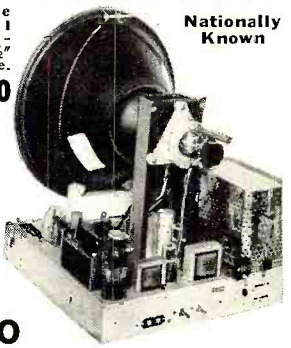
SIZE	PRICE	SIZE	PRICE
10-Inch	$10.95	16-Inch	$17.95
12-Inch	$12.95	17-Inch	$19.95
14-Inch	$15.95	19-Inch	$22.95
7-Inch	$15.95	20-Inch	$23.95
15-Inch	$14.95	21-Inch	$25.95

RESISTOR KITS—Insulated ½, 1 and 2 watt assortment of most used values, I.R.C. Ohmite, Stackpole, Speer, etc. 100 for $2.95

TERMS, 20% DEPOSIT with order, balance C.O.D. All shipments F.O.B. Chicago
Orders Less Than $5.00—$1.00 Service Charge

Finest TV CHASSIS

Complete with all tubes, including 12½" picture tube. $69.50



Nationally Known

20" Rectangular Tube with Complete Chassis $149.50

17" Rectangular Tube with Complete Chassis $129.50

Manufacturer licensed under RCA patents.

INCLUDES:
- beautiful bronze metal mask
- permanent magnet 12" speaker
- all tubes aligned perfectly
- ideal for fringe areas . . . works better than other receivers and where others can't
- ultra-sensitive fringe area tuner
- standard 90-day guarantee on all tubes and parts
- full band reception and output
- gated AGC—finest automatic gain control
- COMPLETE . . . READY TO OPERATE

TV SET SPECIALS!

"Famous Name Television Sets"!

- Automatic Gain Control
- Saw Tooth AFC
- Standard Coil Tuner—adaptable to UHF
- Transformer-operated throughout—no selenium Rectifiers.

- All the exclusive features of most expensive sets
- Meet all Standard RTMA requirements
- Finished in luxurious mahogany

17" Table Model now only $149.00
20" Table Model now only 169.00
21" Table Model now only 179.00

Console Sets $20.00 additional.
Limed Oak Finish ..... $12.50 extra

OUTDOOR TV ANTENNA SPECIAL!

Famous Make Folded Dipole Inline Antenna—no assembly necessary—elements snap in place with guaranteed positive lock. At this low price, we cannot mention manufacturer's name. ..... ONLY $4.95

Fringe Area DOUBLE "V"

TV ANTENNA KIT

High Gain, Best Pictures Possible . . . complete with 300 ohm line, Insulators, guy wire, hardware, full size antenna with double length 9 ft. mast $6.95 Complete

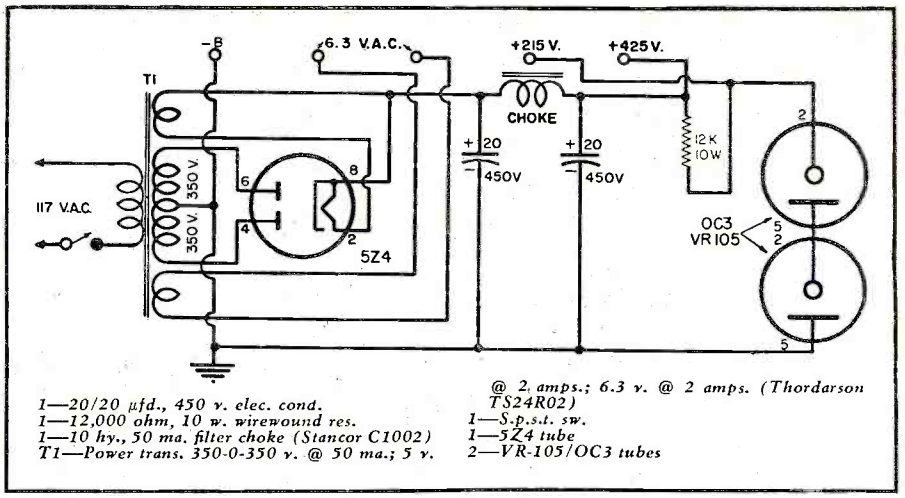
I. F. TRANSFORMER 456 Kc **19c**

PILOT LIGHTS Type No. 47
10 for **39c** 100 for **$2.95**

VOLUME CONTROLS with switch, 2" shaft 1 meg, ½ meg, ¼ meg **34c ea.**

SINGLE ION TRAPS ..... ea. 15c
OUTPUT TRANSFORMER ..... for 50L6 29c
..... for 6V6 39c
UNIVERSAL OUTPUT TRANSFORMER, 12 watt 79c
CHIMNEY MOUNT for TV antenna 98c
WELLER SOLDER GUN $8.95
3 SPEED G. I. CHANGER 24.95
300 ohm TWIN LEAD ..... 1000 ft. 16.95
100 ft. 1.89
6 foot LINE CORD UL ..... 10 for 1.95
TV INTERLOCK CORDS ..... ea. 49c

PREMIER Radio Tube Division
CONTINENTAL CORPORATION
551 W. Randolph St.
Chicago 6, Illinois
ANdover 3-1590



1—20/20 μfd., 450 v. elec. cond.
1—12,000 ohm, 10 w. wirewound res.
1—10 hy., 50 ma. filter choke (Stancor C1002)
T1—Power trans. 350-0-350 v. @ 50 ma.; 5 v. @ 2 amps.; 6.3 v. @ 2 amps. (Thordarson TS24R02)
1—S.p.s.t. sw.
1—5Z4 tube
2—VR-105/OC3 tubes

Power supply unit for the deflection amplifier. It is built on a separate chassis.

pedance coupling circuits from cathode and plate to the 6CB6 grids.

If favorable operating conditions for the 6CB6's are to be provided and anything approaching full utilization of their possibilities made, a substantial plate current must be assumed. In applications and under conditions such as this, permitting a fairly large value of load resistance, this means that a sufficiently high voltage supply must be provided to overcome the loss in the load and still permit the desired plate current. The 425 volt supply used accomplishes this.

The combination of the desirable features and conditions mentioned results in an exceptional gain-bandwidth index for what is virtually a single push-pull stage with straight resistance coupling. The function of the 6AB4 is to provide phase splitting and, equally important, favorable input characteristics rather than amplification. The gain that is lost is well spent indeed in exchange for these desirable features.

The power transformer is a standard receiver replacement type with 350-0-350 volt secondary. With full-wave rectification and condenser input filtering at the small current of about 30 ma. (including regulator current), the output is about 425 volts. The cathode-type 5Z4GT rectifier not only lessens the possibility of dangerously high surge voltage, but has lower losses than the filament types. The extra regulator tube provides enough regulated voltage to permit the use of large screen and triode plate filter resistors.

If a filament type rectifier is used, there is danger that the filter condensers may short out, as the plate voltage will rise to a high value before the tubes reach operating temperature and start to draw current. In view of this, it is advisable to use a cathode-type rectifier as was specified.

Since there is considerable variation in 6CB6 tubes, a bias potentiometer is provided to permit balancing the outputs. The a.c. potential between plate and ground of both outputs should be the same.

The prototype of this amplifier has proved itself in a year of constant service with a highly satisfactory record. —30—

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.

MOBILE ANTENNAS

Two booklets on mobile communications antennas have recently been published by *Ward Products Corp.*, Division of *The Gabriel Co.*, 1523 E. 45th Street, Cleveland 3, Ohio.

Every antenna and accessory for mobile use, along with their description and specifications, is included in this new catalogue.

"How to Specify Mobile Antennas" is the title of the second booklet, describing the popular base, whip, and spring combination, factors involved in their purchase, and a description of how these components are produced.

Free copies may be obtained from radio parts distributors or direct from the company.

CONTACT RIVETS

Electrical contact rivets, manufactured by *Gibson Electric Company*, Frankstown Ave., Pittsburgh 21, Pennsylvania, are described in their recently published catalogue.

Discussed in the 6-page folder are the company's contact rivets made from fine silver, coin silver, *Gibson* silver alloys, palladium, and powdered metal compositions. Standard sizes of flat, crowned, and pointed contact rivets are also listed.

Free copies will be sent upon request. Inquirers should specifically designate Catalogue C-521.

COUNTER GUIDE

Counter Catalogue C-832, issued by the *Sprague Products Co.*, 51 Marshall Street, North Adams, Massachusetts, contains a listing of "Atom" and "Twist-Lok" electrolytics, "Telecap Black Beauty" molded tubulars, "Cera-mite" disc ceramics, and universal doorknob ceramics.

Both net and list prices for each item are tabulated in the 12-page catalogue.

Copies are available to jobbers upon request to the manufacturer.

REPLACEMENT GUIDE

A TV condenser replacement guide, TVR-7A, published by the *Cornell-Dubilier Electric Corp.*, South Plainfield, New Jersey, lists 1149 television set models of 73 manufacturers.

Arranged to enable the location of the correct replacement condenser with a minimum of time and effort, the guide's various sections include an alphabetical listing of television re-

ceiver models, with serial and chassis numbers; original condenser ratings; and the *C-D* recommended replacement. Rated capacity and voltage of each *C-D* twist-prong electrolytic, physical specifications, rotation stock number, dealer's net cost, and list price, are among the contents of the guide.

The new guide, TVR-7A, is available to service technicians free of charge, only through local *C-D* distributors.

THORDARSON TRANSFORMERS

Thordarson-Meissner, Mt. Carmel, Illinois, has recently announced the publication of a new transformer catalogue.

Designated as the 400-K, the catalogue features the addition of 42 new transformers, all of which are designed primarily for television receiver replacements.

Requests for copies should be sent to the company direct.

PROCUREMENT MANUAL

Trilane Associates, Inc., 1 Hudson Street, New York 13, New York, has published a new U. S. Government procurement manual designed to aid manufacturers in obtaining government business.

The 16-page booklet covers such topics as "How to Finance Defense Contracts," "Converting to Military Production," "Helpful Hints to Prospective Bidders," "Fundamentals of Government Procurement," and "Common Difficulties Encountered."

Free copies may be obtained by writing direct to the above address.

SPRAGUE "POCKETBOOK"

A pocket-sized, dual-purpose catalogue and envelope stuffer, designed to increase distributor sales by listing its line of "TVL Twist-Lok" electrolytic condensers, has been made available by *Sprague Products Co.,* 51 Marshall Street, North Adams, Massachusetts.

Form M-489 pocket catalogue can be used for special mailings or included with monthly statements or letters to service customers. A return order card "built-in" the back cover is imprinted with the distributor's address to make it easy for customers to order "Twist-Loks" by return mail.

These catalogues are available by writing to the company direct.

SIE CATALOGUE

Southwestern Industrial Electronics Co., 2831 Post Oak Road, Houston 19, Texas, has available for distribution a new catalogue on low frequency transformers and reactors, including data on a new miniature line.

The catalogue gives information on *SIE*'s special transformers and reactors with detailed specifications on recent designs. It is available upon request.

TUNING FORK DATA

A 2-color, 34-page catalogue describing the development of precision fre-

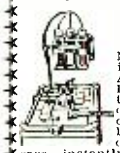
P ATT

★ FOR BEST BUYS ANYWHERE!
★ FOR IMMEDIATE SERVICE!
★ FOR HARD-TO-GET ITEMS!

NOW YOU CAN SHOP AT EITHER OF PLATT'S TWO GREAT STORES!
NEW BRANCH STORE: 159 Greenwich St., N.Y.C.
MAIN STORE: 489 Broome St., N.Y.C. (Send all Mail Orders here.)

SPECIALS-OF-THE-MONTH!

NOW! Fill Your Battery Only Twice a Year



with Automatic Battery Filler

Made by leading Detroit Auto Mfr. Doubles battery life over ordinary care, prevents battery breakdowns, fits all cars, instantly installed.

ONLY **89c** COMPLETE

CD 307A CORDS

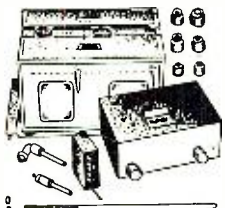
with PL 55 Plug and JK 26 Jack. long cord.

SPECIAL! **79c**

ARC-5/R-28 2 MTR RCVR $25.95

Here is the 2-meter superhet you have been looking for! Absolutely one of the BEST available today! Tunes from 100 to 156 Mcs. in four crystal channels. (Easily converted to continuous tuning.) Tube lineup is as follows:
717A—R.F., 717A—Mixer, 2-12SH7—1st and 2nd I.F. 16.0 Mc.,
12SL7—Det. AVC Squelch. 12SL7—1st audio-speech amplifier.
12A6—2nd audio. 12SH7—R.F. Osc.—4th Harmonic Gen.
717A—Trip. 12th Harmonic Gen., 717A—Dblr.—12th Harmonic.
Excellent, used $25.95

VHF Excellently Reconditioned Guaranteed



SCR-522 AIRBORNE COMMAND EQUIPMENT

Frequency Range 100 to 156 mcs. in 4 channels receiver and transmitter. Crystal controlled. Complete equipment. Consists of trans/rec, control box BC-602, dynamotor PE-94, AN104A antenna, plugs, etc. Power input with PE-94 is 28 v.

Electrically Tested—Complete as Shown.
Only **$129.50**
BRAND NEW—PRICES ON REQUEST

20 POUNDS OF ASSORTED RADIO PARTS

A TERRIFIC BUY AT ONLY **$2.79**

ARMY TEST UNIT I-236

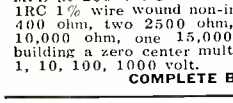
Meter is contained in a metal box 5½" long x 3¾" wide x 3¼" deep. Comes complete with test leads and instruction book. Can be used for testing between AC and DC measuring resistances of circuits, checking fuses and testing capacitors.

SPECIAL **$4.19**

Multitester Foundation BIAS METER 1-97A

Contains a zero center 3½" round Marion voltmeter calibrated 0-100 volts each side. Movement is one mill each side of center. The unit is mounted in a steel box 7" x 5" x 4½" and contains 8 contact push button, line cord dual 100 MFD at 200 V DC condenser, a potentiometer 6 1RC 1% wire wound non-inductive resistors: one 400 ohm, two 2500 ohm, one 5000 ohm, one 10,000 ohm, one 15,000 ohm. Excellent for building a zero center multitester with ranges of 1, 10, 100, 1000 volt.

COMPLETE BRAND NEW **$5.95**



PRE-AMPLIFIER MODEL K-1

The K-1 is used to amplify output level for microphones and phonographs. Operates on 24-28 VDC, can be converted to 110 AC. Comes complete with PL 55 plug and 2-foot 119-B cord, 2 terminal blocks and instruction book.
BRAND NEW ..... SPECIAL! **$3.95**

BC-221 Frequency Meter

Real Value! QUANTITY IS LIMITED—so first come, first served. They are just like new, with original calibration charts. Range 125-20,000 KC with crystal check points in all ranges. Complete with crystal and tubes..... **$129.50**
MODULATED TYPE..... $159.50
MODULATED TYPE WITH AC POWER SUPPLY..... 179.50
These Frequency Meters are factory tested, checked for frequency alignment and GUARANTEED.

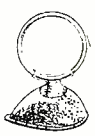
PLATT ROLLS BACK PRICES!

TUBES — BRAND NEW! JAN! BOXED!

1B22	69c	100R	49c	954	13c
1B23	$3.75	114B	29c	1616	49c
2B22	49c	721A	09c	1619	19c
2C22	14c	221A	29c	1625	29c
2C26	09c	304TH	$5.95	1626	19c
2C26A	09c	316A	29c	1629	22c
3B22	$1.19	371B	29c	1630	39c
3BP1	$3.29	388A	59c	1633	29c
3C24	98c	471A	$1.19	7193	19c
3D6	39c	532A	$1.19	9002	69c
3DP1	$1.79	722A	99c	9006	19c
7C4	39c	801A	19c	E1148	49c
10Y	19c	826	39c	E19AH	11c
12K8Y	39c	841	29c	RK34	99c
15R	39c	843	17c	VR92	14c
39/44	29c	864	19c	VT127	15c

MN-26 INSTALLATION

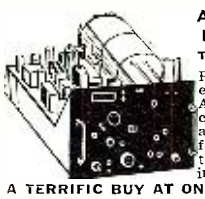
MN-26C RECEIVER—Remote control commercial type navigational. Indicates direction of any desired transmitting station. 3 bands—frequency range: 150 KC to 1500 KC; has 12 6V type tubes. Brand New—Original Cost $600.00.... **$39.95**



TYPE MN-20E ROTABLE LOOP UNIT

8" diameter, used with MN-26 Compass and RA 10DB. Manufactured by Bendix.

A TERRIFIC BUY! ONLY **$9.95**



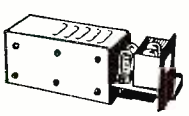
AIRBORNE EQUIPMENT Designed for Aircraft
T-8S/APT-5 UHF Transmitter

Radar Set AN/APT-5 operates on 80 or 115 volts A.C. at 400 to 2600 cycles requiring 6.40 volts amperes at 0.90 power factor. Complete with all tubes. Brand new in original packing.

A TERRIFIC BUY AT ONLY **$149.50**

HEADSETS

HS-33 low impedance with cord and plug. used, fine condition $2.79
HS-23 high impedance. BRAND NEW with ear pads..... 4.95
HS-33 low impedance. BRAND NEW with ear pads, cord and PL54 plug $5.39
HS-33—BRAND NEW—Western Electric.... 5.95
CD-307A Cords, 6 ft. NEW..... .89
H-16/U high impedance. Includes two receiving units 3.95
HS-16 high impedance—used 2.49



TURBO AMPLIFIER

4 tube Amplifier used by U. S. Air Force. 115 V. input at 400 cycles. Without tubes—BRAND NEW

SPECIAL **$1.19**

Field Telephones

Army surplus, completely reconditioned and electrically tested, using 2 flashlight cells and a pair of interconnecting wires. GUARANTEED—like new.

$20.95

PE 98 12 VOLT DYNAMOTOR

Excellent Condition.

SPECIAL! **$39.95**

NEW! COMMERCIAL MOBILE EQUIPMENT

NOW BEING MANUFACTURED BY

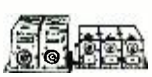
Platt Manufacturing Corp.

Has many new features. Latest design, compact, easy to handle. Excellent Price. Write for data and price.

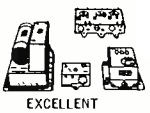
MINIMUM ORDER $2.00

Immediate Delivery—Send 25% deposit on C.O.D. orders. All shipments F.O.B., N.Y.C. (N.Y.C. residents add sales tax to your remittance.)

ORDER NOW at these REDUCED PRICES!



SCR-274N COMMAND and ARC-5 EQUIPMENT



	USED	EXCELLENT USED	NEW
RECEIVERS			
BC-453—190 to 550 KC.....	$29.95		$49.95
BC-454—3 to 6 MC.....		$12.95	19.95
BC-455—6 to 9 MC.....	9.95	11.95	16.95
TRANSMITTERS			
A-958—2.1 to 3 MC.....			29.95
BC-458—5.3 to 7 MC.....	7.95	9.95	17.95
ARC5-T-19—3 to 4 MC.....		24.95	34.95
BC-459—7 to 9.1 MC.....			24.95
T-15 ARC 5—500 to 800 KC.....			29.95
ADDITIONAL EQUIPMENT			
BC-456 Modulator.....	2.49	2.95	5.95
BC-450 Control Box (3 Receiver)....	1.49	1.95	2.75
BC-451 Control Box (Transmitter)...	1.29	1.79	2.39
BC-442 Relay Unit (ANT).....	2.39	2.89	3.69
Plugs: PL-147, 148, 151, 152, 153, 154, 156—EACH.		1.25	
Flexible Shafting with gear to fit receivers			2.69
3 Receiver Rack	1.79	2.29	2.98
2 Transmitter Rack.....	1.69	2.39	3.97
Single Transmitter Rack.....			3.97
DM-32 Dynamotor for Command Set.		3.95	5.95
DM-33 Dynamotor for Command Set.		2.95	3.95
Mounts for 2 Trans. Rack, 3 Rec. Rack, Modulator, & Antenna Relay Unit...		1.95	

LIMITED QUANTITY

COMMAND SET BC-455—6 to 9.1 MC. Excellent, 95% completely wired—a few minor parts included require assembling. Instructions included.

ONLY **$6.95**

COMMAND TRANSMITTER—Navy and Army Type—3 to 4 MC, 75% complete spare parts—LIMITED QUANTITY **$8.95**

ELECTRIC MEGAPHONE SYSTEM

For Rural Areas, Hotels, Commercial Steamers, Ball Parks, Etc.

U. S. NAVY Type PAE-1 Electric Megaphone equipment is designed for voice reinforcement in much the same manner as, but to a greater degree than, the familiar acoustic megaphone. Consists of Megaphone Unit (which combines a microphone and reproducer in a single assembly), Portable Amplifier which electrically amplifies the output signal of the microphone section of the megaphone and feeds this amplified signal to the reproducer section. Charging Rack for recharging the self-contained storage battery of the portable amplifier. BRAND NEW—A TREMENDOUS VALUE! DEMONSTRATION GIVEN AT EITHER OF PLATT'S STORES **$149.50**

NEW SUPPLY ARRIVED! LIMITED QUANTITY TRANSMITTER-RECEIVER Navy Model ABA-1 (CG-43AAG) Army Model SCR-515A, known as the BC-645 450 MC — 15 Tubes

BRAND NEW—ORIGINAL CARTON

Can be easily converted for phone or CW 2-way communication. Covering for the following bands: 420-450 MC ham band. 450-460 MC for fixed or mobile, 460-470 MC for citizens, 470-500 MC television experimental. Size 10½ x 13½ x 4¾. Contains 15 tubes: 4—7F7, 4—7H7, 2—7E6, 2—6F6, 2—955, 1—WE-316A door knob.

Price includes Dynamotor, Control Box, Mount, Tubes..... $34.95

ADDITIONAL BARGAINS!

Space does not permit us to list fully the following items. However, if you are interested in any of the equipment, please let us know. Your letter or wire will be promptly answered.

SCR-284
SCR-583
SCR-694
SCR-511
BC-348 Q & R Models.
ARN-7 Compass Rec.
SCR-269G Compass Rec.
Hallicrafter Sets.
National TV Boosters.
BC-375 Trans.
BC-191 Trans.
SCR-625 Mine Detector.
FL8 & FL5 Filters.
BC-348 Spare Parts.

PLATT ELECTRONICS CORP.
DEPT. A, 489 BROOME ST., NEW YORK 13, N. Y.
PHONES: WO 4-0827 and WO 4-0828

quency generators, has been made available by the *Riverbank Laboratories,* Department of Engineering, Geneva, Illinois.

A description of the method used for temperature compensation eliminating all complicated heat controls is discussed along with the effect of temperature variations on frequency accuracy.

Charts, photographs, and fundamental circuits are shown as well as the physical dimensions of the forks and their mountings.

Copies of "Temperature Compensated Frequency Standards" may be obtained upon request.

MICRO SWITCH CATALOGUE

A 24-page, 2-color, Catalogue No. 82, containing information on safety, limit, and interlock switches designed especially for switching a.c. circuits in industrial and commercial applications, has just been published by *Micro,* Freeport, Illinois, a division of *Minneapolis-Honeywell Regulator Company.*

Complete information on each switch, including description, dimensions, mechanical and electrical characteristics, and electrical capacities, as well as technical data and applications are covered.

HI-FI AUDIO

An illustrated, high-fidelity audio catalogue has been announced by *Harvey Radio Company, Inc.,* 103 West 43rd Street, New York 18, N. Y., which emphasizes descriptive information worded to reach the music lover approaching this field for the first time.

The catalogue includes data which permits technical comparison of the various amplifiers, speakers, tuners, etc., and non-technical articles designed to assist the layman in evaluating various elements of a high-quality music system.

Copies are available without charge upon request.

WIRE AND CABLE

The electrical wire and cable department, *United States Rubber Company,* Rockefeller Center, New York 20, New York, has published a 186-page general catalog of its 500 different types of wires and cables.

Containing comprehensive data on construction and operating characteristics for control and signal cables, railroad wire and cables, wire and cables for the building industry, telephone wire and cables, mine cables, and portable cords, the catalogue also features a detailed technical engineering data section.

Copies may be obtained from R. H. Turner, at the above address.

TV CAMERA CHAIN

Available to TV station personnel, prospective TV broadcasters, and others in the television and radio industry, a 20-page, illustrated booklet on the *Du Mont* universal image orthicon television camera chain, Model TA-124-E, has just been announced by

Allen B. Du Mont Laboratories, Inc., 1500 Main Avenue, Clifton, New Jersey.

The booklet explains how this chain can be used in studios, in the field, and for film pickup, outlining versatility and economy for new stations operating under budget schedules.

A specification section gives facts and figures on power supplies, monitors, generators, and associated equipment.

A copy of this booklet may be obtained from the Television Transmitter Division of the company.

TOROIDAL INDUCTORS

Precision-wound, high *"Q"* toroidal inductors are covered in the new four-page bulletin just released by *Lenkurt Electric Sales Co.*, 1115 County Road, San Carlos, California.

Designated Bulletin TL-P4, the new publication lists five different types of coils, with or without hermetically sealed cases.

Included in the bulletin are *"Q"* curves and other design data for representative standard values of the varied coil types. The coils listed make available a wide range of inductance values between 1 mhy. and 80 henrys.

Information is also included on the effect of d.c. current on the inductance values of each type of coil.

TRAINING DATA

American Electronics Co., 1451 Wilkins Ave., New York 59, N. Y. is now offering a 4-page folder describing its courses in radio code and theory.

Complete details are given and copies of the folder are free on request.

HAMMARLUND FOLDER

Hammarlund Manufacturing Company, Inc., 460 W. 34th Street, New York 1, New York has issued a new four-page folder which describes in detail the design, operation, and suggested uses of the company's recently-introduced "DSU-2" duplex signaling unit.

The new unit is designed for use by pipeline and power companies, military and governmental agencies, railroads, airlines, emergency services, and other groups requiring remote "on-off" switching, continuous indication of operating conditions, and automatic detection of line or power source failures along wire lines, telephone or power line carrier, and radio or microwave communications circuits.

WIRING DEVICES

Eagle Electric Mfg. Co., Inc. of 23-10 Bridge Plaza South, Long Island City 1, New York has issued its 1952-53 catalogue which contains a listing of over 1400 electrical wiring devices, lamps, and specialties.

The 48-page catalogue is profusely illustrated and provides full information on electrical wiring devices, extension and cord sets, fuses, lamps, wall plates, push-buttons, nichrome wire and elements, etc. —30—

4-Problem Preamps

(*Continued from page 62*)

use, and since there have been no circuits published expressly for this fine unit, Fig. 7 shows the schematic of a preamplifier designed specifically for the *Audak* pickup.

For some time Mr. Charles P. Boegli has been insisting that the most satisfactory preamp circuit is a simple *RC* equalizing network inserted between two triode stages.* We think, after trying all of them, that Boegli is probably right. Although many other designs give excellent results, the interstage equalizer gives less trouble from hum and noise and is easier to design than any of the others. In the Boegli circuit, separate equalizers are switched in and out of the circuit to give any number of response curves. Boegli uses each equalizer group for both treble and bass equalization. This leads to a lot of parts for four or five switch positions and, it seems to us, a lot of duplication of functions.

In our *Audak* preamp we split up the treble and bass equalization and moved the treble elements to the pickup load. This allows us to use only two equalizer groups for the treble and three for the bass end of the audio spectrum. With this saving in components, however, we still have six response positions to compensate for various recording characteristics. Our equalizers don't come as close to the curves which the record companies are *supposed* to use as do Mr. Boegli's, but they were adjusted by ear until they gave the most pleasing results on our music system.

The first switch position gives a 250-cycle bass turnover coupled with a sharp treble cut-off for noisy 78 rpm foreign recordings. The second position is still the 250-cps crossover, but with the treble cut-off removed. The third position connects the filter back in the circuit with a 500-cycle bass turnover for standard American recordings and the fourth position again removes the treble filter. Positions five and six retain the 500-cycle point, but introduce a treble de-emphasis for use with LP recordings. Position six differs only in that it provides the droop below 100 cycles which *Columbia* specifies. If a pickup other than the *Audak* is used with this circuit, different values will have to be worked out for the treble equalizers to give the same results.

The preamp does a nice job with all the records we own. It has only one disadvantage that we have noticed: its bass response is *too* good. We know for a fact that our speaker system will reproduce a 50-cycle note without any difficulty, and we were therefore horrified to discover that the differ-

*Boegli, Charles P.; "An Improved Equalizer-Preamp," Radio & Television News, April, 1951.
Boegli, Charles P.; "Phono-Equalizer Chart," Radio & Television News, April, 1952.

ence between the standard LP and *Columbia* LP positions is just barely audible. "Something horrible has happened" we thought. "Somehow the bass response of our amplifier has been cut off below 100 cycles." We soon found out that it wasn't. What happens is that the speaker, *any speaker*, introduces so much distortion at extremely low frequencies that an extension of bass response below 60 cycles is masked by all the gruesome things that are happening in the 60-150 cycle range. Of course if you own a full-sized horn-type system such as those we described in the November, 1951 issue of "*Audio Engineering*" you will be able to hear the difference. With anything less, 60 cycles seems to be about the lowest practical limit for the bass response.

The mere fact that you can't tell what is below 60 cps doesn't mean that there isn't anything there. We hooked up a tape recorder to our system with both a meter and a "magic eye" volume level indicator. The tuning-eye tube shows up all sorts of weird low frequency pulses in the 5-15 cycle range that the meter ignores altogether. These subsonic pulses aren't enough to drive the 25-watt power amplifier off its linearity curve, but they certainly work mischief with the tape recorder. When using a microphone, the air conditioning system must be turned off. When dubbing from 78 rpm records, we must use a low frequency filter to keep groove irregularities and eccentricity from overdriving the recorder amplifier. Long playing records, due to the slow speed and more regular stamping, seldom give any trouble.

This digression into the problem of useful low frequency response was included because it brings up several important points. Extended low frequency response in an equalizer preamp is always obtained at the expense of over-all gain and in the average system there is no sense in sacrificing gain to extend the response below 60 cycles. If a small amplifier is used, the subsonic stuff that gets through may actually drive the amplifier completely off its normal operating curve. If you have only an eight-watt amplifier, don't insist on a preamplifier which carries its bass equalization down to ten cycles.

Also it would seem that a lot of the trouble that amateurs have in making good tape recordings might be traced to sources of subsonic disturbances. Always use an electron-ray tube as well as a vu meter so that low frequency pulses can be detected.

Now that the lecture is over, we conclude this group of ideas on magnetic pickup preamplifier design. They all work, they all sound good, they all meet a common enough need to be of general interest.

Complications often encountered in highly touted preamps simply do not exist, with the end result that the builder may work with confidence.

—30—

SELF-FOCUS PICTURE TUBES

By EDWARD M. NOLL

Details on Du Mont's self-focus picture tube which uses magnetic deflection and electrostatic focus.

THE self-focus picture tubes developed by *Du Mont* use electromagnetic deflection and electrostatic focus. The focusing electrode of the picture tube is tied to the cathode through an internal resistor, Fig. 2. Consequently, this anode remains at zero potential with respect to the cathode and the beam will remain in focus over a wide range of anode voltages. This is of substantial benefit in the design of new receivers and the conversion of present receivers to larger screens. It permits improved focus stability under conditions of erratic line voltage and, in addition, no external focus circuit is necessary.

To understand the action of the self-focus tube first consider some of the basic functions of the conventional electron tube (electrostatic focus type) shown in Fig. 3. Basically, it is a dual-lens system—the first lens consisting of cathode, grid, and first anode that brings the cathode-emitted electrons to a point referred to as a "crossover" and a second lens consisting of a first and second anode that brings electrons diverging out of crossover into focus on the fluorescent screen. Crossover must be brought to focus at the plane of the screen to obtain a sharp in-focus picture—not ahead or behind it. This, in effect, is what is done when the external focus control of the receiver is set for the best picture. There are numerous conditions that can upset this optimum focus condition. For example, a shift in the crossover position as caused by any change in cathode, grid, or first anode potentials or a readjustment of the brightness control requires compensating focus adjustment of the first anode potential. Any shift in the voltage ratio between the second and first anodes causes the point of focus to move away from the plane of the fluorescent screen and thus makes refocusing necessary. Line voltage changes can influence a number of electrode potentials and cause improper focus. This type of gun is especially critical of supply regulation because the first anode is part of both lenses and draws appreciable current.

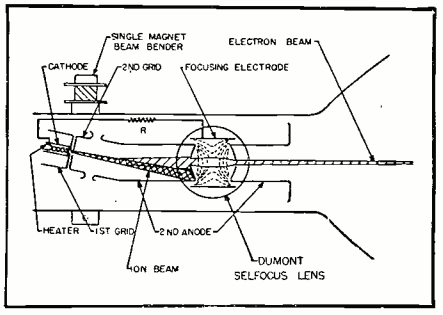


Fig. 2. Mechanical construction of the tube.

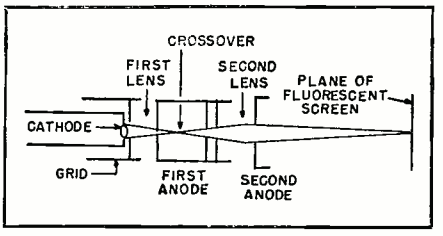
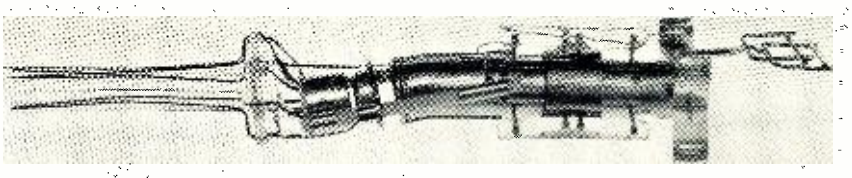


Fig. 3. Conventional electrostatic focus gun.

In the self-focus gun, crossover formation is taken care of by the cathode, control grid, and the second grid. Focusing of crossover on the screen is the task of the second anode and the focusing electrode. The second anode is split at a point beyond the bend and electrons come under the influence of the zero potential of the focusing electrode. This action as a function of the length of the anode split brings diverging electrons to focus at the screen. Proper focus, however, is much more of a constant with changes in electrode or line voltages. Focusing electrode potential is held constant at the cathode potential and the voltage ratio between the two sides of the split

Fig. 1. The electron gun structure of the Du Mont self-focus picture tube.



THERE'S PROFIT IN HIGH-FIDELITY

More Money Do you have spare time that you can use to make additional income, perhaps as a way to start a business of your own? Or do you have a radio service shop that can be expanded to handle additional, extra-profit work? Or a radio store where you can find space for fast-moving items that show a higher net?

If so, you should consider getting into the high-fidelity field, and fast, because the time to get started is RIGHT NOW! Already, public interest has reached the point where the dollar volume of hi-fi equipment sales exceeds that of conventional AM radio sets. The attendance at the recent audio shows in Philadelphia and New York far exceeded all expectations. The new Society of Music Enthusiasts reports a veritable avalanche of applications for membership who are forming local listening and discussion groups.

How to Find Out You can see how big and important the hi-fi business has become by looking at the latest copy of HIGH-FIDELITY Magazine. You'll be amazed to see what a big publication it is, and it's getting bigger with each succeeding issue!

The fact is that everything connected with hi-fi is expanding at an almost unbelievable rate. Sales of equipment for high-quality reproduction from FM radio, records, and tape are going up and up, and there is no levelling-off point in sight. Yet for all its progress in the last two years, the public is only beginning to discover the possibilities of fine musical entertainment at home. Relatively few people have had an opportunity to hear a hi-fi system.

How can you fit into this new business? Take two or three evenings to study the new issue of HIGH-FIDELITY Magazine. Go over it carefully, from cover to cover. Read the Noted-with-Interest columns, the Letters from Readers, the elaborately illustrated articles on equipment and installations; the news about recorded music, and the Tested-in-the-Home Reports. Check the advertising. Note the companies and products represented.

By the time you have finished, you will know just what angle fits into your particular situation, and what your first move should be. For HIGH-FIDELITY covers all the aspects of this field, giving you a complete picture of the business, and the people who spend $250 to $5,000 for hi-fi installations, and they keep on spending for further improvements.

From your study of HIGH-FIDELITY, you will come to realize that this Magazine can serve you in three essential ways:

Demonstration First of all, you must be prepared to demonstrate high-fidelity, because people can only appreciate full-range tone by *hearing* it. It can't be described in words. It must be *experienced.* Only then can people realize how much it will contribute to their enjoyment and relaxation, what it will mean to their children, and how it will help to entertain their friends.

What kind of a demonstration setup do you need? You will find all kinds of answers to that question in HIGH-FIDELITY, together with information on the choice of equipment for FM, records, and tape. It covers the entire what-why-how of tuners, amplifiers, turntables, tape machines, speakers, and all the associated instruments required in a hi-fi demonstration system. That information you must have as your starting point.

Choice of Music Records provide the most convenient source of music for demonstrating high-fidelity. But you must choose your records with the greatest care. For example, if a prospect is a lover of Haydn's music, you would play the Haydn Society's HSL 2048, because it not only does justice to the composer but it is a particularly fine example of full-range recording.

Or if he prefers the melody of popular airs, you might choose Columbia's ML 4487, which is an excellent presentation of Morton Gould, or the collection of waltzes on a London LL 570, because they sound spectacular on hi-fi reproduction.

How do you find out about these things? Why, HIGH-FIDELITY has a 24-page section devoted to records in each issue, written by reviewers who are top authorities on both music and recording techniques.

System Planning When you have staged a first-class demonstration, you can expect your prospect to ask: "How can I arrange an installation like that in my living room so it will be as attractive in appearance as it is fine in performance?"

That question might give you trouble. Every home is different, and each person has his own ideas as to what will look most attractive.

But at this point, HIGH-FIDELITY performs a third essential service. In each issue there are six to eight pages of detailed photographs which show outstanding examples of hi-fi installations. They range from simple bookshelf arrangements to functional music walls, and on to elaborate cabinet designs.

Among them, any prospect will find a type of installation that can be adapted readily to his particular home, at a price he is willing to pay.

Act Today If you are interested in extra income or increased profits, look into this hi-fi business without delay. Your first step is to order a subscription to HIGH-FIDELITY. This is a large-size magazine, beautifully printed on fine paper, handsomely illustrated, published on the first of every other month. It may prove to be the biggest little investment you have ever made. It may pay back its cost to you many, many times. Use the coupon below.

High-Fidelity

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anode is unity and constant despite a possible shift in the high voltage.

The base of the 17KP4 and 20JP4 self-focus "Teletrons" is identical to the standard five-pin duodecal used commonly for magnetically focused picture tubes. Thus, these new tubes are convenient to use in replacement or conversion work.

If sufficient deflection is available for a particular conversion, it is only necessary to remove the focusing unit and install the self-focus tube. The focus coil is removed and replaced with a fixed resistor of the same equivalent resistance (five watt rating). Permanent magnet types are simply removed. The ion trap magnet is set for maximum brightness according to the standard procedure. The point of maximum brightness will coincide with the optimum focus.

—30—

SPOT CHECK FOR STYLI

By J. GORDON HOLT

IT isn't necessary to peer through a microscope to see whether a phonograph stylus tip is in good shape.

A much simpler method is to draw your thumbnail across the stylus tip, allowing the stylus as much pressure as it will be exerting on the record.

Worn or chipped styli will have a definite rough feeling when passing over the nail, and will leave a ragged scratch. A microgroove stylus in an arm exerting over five grams pressure will leave a slight scratch but will have a smooth feeling when making the mark.

The fingernail is soft enough to be incapable of damaging the stylus, regardless of the pressure exerted upon it.

—30—

NEW FOCUS SYSTEM

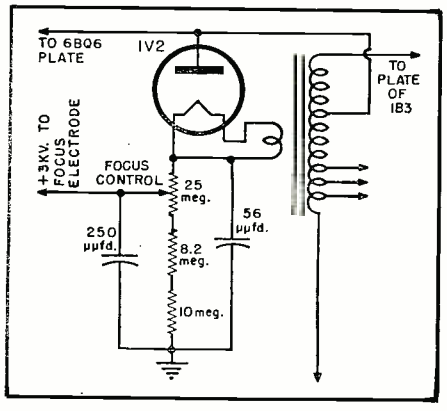
By EDWARD M. NOLL

A DIFFERENT means of obtaining focusing anode voltage is used in the new RCA receivers. The high voltage for the second anode is obtained via the 1B3GT and conventional means while the focusing voltage is obtained via a separate rectifier off the plate connection of the horizontal output transformer. See Fig. 1.

The high voltage pulse at the plate connection is rectified by a 1V2 and focusing voltage is taken off a divider network to ground. A separate winding on the horizontal output transformer supplies filament power.

—30—

Fig. 1.



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TS-102/AP—Range Calibrator
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TS-118/AP—Power Meter
TS-125/AP—S-Band Power Meter
TS-155/UP—S-Band Signal Generator
TS-164/AP—Frequency Meter
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TS-184/AP—Test Set
TS-226/AP—300-1000 MC Power Meter
TS-268/UP—Crystal Test Set
TS-278/AP—APS-13 Test Set
IE-19—SCR-522 Test Set
IE-36—SCR-522 Test Set
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1A3	.70	6AQ6	.85	6V6GT	.65
1A7GT	.80	6AR5	1.25	6W4	.65
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1C5GT	.75	6AU5	1.19	6X5GT	.65
1D8GT	.65	6AU6	.59	6Y6G	.95
1G6GT	.65	6AV6	.55	6Y7G	.75
1L4	.67	6B4G	1.25	7A6	.75
1LA4	.85	6B7	.95	7B7	.75
1LA6	.95	6BA6	.75	7C5	.75
1LB4	.98	6BA8	.65	7C7	.75
1LC5	.75	6BC5	.75	7F7	.75
1LC6	.91	6BE6	.65	7N7	.85
1LN5	.75	6BF6	.72	7Y4	.59
1N5GT	.75	6BG6G	1.89	12A6	.65
1P5GT	.69	6GH6	.95	12A7	.90
1R4	.69	6BJ6	.95	12AH7GT	1.19
1R5	.65	6BQ6	1.25	12AT6	.55
1S4	.65	6C4	.55	12AT7	1.10
1S5	.65	6C5	.60	12AU6	.75
1T4	.65	6C6	.59	12AU7	.88
1U4	.67	6C8G	.85	12BA6	.69
1V	.65	6D6	.72	12C8	.69
1X2	.96	6D8	.85	12H6	.69
2A3	1.10	6E5	.79	12K8	.72
2X2	.50	6F6	.85	12SA7GT	.79
2X2A	1.55	6F7	.85	12SC7	.85
3A4	.65	6H6	.65	12SG7	.85
3A5	.85	6H6GT	.65	12SJ7GT	.65
3B7/1291	.42	6J5	.75	12SK7GT	.80
3D6/1299	.69	6J5GT	.75	12SL7GT	.75
3Q4	.63	6J6	.95	12SN7GT	.85
3Q5GT	.79	6J7	.95	12SQ7GT	.72
3S4	.74	6J7G	.60	12SR7	.72
3V4	.74	6K6GT	.85	14B6	.75
5R4GY	1.65	6K7	.79	14H7	.85
5T4	1.32	6K8GT	1.15	25L6GT	.65
5U4G	.69	6L6	2.25	25Z5	.65
5V4G	.98	6L6G	1.50	25Z6GT	.68
5W4	.79	6L6GA	1.50	41	.69
5Y3GT	.45	6L7	.85	43	.65
5Y4G	.67	6N7GT	.85	45	.75
5Z3	.85	6R7	.79	50A5	.89
5Z4G	.95	6SA7GT	.65	50B5	.75
6A3	.95	6SC7	.95	50C5	.67
6A6	.82	6SF7	.75	50L6GT	.65
6A7	.75	6SG7	.75	50Y6	.72
6A8GT	.95	6SH7	.65	53	.68
6AB7	.98	6SJ7	.75	53	.82
6AC5GT	1.05	6SK7GT	.72	75	.65
6AC7	.95	6SL7GT	.75	80	.95
6AG5	.75	6SN7GT	.75	83	.92
6AG7	1.45	6SQ7	.65	83V	.92
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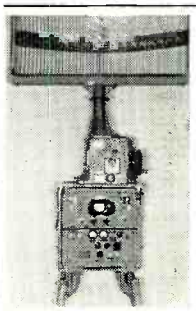
APS-15A—X-Band Blind Bombing Radar
APT-4—Radar Jamming Xmitter 165-780 MC
APT-5—Radar Jamming Xmitter 350-1400 MC
SO-13—S-Band Marine Radar, Lightweight
SQ—10 CM Portable Radar
TPS-1—Portable Search Radar
TPS-3—L-Band Search Radar
UPN-1 & 2—S-Band Portable Beacon Battery or 110v AC



SQ 10 CM PORTABLE RADAR

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GN-58—Hand Cranked Generator W/Legs & Seat
SCR-578—Gibson Girl (Emergency Xmitter)
CRT-3—Victory Girl Dual Freq. Emergency Xmitter Sound Powered Chest & Headsets MI-2454-B; Type O, Mfg. RCA.
AS-32/APX-1—Antenna
AN/CRC-7—V.H.F. Handi-Talkies 112MC Xtal Controlled
MN/26-Y—Compass Receiver
BC-733D—Receiver with Tubes
C-3—Navy Snooperscope in Carrying Case
BC-1284—Lighthouse Tube Preamplifier
BC-996—Interphone Amplifier
RL-42—Motor Antenna Reel
30 MC—I.F. Strips Using 6AK5
RD-7/APA-23—Recorder for APR
AS-27/ARN-5—Antenna
ARA—Receiver—500-1500 KC
ID/80?APA-17—Indicator
R-28/ARC-5—Receiver—100-156 MC
RM-29—Remote Control
BC-455—Receiver—6-9 MC
BC-454—Receiver—3-6 MC
BC-800—Transmitter/Receiver
BC-950—Transmitter—100-156 MC
RA-300—FM Exciter (Mfg. Tempco)
FL-8—Filter
FL-5—Filter, Less Cables
3C-16-D GSAP—Gun Camera Computers with All Accessories; in Carrying Case
AT-2A/APN-2—Antenna

SPARE PARTS AND COMPONENTS AVAILABLE FOR MANY EQUIPMENTS

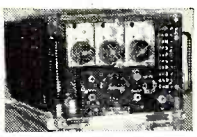
ALL EQUIPMENT SOLD IS CAREFULLY RECONDITIONED AND CHECKED OUT TO ORIGINAL SPECIFICATIONS IN OUR OWN SHOPS USING FINEST LAB TYPE TEST EQUIPMENT.

THESE COMPLETELY EQUIPPED SHOPS AND OUR EXPERIENCED TECHNICAL STAFF ARE AVAILABLE FOR GOVERNMENT PRIME OR SUB-CONTRACT WORK OR PRIVATE COMMERCIAL ORDERS ON ANY TYPE OF COMMUNICATIONS OR RADAR APPARATUS.

COMMUNICATIONS

AN/ARC-1 TRANS/REC.

Provides Radio-Telephone Communication between Aircraft or Aircraft and Ground. Complete with Shock Mount and Control Box. Input: 28V DC. Excellent condition. Available in either 10 or 20 Crystal Controlled Channels 100-156 MCS.



APA-11—Pulze Analyzer
APN-1—Airborne Radio Altimeter
ARC-4—VHF Transceiver 140-150 MC
ARN-5—Glide Path Receiver
ARN-7—Airborne Direction Finder
ARR-2—Homing & Receiving Equipment
ART-13—Collins Autotune Transmitter
BC-223—30-Watt Transmitter 2-5.2 MC
BC-342—Receiver—1.5 to 18 MC 110v AC
BC-348—Receiver—1.5 to 18 MC 28v DC
BC-375E—Radio Transmitter
BC-639—VHF Receiver 100-156 MC
BC-640—VHF Transmitter 100-156 MC
BC-1206—Beacon Receiver 200-400 KC
RC-103—Airborne Localizer Receiver
SCR-269—Radio Compass
SCR-274N—Command Equipment
SCR-284—Field Radio Station
SCR-291—Semi-Portable Direction Finder
SCR-300—Field Transmitter and Receiver
SCR-522—VHF Transmitter and Receiver
SCR-536—Handi-Talkie
SCR-555—Semi-Portable Direction Finder
SCR-694—Portable Field Transceiver
SCR-625—Mine Detector
SCR-718A-AM-C—High Altitude Altimeter
T-50—Radio Telegraph Transmitter
TCS—Marine Telephone Transceiver

XMITTING TUBES

0A3/VR75	$1.04	15R	$0.69	866A	$1.35
0B3/VR90	1.19	28D7	1.95	866JR	1.29
0C3/VR105	1.19	30 Spec.	.45	869B	65.00
0D3/VR150	.95	35T	3.25	872A	2.95
1B23	9.75	45 Spec.	.32	874	1.19
1B24	9.75	100TH	7.95	878	1.59
1B27	14.95	211	.65	885	1.39
1B29	2.45	250TH	19.95	902A	9.95
1N21B	3.25	250TL	17.95	918	.10
1N23	1.25	262B	3.95	922	1.25
1N23A	2.39	274B	2.95	923	.95
1N23B	3.69	304TH	8.95	927	1.05
1N34	.76	304TL	8.95	930	.95
1N34A	.97	307A/RK75	3.95	931A	4.45
2AP1	10.95	316A	.65	954	.25
2C40	7.50	328A	8.95	955	.35
2C43	14.95	350A	6.45	956	.35
2C44	1.19	350B	3.95	957	.39
2C46	7.95	368AS	7.50	958	.49
2C51	6.25	371A	.95	959	3.95
2D21	1.35	371B	.69	991/NE16	.35
2E22	1.75	393A	7.95	1603	4.95
2E24	4.65	394A	3.95	1613	.79
2E26	3.15	417A	8.75	1616	.69
2K25/723AB	28.75	434A	27.50	1619	.24
2K28	32.50	446B	3.75	1622	2.45
2K33A	310.00	575A	15.75	1624	1.45
3AP1	9.95	701A	5.75	1625	.35
3B24	5.25	703A	5.25	1629	.25
3B24W	7.95	705A	1.65	1630	.75
3B26	3.59	707B	13.95	1632	.72
3BP1	5.95	714AY	7.95	1638	.45
3C22	115.95	715A	6.39	1851	1.55
3C24/24G	1.75	715B	8.75	2051	1.18
3C45	15.95	715C	19.95	5670	6.95
3CP1	1.95	717A	.98	8008	5.95
3CP1S1	1.95	721A	2.45	8011	.90
3DP1	4.45	723A	9.50	8012	2.65
3DP1A	6.95	723A/B	19.95	8013	2.59
3DP1-S2A	8.95	724B	3.25	8020	.98
3D21A	14.25	725A	6.75	9001	1.50
3E29	13.95	726A	18.95	9002	.98
3FP7	1.65	730A	29.50	9003	1.65
3GP1	4.39	800	1.75	9004	.35
4-125A	27.50	801	3.95	9005	1.45
4-250A	37.50	803	3.25	9006	.27
4AP10	4.45	804	11.75	C1JA	9.95
4C35	27.50	805	3.75	C6A	7.95
4E27	14.95	806	24.95	C6J	6.39
5AP1	3.45	807	1.59	CK1005	.48
5AP4	3.45	808	2.69	F123A	7.75
5BP1	4.45	810	9.50	F124A	27.50
5BP4	4.45	811	2.95	F128A	89.50
5CP1	4.59	812	2.75	FG17	4.89
5CP7	11.75	813	11.75	FG27A	4.95
5D21	19.95	814	2.69	FG32	8.95
5FP7	1.85	815	2.39	FG57	14.95
5GP1	4.85	816	1.05	FG81A	3.49
5JP1	24.45	826	.69	FG105	17.95
5JP2	22.50	828	9.95	FG172	32.50
5LP1	22.50	829	10.95	GL434A	29.95
5NP1	5.50	829B	12.95	GL502A	1.79
6AN5	3.30	830B	2.75	HF100	8.95
6AS6	2.50	832	6.75	HF300	22.45
6AS7	4.45	832A	8.50	HY114B	.69
6C21	21.00	836A	3.49	HY115	.69
6J4	6.75	837	1.45	ML101	47.50
7BP7	6.55	838	2.25	REL21	1.95
7DP4	14.50	845W	4.25	RK60/1641	2.25
9LP7	4.95	849C	27.50	RK65	26.50
10BP4	17.45	851	47.50	RK72	.48
10Y	.39	860	3.95	VT127A	2.45
12QP7	14.75	865	.98	WL616	34.50
15E	1.35				

PHONE: DIGBY 9-0347 **WRITE FOR CATALOG** **CABLE: HAMSHACK, N. Y.**

WRITE FOR QUANTITY PRICES

Prices subject to change without notice. F.O.B., NYC minimum order $10.00. 20% deposit required. All merchandise guaranteed.

RADIO HAM SHACK Inc.

189 GREENWICH STREET . NEW YORK, N. Y.

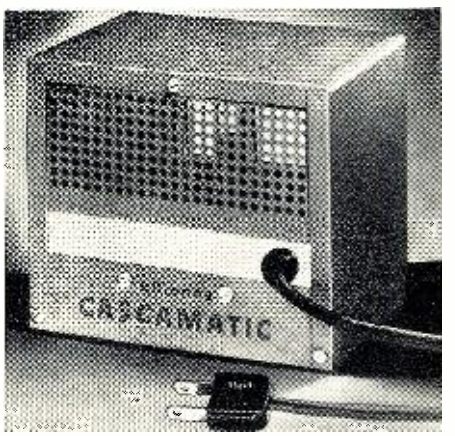
WHAT'S *New in Radio*

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.

AUTOMATIC BOOSTER

The Alliance Manufacturing Company, Lake Park Boulevard, Alliance, Ohio, has added an automatic television booster to its line of television accessories.

The new "Cascamatic" can be mounted on the back of the television



receiver and is thus hidden from view. Its main feature is the fact that it operates automatically, turning on and off with the set. The booster contains three tubes and is pre-tuned to all channels.

TUNER AND CONVERTER

Manufactured by *General Instrument Corporation,* 829 Newark Ave., Elizabeth 3, New Jersey, the u.h.f. tuner Model 60 features low noise factor, no sliding contacts, straight-line-frequency dial calibration, full u.h.f. channel coverage, and is capable of being fitted and mounted in any position around a v.h.f. tuner.

The u.h.f. Model 61 converter, containing a Model 60 tuner, is designed to operate with any television set. It incorporates its own power supply and built-in antenna. For installation, the converter is plugged into the wall, and the TV set plugged into the converter.

MIDGET WRENCHES

The *Plomb Tool Company,* Los Angeles, California, has announced the addition of three midget open-end wrench sets to its "Proto" line.

Used for delicate adjustments on television sets, each is equipped with a vinyl plastic kit to separate the wrenches from larger tools.

Set No. 3200B includes a 4½" midget plier, and four obstruction-type wrenches with eight different opening sizes ranging from 13/64" to 3/8".

Set No. 3200D is an expanded master set that contains all of the above tools plus four additional wrenches, providing eight opening sizes in both 15° and 60° head angles.

Set No. 3300A is a professional set of nine electrical-type wrenches with opening sizes from 7/32" to ½". Each wrench has the same opening on both ends, but at different head angles of 15° and 80°.

All of the midget open-end wrenches have narrow shanks, compact heads, and small fillet radii to increase their usefulness where maximum clearance is required.

HELIPOT "DUODIAL"

The Helipot Corporation, South Pasadena 29, California has developed a completely new dial for use with multi-turn instruments.

Known as the Model RA "Duodial," the new unit features a glare-free satin-chrome finish, jump gearing of the secondary dial, a large black nylon knob that eliminates hand capacitance, a vibration-proof lock, and space-saving proportions.

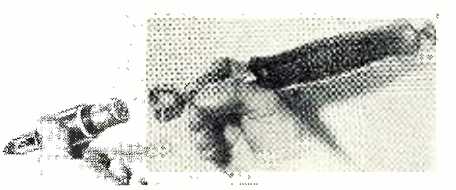
Numerals are of optimum size, recessed, black on satin-chrome dial surfaces. To simplify readings, only three numbers of the secondary dial are visible at one time. They remain stationary until the primary dial, which is coupled directly to the potentiometer shaft, is about to complete a single revolution. At this point the jump gear automatically engages to turn the secondary dial to the next digit.

The new unit comes complete with all of the necessary installation hardware and tools. Complete details on the RA series are included in Bulletin 111 which is available without charge on request.

"QUIK-SHOT"

The Kemode Manufacturing Co., Inc., 161 West 18th Street, New York 11, New York has announced production of a non-electrical soldering iron which utilizes a chemical cartridge to heat the instrument to working temperature in 10 seconds, maintaining an average soldering temperature of 800° F for seven minutes.

The cartridge is ignited by the impact of a spring rod that is pulled out and released at the back of the handle.



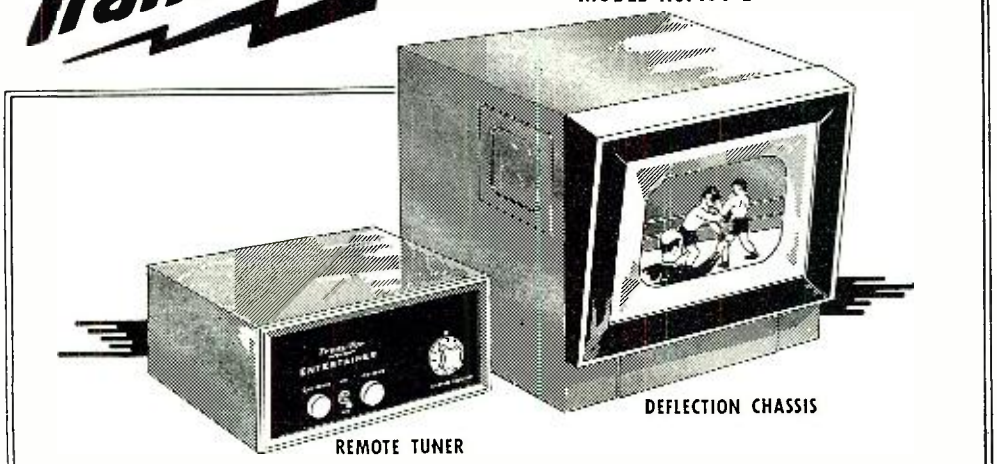
"Quik-Shot" is adapted to all kinds of soldering work where line power is neither available nor convenient, and is particularly useful for outdoor portions of television installation jobs.

OLYMPIC ELECTRONICS SUPPLY

Sensational new TV set for remote operation!

Trans-Vue "ENTERTAINER"

MODEL No. 160-L



1 REMOTE TUNER SERVICES UP TO 4 DEFLECTION CHASSIS!

- 22 Tubes in Chassis
- 12 Tubes in Remote Tuner
- 16AP4 CR Tube
- 8 In. P.M. Speaker
- Cabinets of Highly Polished Mahogany!
- Can Be Easily Converted to 20"

The TRANS-VUE Model 160-L consists of two units—the Remote Tuner and the Deflection Chassis. The antenna installation should be made under the supervision of a qualified serviceman. Use an antenna with a balanced 300 ohm impedance. All controls on the Deflection Chassis have been pre-set at the factory. Both Chassis and Tuner are ready for immediate installation and operation.

The set should be operated from a 105-125 V. source, AC, 50-60 cycles. Deflection chassis gets its AC supply through long cord connecting it to Remote Tuner which has 4 AC outlets. One tuner services up to 4 chassis all of which are regulated simultaneously with on-off switch on remote tuner. DIMENSIONS: Deflection Chassis: height, 23¼"; width, 23½"; depth, 26½" (top), 23¼" (bottom). Remote Tuner: height, 9"; width, 16¼", depth, 15½".

SET OF REMOTE TUNER AND DEFLECTION CHASSIS $139.50 for Both

Complete with all cables, wire, connectors and full schematic covering installation, operation and maintenance.

EXTRA CHASSIS $79.50 Each

EXTRA CHASSIS less CR tube for conversion $59.95

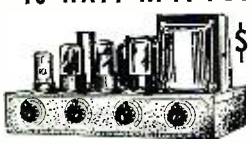
JACKSON HI-FIDELITY FM-AM CHASSIS

- Custom Engineered for High Quality at Low Cost
- Ideal for Modernization or New Cabinet Installation
- Advanced Design—Superior Components—Unexcelled Performance—Chrome plated chassis

The extra-sensitive superhet circuit, with separate RF amplifier, covers the FM band from 87.5 to 108.5 Mc, and the AM band from 540 to 1620 Kc. Tube complement, 1—12AT7, 1—6BE6, 2—6BA6, 1—6AL5, 1—6AT6, 1—6AQ5, plus a 6X4 rectifier. Phono input with front panel control. An extra heavy duty transformer type power supply is used. The music lover will appreciate its colorful tone on FM, AM and phono, plus the convenience of varied tone control on all. The 3.2 ohm output transformer may be used with any good speaker. A template is furnished to facilitate cutting dial opening and control shaft holes. Chassis comes complete with all tubes, large 8½" slide rule dial with soft-lite rear illumination, escutcheon, knobs, mounting parts and complete instructions. For 105-125 volts 60 cycles AC. Dimensions: 7" high, 12" wide, 6½" deep. Shpg. wgt. 11 lbs. **$54.95**

MODEL FA8A SPECIAL.....

10 WATT HI-FI PUSH-PULL AMPLIFIER



$32.95 with tubes

- Bass & Treble Boost.
- Inputs for crystal & magnetic pickups, radio tuner and crystal mike.
- Aluminum Chassis.

A full 10 watt Hi-Fi Amplifier, completely assembled and ready to play. Has built-in PRE-AMP for G.E. and similar types of magnetic pickups. 4 Inputs: 1 crystal phono, 1 magnetic phono, 1 radio, 1 mike. 4 Controls: 1 Bass, 1 Treble, 1 Volume, 1 Phono-radio Switch. Output Impedances: 4, 8, 16 ohms. Peak power output 17 watts. Every one in factory sealed carton. Remember this is a full size amplifier, transformer operated, not an AC-DC job. Frequency response 20 to 20,000 cps at less than ½ of 1% distortion. Size 12"x6½"x5½".

SANGAMO MOLDED BY-PASS CONDENSERS

.01—600V	$0.12	.001—600V	$0.10
.02—600V	.12	.002—600V	.10
.05—600V	.16	.005—600V	.10
.1 —600V	.19	.006—600V	.10

VIDEO BEAM

INDOOR ANTENNA: 3-section. New low price. Ea. $1.49

3-WAY PHONO PICK-UP L-29 ASTATIC #507 $3.45

C.R. TUBES—Your Choice—1 yr. guar.

12LP4	$16.95	16AP4	$19.95
14BP4	17.50	16RP4	18.75

SENSATIONAL SPEAKER VALUES

Most popular types for replacement and new construction!

4-inch	PM....$1.39	10-inch	PM.....$3.25
5- "	PM..... 1.49	12- "	PM..... 3.95
6- "	PM..... 1.69	8- "	Electro-dynamic 1.49
4x6- "	PM..... 1.49		
6x9- "	PM..... 2.99	10- "	500 ohm. 1.89
8 "	PM..... 2.95	12- "	1,000 ohm 2.29

UTAH 15" PM CO-AXIAL SPEAKER

With 5" Tweeter. 21.5 oz. Alnico V Magnet. Will respond up to 17,500 cps. and down to 20 cps.

A HOT SPECIAL, This month only **$21.95**

UTAH 15" PM SPEAKER.....$14.95

IRISH PLASTIC RECORDING TAPE

BRAND NEW! NOT SURPLUS. This First Grade recording tape is ¼ in. wide. Frequency response: 50 to 8,000 cy. Plastic reel included with each

600 FT. $1.35 1,200 FT. $2.25

ASTATIC CRYSTAL MIKE

Super-smooth response from 30-10,000 cps. Output level about -52 db. Use as hand or desk mike. Stand and mike are one piece, equipped with 7' shielded cable.

WITH ON-OFF SWITCH **$6.95**

PHONO PRE-AMPLIFIER

$8.95

For use with G.E. and other low level magnetic pickups. Can be attached to any radio or amplifier. Built on aluminum chassis, finest workmanship throughout. Ample bass boost provided. Operates on 115 volt AC. Sizes 4¼"x2⅛"x3¼". Complete with 12AX7 tube. Shpg. wt. 2 lbs.

EICO 5" SCOPE

TOP QUALITY KIT!

All kits and wired instruments in stock.

Write for complete EICO Catalogue.

425K .. $47.20 | 425 Wired $83.25

LAMP CORD #18

ZIPS APART 2-CONDUCTOR 250 Ft. Spool

$4.95

SUPERSONIC TV BOOSTER

2 STAGE SPECIAL **$8.95**

All orders F.O.B. Los Angeles. All goods subject to prior sale. 25% deposit required with order.

OLYMPIC ELECTRONICS SUPPLY

DISTRIBUTORS
1440 W. OLYMPIC BLVD.
LOS ANGELES 15, CALIF.

"Quik-Shot" is made with five interchangeable tip sizes from ⅜ to 1 inch.

RCA CONVERSION KIT

A special "Converkit" which houses a horizontal-deflection-output and high-voltage transformer and ferrite-core deflecting yoke for use in converting small-screen TV receivers to use picture tubes up to 21 inches, has been announced by the Tube Department of the *Radio Corporation of America,* Harrison, New Jersey.

The heart of the "Converkit" is a "universal" horizontal-deflection-output and high-voltage transformer,

which is designed for replacement use in TV receivers utilizing transformers which have isolated secondary windings, or for general conversion service. This transformer covers a high-voltage range of 10 to 15 kv.

The transformer's universal-type bracket permits mounting the unit on the chassis of all types and makes of television receivers. It incorporates numerous combinations of precisely engineered mounting slots and holes which permit either vertical or horizontal mounting.

Equipped with a multi-tap arrangement, the transformer can be used with a wide range of kinescopes having horizontal-deflection angles from 50° to 66°.

PLASTIC PLIERS

Insulated long-nose plastic pliers for television service technicians working near high voltages have just been introduced by *General Cement Manufacturing Company,* Rockford, Illinois.

The new *G-C* tool, measuring 6½" in length, is claimed to be shock-proof and useful for picking up nuts and bolts when a television set is "hot."

The pliers are made of high-impact bakelite material and are sturdily constructed.

HIGH-VOLTAGE CERAMICS

Sprague Electric Company, 237 Marshall Street, North Adams, Massachusetts, has recently developed a high-voltage ceramic condenser which is molded in moisture-resistant, nonflammable thermosetting plastic, and designed for 85°C operation.

The Type 700C is useful as a high-voltage supply filter in television receivers and cathode-ray instruments, is rated at 20,000 volts d.c., has a minimum insulation resistance of 10,000 megohms under standard test procedures at 25°C, and can withstand a dielectric test potential of 30,000 volts.

Bulletin No. 606, giving complete details on the Type 700C units is available on letterhead request to the company.

VOLTAGE REGULATOR

Marine View Electronics, 744 East 138th Street, New York 54, New York, has recently developed an automatic line voltage regulator, designed for use in conjunction with television receivers in low or varying voltage areas.

The "Auto-Volt" makes possible proper voltage supply to the television receiver and is available in four models: 150 to 200 watts. 200 to 250 watts, 250 to 300 watts, and 300 to 350 watts. Each model is equipped with a switching arrangement for initial selection of proper current consumption.

LEADLINE PROTECTION

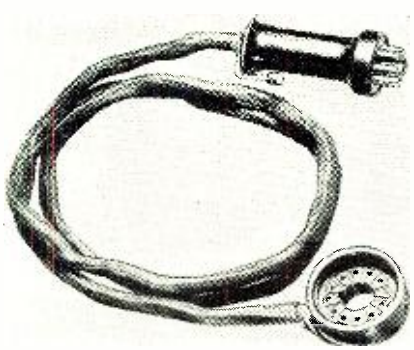
Don Good, Inc., 1014 Fair Oaks Avenue, South Pasadena, California, has announced four new leadline protective products in two groups: "Leed-Sheath" and "Sheath-Lead," developed to insure good television reception from antenna-to-set.

"Leed-Sheath" is a protective tubing of polyethelene designed to meet all weather and climate conditions and is particularly adaptable for use against corrosion, heat, snow, and icy conditions. Made with a 7-strand inner wire in the tubing, it provides easy installation of a twin-lead line in the protective casing.

"Sheath-Lead" is lead-in line factory-installed in the "Leed-Sheath" to save work for the dealer or television service technician. Both numbers of the "Sheath-Lead" are adaptable for 300-ohm use.

ADAPTER UNIT

To increase the range and usefulness of its tube testers for television work, the *Electronic Instrument Co., Inc.,*



84 Withers Street, Brooklyn 11, New York, has just released the Model CRA, television picture tube test adapter.

The Model CRA, designed for accuracy and safety, gives a quantitative measurement of cathode emis-

sion, and tests for filament continuity and inter-element shorts. The adapter is equipped with a standard 12-pin television tube socket, octal plug-in connector, and features an extra long (4-foot) cable that enables the picture tube to remain in the set while testing.

INTERFERENCE FILTER

In order to alleviate interference created by the opening of the new 21 mc. band to "ham" communications traffic, the *Grayburne Corp.*, 103 Lafayette Street, New York 13, New York, has introduced a new TV interference filter.

Known as the Model CPH "Clear-Pix Filter," it incorporates newly designed circuits and provides high rejection efficiency for the 21 mc. ham band. The time for installation is said to be less than one minute.

"WF" SERIES

A two-watt wirewound front control section, known as the "WF" series, has been announced by *P. R. Mallory & Co., Inc.*, 3029 E. Washington St., Indianapolis 6, Indiana.

The sections are available in 10 resistance values ranging from 750 to 7000 ohms in tapped and untapped types, and may be employed in conjunction with any "UR" carbon rear control sections to fabricate a dual concentric volume control.

Assembly fittings consisting of an inner shaft, phenolic spacer, a coupling cup, and a shaft end are supplied with each "WF" section, along with illustrated instructions for assembly without special tools or soldering.

V.H.F.-U.H.F. ANTENNAS

Ward Products Corp., Division of *The Gabriel Co.*, 1523 East 45th Street, Cleveland 3, Ohio is introducing two new antennas which can be used on both the v.h.f. and u.h.f. bands.

The "Trombone" offers gains up to 10 db for single-bay models on v.h.f. and up to 13 db for two-bay models in addition to high front-to-back ratio, sharp directivity, and close impedance match to 300-ohm line.

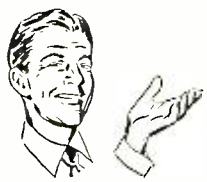
The mechanical features of the "Trombone" include complete preassembly, light weight, all-aluminum construction with dowelled elements, and vibration-proof construction.

The "U-Vee" combination v.h.f.-u.h.f. antenna incorporates many of the features of the "Trombone" but has somewhat less gain. It is designed for local area reception.

V.H.F. BROADBAND YAGI

The Antenna Development Laboratory of *Channel Master Corporation*, Ellenville, New York, has just announced the development of a v.h.f. broadband yagi, known as the "Futuramic."

This antenna has the high gain and directivity of a multi-element yagi and operates across a wide band of channels. The low-band "Futuramic" performs with high gain and direc-



YES, RIDER SERVICING DATA DOES MAKE TV SERVICING EASY!

Read what these satisfied Rider users say. These are men like yourself: professional service technicians who are faced with the same servicing problems as you. They found, just as you will, that tv servicing can be easy. Here's what they say:

". . . 3 weeks ago I had a receiver in my shop for which there seemed to be no repair possible. According to the one schematic I had for this receiver, it should have operated perfectly. I was on the verge of returning the receiver to the customer and admitting defeat, when a technician friend suggested I check the receiver with Rider servicing data. I did; with the result that I found the trouble to be a production change which was not explained in the data I had been using. Needless to say, I'm a Rider user from now on!" John Ottenheimer, Radio Television Clinic, 137 Main St., Hempstead, L. I., N. Y.

". . . and as a result of using your data, I haven't had a single callback in 9 months!" J. W. Scatchard & Co., 7135 Germantown Avenue, Philadelphia 19, Pennsylvania.

WHAT'S THE SECRET?

It's simple! The one thing that Rider gives you is *all the facts*. That's the one big difference between Rider Servicing Data and any other kind. Rider Servicing Data is official, complete, factory-authorized data. Exactly as issued by the manufacturer who made the set . . . with all of his changes and modifications . . . organized into indexed, easy-to-follow style. This means that when you repair a set with Rider Servicing Data, you have everything in front of you. Everything that you must know in order to do a fast, accurate diagnosis and make a prestige-building, permanent repair!

In Rider Servicing Data you get all of the manufacturer's troubleshooting test patterns . . . schematics of all his productions . . . stage by stage alignment curves . . . clear, enlarged chassis views . . . the manufacturer's circuit changes . . . circuit explanations . . . voltage data, disassembly information and much, much more. For example: Rider Servicing Data has shown scope waveforms in TV receivers ever since the first TV receiver was made!

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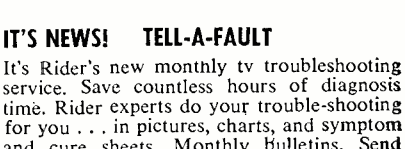

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tivity across as many as four of the five low-band channels and the high-band unit performs across the entire high band. These high- and low-band antennas can be tied together to give the installation technician a sensitive high-low combination for all-channel v.h.f. reception.

The new antenna, which is made in five different models, can be stacked with the company's "Z-Match" system, eliminating mismatch, giving maximum stacking gain, and providing stacking bars at no extra cost.

"UNISTAGE"

Technical Development Corporation, 4032 Ince Boulevard, Culver City, California, has announced a unit assembly designed to self-contain all the components necessary to a functional circuit in such a manner that the unit may be plugged into an electronic device.

"Unistage" is available in four sizes, whereby any combination of from 1-tube to 4-tube circuits may be utilized.

The basic unit comprises the die cast aluminum housing; a terminal board having a large number of single and through terminals which are coded for easy assembly of components; the tube plate which allows the use of standard miniature and noval sockets; and the tube well or wells.

"TELECART" TV

A new item in "mobile" television, known as the "telecart," is offered by *The Hallicrafters Company,* 4401 W. Fifth Avenue, Chicago 24, Illinois.

Available in mahogany or blonde

finish, the tea-table is designed to accommodate any of the company's table model sets in contrasting or matching cabinets.

"PERFORATED FIBEROK"

The *Pearson Industries,* 4554 North Broadway, Chicago 40, Illinois, has announced the development of a non-metallic material that replaces perforated metals.

"Perforated Fiberok" is comparable in characteristic to laminated plastics or vulcanized fiber and is obtainable in many different patterns. Extensively used by the radio and television industry is a .045" diameter round hole on

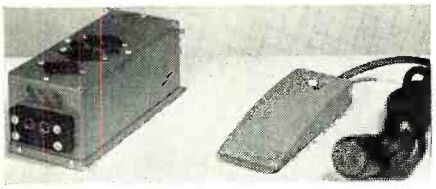
square centers, providing 225 holes-per-square-inch and a 37% open area. Free from rattle, "Fiberok" produces clearer tonal qualities from any size loudspeaker, according to the company.

The material may be stapled, nailed, glued, screwed, cut with shears, knife or scissors, and is available in many colors.

Full particulars may be obtained upon request.

CONTROL SWITCH

The *American Radiotelephone Company, Inc.*, 3505 4th Street North, St. Petersburg, Florida, has designed a radiotelephone microphone control, which provides a means of switching



an operator's headset microphone from one communication system to another.

Known as the DFS-100, the unit is operated by a foot switch so that the operator's hands are free for logging and other functions. It is designed for use in dispatching stations where directions are received by land-line telephone and communicated by an operator to mobile units by radio.

H.F. LINE FILTERS

Telematic Industries, Inc., 1 Joralemon Street, Brooklyn, New York, has announced the development of two low-pass line filters which eliminate diathermy interference above 70 cycles entering the TV receiver through the a.c. line.

WT-29, a tunable h.f. line filter with a variable frequency range of high attentuation in the diathermy spectrum, prevents diathermy frequencies from entering a TV set via the a.c. line.

The h.f. line filter, WT-30, with a cut-off frequency of 70 cycles, prevents any frequency above 70 cycles from entering the receiver through the power line.

"FOLD-OVER TOWER"

Rohn Mfg. Co., 2108 Main Street, Peoria, Illinois, has introduced a new antenna tower which incorporates the company's standard tower sections and a "Fold-Over" kit.

The kit consists of a short base section, hinge section, boom and reel, and cable mechanism.

The tower hinges near the midsection and can be easily raised or lowered by merely turning the crank on the reel. When the tower is lowered, antenna changing and servicing can be quickly accomplished on the ground.

The unit is recommended for experimental use and ham antenna installations, as well as for TV service departments and retailers.

—30—

International Short-Wave

(*Continued from page 63*)

Afghanistan—Reception reports, comments on kinds of programs desired, requests for musical numbers, and the like now should be addressed to Soyed Edris Ali-Shah, London Correspondent, Kabul Radio, 134 Fellows Rd., Hampstead, London N.W. 3, England. (Pearce, England).

Albania—New schedule for *Radio Tirana* is 2300-0100, 1100-1130, 1215-1700 on 6.560, 0.5 kw., and 7.850, 3 kw.; *English* 1600. (WRH) Heard in Britain on *measured* 7.854 with Greek transmission 1300, good level. (Catch).

Algeria—Radio Algerie, 9.57, Algiers, noted with dance music 1735; news in French 1752; signing off 1759. (Pearce, England) Is now scheduled on 9.570, 1500-1800 (Sat. to 1900), French program, news 1500, 1750; on 6.145, 1300-1500 Kabyl program, 1500-1745 Arabic program. (WRH)

Angola—CR6RJ, *Radio Clube da Huila,* Sa da Bandeira, noted near 10.050 when tuned 1505, light musical records; signed off with "A Portuguesa" 1530. *Radio Clube de Angola,* 11.862, Luanda, noted 1715 with dance music and signing off 1730 with "A Portuguesa" (runs to only 1530 Sun.). *Radio Clube de Benguela,* 9.165, heard with varied recordings when tuned 1310; CWQRM. (Pearce, England) CR6RJ, 10.050A, also is noted by O'Sullivan, England, around 1400 with music, bad CWQRM.

CR6RG, *Radio Diamang,* Dundo, is operating on 6.870, 1 kw., at 1300-1430 weekdays, also 0530-0700 Sundays. (WRH) CR6RN, 9.475A, noted 1545 with musical program in Portuguese. (Cox, Dela.)

Australia—VLI6, 6.090. Sydney, has news 0400, good level in Va. (Saylor) The *new* outlet, VLC7, 7.220, *Radio Australia,* used 0500-1115 to Southeast Asia, is being heard from sign-on (Stark, Texas; Ferguson, N.C., others) VLW9, 9.610, Perth, noted 1000-1030 sign-off at fair level. (Lane, Wyo.) With news 0400. (West, Va.) *Radio Australia* heard signing on 1300 for Central Europe over VLA9, 9.580, news 1400, off 1459; on Sat. appears to also use VLA11, 11.760 in parallel for this *new* beam. QSL card was received from VLX4, 4.8975, said transmitter is located at Wanneroo near Perth; QRA is ABC, Box D190, G.P.O., Perth, Western Australia. (Pearce, England)

Austria—Blue Danube Network, 9.617, Salzburg, noted 0110 with sports results; sent *new* type QSL card; QRA is still A.P.O. 541, U.S. Army; lists short-wave channels of 9.617, 5.080, 6.055. (Peace, England) Noted by Catch, England, on *measured* 5.080 recently at strong level 1730; had newscast 1800.

Belgium—The Belgian National Broadcasting Service, P.O. Box 26, Brussels 1, Belgium, currently is scheduled over its *International Goodwill Station,* ORU, Wavre (near Brussels) on 5.970 at 1830-2400; 9.745 at 1200-2400; 11.850 at 0715-0800 and 1200-1830; 15.335 at 0500-0700, and 17.860 at 0500-0700; OTC, Leopoldville, Belgian Congo, relays ORU to North America on 6.140 at 2000-2400.

Noted on 11.85 with "Amongst Friends" feature 1435 following news in *English.* (Hord, Ind.) This channel is good 1700. (Cleveland, Md.) Heard with news in French 1501. (Harris, Mass.) And at 1800. (Balbi, Calif.)

Bolivia—CP38, 9.500A, La Paz, noted opening 0557 with "Onward, Christian Soldiers"; signal is weak and usually fades out *before* 0630. (Ferguson, N.C.) Recently tested in *English* to North America around 0400-0430, 0900-0930. Is operated by the Canadian Baptist Mission in Bolivia under the title "La Cruz del Sur" ("The Southern Cross").

British Guiana—ZFY, 5.98A, Georgetown, noted recently with Hindu music around 1924 tune-in; had CWQRM; commercials in *English.*

British New Guinea—VLT9, 9.52, Port Moresby, is noted at good level some days around 0230-0300 sign-off all-native at that time. (Alcock, Ky.)

British Somaliland—Radio Somali, Hargeisa, broadcasts programs in native languages 0815-0930 on 7.125, 1 kw., according to letter of verification. (Radio Sweden)

Bulgaria—Radio Sofia noted with news on 6.070, 7.671 at 1500-1515, 1600-1630; announced broadcasts for USA at 2000-2030 and 2300-2315 on 15.330; at 1515 continued with broadcast in German. (Pearce, England) Heard on 15.330 with news 2300. (Pelland, R.I.) Noted on 7.671 with all-Bulgarian program from tune-in 2300 to 0030 sign-off. (Saylor, Va.)

Burma—Millar, Washington State, reports Rangoon, 9.543, with newscast 1000.

Canada—CHNX, 6.130, Halifax, Nova Scotia, noted 0725; CFRX, 6.070, Toronto, Ontario, is good level 0730; some days CFBY, 11.705A, Montreal, Quebec, is like a local all morning (*EST*). (West, Va.) VED, 7.320, Edmonton, Alberta, good with news 2130 recently; VE9AI, 9.540, also Edmonton, noted with weak signal 1055; good 2235. (Lane, Wyo.)

Canary Islands—Radio Clube de Tenerife, 7.518, noted around 1745 at fair level. (Pelland, R. I.) Local news and announcements in Spanish are scheduled *daily* around 1705-1710; however, during the few days preceding press time, the station could not be located in the vicinity of 7.520A so may have moved? (Kary, Pa.)

Ceylon—Commercial Services of *Radio Ceylon* sent schedule for Indian beam as 2045-0230, 0630-1145, BBC news 2100, VOA relay 1030; listed 15.120, 7.190, 11.975. (Pearce, England) The 15.120 channel is good level signing on 2045; BBC news relay 2100. (Ferguson, N. C., others) Noted closing down with "Strike Up the Band" 1144 on 11.975. (Bellington, N. Y.)

Colombia—The Spanish-speaking station on 5.964A commencing operation around 0610 with BBC's *"English*

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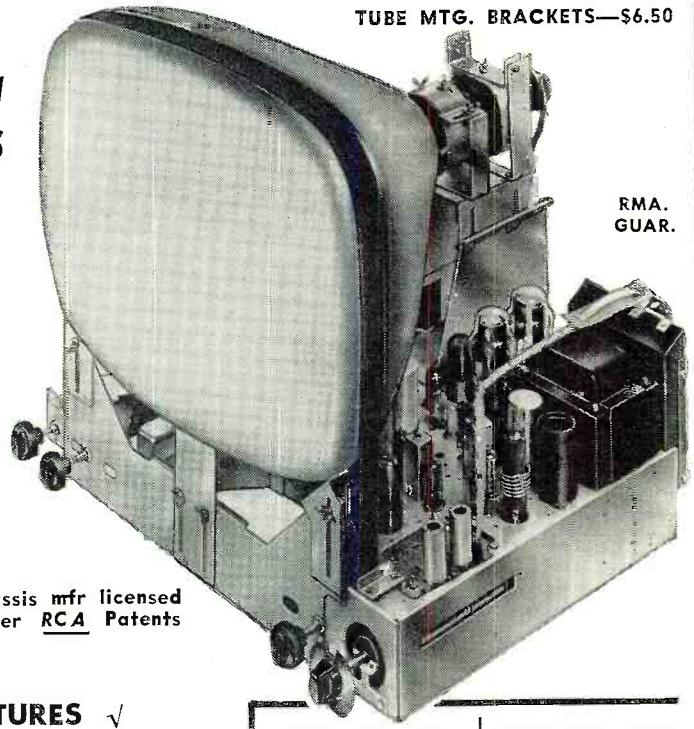

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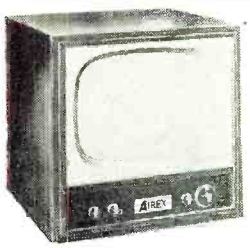

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by Radio" at 0620 is HJCF, Bogota. (Stark, Texas) This one was heard in Australia by Gillett, who asked for identification thereof.

Costa Rica—TIHH, 11.970A, San Jose, noted most of the day and evening (*EST*); especially good 2300-2400; all-Spanish. (Alcock, Ky.)

Cuba—COBL, 9.833, Havana, fair around 2200 but with bad heterodyne. (Lane, Wyo.)

Czechoslovakia—*"The Voice of Peace,"* 9.504, Prague, noted signing on in *English* 1400. (Pearce, England) Heard on 9.55 in dual with Soviet 9.662A at 0240-0245 relaying Moscow's Eastern Service. (Lane, Wyo.) The 9.550 channel is excellent in *English* session to North America daily 1930-2000. (Wicker, N. C., others) The *English* period 0715-0745 over OLR4A, 11.840, is at weak level in Pa. (Kary)

Denmark—OZF, 9.52, is good level in Michigan in the first North American session 2030-2130. (Pingitore) Noted on (announced) 15.180 recently at 1413 in *English*, giving address of Radio House, Copenhagen, Denmark, and asking for reports; clear signal. (Cox, Dela., Ferguson, N. C.)

Has been experimenting with its antennas recently in the North America periods 2030-2130 and 2200-2300 over OZF, 9.520; asks for reception reports. (Hoffman, N. Y., Winch, Calif., others) Noted on this channel 2200 with very good level and requesting reports. (Walgreen, Mass.) Is strong in Florida 2030-2130. (Wade)

Dominican Republic—H19B was *measured* 4.9166 recently 2100; strong signal, music (Oskay, N. J.)

HI1A, 4.980, *Radio Caribe*, has fine level to 2200 sign-off. (Saylor, Va.) HI4T, 5.970, and HI2T, 9.727A, on Wednesdays at least (may be daily?) has *English* talk 2100-2110A. (West, Va.)

Egypt—*Radio Cairo* has *moved* from 9.715 to 11.815 where it has a much improved signal; is on the air daily around 1320-1600 (Sat. to 1700) using mostly French and *English;* usually has news 1330. WRH says has French 1320, *English* 1330, Greek 1340, Italian 1340; time signal and musical program 1400 (with talks in French and *English* on alternate days).

Cairo now sends card printed in Arabic, French, *English* instead of letter; asks for further reports on the 11.815 channel. (Pearce, England) SUX, 7.865A, Cairo, is coming through some days at nice level 1515-1800 sign-off with Arabic session. (Saylor, Va.) Closedown varies; was heard one day signing off 1655. (Kary, Pa.)

Ethiopia—*Radio Addis Ababa*, 15.05V, noted closing 1302; *no English heard lately;* is noted some days in Britain as early as 1130. (Pearce) Good level with native music 1245. (Catch, England) Heard poorly then in N. Y. (Bellington)

Finland—OIX4, 15.190, Helsinki, still signs on 2200 to North America; has short newscast, then goes into Finnish. (Niblack, Ind.) OIX2, 9.555, noted 2230 with Finnish news, music.

(Sanderson, Australia) Noted on this channel 2335-0004 sign-off with anthem; had popular musical program. (Lane, Wyo.)

France—Paris, 11.845, noted 1210 with light orchestral music. (Niblack, Ind.) Currently, Paris, 6.200, has a poor to fair signal 1530-1600 in *English* session directed to the United Kingdom; entire transmission runs 1500-1700; at 1600 begins German period. (Kay, Pa.) The *Paris-Inter* program is again being relayed over 6.200, 100 kw., Mon.-Fri. 0345-1200, Sat. 0100-1200, Sun. 0130-1200. (WRH) Heard opening on 11.92 at 1145 with usual interval signal, then had Persian session; fair level in N. Y. (Bellington) Heard on 9.685A with fair to good level 1900-2000 sign-off, and on 11.70 at fair to good level, 1500-1630 sign-off; leaves air after playing "La Marseillaise." (Pingitore, Mich.)

Germany—West, Va., recently noted Hamburg on 7.290 at 1830-1907 concluding with German National Anthem; RIAS, 6.005, Berlin, was heard around the same time; both had all-German sessions with popular American music being used.

Deutschlandsender, 6.115, Berlin, was heard recently 0113 tune-in when had popular German recordings; fair level with some jamming QRM and slight splash from London on 6.110; however, was readable. (Bellington, N. Y.) Frankfurt, 6.190, is audible weekdays 2350-0015 when is obliterated by BBC, 6.195; RIAS, 6.005, Berlin, is fair to poor *after* 0000, news in German 0030; Stuttgart, 6.030, radiates a fair signal from around 2345 to *after* 0100, news in German 0000, 0100. (Kary, Pa.) Overseas sources list this one now with 20 kw.

Greenland—Godthaab, 7.094A, has been noted 1745-1840 sign-off; heavy c.w. and phone QRM recently, according to Saylor, Va.

Holland—Hilversum noted using 11.73 and 9.59 for Great Britain, Europe, and North America at 1630 in *English;* best received on 11.73. (Silverman, N. Y.)

English periods are scheduled 1100-1140 to South Asia and Africa, 17.775, 15.22, 6.025; 1630-1710 to Europe and North America, 11.73, 9.59, 6.025; 2130-2210 to North America, Australia, New Zealand, 11.73, 9.59. The "Happy Station Programs," produced and presented by Eddie Startz, are scheduled Sundays *only* at 0530-0700, 21.48, 17.775, 15.22, 6.025 to Europe, Asia, South Pacific Area; 1100-1230, 15.22, 11.73, 6.025, to Europe, Near and Middle East; 1630-1800, 11.73, 9.59, 6.025, to Spain, Portugal, South and Central America; 2130-2300, 11.73, 9.59, to United States-Canada.

Hong Kong—ZBW3, 9.525, noted 0530 with request program, weather reports; 0600 with BBC news relay. (Sanderson, Australia)

India—AIR noted signing on 0830 for Southeast Asia on 11.780, 15.190. (Pearce, England) Presents daily musical program 1000-1030 over 7.12, 11.79; a newscast is given 1030-1045 over 4.891, 4.94, 5.96, 7.716, 9.59, 11.915; is best on the 25-and 31-m. outlets. (Gade-Joergensen, Denmark) Heard at weak level on 11.940 with news 1030-1045. (Lane, Wyo.) Noted on 4.94 at 1300 with native program, good level in Britain. (Catch)

Indo-China (Vietnam)—Radio France-Asie, 9.754A, noted with usual good signal opening in *English* for Europe 1730. According to schedule from the station, *English* is radiated 1730 on 9.750 to Europe; 1830 on 7.230 for Southeast Asia; 2030 on 11.935 for India; 0400 on 15.430 for Australia; 0900 on 11.935 for India; *"French by Radio"* is Tue. and Fri. 0515 on 15.430 and 0915 on 11.935; *Listeners' Letterbox* and request programs Fri. 0400 on 15.430, 0930 on 11.935. (Pearce, England) Heard on 11.935 with popular music 1015-1030. (Lane, Wyo.) *"La Voix de Vietnam,"* 9.620, Saigon, noted 0500 with Vietnamese program, news and music. (Sanderson, Australia) Hanoi has moved from 6.190 to 6.165, heard in Sweden by Engberg around 0900. (Radio Sweden)

Iran—A New Zealand DX-er reports *Radio Tabriz,* 6.092, with *English* 1545, (*Radio Amateur,* London) EPB, 15.100, *Radio Teheran,* still noted with short *English* newscast 1500, music to 1515, then in Russian when the station is badly jammed; closes 1530A with march. (Ferguson, N. C., others)

Shirac was logged recently in Sweden on 7.960 in Persian 1130-1230; poor level. (Engberg)

Iraq—Radio Baghdad, 11.724, is still heard in Sweden with *English* 1415-1500 sign-off. (*Nattugglan,* Sweden) This one can be heard with weak to fair level signing on around 2300 in Arabic session. (Bellington, N. Y., others)

Ireland (Eire)—Experimental transmissions continue with news at 1330 on 15.120, at 1710 on 9.595. (ISWC, London)

Although the foregoing schedule is "claimed" by the station's officials (in a recent letter to Saylor, Va.), both Bellington, N. Y., and Kary, Pa., recently heard *Radio Eirrean* with its newscast around 1610-1630 on 15.120A; was heard recently on this channel by Saylor, Va., with news 1330-1345A. By this time may have reverted from Irish Summer Time, in which case the newscasts should be on the air daily at 1230A and 1610A.

Israel—Kol-Israel, 9.010A, noted with news 1415-1430 in parallel with 6.830; announces next *English* news for 0545 on 9.010A and 6.830; Kol-Zion program in *English* heard 1515-1600 closedown on 9.010A; French 1430-1515; asks for reports to P. O. Box 754, Jerusalem, Israel. (Pearce, England)

Italy—Rome noted with news for North America 2145 on 15.400; announced 11.905, 11.810, 9.710 in parallel; but more recently was heard on 9.57A instead of 9.71. (Scheiner, N. J.) Fair on 11.810 for this news period. (Baetz, Ill.) And on 11.905. (Sanderson, Australia) Heard on 15.400, good level, with news 0400, woman announcer. (Saylor, Va.) Heard in *English* 1320 on 11.81, announcing 15.400 as parallel. (Scheiner, N. J.)

Italian Somaliland—This country is now called Somalia; by 1959 will be an independent country, similar to Ethiopia. (Bellington, N. Y.) *Radio Mogadishu* was *measured* recently by Catch, England, as 7.3855, quite good signal 1215-1300 closedown. Pearce, England, also notes this one audible from around 1215 with popular music, dance music, songs, and with news in Italian 1225-1235.

Ivory Coast—Radio Abidjan, 7.210, now uses 1 kw.; heard in Britain 0730 with press and news review in French, closes 0800 with call "Ici Abidjan;" verified within 12 days. (ISWC, London)

Jamaica — Radio Jamaica, 4.950, noted from around 2045; at 2100 relays BBC news. (Hord, Ind.)

Leaves the air 2302 after playing "Good Save the Queen." (Kary, Pa.) Good level in N. Y. at 2100. (Machajewski) Heard 0530 with music. (West, Va.)

Japan—Radio Japan, 11.705, noted 0015-0025 with native music and *English* announcements by woman—in beam to North America. (Lane, Wyo.) Heard on 7.180 with news 0600, parallel 6.069; on 9.675 in *English* 0700 in parallel with 11.705. (Sanderson, Australia) The Home Service is noted at fair strength around 0520 on JKH, 7.2575, Yamata; has much drama and/or native music; announces either "NHK" or "Nippon Hoso Kyokai." On the hour, a time signal of three dots and a dash is given; appears to have home news in Japanese 0600. (Kary, Pa.)

Kenya Colony — Verification from Forces Broadcasting Service, East Africa Command, Nairobi, Kenya Colony, Africa, gives this schedule—weekdays 2200-2400, 0430-1500; Sundays and public holidays 2300-1500; uses 1420 kc. and 7.265. (Oskay, N. J.)

Luxembourg — Radio Luxembourg, 15.350, noted signing off in Flemish

AUCTION SALE

Radio Receiving Tubes

A. J. WILNER, AUCTIONEER, WILL SELL ON WEDNESDAY, NOVEMBER 12, 1952 at 11 A.M. on PREMISES 472 BROAD ST., NEWARK, N.J., 2nd FLOOR, ENTIRE STOCK OF RADIO RECEIVING TUBES, SPECIAL PURPOSE TUBES, EQUIPMENT, OFFICE FURNITURE, ETC. REMOVED FOR CONVENIENCE OF SALE FROM STANDARD ARCTURUS CORPORATION.

Approximately 500,000 Tubes

Most Tubes are Cartoned—75% are JANS

ALL BRANDS—RCA, GE, SYLVANIA, ARCTURUS, TUNGSOL, HYTRON, ETC.

TYPE	QUANTITY	TYPE	QUANTITY
0A2	1878	6SK7GT	2943
0B2	2753	6M8GT	427
0Z4	1101	6SQ7GT	61
0Z4G	7754	6U4GT	1875
01A	360	6U7G	1252
1A5GT	1000	6V6GT	1000
1A6	338	6W4GT	2486
1B5	213	6W7G	187
1C6	381	6X4	2982
1D5GP	524	6X5G	324
1C7G	384	7C4	10727
1E7G	327	7E5	3716
1E7GT	148	12A5	190
1F4	517	12A6	27000
1F5G	251	12BA7	6216
1G4GT	244	12AV6	209
1G6GT	900	12C8	7989
1H5GT	1000	12F5GT	1052
1H4G	1812	12H6	3789
1H6G	209	12J5GT	4272
1H6GT	190	12K8	9238
1G6G	1300	12Q7GT	1039
1J6GT	301	12SR7	386
1L4	12608	12Z3	332
1L5G	351	14A4	291
1LA4	124	18	339
1LC5	249	19	759
1N5GT	1000	19BG6G	4672
1U4	791	22	373
2E5	560	27	190
3B7	2221	30 Spec	65
3D6	1900	31	227
3Q4	4333	32	741
6A6	775	33	998
6AJ6	2730	34	483
6AL5	415	35	1391
6AS5	234	36	1083
6B5	2282	37	958
6B8G	1422	38	3866
6B8	4178	39/44	50,000
6BQ6GT	913	46	347
6CB6	2698	49	151
6G8G	241	50	188
6J7G	305	50C5	480
6J8G	181	55	180
6L5G	284	56	316
6P5GT	947	57	67
6R7	200	58	445
6R7G	221	70L7GT	1345
6R7GT	394	71A	649
6S4	256	77	3889
6S7	337	79	113
6SD7GT	7958	81	359
6SN7GT	1000	82	288

Tens of Thousands Other Tubes Not Listed

50,000 Special Purpose Tubes Including:

100-T-H • 705A • 866A • 395A • 394A • 869B • 814 • 872A • 359A • 25Z6WGT • 2J32 • 211 • FG17 • 2050W • 0D3W • 5CP1 • 3C29 • 3B25 • 6AL5W • 0R3W • 5BP1 • 719A • 3B28 • 6H6WGT • 2AP1 • 2050 • 2D21 • 5R4WGY • 3GP1 • 2051 • 122 • BS101 • 3C31 • 884 • 1Y2 • 2D21W • C1B • 885 • 5594 • 4B32

200,000 Assorted Cartons and Fillers

Up-To-Date Customer Mailing List with Plates and Machine

Equipment Used by Standard Arcturus Corporation Tube Testers, Branding Equipment, etc.

INSPECTION—10 A.M. to 4 P.M.—
Tuesday, November 11, 1952

whatever means are found necessary, within 30 days of the time knowledge of the interference is first brought to his attention by the Commission; and vertical polarization is used.

During the term that these proposals are being considered, the FCC declared, all grants made under the existing rules will be made on a temporary basis and will expire 90 days after the rule-making proceedings have been concluded. At that time, those holding authorizations will be eligible to apply for the normal licenses.

A HISTORIC RECIPROCAL RADIO CONVENTION between Canada and this country has become an official law, and hams, mobile operators, and aircraft radio operators, too, now have striking border-entry privileges.

According to the terms of the convention, which was originally ratified last year, citizens of this country holding air pilot and radio operator's licenses can now operate radio gear on aircraft registered in Canada and being flown in either country. Mobile radiotelephone stations licensed here and installed in police, fire and other such vehicles, as well as trucks, trains, buses, taxicabs, etc., regularly engaged as public carriers of persons or goods between the two countries, will hereafter not be required to cease operation when entering Canada. In addition, mobile radiotelephone units installed in private cars and other vehicles connecting with public telephone service, will now be able to continue operation in Canada, and also obtain telephone service through Canadian telephone companies, where available. American hams, according to the treaty, can now enter Canada with equipment and operate it in their cars or summer homes, during their stay in Canada.

The convention, which will remain in force for a minimum of five years, requires that U. S. citizens obtain a radio permit, before entering Canada, from the Telecommunications Division of the Department of Transport, Ottawa. Canadian citizens will also be obliged to obtain entry permits from the FCC in Washington.

MORE THAN 5000 hams enrolled in Civil Defense in fourteen northeastern states conducted an exciting 24-hour test exercise, during the first days of Fall, in the first large-scale test on the seven channels allocated to CD ham networks. The exercise was based on a theoretical simultaneous bombing of several major cities of the industrial heart of the nation.

Prior to the test, N. Y. State's CD Director, Lt. Gen. C. R. Huebner, told a representative group of amateurs that the lack of sufficient emergency CD communications channels, revealed during recent CD test exercises in all major N. Y. State cities, accented the role amateur radio networks will have to play in saving lives and damage after an enemy attack. The General pointed out that in a recent major test in an upstate city in New York, a theoretical bomb burst temporarily immobilized telephone communications through most of the city and in the control center, throwing the burden of initial emergency communications largely upon the ham networks.

Ham radio officers were urged by Gen. Huebner to plan immediately to achieve the proper use of allocated frequencies, so that maximum use could be made of those available for this vital service.

HIGH-FREQUENCY RADIO may eventually link continents, recently viewed Haraden Pratt, advisor to the President on communications, during a talk at the Centennial of Engineering in Chicago.

In his opinion a . . . "world-wide system could be visualized, connecting the hemispheres via the Bering Strait, as once was planned for a wire line between New York and Moscow, and perhaps some day Africa and Europe, as well as North and South America areas will so be interconnected."

Pratt pointed out that . . . "relay or reflection methods using the moon or an artificial satellite to provide routes for ultra-high frequency transmissions are interesting possibilities, but unfortunately the lunar cycle interferes, and how to establish and control platforms in space is yet to be learned."

Declaring that high-frequency methods could permit any country to communicate with almost any other, virtually without regard for distance, Pratt noted that this facility has made . . . "radio communication a national asset, and in this time of growing nationalism, it is unlikely that any new method that takes this advantage away could be established."

The President's advisor pointed out that future developments . . . "are more likely to be in the direction of organizing the flow of communications over routes where the troublesome effects of natural disturbances to wave propagation will be at a minimum, and the improvement of automatic operational methods, as have been developed in wire transmission."

Pratt's comments on global communications recalled the prophecies of Brig. Gen. Sarnoff who, upon returning from a trip abroad, declared that he felt that during the next five years . . . "we may expect to see television established on an international basis" . . . so that televiewers here will be able to see events as they happen in Europe and the Mediterranean world.

A 700-TV STATION network, extending from the North Cape, well in the Arctic Circle, to Tunis and Morocco in the south and from Turkey in the east to Iceland in the west, proposed during a 21-nation meeting in Stockholm recently, strongly confirmed the earth-circling possibilities suggested by Pratt and Sarnoff.

According to the program, which would be spread over a period of 10 years, two bands would be used: 41 to 68 and 174 to 216 megacycles. Participating countries include Great Britain, Austria, Belgium, Vatican City, Denmark, Spain, Finland, France, Greece, Ireland, Iceland, Italy, Luxembourg, Monaco, Norway, the Netherlands, West Germany, Yugoslavia, Sweden, Switzerland, and Turkey.

Plans for broadcasting on the very-high bands also reviewed during the meeting, provide for the eventual installation of over 2000 stations within an area as broad as that proposed for TV.

TV BROADCAST revenue climbed to a new high in '51, Washington reported in its annual financial analysis of station operation. After a peak loss of $25.3 million in '49 and a further loss of $9.2 million in '50, the telecast industry earned income for '51 was $41.6 million, based on a total revenue of $235.7 million, which was more than double the '50 total, and almost seven times that earned in '49.

For the first time, networks, including 15 owned and operated stations, derived a greater proportion of their total broadcast revenues and income from TV, than from standard broadcasting operations.

Of the 106 TV stations, including all but two stations for which complete data was not available, 92 reported profitable operations in '51, averaging $330,000 income per station. Eight of the 14 losing stations were located in the two seven-station markets; New York and Los Angeles. Seven of the losing stations reported revenues in excess of $1.5 million. Only one of the 40 TV stations located in one-station markets reported a loss in '51.

In '52, it has been predicted, another record income will be reported, wiping out perhaps all losses in TV operations.

THE SHORTAGE of technically trained personnel in Great Britain has become so acute that the Ministry of Education has organized full-time three-year courses at five training centers. Students will be trained in the theory and practice of electronics, so that they will, on completion of the courses, be able to take their places at once as assistants to qualified research and development engineers.

Among the subjects to be studied will be counting circuits, radar techniques, basic electricity, radio measurements, television circuitry, optics, and picture tube design and application.

Progress in the program will be watched closely by educators and industry here, who have noted that perhaps a similar plan, adopted on an industry-wide basis, might help solve some of our engineering shortage difficulties, and provide a continuing flow of trained personnel, so urgently needed in government and industry today . . . . . L.W.

Television "Snow"

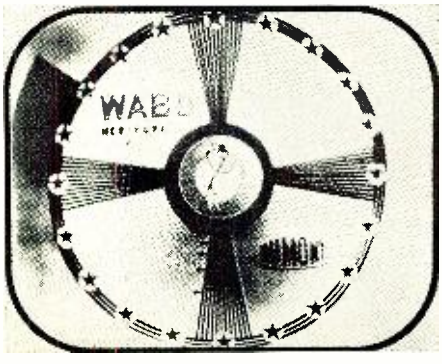
(*Continued from page 59*)

each channel. Detailed descriptions of the cascode tuner have appeared in this magazine and elsewhere and its present wide use is conclusive proof of its advantages. Compared to the 24 db noise factor measured by the author on an *RCA* KRK2 (early 630) tuner, a cascode circuit in a production type *Standard Coil* tuner measured only 11 db noise factor on Channel 13. In the actual picture this meant that the "snow" was greatly reduced and while it could still be seen on weak stations, it was of much finer grain and therefore less objectionable.

In addition to these improvements in the r.f. amplifier, many TV sets suffer from other noise sources such as the i.f. and the video amplifiers. In some receivers the maximum gain through the i.f. section is so great that the shot effect becomes pronounced. Reducing the "B plus" voltage and assuring at least -.35 volt of a.g.c. bias at all times limits the gain somewhat but will also reduce the noise considerably. Running a video amplifier without bias and high plate voltage often causes regeneration. This may not be enough to wreck the picture entirely but can result in a picture like the one shown in Fig. 5. In such instances the voltages of grid, plate, and screen should be measured and compared with the recommended values in the tube manual.

The a.g.c. system of many receivers is designed to operate better on strong than on very weak signals and with suitable modification a better noise factor can be obtained. Fig. 6 shows an a.g.c. system operating on the average detected signal and featuring a variable delay. The purpose of the delay is to further reduce the bias on very weak signals. In effect it provides some manual control in addition to the automatic control. On very weak signals the bias on the r.f. and i.f. stages can be reduced to permit more gain and a better noise factor. This is especially desirable when average type a.g.c. is used, since in this system the bias depends on the average signal, including the noise. If no delay were used it would be possible for high noise values to maintain

Fig. 5. Effect of regeneration on picture.



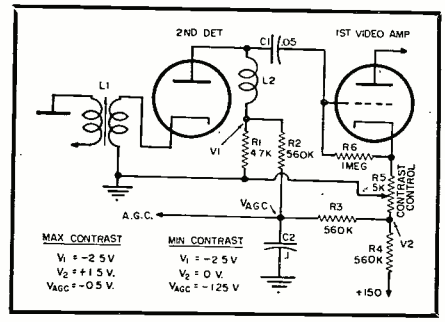


Fig. 6. Typical a.g.c. with variable delay.

so much bias that the gain of all stages would be reduced, further cutting down the desired signal. By adding the manual control it is possible to overcome the effect of noise on the a.g.c. bias and get more gain for the desired signal. In some receivers the delay is connected into the circuit by means of a separate "fringe" switch.

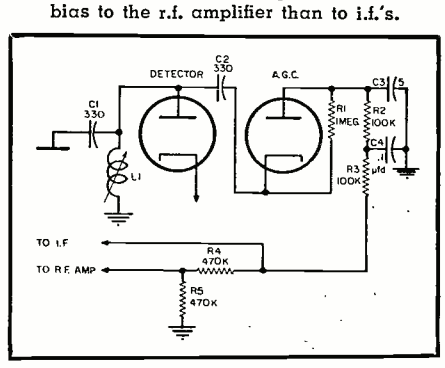
Another frequently used scheme to get better noise factor through the a.g.c. system is shown in Fig. 7. Here peak detection is used to obtain the a.g.c. bias. While there is no delay in the circuit as shown here, the amount of bias supplied to the r.f. amplifier is half of that sent to the i.f. grids. In some measure the result is similar to the previous case. The r.f. stage can have more gain at all times than the i.f. stages because only half of the developed a.g.c. bias is applied to it.

Reducing Noise

The various noise reducing measures mentioned up to now are generally already built into the TV receiver. While it is important for the technician to know their operation and their effect, it is often desired to correct "snow" on a set lacking all of these features. The following are suggestions for reducing "snow":

1. Check to see if the antenna is the best type for that particular location.
2. Check antenna connections and transmission line for cold solder joints. Their presence means a high resistance and therefore a source of noise.
3. Check for mismatch at the antenna and the receiver ends of line.
4. Reduce bias on r.f. amplifier by connecting a 220,000-ohm resistor from bias lead to ground.
5. Reduce the "B plus" for several

Fig. 7. Peak type of a.g.c. with less bias to the r.f. amplifier than to i.f.'s.



or all i.f. tubes to about 135 volts. Use a suitable series resistor and bypass with a .01 μfd. condenser.

6. Substitute a 6AK5 for 6AG5, 6BC5, or 6CB6 r.f. amplifier.

7. Add some delay to the a.g.c. by connecting a large resistor from "B plus" to a.g.c. Be sure that the bias is no less than .3 volt negative.

8. Check for possible regeneration tendencies in video amplifier.

9. If possible, try a new cascode tuner.

10. Try connecting a cascode type booster between the antenna and set.

The ten steps mentioned are intended as a guide to the technician in approaching the "snow" bound TV set. In each instance a different remedy may be best and by understanding the sources of noise or snow and the theory of noise in general it will be possible for the technician to judge each case individually and then decide which measures will help most. Often a combination of different things will improve noise, each contributing a small part, sometimes so small that the improvement is hardly noticeable. In a fringe area, however, every little improvement helps and the sum total often spells the difference between just snow and a usable picture. —30—

New Tape Recorder

(*Continued from page 49*)

grids of the triode bias amplifier, which, in turn, feeds the record head from the secondary of a transformer loading the plates. Suitable trimmers balance the circuit and assure a bias waveform of low distortion.

The record amplifier is a push-pull triode, as is the line amplifier. The line amplifier, with its +10 vu output to a 500/600 ohm line, may be switched to bridge the input signal or the tape, permitting A-B comparison of the performance of the recorder. It also permits simultaneous use of the equipment for recording and feeding the line directly from the signal.

The metering circuit is a v.t.v.m. type, being switched to read input level, output level, and bias level. A zeroing adjust is provided to correct for tube and other possible variants. The circuit is heavily damped and is designed to approximate the action of a standard vu meter with some added sensitivity to short peaks.

Construction of the amplifier is on a steel chassis with full access to all components when the back dust cover is removed. Some of the adjustments include: meter adjust, erase balance, noise null, bias level, and playback treble equalization.

The equipment is designed so that it may be easily transferred from relay racks to portable cases. The backs of the cases are demountable and provide full access to the recorder from the rear. Operation may be either vertical or horizontal with no modification required. —30—

International Short-Wave

(*Continued from page* 141)

heard on 6.250V by Balbi, Calif., *after* 0200 and at 0800. Ido, Japan, informs *Radio Australia* that Pyongyang announces use of 1800 kc., 970 kc., 4.400, and 6.250.

Northern Rhodesia—By this time, the Central Broadcasting Station, Lusaka, will have changed schedules to be on the air 0700-1400 *daily;* frequencies are 3.914, 7.220; programs in *English* are weekdays 1300-1400, Sundays 0700-1400.

Norway—LLS, 7.210, Oslo, is heard in Britain around 1015-1100 when is obliterated by BBC's European Service signing on; carries Home Service programs. (Pearce, England) Noted Sundays over 15.17A at 1215-1224 with weekly *English* session *("Norway This Week");* good level in Ky. (Alcock)

Panama—H050, 5.995, *Radio Programas Continental,* noted from around 1500 to 2200 when QRN took over; fair level; all-Spanish. (Saylor, Va.) HOLA, 9.505, Colon, heard with popular music 1609. (Cox, Dela.) HOJA, 9.645, Chitre, has fair to good signal *after* 2100 when USA station on 9.650 signs off; announces "Radio Provincias, La Voz de Chitre." (Seese, Va.)

Peru—OAX4T, 9.562, Lima, noted signing on 0655 with trumpet fanfare; had music, then news in Spanish 0710; excellent level at sign-on but began to fade *after* 0725 although was still audible to 0800. (West, Va.) Cushen, N. Z., says OAX4Z, 6.082, and OAX4T, 9.562, sign off 2400 on weekdays, at 0055 Sundays although sometimes the last 55 minutes is on 6.082 only. (WRH)

Radio San Christobal, listed OAX4S, Lima, is being heard in Brazil around 6.380-6.550, varying day by day; soon will open a *new* outlet in the 25-m. band. (Serrano, via WRH)

Radio America, OAX4W, 9.405A, noted with news in Spanish 2155-2200; good level. (Niblack, Ind.)

Philippines—Schedule from the Far East Broadcasting Co., "The Call of the Orient." Manila lists DZH8, 15.3, DZH7, 9.73, DZH6, 6.03, DZB2, 3.32, and DZAS, 680 kc., as scheduled 1600-0100, 0300-1200; lists news for 1830, 0000, 0500, 0730 on Mon.-Sat. Also operates over DZH9, 11.855, although this was not listed in schedule received. (Kary, Pa.) DZH9, 11.855, noted at fair level 1010-1025 with religious program and news. (Lane, Wyo.) *Radio Free Asia* relays are heard over DZ15, 11.940 (*measured* 11.938) from 0700; announces DZI4, 6.110, in parallel. (MacDonald, Korea) Closes 0920.

DZH5, *"The Voice of the Catholic Philippines,"* Manila, verified with nice QSL card via airmail; lists DZST, 860 kc., 1 kw., and DZH5, 9.690, 0.25 kw.; QRA is University of Santo Tomas, Manila. DYH4 sent schedule of 0500-0830 daily on 6.055, 0.25 kw.; QRA is Silliman University, Negros Oriental, Dumaguete City, Philippines; has VOA *"Stamp Club"* program Wednesdays 0730-0745; on Sundays 0515-0600, Tue., Thurs., Sat. 0630-0715 has Visayan programs; all other sessions are *English.* (Casey, Ky.) DZH5, 9.690, is heard in Australia at good strength *after* BFEBS, Singapore, closes on this channel 0745. (Gillett, Australia)

Saudi-Arabia—A Belfast, Ireland, DX-er has heard the rarely-reported 3.950 outlet of Djeddah to sign-off 1330, and once was surprised to find the signal S7-9 around 1310; this channel is intended only for reception in the Southern Red Sea Coastal Area. (*Radio Amateur,* London) The 9.645 outlet is good strength from 1030 in Japan. (Ido, via Radio Australia)

Djeddah, 11.850, noted recently signing on in Arabic around 2300 with 8-note interval on wind instrument. (Niblack, Ind.) Was heard recently by Bellington, N. Y., on a *new* channel of 7.245A opening 2249 with 8-note interval signal followed at 2251 by usual

CORRECTING OSCILLOSCOPE NONLINEARITY

By RUFUS P. TURNER, K6AI

HORIZONTAL nonlinearity is a common and annoying trouble in oscilloscopes that have been in use for some time. It shows up as crowding (compression) of the pattern in one half of the screen, usually the right-hand half.

The sweep oscillator invariably is blamed, but often replacement of the sweep tube does not correct the fault. The trouble will be found to be nonlinearity in the horizontal amplifier. Check the amplifier tube(s) and replace if necessary. But the cause usually is a large shift in the value of plate, screen, or cathode resistors. Replace either one of these resistors showing a variation of 10% or more from its rated value. Check coupling and bypass condensers for leakage.

Vertical nonlinearity also may show up, but it is not the obvious attention arouser that horizontal nonlinearity is. Both horizontal and vertical channels of an oscilloscope should be checked carefully for nonlinearity at frequent intervals. The following procedure is recommended: (1) Switch-off the internal sweep. (2) Set both horizontal and vertical gain controls to zero. (3) Position the spot in the center of the screen. (4) Apply a sine-wave signal to the horizontal amplifier input terminals. 60 cycles will do. (5) Slowly advance the horizontal gain control, observing the line trace that grows out simultaneously to the right and left of the original center-screen spot. (6) The growth of this line should be equal in both directions as the gain control is advanced. If one side moves out faster than the other, the amplifier is nonlinear. The vertical channel is checked similarly by applying the sine-wave signal to the vertical amplifier input terminals and noting growth of the line trace up and down as the vertical gain control is advanced. As before, the internal sweep is switched-off, and the horizontal gain control is kept at zero.

—30—

march; uses Arabic. Also heard by Kary, Pa., who believes may be as high as 7.250; noted with closing announcements 2337 and leaving the air 2339 after march.

Seychelles—In response to a query as to the existence of a broadcasting station in the Seychelles, Kary, Pa., has received this information from W. D. Gregg, Director of the Education Department, Victoria, Seychelles—"There is a small broadcasting station here in Seychelles. The programs are arranged by my Department and the technical services are performed by Messrs. *Cable and Wireless Ltd.* It is probable that some changes will take place in the near future regarding the times of broadcast, but at present these take place between 1000-1100 on Wednesdays and between 0900-1000 on Sundays, News bulletins *(English)* and local announcements (French) generally take place at the half-hour. Frequency is 5.770, output 100-130 watts. We shall be interested to learn if you manage to pick us up from the USA, but our effective range is not considered to be more than 600 miles except under freak conditions."

South Africa—SABC's "Calling South Africa" session noted on 11.937 with news 1200, weather 1210, sports roundup 1215; some days has news in Afrikaans instead of *English* 1200. (Pearce, England) Should run to 1505A.

Spain—Radio Juventud de Murcia has *moved* from 7.310 to 7.275 where it suffers strong QRM from Tangier on 7.270 although still radiates strong signal; noted to 1908 sign-off on Sundays; other days closes earlier. Malaga, 7.022, signs off 1830A. (Kary, Pa.) *La Voz de Falange,* 7.380, is fair level some days to 1900 sign-off. (Saylor, Va.) *Radio S.E.U.,* 7.090A, noted recently to 1725 with youth program in Spanish. (Kary, Pa.) Madrid, 15.625, noted from tuning 1148 to 1153 close-down of program to Canary Islands. (Ferguson, N. C.) *Madrid Radio,* 9.363, recently *announced* that a *new* 400-watt short-wave transmitter is soon to be constructed in Barcelona. (Faivre, Fla.) *Radio Juventud de Sabadell* has been noted in Britain with good signals on 7.155 and later on 7.140 afternoons *(EST).*

(Continued on page 150)

Spanish Guinea—Radio Sweden relates that *Radio Santa Isabel,* 7.200, was heard by a DX-er in Lagos, Nigeria, at 0813; is scheduled 0130-0230, 0700-0900, 1200-1400, but no transmissions have been reported logged on Sundays.

Surinam—PZC, 15.405 (announced 5.752 in parallel) noted with *English* news 2030 on Saturdays mostly Caribbean news; gave QRA of P. O. Box 297, Paramaribo, Surinam; at 2045 had news in Spanish; Dutch program 2050; excellent signal. (West, Va.) Noted recently on 15.405 at 1530 when announced for station and for "Voice of America" and continued with VOA's "Sidney Lavin" recordings. (Ferguson, N. C.)

Is scheduled on 5.7575 and 15.405 Sundays 0645-1145, 1445-2105; Mon.-Sat. 0815-1045, 1545-2045. (Radio Sweden)

Switzerland—HER3, 6.165, Berne, noted 0130 with French news, music. (Sanderson, Australia) Berne noted on 11.715 at 0950-1010 with Home News in *English,* then press comments.

Syria—Radio Damascus, 11.914A, sometimes can be identified by "Ici Damas" at 1600 but signal is seldom strong enough to come through HCJB, 11.915. (Niblack, Ind.) Is heard in Britain closing French session 1630, then in *English* with news 1715, closing down 1730. (Pearce) Damascus was heard recently signing on 2100 on 7.145; news in French 2200, then recorded music; had time pips 2200; much CWQRM and phone QRM.

Taiwan—Present schedule of "The Voice of Free China," Taipeh, is 1730-2300 to Japan, Korea, Malaya, China over 7.130, 11.735 (1735 Japanese, 1800 Korean, 1945 Malayan, "The Fatherland Is Calling" at 2050 and 2250); 2300-2400 *English* to USA on 11.735, 15.235 with news 2305; at 1100-1200 has dictation speed news in Chinese over 11.735 for China; 1400-1600 for Europe and Near East over 11.920 with *English* 1420, French 1450. (WRH) QRA for this one is 53, Ren Ai Road, Section 3, Taipeh, Taiwan, China. (ISWC, London) Noted on 11.735 around 0625-0655 recently in Chinese; frequency was *measured.* (Ferguson, N. C.) BED26, 10.080, noted 0430 with Chinese news, then Western music; BED32, 9.775A heard 0630 with Chinese news, music. The 7.130 outlet noted 0430 with Chinese news, then Western music. (Sanderson, Australia)

Thailand—Bangkok on 6.240 and 11.910 opens 0500 with recorded music and announcements in *English;* news 0515-0525; *English* ends 0630 but continues with native session. (WRH, others) Heard well in Australia. (Sanderson) Noted by Balbi, Calif., on 6.24 in parallel with 7.10A at fair level 0800 in native program; still audible 0915.

Uruguay—CXA19, 11.835, Montevideo, noted 1948-2010 with news and music; all-Spanish. (Lane, Wyoming) Noted with identification 1715 in *English* and French. (Pelland, R. I.) Heard in Britain 1915 with organ music. (Catch)

USI (Indonesia)—"Voice of Indonesia," YDF7, 11.77, noted signing on broadcast for Europe and New Zealand 1400, news 1415; closed 1500; R8 on 11.77, R7 on 15.15 in parallel. YDC, 15.15, noted with news 1000 during 0930-1030 beam to India. (Pearce, England) YDF, 6.045, Djakarta, noted with announcement 0645, then popular recordings; also heard 0725-0800. (Lane, Wyo.) A station heard on 6.045 around 1815-1845 fade-out with Indonesian program is believed Djakarta. (Kary, Pa.)

WRH lists this schedule for the Sumatra stations of *Radio Republic Indonesia*—Padang, YDL2, 2.320. YDL, 3.960, 1828-2030, 0030-0300, 0530-1130; Palembang, YDK, 4.855, 1800-2000, 2357-0215, 0500-1100; Kutaradja, YDN, 2.390, 1828-1945, 0525-1130; Bukittingi, YDM, 3.270, YDM2, 5.030, 1827-2030, 0030-0300, 0530-1130; Medan, YDP2, 3.350, YDP, 4.930, 1828-2030, 0030-0315, 0458-1130.

Vatican—HVJ, 11.685, noted signing on Spanish transmission 1630; heard with *English* session, *"Your Faith and Your Life"* 1315 on 9.55, 11.685, 15.120. (Pearce, England) At least on Sundays, HVJ is noted on 15.120 in parallel with 11.685 to Central Europe 1245. (Kary, Pa.) Noted on 11.74 with *English* 1315. (Bellington, N. Y., others)

Venezuela—Caracas, 4.92, noted 2200 in Spanish, strong level. (Scheiner, N. J., others) *Radiodifusora Nacional,* 6.170, noted Sundays to 2230 sign-off; 9.640 is in parallel; calls are given as YVKO, 6.170, and YVFC, 9.640. The Venezuelan on 4.850 is Barquisimeto. (Stark, Texas) YVKM, 5.040, noted 0615 with good signal in musical program and Spanish news. (Sanderson, Australia) YVLA, 4.780, San Cristobal, is scheduled 0530-2230; YVOC, 3.550, and YVNB, 4.820, operate 0630-2230. (WRH)

Yugoslavia—Radio Yugoslavia is widely reported on 15.240A (announces 15.240) with news 1100, 1315, 1645; is *new* 100 kw. transmitter; the low-powered 6.100 station parallels. Hord, Ind., says is heard with good level in Indiana.

* * *

Press Time Flashes

SBO, 6.065, Stockholm, Sweden, becomes audible nightly around 1650 with recorded music to closedown, varying 1737-1740; has DX program Fridays 1730; fair signal but with interference from CFRX, 6.070, Toronto, Ontario, Canada. (Kary, Pa.)

Radio Free Europe was noted recently on a *new* channel of 10.30A around 1715 in a Balkan tongue; strong signal with some CWQRM. (Bellington, N. Y.)

Pearce, England, recently noted a Spanish-speaking station on 7.530A with popular songs, music, man and woman announcers, when tuned 1645; clock chimed at 1700; appears to be a Spanish Nationalist station; tuned another day at 1530 when had recordings; appeared to say *"Radio Menorca,"* relay of Madrid 1545.

HLKA, 7.935A, Pusan, South Korea,

was noted weak with flutter QSB recently 0600-0613 with what appeared to be news broadcast in Korean; male announcer; had martial tune 0615, then speech again by man; announced in *English* 0615 as "Korean Broadcasting System." (Kary, Pa.)

Radio Pakistan now has a *new* verification card; gives calls for these channels—APK2, 5.990, 7.096, 9.645; APK3, 11.674, 15.620. (ISWC, London)

According to an announcement by *Radio Sweden,* the Norwegian Technical School transmitter at Tromsoe is now testing on 11.850, 7.240 with 400 watts, for a half hour after Oslo leaves those channels 1800. (Kary, Pa.)

Gade-Joergensen, Denmark, sends this current schedule for the Danish State Radio—1730-1830 (Mon., Wed., Fri.) over OZF, 9.52, 1830-1850 (Mon., Wed., Fri.) over OZF, 9.52 for Danish ships in South American waters; 1900-2000 (daily) for Greenland over OZF, 9.52, 2000-2020 (Mon., Wed., Fri.) for Danish ships over OZF, 9.52, 2030-2130

A CARRIER-CURRENT TRANSMITTER

By GEORGE R. ANGLADO

HERE'S a simple carrier-current transmitter that can be used for either phone or c.w. operation. I have had good results with this transmitter—the phone or c.w. signals being consistent for over two miles.

The unit can be constructed from "junk box" parts which can be found in most ham shacks. The circuit uses a 6L6 as the oscillator, being modulated for phone transmission by a 6V6.

A 6J5 is used as a speech amplifier and can be worked with a crystal, dynamic, or carbon mike. Although the author uses a dynamic mike, the proper hookup for a carbon type is also given in the circuit diagram. Note that with a carbon mike no batteries are needed. The necessary excitation voltage is obtained from a tap on the 6V6 modulator cathode resistor.

The oscillator coil, L_1, is an old 175 kc. i.f. transformer with one of the windings removed and replaced with 100 turns of No. 30 d.c.c. wire scramble-wound. This is the tickler winding, L_2. The output coil, L_3, is 10 turns of No. 20 d.c.c. wire wound around the tickler. The frequency is set by tuning condenser C_6 which can be either the standard type or a trimmer. Capacity is from 15 to 250 $\mu\mu$fd.

T_1 is a modulation transformer and the condensers used in the line are 1000 volt micas.

For best operation the output coil is adjusted so that the oscillator draws about 70 ma. with 300 volts on its plate. For c.w. operation, the modulation switch is opened, disconnecting the plate supply from the speech amplifier, and a key inserted in the closed-circuit jack in the oscillator cathode lead.

A three-pole, two-position switch opens the receiver's "B-minus" lead, closes the transmitter's "B-minus," and connects the pickup coil to the line. For receiving the connections are reversed.

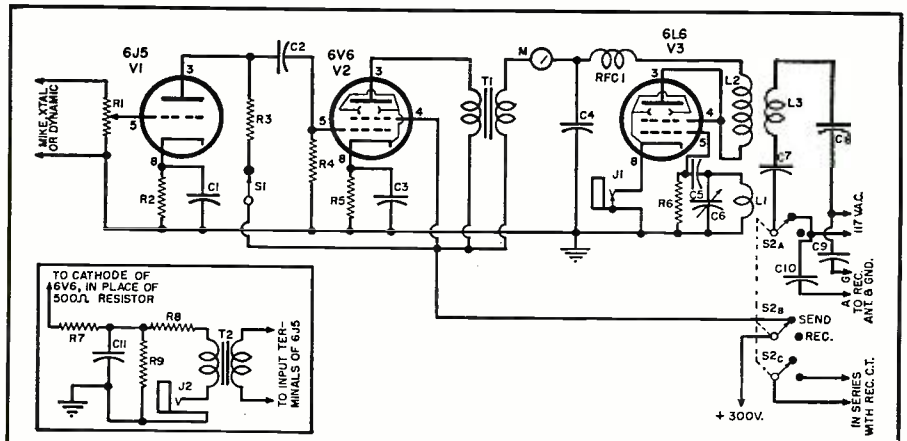
The author operated these transmitters on 190 kc., the tuning being accomplished by means of C_6.

To make sure the signal is properly loaded to the line, adjust the output coil L_3. Adjust this coil until the meter reads 70 ma.—no more or no less. This indicates that the oscillator is putting out all it has. Be sure there is 300 volts on the plate when making this adjustment.

Hallicrafter's marine units were used as receivers for the two-way communication.

—30—

Complete schematic diagram covering the simple carrier-current transmitter.



R_1—500,000 ohm pot.
R_2—1000 ohm, ½ w. res.
R_3—50,000 ohm, ½ w. res.
R_4—470,000 ohm, ½ w. res.
R_5—500 ohm, 5 w. wirewound res.
R_6—100,000 ohm, ½ w. res.
R_7—200 ohm, 1 w. res.
R_8—30 ohm, 1 w. res.
R_9—300 ohm, 1 w. res.
C_1—25 μfd., 25 v. elec. cond.
C_2—.01 μfd., 400 v. cond.
C_3, C_{11}—10 μfd., 25 v. elec. cond.
C_4, C_5—.005 μfd., 600 v. cond.
C_6—15-250 $\mu\mu$fd. trimmer cond. (see text)
C_7, C_8, C_9, C_{10}—.25 μfd., 1000 v. cond.
S_1—S.p.s.t. switch ("Modulation Switch")
S_2—3-pole, 2-pos. switch
T_1—15 w. modulation trans. 5000 ohm pri., 4300 ohm sec. (Stancor A3891 or equiv.)
T_2—Single button carbon mike trans.
RFC_1—2.5 mhy. choke
M—0-100 ma. d.c. meter
J_1—Closed circuit key jack
J_2—Mike jack
L_1, L_2, L_3—See text
V_1—6J5 tube
V_2—6V6 tube
V_3—6L6 tube

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P-6410 — Electrostatically shielded isolation transformer designed for servicing small receivers, amplifiers and test equipment, 50-60 cycle. Conservatively rated at 50 watts.

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P-8171—Power transformer replacement for Air King part A10109. Plate supply 375-0-375 AC volts, 225 DCMA. rect. fil. 5V. at 3 amps. Other filaments 6.3 at 2.0 and 6.3 at 9.0.

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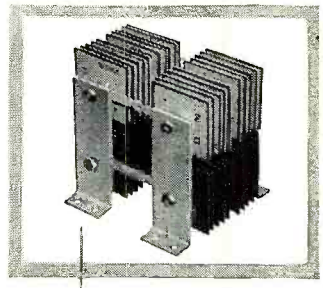

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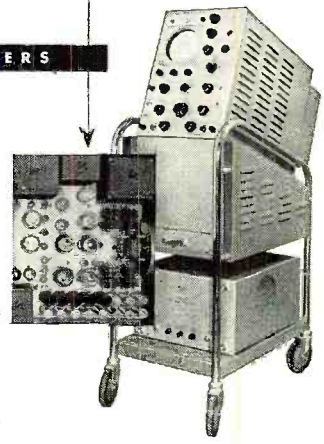

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Radio Carve, 6.155, Montevideo, Uruguay, noted signing off around 2155. *Radio Guanacaste,* Costa Rica, noted on 6.200 signing off 2300; probably is TIMC, Heredia.

Flashes received at press time from Cushen, N. Z., include these—The central African colony of Uganda is to have a new short-wave and medium-wave service; the medium-wave transmitter will be 1 kw. and will be located at Entebbe, with coverage of that town and possibly Kampala; the short-wave transmitter, using 7.5 kw., will give complete coverage of Uganda and is expected to operate in the vicinity of 4.000 in the Tropical Band; the station—being built under the supervision of BBC engineers—will be completed in about a year. *Radio Malaya,* Kuala Lumpur, using new equipment and broadcasting from a transmitter site at Kajang, nine miles from Kuala Lumpur, has 5 kw., and is beamed north and south on 6.025 (has news 0625); two *new* 10 kw. broadcast-band transmitters are now in service—on 675 kc. with *English* and on 695 kc. with Chinese—both sign off 1030 except that the *English* outlet continues to 1100 Sats. The University of Istanbul, Turkey, 7.080, is heard daily 1330-1500 with fair strength; has been heard at closedown with *English* announcements, acknowledging reports from Australian and New Zealand listeners; signs with Mozart's "Turkish March." Says Sarawak is to operate regularly on short-wave shortly, and already has been heard by Edwin Knewstubb while off Singapore, Ma-

(*Continued on page* 156)

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laya, on "M.V. Ettrickbank," radiating on 7.210 on Sats. 0100 with race results; location is Jesselton or Kuching; signals were only fair with poor modulation. *Radio Ceylon* has announced that by now the beam to India from 2045 would be on 11.975 instead of 15.120; the schedule was to be 2045-0230 on 11.975; 0415-0615 on 9.520; 0630-1200 on 11.975. A complete list of *Radio New Zealand* channels allocated is—ZL6, 6.080; ZL11, 6.130; ZL12, 7.220; ZL13, 7.290; ZL18, 9.520; ZL2, 9.540; ZL8, 9.620; ZL3, 11.780; ZL9, 11.810; ZL10, 15.220; ZL4, 15.280; ZL5, 17.770; ZL14, 17.820; ZL15, 21.480; ZL16, 21.580; ZL6, 25.800; ZL17, 26.000. *Radio France-Asie,* Saigon, Indo-China (Vietnam), is fair on 6.115 to sign-off 0610 after French session.

Balbi, Calif., recently noted *Radio Dakar,* Fr. West Africa, on 9.56 signing on 0200 to 0315 sign-off, in native, but with announcements in French; fair level. He confirms *Radio Noumea,* New Caledonia, is now on 6.000 (moved from 6.03A), heard 0215 with bad CWQRM, but with over-all signal about the same as when was on former channel. Reports Moscow on 9.66 and 9.545 in *English,* strong signals 0100-0200.

The Russian clandestine station on 7.700A has been heard in Sweden 2230 broadcasting in the Russian language. (Radio Sweden)

Radio Peking, Central People's Broadcasting Station, No. 3, Hsi Ch'ang An Chieh, Peking, China, sent this schedule — Japanese 1530-1600, 6.100, 10.260, 15.060; Korean 1600-1630, 6.100; *English* 1730-1800, 11.690, 15.060; Indonesian 1800-1830, 11.690, 15.060; Vietnamese 1830-1900, 11.690, 15.060; Thai 1900-1930, 11.690, 15.060; Ke-Chai Dialect 1930-1945, 11.690, 15.060; Amoy Dialect 1945-2000, 11.690, 15.060; Burmese 2000-2030, 11.690, 15.060; Cantonese Dialect 2030-2045, 11.690, 15.060; Chaochou Dialect 2045-2100, 11.690, 15.060; Mongolian 0330-0400, 6.100, 7.500, 10.260, 15.170; *English* 0400-0430, 6.100, 9.040, 10.260, 11.690, 15.060, 15.170; Korean 0430-0500, 11.690, 15.060; Amoy Dialect 0500-0530, 11.690, 15.060; Indonesian 0530-0600, 11.690, 15.060; Japanese 0600-0630, 11.690, 15.060; Cantonese Dialect 0630-0700, 11.690, 15.060; Vietnamese 0730-0800, 11.690, 15.060; Standard Chinese 0800-0830, 6.100, 7.500, 9.040, 10.260, 11.690, 15.060, 15.170; *English* 0830-0900, 11.690, 15.060; Thai 0900-0930, 11.690, 15.060; Chaochou Dialect 0930-1000, 11.690, 15.060; Burmese 1000-1030, 11.690, 15.060. (Oskay, N. J.)

A correspondent for a British newspaper recently wrote from Berlin: "Plans for a new 5,000,000-pound (British Sterling) broadcasting station, transmitting in half a dozen languages—including *English*—are being worked out in secret in Bonn by West German Government officials. It will enable Germany to beam propaganda broadcasts all over the world, for the first time since the Goebbels-run Nazi propaganda stations were closed down at the end of the war. An official said

today, 'The aim is to give Germany back an international voice, which is powerful enough to be heard all over the world.' One of the propaganda 'backroom boys' behind the plan is Dr. Wilhelm Scheidt, who wrote Hitler's war diaries in the Fuhrer's headquarters during the war, and is now in the Bonn Government's propaganda section." (Catch, England)

WRH lists these schedules for some of the Indo-China (Vietnam) stations —*Radio Hanoi,* 6.165, 1800-1805 national anthem and announcements, 1805-1820 news in French, 1820-1900 Vietnamese, 2345-2400 news in French, 0530-0545 European music in *English,* 0545-0600 news in *English* (Sundays 0530-0600 *English by Radio*), 0700-0725 news in French, 0800-0900 European music. *Radio Dalat,* 7.265, 0550-0630 music, 0630-0700 news in French (Sat. only). *Radio Hue,* 7.205, 0530-0615 Vietnamese music, 0630-0715 news in French followed by European music.

WRH lists experimental stations in Thailand as HS1JS, Thai Army Signal Corps, Bangkok, 4.875, 0.5 kw., and 6.000, 0.3 kw.; HSE2, Territorial Department, Bangkok. 6.175, 0.2 kw., and HSU20, Thai Royal Air Force, Den Muang, 6.035, 0.2 kw.

* * *

Acknowledgment

Thanks for the increasing number of FB reports; sorry that space limitations this month prevented use of more of them; but keep them coming to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA. Good listening, fellows and gals! . . . . . K.R.B.

Disc Recorder

(*Continued from page* 40)

5x7 PM type with heavy duty magnet and 3.2 ohm voice coil. Since this is an RTMA standard, it is practical to include the cutter in this circuit—in which case the value of R, in parallel with M_c, is 10 ohms. Considering that high frequency response of a magnetic cutter is partially governed by the ratio of its impedence to R, it is essential that the value of R should be equal to M_c, or slightly higher—but in no case to exceed twice the value of M_c in ohms. It is also well to note that the impedance of the magnetic cutter's input source has a marked effect on its high frequency response; thus, if greater pre-emphasis is desired, the cutter may be connected to the 16 ohm secondary tap—or even to as high as 60 ohms for maximum emphasis! Needless to say, this would be an extreme case where normal procedure had failed to register satisfactory highs. It must be remembered, too, that the higher the impedance used in the output's secondary, the more power must be available at the amplifier to give the same working voltage across the cutter.

Correct values may be determined for any speaker circuit impedance by Ohm's law, if impedance factors at 400 cps are considered as pure d.c. resistance. The 400-cycle impedance of a magnetic cutter, however, will be approximately 2½ times its d.c. resistance, whereas the 400-cycle impedance of a speaker voice coil will be only 1¼ times its d.c. resistance. Thus, in computing values for R, the cutter has effectively 4 ohms d.c. In connecting M_c to a higher impedance source (16 ohms, or greater), R may be eliminated from the circuit entirely.

Incidentally, the M-41 employs a strong *Alnico* magnet with pole pieces of high permability steel, rendering it absolutely free from saturation distortion. Its coil winding has a sensitivity of .6 volt-ampere, and any change of this sensitivity effects a corresponding change in the frequency response of the unit.

A NE-51 neon bulb is used to indicate correct cutting voltage during recording, and since this voltage is of prime importance, accurate adjustment of the 1-megohm control is highly essential. Cutting too heavily is a common tendency among beginners, but careful adjustment of the indicator is the best insurance against this fault. Such adjustment should be made with a good, high-resistance voltmeter across the cutter, and a phono pickup or other source feeding the amplifier.

Since satisfactory operation requires

a power level of approximately ¼ watt, this represents a voltage of 1.58 across M_c, and for standard groove cuttings, the indicator should be adjusted to blink on 1½ volt peaks. For 160-line fine groove recordings, this voltage must be reduced by 25% to prevent over-modulation and subsequent breakdown of the delicate groove walls. This will, of course, necessitate slightly higher gain in playback, but this is of little consequence in view of the high-output crystal pickups commonly used in modern phono systems.

It will be noticed that the function of blocking condensers C_1 and C_2 is to pass only a.c., or signal voltage, and it is most important that they be of proven quality, since any d.c. voltage in the indicator circuit would render it worthless.

Proper connections for the *Astatic* X-26 or X-29A are shown in Fig. 6C. Here again the blocking condensers are of critical importance, for in this instance, they not only feed the audio frequency voltage to the indicator for determining correct cutting volume, but also pass these impulses to the cutter.

As mentioned, the crystal cutter works right into the plate circuit of the output tubes. It is a high-impedance unit (70,000 ohms), and requires from 125 to 150 volts for normal operation. Characteristic approach to commercial recordings is obtained with a 50,000 ohm, 1 watt resistor at R_1, in series with the cutter, and any desired accentuation of high frequencies may be obtained simply by bypassing R_1 with a paper condenser, C_x connected at S_1. It may be of any value from .001 μfd. to .01 μfd., depending upon the frequency emphasis desired, and remembering that the greater the capacity, the greater the pre-emphasis on highs. This boosting of highs is especially important while recording at slow speeds. If, on the other hand, more pronounced low frequencies should be desired, R_1 may be varied upward, even to as much as ¼ megohm.

Crystal response at normal room temperature is substantially flat below 250 cps with constant voltage across the cutter, but at that point it begins to rise with frequency increase, hence the 50,000 ohm resistor in series, as indicated, tends to equalize the recorded level curve. Still higher values at R_1 will flatten the curve still more, or even slope it upward at the low frequency end, but general practice favors a value of 50,000 ohms.

Since a crystal cutter is not used in the output transformer secondary along with the playback speaker, a 3-position switch, S_{1a}, is used to disconnect the speaker while recording, at the same time placing R_x across the secondary in order that proper loading be reflected back to the output plates. In its center position, S_{1a} eliminates both speaker and resistor, leaving J_3 free for external speaker connection.

If at any time speaker monitoring is required while recording from a radio tuner or similar input other than

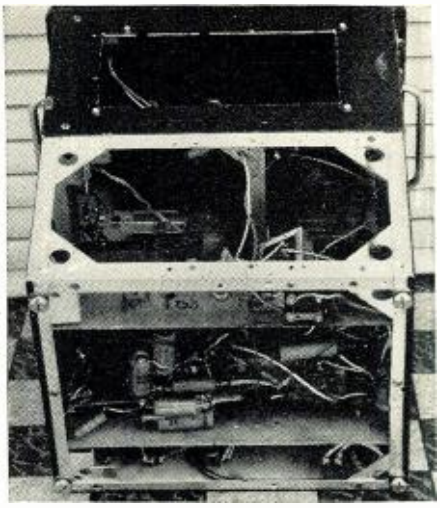


Fig. 7. Bottom and back sections of recorder showing ventilator panels removed. Note 2" air space between chassis and case both front and rear. This facilitates wiring, incidental adjustments, and provides additional ventilation. Case is in two sections bolted together at center braces on frame.

microphone, it is quite simple to use "L-pad" type attenuation in the voice coil lead. This is accomplished with two fixed resistors: 10 ohms in series, and 4.5 ohms in parallel with the voice coil, thus providing attenuation of 12 db below recording level—which is wholly adequate for monitoring purposes. For the most part, no monitoring will be found necessary.

Adjustment of the level indicator is made with a voltmeter across the cutter, but for the crystal unit, peaks of 125 volts were found to be most satisfactory on standard cuttings, while this voltage must be reduced 25% for microgrooves. Manufacturer's specifications for the X-26 and X-29A are listed tentatively at 150 volts r.m.s., but variations for individual working conditions are usually in order. A few trial cuttings will serve as a basis for determining correct modulation, since many variable factors must be considered. Even the disc coatings must not be discounted in the final micro-adjustment necessary for top quality recordings, since a hard material offers more resistance to the cutting stylus than a softer one.

Mechanical Adjustments

Uniform quality in disc cutting requires only a few mechanical adjustments, but these are of utmost importance, and should be given most careful consideration before any initial tryouts. All basic adjustments are the same, regardless of the assembly used, and the instructions which follow apply to either unit.

Most important, perhaps, is the depth of cut adjustment, which regulates the "bite" taken by the cutting stylus as it pierces the coating material on the disc. This setting determines the size and, to some degree, the shape of the finished groove, both being highly important, since a clean groove of proper depth not only insures quiet tracking for playback, but also provides snug

contact with the pickup needle's radius so that the delicate modulation pattern is faithfully reproduced.

This depth of cut is regulated by a sunken screw adjustment, conveniently located on top of the recording arm. As a general rule, only a few turns—two or three at the most—will serve to vary the spring assembly for proper cutting tension. A test run of several grooves is the only practical means of determining the exact setting for this adjustment.

A good rule to follow is to effect such adjustment as will produce a 1:1 ratio, *i. e.,* depth and width of the groove to equal the depth and width of "land," or uncut portion on the disc's surface. A fine, hair-like thread will trickle from the cutting stylus as the disc spins during recording, and the operator will soon be able to pass unerring judgment on his depth setting merely by an occasional inspection of this chip. A small tester, or magnifying glass, is also invaluable for close examination of size, spacing, and depth of the various groove formations. A disc, properly cut, will retain most of its glossy sheen when held at a diagonal to the light, whereas a disc that has been over-cut will present a dull, lackluster appearance. Similarly, a shallow cut will appear too glossy, with its lines very thinly etched and scarcely noticeable.

It must not be assumed that once proper adjustment is obtained, no further attention is necessary, for such is not the case. In fact, any change of brand in the discs used will invariably necessitate some minor change in cutting tension, since various coating materials possess entirely different characteristics and degrees of hardness, which means that corresponding variation of cutting tension will be needed to produce a given depth of cut. Thickness and type of base material must also be considered, in view of the fact that manufacturers' products vary from .020" to .100" in thickness for some types.

For general home-recording practice, it will be found highly expedient to select a standard brand of recording disc and then stick to it! Much experimenting, testing, and readjusting of equipment can thus be eliminated—not to mention the inevitable waste involved. The same applies to choice of cutting styli, and more detailed consideration of these items will be treated later.

Perhaps next in importance is the stylus angle adjustment, or in other words, the angle between the *cutting face* of the stylus and the *surface* of the recording blank, for upon this relationship rests the good reproductive quality of a groove cutting.

The stylus should cut at an almost 90 degree perpendicular for best overall quality. When this angle is greater than 90 degrees, the stylus is said to "lead," while less than the prescribed 90 degrees is called "lag." Usually, a slight lag is preferable, but should always be kept within 5 degrees of vertical for a hardened steel stylus,

and even less for sapphire or Stellite types. This is explained by the fact that most hardened steel varieties have a much broader cutting face than the more expensive types, and therefore have the tendency to take a larger bite at any given angle of adjustment. On the other hand, a saphhire has a very thin, V-shaped face and will operate quite satisfactorily at very near a 90 degree perpendicular.

A simple check of the stylus angle is made by placing the cutter on a disc in recording position and then sighting across the surface of the disc, at a low angle, in such a manner as to include the stylus shank and one side of the turntable shaft in a direct line of sight. Thus any departure from absolute vertical is easily detected in the stylus, and may be corrected by varying the recording arm's height.

A stop-screw is provided at the base of the arm for this purpose, and it follows, of course, that any variation of height at this point affects the angle at which a stylus will contact the recording surface. Sufficient adjustment is available at the stop-screw for correct alignment, provided a short-shank stylus, for which the equipment is designed, is used. It will be absolutely impossible, however, to obtain satisfactory alignment if a long-shank type is inserted in the chuck, and such substitution should never be attempted with this equipment.

Any further mechanical adjustment is purely incidental, insofar as the cutting assembly is concerned. It is now an accepted practice for stylus manufacturers to incorporate a "flat" or positioning surface on their products, so that the chuck screw automatically assures correct "set" of the cutting face when a new stylus is inserted. They also feature an included angle of approximately 87 degrees which causes the shaving to throw inward during the cutting process. This feature, together with the shaving collector supplied on the R-85L or R-90L, will make the thread-like cutting move inward and away from the head, so that no difficulty should be experienced from such accumulations. Bear in mind that they must be brushed occasionally toward the center spindle.

Blanks and Styli

A wide variety of both blanks and styli have been tested on the recorder described—popular commercial types ranging from the very cheapest to the

SWITCHING ARRANGEMENT FOR HI-FI

By JESSE L. MEREDITH, JR.

AFTER a long search and many building experiments looking for a suitable control unit for my Williamson amplifier, I have finally settled on the unit described in the article, "Front End Control Unit for Williamson Amplifier." (June 1952 issue of RADIO & TELEVISION NEWS.)

The combination works beautifully incorporating everything I wanted in one unit. However, a fly appeared in the ointment in the person of my spouse. During all my experiments she has voiced the same objections, "There are too many switches to turn on. You have to turn on the radio switch, you have to turn on the TV switch and turn off the radio, you have to turn on the phonograph switch, then you have to turn another switch (the Input) after you get all these turned on or off to hear anything. It's too complicated for me or anyone else except yourself." All of which is true. I want a home entertainment center that will give pleasure and not frustration. There should be just one "on and off" switch for everything. All the adjustment controls can be labelled plainly.

After considerable thought the obvious answer hit me. It's so simple as to be easily incorporated by anyone on his preamp unit. The addition of another rotary switch (by means of a flexible coupling shaft) to the input selector switch solves everything. The reason for the extension shaft is to make possible the external mounting of the a.c. switch on the rear of the chassis. Since one goes to so much trouble to keep hum and a.c. out of the unit, there is not much sense in tempting fate by bringing several a.c. lines inside again.

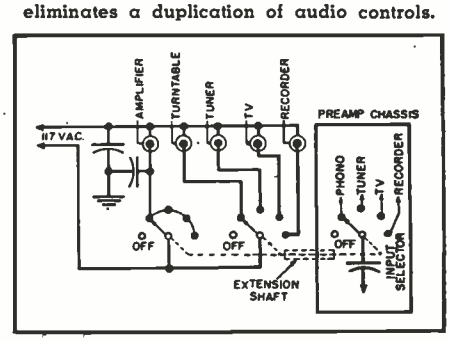
Perhaps the diagram of Fig. 1 will explain the idea a little more clearly.

As can be seen, the amplifier is on at all times, whereas the other units are only on as selected. By removing all "on-off" switches from the various units (TV, tuner, etc.) you eliminate the multiple a.c. switch arrangement. This might necessitate changing a few pots. to those without switches on them. Each unit is then plugged into its respective socket.

One switch now accomplishes the selection of the unit to be used as well as switching the audio. Now both my wife and the children can turn on "Arthur Godfrey" or "Beanie" without my assistance. We now have full enjoyment of high fidelity reproduction minus petty frustrations.

In regards to actual construction, the average builder has his own ideas on the matter so I will say little except to describe briefly my own. I used an octal plug from the chassis to the group of sockets to the preamp chassis connected by the switching cable to facilitate removal. The group of sockets was assembled on a "U" shaped piece of aluminum with two bypassing condensers to ground; these two serve for all the power transformers. —30—

Fig. 1. Author's switching arrangement that eliminates a duplication of audio controls.



very finest—and it must be said that over-all characteristics were found to be fundamentally the same, notwithstanding certain physical properties associated with individual brands, and a resulting necessity for minor readjustments in cutting technique.

In the case of blanks, for instance, it is readily understandable that a hard coating requires more tension on the cutter than a softer type for a specified depth of cut; on the other hand, the soft coating is less durable in playback, since minute frequency variations along its walls are unable to withstand repeated tracking of the pickup needle. Too hard a coating, however, tends to hamper frequency response, in view of excessive retarding action encountered by the stylus, and for this reason, a compromise seems to offer the most effective solution.

Most of the better quality recording blanks are available on a durable aluminum base of approximately .021" thickness, coated with a nitrate or cellulose material. Economy types with essentially the same coating are also supplied with a thinner aluminum base. While flexible and easy to warp, these will be found generally satisfactory in the smaller sizes—8" diameter, or under.

There are several fiber or composition base types available which are excellent for trial cuttings and experimental use at a minimum cost but, generally speaking, these are not recommended where top quality recordings are desired.

Cutting styli for home-recording are of three principal types: steel, Stellite, and sapphire, with both price and effective cutting life ranging upward in that order. Whereas a steel point must usually be discarded after cutting only a few discs, a good natural sapphire point gives good service for as long as 10 or 15 hours and may then be resharpened time and time again.

Stellite is a good middle-of-the-road choice for combined economy and moderately long life, but the operator will no doubt be quick to recognize the long range saving and peak performance of a sapphire as his best investment. Frequency capabilities are uniformly good on all three types, with the sapphire point quite naturally receiving first choice for top rendition.

For microgroove, or 160-line recording, a sapphire stylus is an essential rather than a luxury, since this involves extremely delicate cuttings and very close spacing of lines. The relatively broad cutting face of a steel type is definitely not practical for groove spacings in excess of 120 lines-per-inch.

For general purpose applications, the *Duotone* No. 12 sapphire cutting stylus, in combination with *Duotone's* "Red Label" nitrate-coated, aluminum-base discs, are recommended, since repeated tests under widely varying conditions during the original construction of this recorder have shown them to be of uniform quality and well-suited to home-recording equipment and procedure.

For additional economy, the com-

pany's "Purple Label" disc is also capable of excellent results, possessing the identical nitrate coating material of its "Red Label" companion, but on a very thin aluminum base, and therefore requiring careful manipulation, both in recording and playback, to prevent warping or other structural damage. Practically all types must be given special consideration during hot weather, as there is a marked tendency for the discs to soften and stick together. Upright storage is preferable, with slight interspacing for ventilation.

It will be readily understood, of course, that many good recording products are commercially available, and a conscientious appraisal of several leading brands will no doubt lead to some personal preference.

Making the Recording

The actual process of cutting a record is not only surprisingly simple, but highly fascinating as well. In fact, when one considers the popularity of disc recordings and the host of "platter" fans who go in for extensive collections of various disc types, it is indeed rather surprising that so few experimenters have taken an interest in the recording technique itself. The field is a varied one, and certainly offers unlimited possibilities—all of which are well within the grasp of any average audio fan who can wield a soldering iron and follow a conventional schematic!

Until proper "feel" of the equipment has brought a certain amount of self-assurance, a few trial grooves should always be made before attempting a full record, being careful to note the exact setting of gain controls as the proper cutting level is reached. Trial grooves should of course be made on a blank which is identical to the one to be used for the final recording, and this test disc may be saved for many additional spot-cuttings, it being quite naturally assumed that the operator plans eventually to standardize on one particular brand.

After selecting the speed desired (33⅓, 45, or 78), place a recording disc on the turntable so that the retractable drive pin (see Fig. 2) engages the extra disc hole to prevent slipping, and then very gently position the recording arm over the disc's outer edge, lowering the cutter until its follower spring meshes with the lead-screw underneath. Now let the stylus come to rest on the face of the disc, approximately ¼" from the edge.

In disc recording, it is usually deemed inadvisable for the cutter to rest on a disc or other hard surface while the turntable is not in motion, as any signal fed inadvertently to the recording head will cause intense vibration of the stylus, thereby ruining its delicate point, and likewise digging out a hole in the record. On this unit, however, such damage cannot occur, due to the positive "record-playback" arrangement provided by the dual function of S_{1A}-S_{1B}. Recording voltage is excluded from the cutter until the

turntable has been actually set in motion, at which time the working light comes on, the cutter is energized, and the entire recording process is at your finger tips.

For that professional touch, first allow the cutting head to make two or three silent grooves before advancing controls to get the program under way. This avoids any messy chopped or inarticulate beginnings, and likewise allows the motor-drive assembly to attain full efficiency at its given speed. The incoming signal, or program, should then be boosted immediately to full recording level and remain constant throughout the cutting, as any up-and-down variations from normal at the controls will introduce a very unpleasing effect during playback, necessitating similar up-and-down variations at the playback amplifier.

The indicator light should be monitored throughout the recording to make sure proper voltage is being applied to the cutter. If the volume level is too low, it will be necessary to increase the gain during playback to a point where surface noise will be highly objectionable. On the other hand, if the recording level is too high, frenzied action of the stylus may break down the delicate wall spacings between grooves, thus ruining the record.

Another disturbing result of overcutting is the introduction of "ghosts" and "echo" in the playback. These effects are said to be present when excessive volume and cutting depth have driven the stylus almost through its thin groove wall, so that during playback, traces of its impressions are picked up not only from the groove in which the playback needle is tracking, but from adjacent grooves, as well. Ghost effects are defined as being the sound images from a groove preceding the tracking groove, while echo effects are the images from a groove immediately following the one in which the playback needle is tracking. The remedy for such annoyances is simple and consists of proper adjustment of both cutting depth and recording level, as previously discussed.

As shavings trickle from the cutter, have a small camel's hair brush handy to assist the continuous thread toward the center. Under no circumstances should these chips be allowed to accumulate under the cutter since they may hamper free-floating action of the cutting head, and thereby alter its effective cutting tension in the middle of a recording.

If gently fed toward the center at the very beginning of a cut, the shaving will automatically throw toward the spindle; if it does throw in the opposite direction, the cutting face is improperly angled, and the stylus must be repositioned in the chuck. Since the purpose of the trial cutting is to detect such irregularities, a proper adjustment is assured before attempting the actual recording.

The small working light, a simple dime-store plug-in variety as may be seen in the illustration, is invaluable

for close scrutiny of the cutting process, since its beam is shielded from the operator's eye, and effectively concentrated within the area of disc and cutting arm. This lamp is controlled by the motor switch, so that it is turned on any time the turntable is set in motion.

At the end of the recording, gain controls should move immediately to the "off" position and a few silent rounds cut before terminating the groove. Gently brush to remove any residue from the freshly-cut grooves and the disc is complete!

It is advisable to apply a thin coating of some good commercial preservative to the delicate grooves as soon as the cutting is finished. Such a coating serves a double purpose: first, it seals the minute pattern of frequency impressions so that the playback needle is less inclined to wear them away; and, second, it practically eliminates the troublesome static effects so common with certain types of disc coating material.

Repeated testing has shown that best results are obtained with the input gain control (either mike or phono, as the case may be) set at its approximate half-way mark, and then varying the master control for correct volume level. Especially with respect to the phono input, this tends to safeguard against overloading the first stage, as, for instance, with a radio tuner or tape recorder, either of which might deliver considerable voltage to the recorder's input.

Recording procedure for this input is more or less self-explanatory, but a few suggestions pertinent to the mike channel may be helpful. Any standard high-impedance microphone may be used, but preferably one with an output of –50 db or higher. All fundamental rules for good microphone transmission apply here—with special emphasis on effective working distance and proper placement of the mike, itself, with respect to subject, acoustics, and incidental background noise.

For speech or vocals, 12 to 18 inches

ADAPTER FITS MIKE TO CAMERA TRIPOD

By ARTHUR TRAUFFER

WITH this easily-made adapter, your tripod does double duty—it can hold either a camera or a microphone.

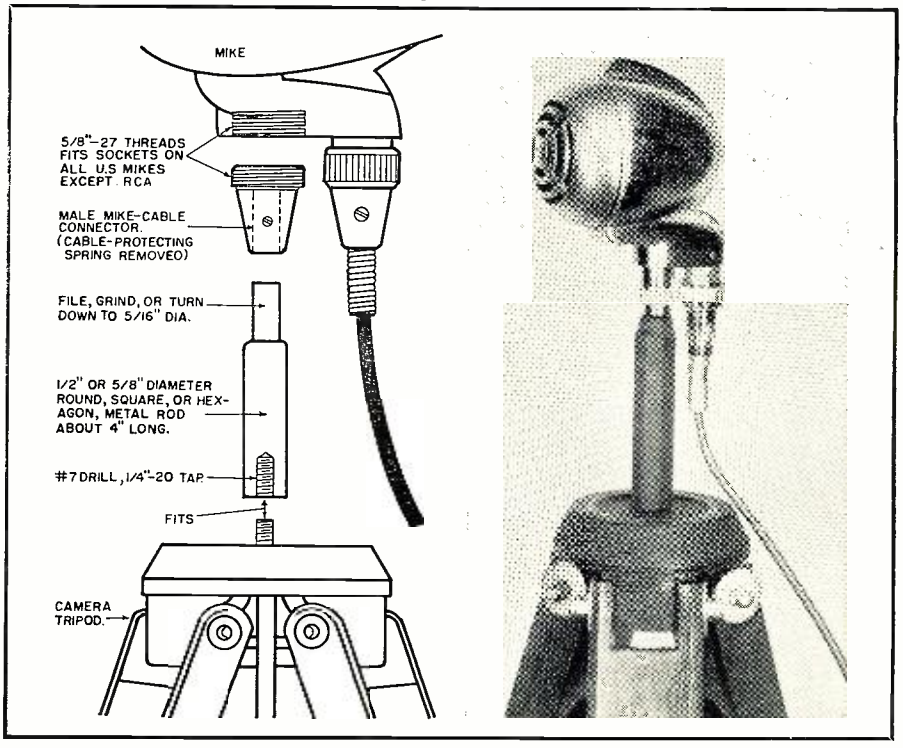
Obtain a 4" length of metal rod, ½" or ⅝" in diameter. The rod can be round, square, or hexagonal and of iron, brass, or aluminum. Using a No. 7 drill, bore a ¾"-deep hole in one end of the rod and thread the hole with a ¼"-20 tap, so the rod can be twisted onto the camera screw on the top of the camera tripod.

The other end of the rod is reduced to 5/16" diameter to receive a male microphone-cable connector from which the cable-protecting spring has been removed. The ⅝"-27 threads on the cable connector will fit the socket on all American-made microphones except RCA. This adapter can also be used as a handle when the microphone is hand held.

In making this adapter, the writer used a metal tool handle with a brown crackle enamel finish that matched the metal finish on the tripod. Had this not been available he would have used a piece of ordinary brass rod of the type obtainable in any hardware store.

—30—

(Left) Construction details for making the tripod adapter. (Right) Complete unit.



is considered good microphone approach, since closer working distance introduces objectionable lip sounds and sibilant effects, while greater distance tends to bring in extraneous background interferences, such as reverberations or tunnel-effects from walls and ceiling. Group performances, whether vocal or instrumental, should be arranged for balanced effect, with musical instruments being placed in strict accordance to their pitch or timbre characteristics.

Generally speaking, violins and other stringed instruments should come first, with reeds, trumpets, and associated basses falling well into the background. Group vocals should range in a compact semi-circle, approximately 3 feet from the mike, with soprano and tenor parts holding key positions, and baritone-bass combinations on each outer wing. Never handle the microphone during recording, and it is usually advisable to place its stand on sponge rubber, or similar resilient material, to absorb floor vibrations. A bit of experimenting will, of course, eventually prove to be the best instructor.

All in all, this recorder offers gratifying possibilities to any careful builder who is intent on obtaining disc cuttings of flawless quality, for it combines all of those desirable features which make the recording process a distinct pleasure, and yet its design reflects a rigid adherence to the all-important factor of budget economy!

The author acknowledges with thanks the valuable assistance and cooperation of *General Industries Co.* and *Astatic Corporation* in compiling technical data for this article.

—30—

ELIMINATING PARASITICS

By G. R. ANGLADO
Radio Technical Laboratories

THE type of parasitics that cause the most trouble in transmitter r.f. amplifiers is the unwanted oscillation which occurs in shunt-fed circuits in which the grid and plate chokes resonate, coupled through the tube's interelectrode capacity. This condition occurs with series-fed circuits.

The oscillation, being at a much lower frequency than the desired one, causes additional carriers to appear. These additional carriers are spaced from about 20 to a few hundred kilocycles.

One cure for this trouble is to change the type of feed in either the grid or plate circuit in order to eliminate one choke. Another cure is to use less inductance in the grid choke than in the plate choke, or to replace the grid choke with a wire-wound resistor if the grid is series fed. In a class C stage with grid-leak bias, no r.f. choke is required if the bias is series fed.

This type of parasitic is also found in push-pull circuits in which the tubes are effectively in parallel for the parasitics and hence the neutralization is not effective. The grids and plates can be hooked together without affecting the undesired oscillation. This is a simple test for this type of parasitic.

—30—

Use of additional Policalarm listening posts will prove as effective as they have for Fire Chief Van Zile of Barnard, New York who writes:

"Speed in mobilizing a volunteer fire department determines the efficiency of that department. Today, thanks to radio and 80 PR 9 radio receivers, we are able to alert our entire personnel, informing them of the exact location of the alarm, and in most cases a number of firemen are at the scene, waiting for the apparatus.

"The PR 9 receiver was selected for our department after several months of exhaustive testing of various makes, and I would highly recommend them to any department about to start on a similar program."

Radio Apparatus Corporation, 55 N. New Jersey St., Indianapolis 4.

Phone: Atlantic 1624.

31-5331

NEW EQUIPMENT FOR THE AUDIO TECHNICIAN

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.

NEW LOUDSPEAKER UNIT

Ultrasonic Corporation of 61 Rogers Street, Cambridge, Massachusetts is now in production on a new, low-priced, high-fidelity speaker which has been designated as the U-25.

Incorporating the *Baruch-Lang* Sys-

tem, the unit occupies only half a cubic foot (13" high, 19" wide, and 9¾" deep). A 2-watt input into its 4-ohm impedance will achieve full symphony power level in the average living room, according to the company.

The company will supply additional details on request.

HI-FI PLAYER

Introduced by *Califone Corporation,* 1041 North Sycamore Avenue, Hollywood 38, California, is a high-fidelity portable transcription player.

Model 10P2 features a variable reluctance cartridge for playing all types of recordings, including 16" transcriptions.

Equipped with a wrist-action pickup arm and adjustable needle pressure, the instrument includes an all-steel

player base and typewriter-style case for speaker baffling, along with a 6-watt straight a.c. amplifier.

The player features separate tone controls for adjusting treble and bass and a microphone input with a separate mixer control for blending voice with music from the turntable.

BRITISH LOUDSPEAKER

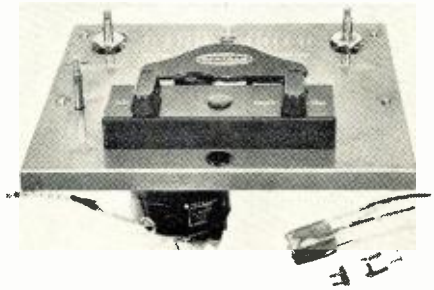
Beam Instruments Corporation, 350 Fifth Avenue, New York 1, N. Y., U. S. agents for *A. C. Barker, Ltd.,* British audio equipment manufacturer, announces the availability of a new, low-cost, high-fidelity loudspeaker.

Incorporating a patented design which features a dual drive, consisting of a light metal tube on which is wound a fine wire over a skin of latex and a cone impregnated with a cellulose, molded with logarithmically graded corrugations from apex to rim, the *Barker* "Duode" loudspeaker is suitable for high-fidelity enthusiasts and custom manufacturers.

For complete information write directly to the U. S. agent in New York.

MULTI-SPEED MECHANISM

A new tape mechanism for custom installations in high-fidelity systems, mounted in radio or television sets, or



joined to existing amplifiers and p.a. systems, has just been announced by the *Pentron Corporation,* 221 E. Cullerton Ave., Chicago, Illinois.

The instrument features two recording and playing speeds, super-speed forward and rewind which permits tape to run at high speed in either direction for spot location, and two heads consisting of one record and playback, and the other the a.c. erase.

The mechanism has a maximum playing time of two hours with a 7" reel, and is offered in two models: dual track or single track heads.

REVERE RECORDERS

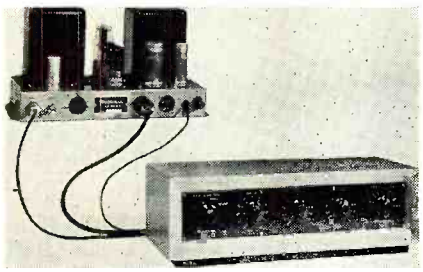
Two new tape recorders, with built-in radios, have just been released by the *Revere Camera Company,* 320 East 21st Street, Chicago 16, Illinois.

The new models are the TR-800, which features a two-hour play on a seven-inch reel at a speed of 3.75

inches-per-second, and studio Model TR-20 which has a speed of 7.50 inches-per-second for a one-hour play. The built-in radio in the TR-800 makes it possible for the owner to press a key to record any radio broadcast. When not being used for recording broadcasts, the radio may be used alone.

HI-FI AMPLIFIER

Waveforms, Inc., 333 Sixth Avenue, New York 14, New York, is now offering a high-fidelity amplifier system, known as the A-20-6. The unit is de-



signed so that it may be removed from its solid-wood blonde cabinet and mounted in the user's own cabinet.

Featuring a continuously-variable electronic filter for sharp treble cut-off of high-frequency noise and distortion, the amplifier includes a 20 db boost or cut bass and treble control, a loudness control, and a four-channel input selector with independent level adjustments for each channel. An output is provided for a tape recorder.

Literature will be sent upon request to the company.

"DUPLEX" LOUDSPEAKER

Altec Lansing Corporation, Beverly Hills, California, and New York, has introduced two new "Duplex" loudspeakers. Known as the 12" 601A and the 15" 602A, the speakers carry an unconditional guarantee that when mounted in a properly designed cabinet, they have a frequency range from 30 cycles to 22,000 cycles.

The speakers are primarily intended for high quality music systems for the home, although their 20-watt capacity makes them suitable for small commercial installations and monitoring purposes.

CORNER REPRODUCER

Brociner Electronics Laboratory, 1546 Second Avenue, New York 28, New York has announced the availability of a three-way corner reproducer which has been tradenamed "The Transcendent."

The bass range is reproduced by a special, heavy-duty 15" speaker driving a large folded exponential horn. The walls and floor comprising the room corner form an extension of this horn. Intermodulation in the middle register is kept to a minimum by restricting the frequencies fed to the bass horn to the range below 250 cycles. Above this frequency the crossover network transfers power to the middle and high frequency horn.

The middle register and high fre-

quencies are reproduced by a twin-cone driver unit with a magnet producing a flux of 20,000 gauss. The twin-cone drives a horn which includes

a reflector-diffuser element that evenly distributes the higher frequencies throughout the listening space.

"The Transcendent" is available in three styles, the Model 250 a fully-enclosed unit in brown walnut finish, the Model 250-R in modern mahogany, and the Model 250-T in traditional mahogany.

"AUDI-BALANCE"

Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, California has introduced a high-fidelity home music amplifier which provides balance of output tubes in seconds.

The device assures minimum distortion and peak performance even when new tubes are installed. Known as "Audi-Balance," the amplifier indicates when a pair of tubes are unusable together. Since low distortion in push-pull audio amplifier output systems is a function of the accuracy of balance between the tubes, this feature should improve performance.

For further information on this product, write directly to the company, asking for Catalogue C-20M.

PRE-RECORDED TAPES

MaVoTape, Incorporated, 225 West Ohio Street, Chicago 10, Illinois has introduced the first of its series of pre-recorded tapes for commercial applications.

To be marketed as "Magnecordings by Vox," the new tapes are processed by *Magnecord* from "master" tapes recorded by *Vox Productions, Inc.*

The first offerings will include: "Fifth Symphony" by Shostakovich, "Symphony No. 2" by Mahler, "The Resurrection," and "Piano Concerto in B Flat" by Tchaikovsky.

The new tapes will be recorded on half tracks of standard recording tape at 7½ inches-per-second, thus providing an hour's program on a professional 7" reel.

MOBILE AMPLIFIER

Don McGohan, Inc., 3700 W. Roosevelt Road, Chicago 24, Illinois has added a new amplifier to its line of amplifiers and sound systems.

Known as the Model M-G 25M mobile amplifier, the new unit will operate on either a 6- or 117-volt supply. Power output is 18 and 25 watts respectively with less than 5% distortion.

The unit features two mike inputs, a tone control, and output impedances of 2, 2.7, 4, 8, 16, 250, and 500 ohms. Four speaker outlets are provided.

The amplifier is housed in a louvered case of two-tone finished steel. The top is removable and the user has the option of a 3-speed automatic record changer, a 3-speed manual record player, or a single-speed manual player, the latter being recommended for mobile operation.

Full details are available on request from the manufacturers.

EQUIPMENT CONSOLE

Electro-Voice, Inc. of Buchanan, Mich. has announced a new sound equipment console, tradenamed the "Peerage."

The unit is expressly designed to house in one compact cabinet virtually any combination of standard tuners, amplifiers, and record changers.

It is currently available in mahogany and blonde finishes and measures 29¾" x 20½" x 18¾".

Bulletin No. 192 gives full details on the new unit.

SMALL TRANSFORMERS

United Transformer Company, 150 Varick St., New York 3, New York has developed a line of hermetic transformers which are said to be the smallest hermetic units ever made.

The new line covers the entire range of audio requirements for subminiature equipment. The line includes input, interstage, and output transformers, as well as a reactor.

The over-all case dimensions of these units is only ½" x $1\frac{1}{16}$" x $\frac{29}{32}$" which is approximately half the volume of other currently-available hermetics. The units weigh .8 ounce. Mounting is effected through a unique single-threaded stud arrangement with case tabs to prevent twisting.

"END TABLE" CABINET

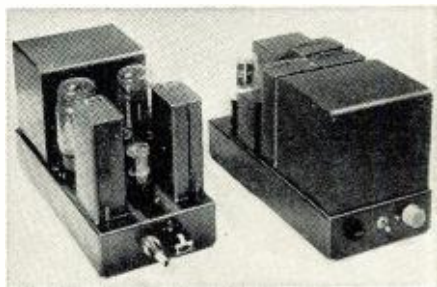
Jeff Markell Associates, 108 West 14th St., New York 11, N. Y., has announced the development of a high-fidelity radio-phonograph end table.

The table will house a changer.

tuner, and amplifier, and is big enough to accommodate all popular changers and almost all of the popular tuners and amplifiers. Available in 12 color finishes on birch, mahogany, korina, walnut, and oak, the end table cabinet is available from dealers or directly from the above company.

WILLIAMSON AMPLIFIER

British Radio Electronics, Ltd., 1 Thomas Circle, Washington 5, D. C., has announced the availability of the "Hallmark" Williamson amplifier



which is the first and only model endorsed and guaranteed by the designer, D. T. N. Williamson.

The amplifier and power unit are built on separate chassis in order to reduce hum and noise content. Two 6SN7's, two KT66's and one 5V4 are used in this amplifier. All of these tubes are currently available in the United States.

All transformers and chokes used in the unit are screened in matching compound-filled steel cases. The unit operates on 117 volts a.c., 50 or 60 cycles. Input impedance of the unit is 1 megohm with the input for full output 1.9 volts.

A choice of 1, 4, 9, 16, 25, 36, 49, or 64 ohms by series-parallel connections of eight 1 ohm secondaries is available to provide accurate matching for any combination of loudspeakers.

Output is 12 watts undistorted with a 15-watt peak. Response is linear within .2 db from 10 to 20,000 cps. Harmonic distortion at 12 watts output is within .1 per-cent. Noise level is said to be better than 90 db below full output.

A companion preamplifier-control unit is also available for use with the amplifier.

EQUALIZER-PREAMP

The Radio Craftsmen, Inc., 4401 N. Ravenswood Ave., Chicago, Ill., is in production on the *Craftsmen* C300 equalizer-preamp.

The new unit features five position low and high record equalization, five position low and high sharp frequency cut-off filters for reduction of rumble and record scratch, choice of loudness or straight volume control action, continuously variable bass and treble controls, and five audio inputs.

Other features include a self-contained shielded power supply, d.c. powered tube filaments, shock-mounted tubes, and an all-triode circuit with cathode follower output.

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Cabinetry

(*Continued from page 37*)

dle. Power and frequency loss in leads between components is not a factor in cabineted systems, although this problem occasionally arises in built-in systems. Adequate ventilation and accessibility for servicing are important considerations, but these are usually both taken care of at the same time by leaving the back of the cabinet open. If, due to the proposed placement of the cabinet in a room, the back must be exposed, there are several types of perforated materials available to cover the back, and still allow adequate ventilation. Of course even with adequate ventilation, crowding of components does not tend to improve matters.

If by now you have managed to house your equipment allowing for ventilation, allowing a bit of space between components, and if you haven't done something unfortunate such as hanging the preamplifier up over a power transformer, internal arrangement is not likely to give you trouble. The only consideration left regarding placement of components in the cabinet is the question of accessibility of controls. The writer prefers to keep all controls at least 30" above floor level, since being a lazy fellow I don't like to stoop to get at them.

It is also well in laying out control panels to eliminate all duplicate controls. It often occurs that volume and tone controls appear on both tuner and amplifier or preamplifier. If the preamplifier is included in the tuner or the amplifier I generally eliminate amplifier controls entirely in such cases, controlling it from the tuner. Where a separate preamplifier is used I usually eliminate the duplicated controls from the tuner, using those on the preamplifier.

On the basis of the information given in this article plus a little thought, you should be able to supervise a presentable cabinet job for your client. Most clumsy jobs result from clumsy designs rather than poor workmanship, at least that has been the writer's experience.

A good design is usually relatively easy to construct. Be wary of designs that are complicated and difficult to build. There is a likelihood that such designs will not be too effective when built. Keep the size and proportions of the cabinet in scale with the room in which it will be placed. In order to do this, wherever possible see the room before suggesting a specific cabinet. Except when the client's budget will not allow it, consult a competent designer. You'll find it's worthwhile.

The new business you will get from doing a good job plus the added income that will accrue from handling the complete job will more than pay for the time and trouble involved.

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RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

WHAT are *you* doing to back up the national consumer advertising by manufacturers to inform the public of your important status as a skilled TV technician? What are you doing to tell TV owners in your community that you are a qualified member of this new technical profession? What are you doing to improve the appearance of your place of business and the appearance of your shop to make it *look* like the headquarters of a competent professional technical organization? Are you carefully studying every phase of your customer relations activities, in your telephone technique and in your face-to-face contacts with your customers, to make certain that you *leave* the impression with your customers that yours is a professional activity?

These are very important questions. They are important because the success or failure of manufacturers' expensive consumer educational campaigns to create a healthier respect for TV service will depend entirely on how *you* conduct your business to justify their claims that TV servicing *is* a technical *profession.*

Millions of people, including most TV set owners, will read the *General Electric Company's* full page ads in "Life" and "Collier's." Presented in the style of pictorial news stories the lead line, "America's Newest 'Profession' Keeps 18 Million TV Sets Healthy!", will draw the reader's attention to the pictures and their descriptive captions.

Your customers and prospective customers will read this about *you:*

"Television itself embodies new electronic principles which had to be learned by over 51,000 servicemen, most of whom were radio specialists. Manufacturers did everything they could to make it easy for these men to become the highly-qualified TV experts they are today. Schools and courses were established . . . new test equipment was developed . . . replacement tubes and parts were distributed to every TV area.

"But the real responsibility for acquiring TV know-how rests with the serviceman. As a group, these technicians have done an unprecedented job of meeting the service needs of the 'TV epidemic.' *They have built for themselves an important new industry based on one ideal: to safeguard a billion-dollar owner investment in TV.* (Italics ours.)

"Your TV serviceman deserves your full respect and confidence. He has invested over $3000 in special test and other equipment. He spends an average 12 hours a day servicing sets. He is technically trained . . . experienced . . . familiar, by constant study, with latest television improvements. Call your favorite TV serviceman whenever you want your set put in top working order. He will always do his best to serve you promptly and at a fair, reasonable cost!"

After a TV set owner reads this ad and calls your shop for service what impression does he get from his telephone contact with you? When your technician calls at the home to check the set what impression does he make? When he works on the set in the home does he handle himself and his tools in the organized manner of a competent, skilled technician or is your technique for handling service in the home an unstudied, haphazard proceeding?

These are vitally important matters of servicing procedure. In the final analysis the TV set owning public will form its own opinion of the caliber of independent TV servicers from the impressions it gets in dealing with the technicians who call at the home. It is the responsibility of every man engaged in TV service to learn to do all of the things right that are necessary to create the impression of professionalism. In other words, it's up to the independent servicing industry to maintain and build the good-will that advertising will stimulate.

Advertising Alone Can't Do the Job

While millions of people will read these and other ads and acquire the basis for a new and higher respect for the profession of TV servicing, it will mean nothing to you as an independent TV service businessman unless you identify yourself with these programs. You must fix up the appearance of your place of business to look like the quarters of professional craftsmen; you must make a studied effort to know and use the simple

fundamentals of good customer relations; and you must regularly tell your customers and prospective customers who you are, where you are located, and what you are prepared and competent to do for them.

Point-of-Sale Helps

If you want to get a substantial share of the service business that develops in your community you must use some kind of a sales promotional program regularly to keep *your* business before prospective customers. National advertising campaigns may sell independent service as a professional activity but it is up to *you* as an individual business man to identify your business and to sell yourself in your community.

Manufacturers make available to you, usually at less than cost, professionally prepared promotional material that will help you create and maintain the individual identity of your business and your facilities for rendering professional technical service.

In a recent article, Robert A. Penfield, advertising manager for the *Sylvania Electric Products Company*—a company that has done much to create an atmosphere of consumer good-will for independent TV servicers—outlined the kinds and purposes of the several types of promotional aids that are available from many manufacturers. He said:

"In addition to the maintenance of continuing programs of promotion through the selection and use of manufacturers' cooperative campaign material—TV service operators usually have considerable room for improvement in the use of their 'point-of-sale'—the service shop.

"Manufacturers offer many items that are necessary for day-to-day work. Fortunately for the TV serviceman, the prices of these items reflect more of the manufacturer's cost than the retail replacement price. Business aids available to TV servicemen at nominal cost or on a no-charge basis may be classified according to use as follows:

1. Professional Appearance
2. Display Materials
3. Tested Promotional Items
4. Remembrance Advertising
5. Time-saving Business Methods

"A quick run-down of these five classifications that are always needed by TV servicemen, shows that *professional appearance* means more than a tidy shop layout. It means the 'whole package' in which the serviceman presents himself and his associates to customers. Attractive shop coats assure a trim, professional look. They inspire customer confidence. These coats cost very little when they are purchased through leading industry manufacturers.

"During home calls the service package is important too. Customers know that service is a *combination* of skill, tools, and replacement parts. Tool and parts kits should be attractive. Give them a neat, professional appearance

that is associated with camera, medical, or other cases for professional instruments. This need not mean having a custom-built case made at high cost. Manufacturers, after careful study of the needs of servicemen—and the best cases the market affords—will supply what is needed and on a below-cost basis.

"*Attractive display material* at point-of-sale means more than the use of window displays—which should be changed frequently to conform to the continuing merchandising program. It means the full use of counters and walls for merchandising cards, posters, streamers, easels, booklets, and folders. These items are available from manufacturers, frequently on a no-charge basis.

"Remember—it is up to the TV service organization to request and put these sales aids to work and to maintain a good housekeeping rule. Sales aids and the over-all appearance of point-of-sale should provide a fresh, appealing atmosphere that almost whispers aloud—this is a good place to do business!

"During customer contacts make it a point to do more than a good service job. Leave something for your customer to *remember you by*. Suitable for this purpose are imprinted book matches, mechanical pencils, imprinted and informative literature, imprinted calendars, and many other articles. Watch your mail for manufacturers' announcements of these inexpensive business builders. And remember—your manufacturer will get them for you at a wholesale price.

"*Time-saving business methods* interest manufacturers as much as they interest TV servicemen. Efficient systems increase servicemen's sales by providing market data, and by acting as a recorder of the pulse of business conditions. They pay dividends in time saved for productive sales and service work. Manufacturers help solve these problems by providing systems for accurate, perpetual, and understandable records. These systems greatly reduce the chore of keeping books. Look to the manufacturers for simpler, more efficient accounting methods and the forms that are best suited to your accounting needs.

"Manufacturers help alert TV servicemen solve the problems of change in the service market. They have to plan their own operations years in advance and can't afford to be caught napping in business transitions such as one from initial sales to replacement sales—but they need the TV serviceman's cooperation, if full mutual benefits are to be realized."

Progress in U.H.F.

Further evidence that u.h.f. may expand far more rapidly than early predictions indicated is showing up in press releases from equipment and parts manufacturers that describe new components for u.h.f.—now available in quantity. One of the latest of these from *G-E* states:

"All tubes necessary for manufacture of a television tuner designed to receive new ultra-high-frequency television channels and television channels already in use are now available in substantial quantities. Any television set manufacturer who wishes to include an all-channel television tuner in his set can now get the necessary tubes immediately."

The tubes referred to are the 6AF4 oscillator tube, the 6AJ4 radio frequency amplifier, and the 6AM4, a mixer tube. They are designed primarily for use by television set manufacturers in tuners for new receivers and not for sets already in operation.

Radio Service Still Good

The concentration on the opportunities and problems of TV service has kept radio progress and developments more or less in the background but an examination of statistics shows that radio is still a very substantial business. For instance, it is surprising news to learn that homes with television now have *more* radios than non-TV homes. Two-thirds of all TV-homes have bedroom radios, and about half have kitchen sets. The kitchen has become the main "listening center" in the TV homes with 50 per-cent of all radio listening done there.

Most TV servicing organizations have been focusing their sales promotion programs almost exclusively on television and have been neglecting a service market that can supply a substantial volume of business. It is quite probable that a door-to-door survey of radio sets in operation in any TV community would disclose that every home has at least one radio set that badly needs repairs and that the owner would be happy to have it repaired.

There is a natural indolence on the part of the average consumer about having radios or appliances repaired when they need service attention. And yet it is surprising how glad they are when some aggressive service company makes it easy for them to get the units repaired.

Any aggressive service selling program that would include radio as well as TV sets would uncover a lot of this dormant business. A dealer with complete facilities for handling appliances as well as radio-TV repairs probably would strike a bonanza of service business in practically any residential district of middle class people in any city.

Service Training

Those who aspire to create substantial businesses in TV servicing now have the advantage of a "backlog" of successful experiences to guide them if they will take advantage of it. This was not true five years ago. Service businesses that got started then had to learn by "trial and error" methods and those who "erred" too much went broke.

The creation of a major TV service business is a complicated project that now requires a very substantial in-

vestment. While it is true that an unusually competent TV technician who is willing to work long and hard hours and can make his headquarters in his home or some other low overhead location, can make a fair income working as an independent TV servicer —he cannot develop what can rightly be termed a "business." When sickness slows him down or stops him, his income stops. Since his activity is built purely around his own special abilities and qualifications he does not "build a business," hence he does not create anything that can be sold as a going enterprise.

Studies of the incomes of men working independently as TV technicians in many areas indicate that some men might get larger "take home" incomes, and build a greater security for themselves, by working for a major TV service business. The unusual abilities and aptitudes that make it possible for them to make a living as one-man operators would produce a greater dollar return per hour worked if they were applied in a well-organized and skillfully managed major service business.

Karl Korn, general manager of *Central Television Service* of Chicago, one of the country's largest and most successful independent TV servicing organizations, recently outlined the extensive "on-the-job" training that major servicing companies now give their technicians.

Service Quality Control

The operating "heart" of the *Central* organization and the key to maintaining the good-will of its thousands of service customers is its "Quality Control" department. This department is charged with the responsibility of maintaining a high quality of service and, through a carefully developed system of customer checks, it is able to gauge the day-to-day work of every one of their scores of technicians who handle consumer service.

Each new technician employed by *Central* spends his first month on the job working with a supervisor or with an experienced technician. This is his preliminary training period. When he starts out on his own to handle calls he is still under training and phones the Quality Control department whenever he runs into a confusing service job. Since these calls are made from set owners' homes the men are provided with logical reasons for calling the *Central* office for servicing information. This is to avoid creating an impression in the customer's mind that *Central* has sent a novice to handle the job. Usually the reason given is that recent developments in the chassis under discussion have not shown up yet in field service charts hence the reference to the central office for detailed information.

Mr. Korn said that *Central* technicians are able to complete about 90% of their service jobs in the home. The other 10% pulled to the shop for service are largely intermittents.

The three servicing fundamentals of the *Central* organization are:

1. Repair the set to the customer's satisfaction.
2. Give the customer his money's worth.
3. Do it as quickly as possible.

Service Suggestions

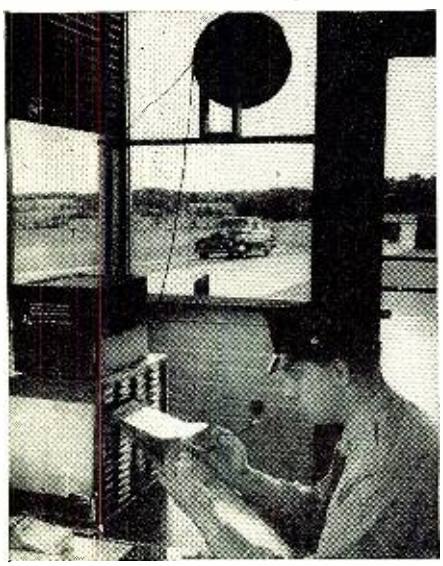
In a talk before the *Capehart* national distributors' convention in Chicago, Frank Moch, president of the national association, NATESA, made the following suggestions to set distributors which would help create better owner satisfaction with the receivers they distribute:

1. Cooperate in all programs of consumer education in the technical complexities of TV receiver circuits. When set buyers, through advertising claims, are led to believe that a manufacturer has succeeded in simplifying the construction of his sets so they will be practically "trouble-free" they lose confidence in the brand when service is required.
2. Inform servicing organizations as quickly as possible when inherent circuit defects are detected in a new model. When servicing organizations are informed of inherent defects it saves the customer money by speeding up servicing time and it helps to retain the customer's confidence in the brand.
3. Select and recommend only proven, reliable service depots to handle service on the brands they sell.

If distributors would adopt any or all of the "planks" of this platform they could go a long way toward helping to solve some of the problems facing service technicians.

—30—

A warning that a car is approaching the gatehouse of the General Electric Research Laboratory is given by an electronic device resembling radar. From the reflector, a beam of radio waves is aimed down the road. The echo returned from the moving object causes a warning bell to ring. Thus even if the guard is not watching the road, as is the case with Patrolman R. J. French who is checking his files, an intruder would be unable to slip by unnoticed.



Technical BOOKS

"TV TROUBLESHOOTING AND REPAIR GUIDE BOOK" by Robert G. Middleton. Published by *John F. Rider Inc.,* New York, New York. 201 pages. Price $3.90. Paper bound. Volume 1.

This is a down-to-earth handbook for the practicing television technician. All extraneous and most of the purely theoretical material has been eliminated in the interest of providing the maximum amount of usable data.

The book is divided into ten chapters which cover receiver differences and waveforms, handy hints in visual alignment procedures, troubleshooting sync circuits, locating sweep troubles, faults in video-amplifier circuits, checking high-voltage power supplies, test equipment kinks, troubleshooting in the home, receiver buzz—its causes and cures, and external interference.

Block diagrams, oscillograms, performance graphs, photographs, and test patterns have all been used along with circuit diagrams and tables to increase the maximum value of the book to the technician.

The author's style is concise but entirely lucid and those who can read with understanding should have no difficulty in grasping the subject matter. Without actually using this book on a troubleshooting job it may be difficult to appraise its practical value, but it *seems* to incorporate the requisite information in a very usable form.

* * *

"FUNDAMENTALS OF ELECTRONICS" by F. H. Mitchell. Published by *Addison-Wesley Press, Inc.,* Cambridge, Mass. 236 pages. Price $5.00.

This is an elementary text which has been written as a one-semester study to familiarize physics students with some of the aspects of electronics or give the non-electronics major a survey of the field. A general physics course is prerequisite and a course in calculus is desirable but not absolutely necessary to an understanding of the subject matter.

In the absence of a thorough grounding in elementary a.c. and d.c. theory, the author has devoted the first two chapters to a review of the major principles involved. The third chapter deals with electron emission while subsequent chapters cover the vacuum diode and its application as a rectifier, the triode as a voltage amplifier, multi-electrode tubes, multi-stage amplifiers and amplifier coupling, sine-wave oscillators, gas-filled tubes, special purpose tubes and devices, wave-shaping and control circuits, and finally, the electronic voltmeter and oscilloscope in instrumentation.

Two separate folders are included with the book—one containing the answers to the problems which accompany each chapter and the other a series of plate characteristic charts

for eight of the tubes covered in the text.

Lavishly illustrated and containing hundreds of circuit diagrams, line drawings, and graphs, this text provides an excellent basic work for the student of electronics or the layman.

* * *

"WHY YOU SHOULD NOT TRY TO FIX YOUR OWN TV" by John D. Burke. Distributed by *Alert Multigraph Service,* 54 Dey Street, New York 7, New York. 44 pages. Price $.50. Paper bound.

Although this book is addressed to the television set owner, most television technicians will be glad to know that there is such a book on the market to help stem the rising tide of "fix-it-yourself" books flooding the drugstore counters.

Written in a person-to-person style, this chatty and informative little booklet covers most of the points about which confusion exists in the layman's mind.

The author discusses tube failures, explains briefly how tubes work, talks about "picture lock", "high-voltage troubles", the dangers of working on the set even with the plug disconnected, intermittents ("troubles which come and go"), the picture tube and its peculiarities, how to pick a good technician, and then a resumé of the "do's and don't's" of TV ownership.

The "heart-to-heart" talk technique which the author uses throughout the [illegible] convincing and should do some good if the book reaches a large enough segment of the set-owning public. —30—

PHOTO CREDITS

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48, 49	Berlant Associates
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55 (top)	Baltimore & Ohio Railroad
55 (bottom)	Bendix Radio Division
68	Radio Corporation of America
106	Ohio Bureau of Motor Vehicles
122	Allen B. Du Mont Laboratories, Inc.
177	General Electric Company

ERRATA

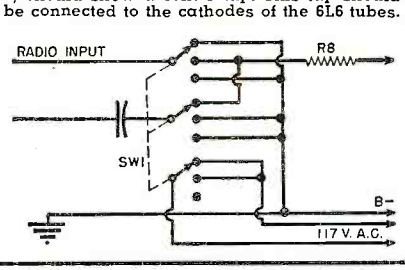
There is a misstatement in the article "A Variable-Voltage Power Supply" (September issue, page 66). The supply will deliver any voltage up to 450 at any current up to 100 ma. instead of 650 volts as stated in the first paragraph.

* * *

In the article "Converter Receives Both Phone and C.W.," appearing on page 60 of the September issue, the accompanying schematic diagram should have a 20 $\mu\mu$fd. variable condenser connected in parallel with C_2. This is the main tuning condenser.

* * *

The correct wiring diagram for the switch appearing in Fig. 3 (page 47 of the September issue) appears below. In addition to making this correction, the 6.3 volt filament winding on the power transformer, T_2, (Fig. 4) should show a center tap. This tap should be connected to the cathodes of the 6L6 tubes.



SELENIUM RECTIFIERS

We specialize in Rectifiers and Power supplies to your specifications. Immediate delivery.

Current (cont.)	18/14 Volts	26/18 Volts	36/28 Volts	54/40 Volts	130/100 Volts
1AMP	1.25		2.20	3.60	7.50
2AMP	2.20		3.60	6.50	10.50
4AMP	3.75		6.75	8.75	
5AMP	4.95		7.95	12.95	27.00
10AMP	6.75	9.98	12.00	20.00	40.00
12AMP	8.50		16.00	25.50	50.00
20AMP	13.25	16.20	24.00	36.00	90.00
24AMP	16.00		31.00	39.50	98.00
30AMP	18.50	24.30	36.00		
36AMP	25.50		45.00		

Full Wave Selen Rect & Trans. in Kit form. All 115V/60cy inputs.
up to 14VDC at 12 amps........$ 23.98
up to 28VDC at 12 amps........ 31.98
up to 28VDC at 48 amps........ 149.50
up to *20VDC at 6 amps........ 12.98
*This 6 amp supply has no ageing taps.

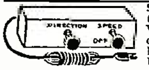
BATTERY CHARGING RECTIFIERS*

VOLTAGE	AIR COOLED	FAN COOLED	PRICE
10-0-10	10 AMP	25 AMP	$ 4.00
10-0-10	20 AMP	50 AMP	8.00
10-0-10	30 AMP	75 AMP	12.00
10-0-10	40 AMP	100 AMP	15.00
10-0-10	50 AMP	125 AMP	17.50
10-0-10	100 AMP	250 AMP	35.00

*Fan Cooling Rectifiers will permit 2½ times normal current rating.

RECTIFIER XFMRS

18.8—19.2—20.4—21.4Volts/12Amp $14.98
31—32—34—36 Volts/12Amp 2 Kvins 16.98
18—12—9—CT—9—12—18V/4Amp... 8.75
18—12—9—CT—9—12—18V/12Amp.. 16.75
36VCT—24V—18V/24 Amp. 35.75

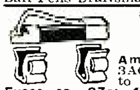


Selenium Power Supply 0 to 12 VDC/2 Amp. Variable DC supply, uncased and completely built—inpt. 115v/60 cy. Usable LAB supply, filament D.C. plating, battery charging, model railroad, includes voltage or speed control and center off reversing sw. Ideal for two "HO" locomotives. **$10.95; 2 for $20.00**

MERCURY THERMO REGULATOR

DUAL CKT. 105° F & 32° F. Extremely sensitive & accurate for most exacting requirements—Research, Fire Prev., Freeze, Pt Control, or Max-Min Temp. Control. Excellent Safety Device for Thermo Control of the Fan Cooled Selenium Rectifiers. Brand New. Individ. Boxed w/data & ckt.
SPECIAL.........**Ea. 98c; 12 for $10.00**
Ball Pens Gtd Red or Blue... 5 for 1.00
Ball Pens Draftsman Black....2 for 1.00

CIRCUIT BREAKER FUSES



PUSH TO RESET

Amps: 3, 5, 7, 10, 15, 20 3AG Size fuse operates up to 24 volts.
Fuses ea. 27c; 4 for $1.00; 25 for $5
Fuse with 2 mtg. clips 39c 3 for $1 20 for $5.98; 100 for $25.00
Heinemann Magn Brks. **Amps:** 0.22, 2, 3, 5, 7, 9, 12, 15, 20, 30, 35, 40, 80, 180. **Each $1.69; 10 for $15.98**
Sq.D & CH Toggle Sw Brkrs. **Amps;** 5, 10, 15, 20, 25.........**Each 98c; 10 for $8.98**
Klixon Thermal Push Button Brks. **Amps;** 5, 10, 15, 20, 25, 30. **89c; 10 for $7.98**

OIL CAPACITORS

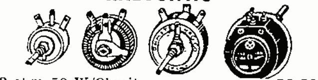
Mfd	Each
50wvdc	
4	$0.49
150wvdc	
1-1-3-5	.98
250wvdc	
2x.25	.35
300wvdc	
1.2	.39
400wvdc	
.1	.49
.5	.59
1	.69
4	1.69
6	2.29
8	2.49
10	2.89
2x.1	.75
2x.5	.94
3x.1	.91
3x.25	.99
600wvdc	
.034	.49
.1	.52
.25	.61
.5	.65
1	.75
2	.92
3	1.08
5	1.98
6	2.69
7	2.89
10	3.29
2x.1	.79
2x.25	.85
2x.5	.98
2x1	1.19
2x2	1.39
2x8	3.49
3x.05	.89
3x.22	.98
3x.25	1.09
700wvdc	
4	1.98
800wvdc	
.1	.69

Mfd	Each
1000wvdc	
.45	.79
1	1.09
2	1.69
5	2.98
15	4.98
1400 wvdc	
.25	1.29
.5	1.39
1500wvdc	
.5	1.49
.75	1.69
1	1.79
5	3.49
6	3.98
2000wvdc	
.1	1.49
2x.1	1.75
1	1.89
2	2.98
3	3.69
8	9.49
2500wvdc	
.25	2.29
3000wvdc	
.1	2.49
.5	2.98
2	4.49
3	6.98
4	7.98
4000wvdc	
2	8.98
5000wvdc	
.2	4.49
2	10.98
4	19.98
7000wvdc	
.002	1.69
.0075	1.98
.1	4.98
7500wvdc	
.03	2.98
.05	3.49
10000 wvdc	
.03	3.49

Mfd	Each
12000 wvdc	
.02	4.98
12500wvdc	
2	95.00
15000 wvdc	
.0016	9.98
25000 wvdc	
.00025	7.49
1	95.00
AC RATED 220vac/600dc	
2	.69
4	.89
5	1.29
225vac/630dc	
3.3	.79
230vac/630dc	
5	1.29
330vac/1000dc	
1.25	.79
1.5	.89
1.75	.98
2	.33
2.5	1.09
2.8	1.15
3	1.19
4	1.29
5	1.49
15	3.98
25	6.49
405vac/1200dc	
.15	1.29
600vac/1800dc	
16	6.98
660vac/2000dc	
5	4.49
6	4.98
10	6.98
16	7.98

2MFD/330VAC/1000WVDC "CD" RND CAN **3 for $1.00; 12 for $3.50**
9MFD/220VAC/600VDC **$1.....12 for $10**
Quantity Users Write for Special Prices

RHEOSTATS

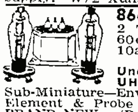


2 ohm 50 W/Ohmite..............$2.59
15 ohm 25 W Ward L........... 1.98
20 ohm 50 W Ohmite........... 2.35
60 ohm 50W Ward L........... 2.69
100 ohm 50W Ohmite........... 2.25
200 ohm 25W Model D.......... 1.98
250 ohm 25W......ea. **1.39; 4 for 5.00**
300 ohm. 200W Model P.......... 5.49
350, 500, 5000 ohm slotted shaft ....25 watt **79c; 3 for 2.00**
1000 ohm 25W Model J.......... 2.19
7500 ohm 50W Model J.......... 2.59

NOVICE XMITTER KIT

Power input 25 watts. Two (2) band oper. 3.7 to 3.75 MC and 26.96 to 27.23 MC. Inclds. all parts to build Xmitter, & pwr. supply. W/2 Xtals. key & tubes...**$32.00**

866A KIT and XFORMER



2 Tubes. Sckts. xfmr 115v 60cyc Inpt, outpt 2.5vct/10a HiV'insul **$6.98**

DIODE PROBE TUBE!

Unexcelled for NO-LOSS UHF Testing. Ultra-Sensitive Sub-Miniature—Envelope App. 1¼x⅜". Element & Probe at Tip. Low Pwr. Htr. BRAND NEW w/Data. VR92. **25c; 5 for $1.**

"TAB" THAT'S A BUY

AUDIO AMPLIFIERS

CSC Model 600AA completely built, compact Hi-fidelity Amp. features PP output Phono & Mike Inputs, separate gain cntrls. inverse feedback w/tone control. Oper 115v/60cy. w/6 tubes...............**$24.98**
CSC Model 305MP 3 tube amplifier, 5 watt completely built, mike & phono inputs, separate gain cntrls, variable tone. With tubes.........................**$14.98**
MODEL 100PO Phono osc. plays records through your radio, with no direct connection. w/tube **$4.98**
MODEL 200MO Mike osc. Same as above, except mike is used...............**$6.98**

SELSYNS

2J1H1 GE Selsyns.. 2 for **$6.98**
2J1F3 GE Brand New 115V/400 cy. ea... **9.75**
C78248 Sync. Transf 115/60 cy **39.95**
C78249 Sync. Diff. 115V60 cy 2 for **25.00**
Sync. Trans. C-69405-2. 2 for.... **90.00**
Sync Repeater 115/60 cy Type 11-4 New ....**$52.00; 2 for 99.00**
Bendix Auto Syn. AY1 & AY5; 2 for **4.95**
Bendix AY20 New Orig. CRTNS.... **12.98**

DYNAMOTORS

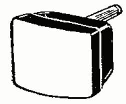
Inpt 28VDC/1.4 out 250V/60ma....**$3.69**
DM4 12 & 24V out 225V/100ma, 440V/200ma **11.98**
DM53A 28V/1.45A out 220V/80ma.. **4.25**
DA3A 28V/10.5A out 300VDC/260ma 150VDC/10ma. 14.5vdc/.5A **6.75**
PE94 Plate Supp. Uses DA3A (SCR522) **8.98**
PE97 Plate Supp., Less Tubes...... **9.98**
INPT 6VDC/27.5A Outpt 590VDC/150MA Carter Mag Motor...... **29.95**
INPT 6VDC output 200v/100ma or 12/24V INPT. 500v/50ma output. **6.95**

LINE FILTERS

10Amp/130vacdc Csd0.1 to 1000Mc's **$1.29**
30AMP/250vacdc Csd0.1 to 1000Mc's **3.98**
50Amp 600vdc/250vac. Fltrs both sides of line. SOLAR "Elim-O-Stat" New **$9.98;**
100Amp Usable 110vacdc GE **2 for $1.98**

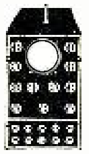
ONE YEAR GTD TV PICTURE TUBES

10 inch Round ...**$14.95**
12 inch Round ... **17.95**
14 inch Rectangular **20.95**
16 inch Round ... **22.95**
16 inch Rectangular **23.85**
17 inch Rectangular **24.85**
19 inch Round ... **28.50**
20 inch Rectangular **29.95**
21 inch Rectangular **30.45**
24 inch Metal **67.00**



Your old pict. tube is worth money, write for trade-in-allowance toward RMA coded and dated tubes witih one year guarantee. Ship defective picture tubes prepaid only. When ordering metal tube, defective metal tube is required.

MODEL HF-1 OSCILLOSCOPE



Laboratory Features. 5 M C Bandwidth, 10MV Sens, PP Horiz & Vert' Amp., Cathode Coupled Multi Vib Swp, Int Retrace, Cathode F'lwr Inpt Vert & Horiz Amp, Non-Freq Discrim Gain Cntrl, Cal Compensated Attenuators. Sync Pos or Neg. Intrnl or Extrnl, Inbuilt Cathode F'lwr for Sig Tracing with Phones. 13 Tubes 3—6C4, 4—6AK5, 2—6AG7, 2—6X5GT, 1—6J6, 1—3BP1 C'Ray Tube. All Data, Diagrams, and Tech Manual.
Write for additional info.

A "TAB" SPECIAL only $99.50

ALIGNMENT TOOLS

Ideal NO-LOSS Alignment Screwdriver TL150, long Insulated Shaft. Sure-Grip Knurled Knob. Only.................**.49c**
RELAY Spring Adjuster & Switch-Bd Tool Slot takes up to .022". WEC No. 293 **.98c**
Feeler Gauge for Relay, Telephone & Teletype contact, 8 Detachable sizes,.....**98c**

TUBE CLAMPS

926B-5, 926B-16, 926B, 929-1 930-19, 926B-19, 926A-10. **Each 25c**

"TABS" TUBE SPECIALS

BROKEN KEYS.—ELECTRICALLY PERFECT

1B3GT, 6H6, 6K6GT, 6SN7GT 12SN7GT **Each 50c; 5 for $2.00**
6L?6G, 6BQ6GT, 12SG7, 19BG6, 6L6G, 6L6GA. **Each 79c; 3 for $2.00**

END EQUIPMENT BUYS

SCR595 IFF. Less Tubes. As Is...$ 3.98
BC605 Amp. Less Tubes. As Is.... 3.98
BC906 Freq. Mtr. exc. cond. Less Tubes 29.95
I-222A Sig. Gen. 115v/60 Cy.... 129.50
BC221 Sig. Gen. Exc. Cond...... 125.00
ANTENNA Relay BC442-A, Meter Thrml Couple, 50 mmf vac Cndsr Complt.. 5.95
TG5 Kexer, New 5.98
R4/ARR2 Rcvr w/Tubes & Dyna.. 21.95
BC733D Rcvr Less Tubes As Is.. 19.98
RM29 Control Unit. BRAND NEW.. 12.98
BE65 Time Interval Signal. Used.. 3.98
I-108 Range Calibrator. Metal Case 29.98
I-198 Sig. Gen. Less Tubes...... 14.95
I-222 Sig. Gen. as is.......... 79.50
PE94A SCR522 Plate Supp....... 8.98
SCR522A Less/Xtals w/Tubes.... 69.95

Infrared Snooperscope

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, Sockets, Resistors, Capacitors & Diag. Oper from 115v60cy **$6.98**

TUBES

"TAB" TESTED & GUARANTEED

PRICES SUBJECT TO CHANGE
WRITE FOR COMPLETE TUBE LISTING

Tube	Price
OA2	.98
OA3/VR75	1.23
OB2	1.37
OB3/VR90	1.09
OC3/VR105	1.19
OD3/VR150	.98
1B3/8016	.81
1B21/471A	2.85
1B22	2.20
1B23	9.90
1B24	17.49
1B26	2.45
1B27	14.98
1B32/532A	3.90
1B35	10.98
1B37	16.98
1B38	29.95
1B40	4.95
1B41	49.95
1B42	18.00
1B46	1.98
1B53	49.95
1B56	38.50
1B58	350.00
1B60	69.75
1B63	50.00
1B63A	75.00
2C39	33.98
2C40	9.98
2C40 JAN	19.90
2C43	26.75
2C43/464A	9.49
2C44	1.20
2C51	6.45
2E31	1.49
2E36	2.19
2E41	2.39
2E43	1.39
2G21	2.39
2J31	27.25
2J31A	79.95
2J32	27.45
2J33	27.25
2J34	27.25
2J36	120.00
2J37	12.70
2J38	11.75
2J39	44.00
2J42	250.00
2J48	24.25
2J49	34.00
2J50	21.25
2J52	249.50
2J55	85.00
2J56	149.00
2J61	49.95
2J62	49.45
2K22	49.95
2K23	49.95
2K25	39.95
2K25/723AB	39.00
2K28	32.00
2K29	23.95
2K33	300.00
2K35	398.00
2K39	100.00
2K41	145.00
2K42	145.00
2K43	135.00
2K46	360.00
2K47	460.00
2K48	118.00
3B22	2.70
3B23/RK22	4.95
3B24	5.40
3B25	4.50
3B26	3.70
3B28	7.90
3C22	95.00
3C23	12.45
3C31/C1B	3.45
3C33	14.98
3C34/HK24	5.49

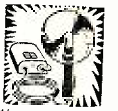
Tube	Price
3C45	17.98
3D6/1299	.69
3D21A	4.98
3D22	13.95
3D23	4.90
3E29	14.95
3K30	300.00
4-125A	29.95
4-250A	40.95
4-1000A	108.50
4C35	27.25
EL5BHD	16.98
5C21/C6J	6.95
5C22	49.95
5C30/C5B	3.95
5D21	27.45
5D23/RK6S	36.50
5J29	12.40
5R4GY	1.80
5R4WGY	1.75
6AG5	.79
6AG7	1.98
6AH5G	1.49
6AH6	1.22
6AJ5	1.40
6AK5	.74
6AK5W	2.98
6AK6	1.05
6AL5	.54
6AL7GT	1.29
6AN5	2.90
6AQ5	.55
6AQ5W	3.98
6AQ6	.81
6AQ7GT	1.29
6AR5	.79
6AR6	2.98
6AS5	.79
6AS6	2.65
6AS7G	4.35
6AT6	.63
6AU5GT	1.10
6AU6	.59
6AV5GT	1.29
6AV6	.49
6AW6	1.89
6B4G	1.23
6BA6	.63
6BA7	1.27
6BC5	.63
6BC7	1.23
6BD5GT	1.65
6BD6	.83
6BE6	.59
6BF5	.98
6BF6	.65
6BF7	2.55
6BG6G	1.39
6BG7	1.98
6BH6	.63
6BJ6	.69
6BK7	2.15
6BL7GT	1.45
6BN6	1.49
6BN7	1.69
6BQ6GT	1.20
6BQ7	2.15
6BY5G	1.45
6C21	29.45
6CB6	.69
6CD6G	1.69
6D4	2.70
C6J/5C21	6.95
6J4	6.98
6J5GT	.47
6J6	.57
6K4A	6.45
6L6	2.09
6L6G	1.35
6L6GA	1.35
6L6GAY	2.29
6SA7GT	.63
6SA7GTY	3.37

Tube	Price
6SB7Y	1.19
6SC7	.90
6SD7GT	.80
6SF5	.77
6SF7	.73
6SG7	.72
6SH7	.90
6SJ7	.70
6SK7GT	.69
6SL7GT	.69
6SN7GT	.70
6SN7WGT	2.25
6SQ7GT	.63
6SR7	.69
6SS7	.75
6ST7	.98
6SU7GTY	2.69
6V6	1.39
6V6GT	.57
6W4GT	.57
12AH7GT	1.45
12AK5	1.98
12AK5W	2.98
12AL5	.83
12AT6	.53
12AT7	.72
12AU6	.72
12AU7	.57
12AV6	.53
12AV7	.98
12AW6	1.79
12AX4GT	1.20
12AX7	.79
12AY7	2.95
12AZ7	1.49
12BA6	.79
12BA7	.79
12BD6	1.23
12BE6	.63
12BF6	.85
12BH7	1.29
12BY7	1.35
12BZ7	1.25
12SG7	1.05
FG17	3.95
19T8	1.09
19V8	1.62
RK20A	8.95
24G/3C24	1.90
25BQ6GT	1.19
25L6GT	.69
25Z5	.79
25Z6GT	.99
FG27A	8.70
HV27	10.95
RK28A	4.89
28D7	1.98
FG32/5558	13.85
35Z5GT	.59
RK39	2.89
RK48	6.85
RK49	7.50
50L6GT	.69
RK61	3.05
80	.69
81	1.69
FG81A	3.90
82	1.19
82V	1.39
83	1.45
83V	1.79
84/6Z4	.99
FG95/5560	24.85
FG98	19.95
100TH	8.89
FG104	37.98
FG105	18.98
117L/M7GT	1.59
117N7GT	1.79
117P7GT	1.39
117Z6GT	1.19
117Z7GT	1.49

Tube	Price
F123A	7.90
F127A	19.98
VT127A	3.90
CV148	4.98
FG166	49.00
FG172	31.50
250TH	22.25
250TL	18.50
304TH	8.90
304TL	8.90
388A	1.49
417A	8.95
417A/5842	18.50
GL434A	24.98
446A	1.05
446B	3.89
450TH	44.00
450TL	52.00
460/HF200	15.95
WL468	13.95
GL471A	2.69
CK501X	1.26
CK501AX	1.26
GL502A	1.79
CK502AX	1.79
CK503AX	1.79
CK505AX	1.79
CK506AX	1.79
RH507	9.98
CK509AX	1.26
CK512AX	3.15
CK522AX	2.49
CK525AX	3.15
CK526AX	3.95
CK528AX	2.39
CK529AX	2.98
GL530	22.00
CK531DX	1.98
531	6.98
CK532DX	1.98
WL532	3.98
CK533AX	1.39
CK534AX	.89
CK536AX	.89
CK537AX	4.98
CK538DX	.89
CK539DX	1.98
CK541DX	1.98
CK542DX	.98
CK543DX	.98
CK544DX	.98
CK546DX	1.98
CK547DX	1.98
CK571AX/5886	4.98
CK573/AX 6029	4.45
WL579	10.49
WL579B	12.98
KU627	18.00
WL652	65.00
WL673	117.00
WL676	39.95
WL677	34.00
WL686	35.00
707A	7.90
707B	17.49
715A	6.45
715B	8.90
715C	29.85
717A	1.49
718BY	48.45
718CY	48.45
719A	49.95
721A	2.49
722A/287	2.45
723A	11.95
723A/B	25.00
724A	3.95
724B	3.45
725A	8.90
726A	8.45

Tube	Price
726B	59.95
726C	69.95
801A	.45
803	3.89
805	3.90
807	1.65
808	2.98
809	2.43
810	9.95
811	2.90
812	2.70
813	12.49
814	3.45
815	2.98
816/866Jr.	1.07
826	.95
829	11.49
829B	12.45
832	7.65
832A	9.65
833A	39.45
834	5.95
836	4.75
837	1.45
849	29.45
860	4.90
861	23.95
865	1.29
866A	1.50
869	36.95
872A	3.29
CK1005	.85
CK1027	3.35
CK1028	9.98
CK1089	2.98
CK1090	2.98
CK5672	2.29
CK5678	2.45
5687	5.75
CK5702	7.45
CK5703	.98
Xtal Diodes	
1N21A	$1.55
1N21B	3.00
1N21C	21.50
1N22	1.25
1N23	1.35
1N23A	2.35
1N23B	3.49
1N25	4.98
1N26	8.75
1N27	1.55
1N29	3.50
1N32	23.75
1N34	.64
IN34A	.90
1N35	1.65
1N38	1.43
1N39	4.15
IN40	7.95
1N43	1.69
1N44	1.21
1N45	1.39
1N46	.69
1N47	5.49
1N48	.59
1N51	.45
1N52	1.85
1N54	.89
1N55	2.35
1N56	.89
1N57	.89
1N58	1.19
1N60	.60
1N61	2.10
1N63/K63	2.49
1N64	.69
1N67	1.95
1N69	1.98
K34	1.39
CK705	.77
CK706	.54
CK707	1.80

NEW THRIFT-LITE Lifetime Photo-Flash



Not a kit. Incl. Pwr pck. Life gtd Lamp. Rflectr & 15' cord 1/1000 Sec flash every 7 sec. True daylite color. Usable all cameras oper 115VAC w/lite Type AC40 Delivered **USA** **$38.00**
Complete Outfit for AC & Battery opr. Incl AC40&BP25 portopak & all accessrs for KODAK&COMPUR SHTTRS. **DLVD/USA $56.00**
AD15 Intensifier. Doubles Light Output of Basic Unit. Delivered **USA**........**$15.85**
AC-45F 115V/60cy Flash Unit. Features Selective Time Delay. Up to 30 Millisecond. Complete. Delivered **USA**........**$49.00**
Write for Complete "THRIFTLITE" Data Boosterpacks. Ext. lites. Units for Focal plane shutters & accessories.

PHOTOFLASH CAPACITORS

2x.36MFD Total .72MFD Per Unit. 30 Units 21.6MFD 1800VDC/38.8 W. Sec...**$5.95**
30 Units 21.6MFD/3000VDC 64.8 W. Sec. **7.95**
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15MFD/330VAC/1500VDC Intermit.. **3.98**
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16MFD/600VAC/2800VDC Intermit.. **6.95**
16MFD/660VAC/3000VDC Intermit.. **7.95**
32MFD/1.2KVDC/23W. Sec. **7.49**
27MFD/460VAC/2KVDC. 54W. Sec... **8.95**
4.5MFD/660VAC/3KVDC In. **20W Sec.** **4.25**
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"Tab" No.	Replaces	W-Sec. Max.	Each
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No. 1	AMGLO5804X	100	10.98
23ST	GE FT 210	200	9.98
53GT	GE FT 403	500	13.50
VA	SYLV. 4330	200	9.98
23MT	FT 214	250	9.98
22ST	FT 110	200	9.98
353GTQ	FT 503	5000	49.98
V4X4	X400	200	10.98
DX	SPRG-FA100	150	9.00
U5W	GE-FT105	100	5.98

PHOTO FLASH PWR SUPP KIT

1800VDC/35MA. Using Doubler Crkt Transformer. Rectifiers, Sockets, Condensers, Resistors, Switch Diagram. W/Flash Tube V4X4/400. Rated 200-300 Watt Sec........**$29.98**

FILTER CHOKES

Dual 30Hy/60ma Csd...........$ **.98**
15Hy/40ma AC/DC sets.........3 for **.98**
12HY/80ma/Csd/H'Sld/3K Vins USN. **2.25**
Dual 10HY/85MA, HMSLD......... **1.95**
10HY/125ma/UTC/Csd/H'Sld/1KVins. **1.69**
50HY/125ma/Csd/H'Sld **2.89**
12HY/300ma/Csd/5KVins/H'Sld **4.95**
20Hy/300ma or 15Hy/400ma/12KVins **8.95**
13.5HY 1A/17KVins/Raytheon **45.00**
10HY 200ma Hmsld Jefferson...... **2.95**
8HY 225ma Thordarson............ **3.50**

FILAMENT TRANSFORMERS

6.3vct/4A (gud 6.5A) H'Sld HVins..**$2.69**
6.3vct/1A ..**$1.98**; **6.3vct/.6A** .. **1.98**
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24v/6a csd.. **4.98**; **24v/1.25** csd. **1.98**
2.5 vct/10 Amp 5KVins ... **3.59**; **2x12V/2A** ... **3.89**
5V/2A, 6V/3A 2.25; **6V/6A** **2.95**
5V/60A ....**13.98**; **5V/115A** **16.95**

400 CYC XFMRS

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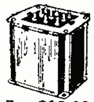
788V/200Ma. 210V/15Ma. 5V/2A... **4.95**
6.3V/7A. 6.7V/.9A. 6.3V/.3A...... **3.98**
6.3V/4.65A, 6.3V/.3A **3.49**
6.3V/1.25A, 6.3V/1.25A **1.98**
6.3V/3A. 5V/2A **2.98**
6.3V/1A **$1.95**; 6.3V/.6A **1.49**
FREED 5V/10A **4.95**
WEco 5V/4A **2.98**
FREED 2.5vct/10Amp Cased........ **4.95**

POWER TRANSFORMERS



2500V for Crt 6.3V/.6A, 2.5 v/1.75A csd Hvins 4/BC-412 replmnt **$7.98**
1320V & 375VCT/110ma, 5 V/3A, 2.5V/3.25A: 6.3 V/2.75A Hsld Hvins.**$8.98**
1000VCT/200MA, 18V/.55A, 6.3V/5A, 5V/6A..**$6.98; 2 For $12.98**
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900V/35MA, 2x2.5V/2A, xclnt 1800 V'dblr two 2x2 fil. winding hsld. **3.49**
840VCT/110MA, 530vct/21ma, 2x5V/3A, 6.3vct 1A, 6.3vct/.3A....... **4.98**
770VCT 85MA, 5/2A, 6.3V/3.5A.... **3.98**
750VCT/200MA, 6.3V/5A, 5V/4amp. **6.49**
700VCT/85MA, 6.3V/.3A. 6.3V/7.5A, 5V/2A **3.25**
650VCT/150MA, 5V/3A. 6.3V/2.1A.. **2.98**
700VCT/120MA. 2x6.3V/3A. 6.3V/1A **3.98**
550VCT/150MADC, 5V/3A, 6.3V/5A. **3.49**
500VCT/60MA, 6.3V/4A Hsld...... **2.98**
420VCT/90MA, 6.3V/1.9A w/Inpt 6, 12, 24, 115VDC & 115, 230VAC Vibrator Xfmr **1.98**

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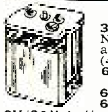
1100vct/212MA, Pri 115V/60cy....**$ 6.50**
3000V/10MA, cased Hivinsul...... **8.95**
5300vct/650MA USN WSTGHS..... **69.95**
750vct/650MA, 500V Tap........ **9.95**
15000V As V'DBLR W.E.Sig3H5629 7500V/35MA **19.95**

STORAGE BATTERIES



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- Ohms: 0-500, 100K, 1 meg.
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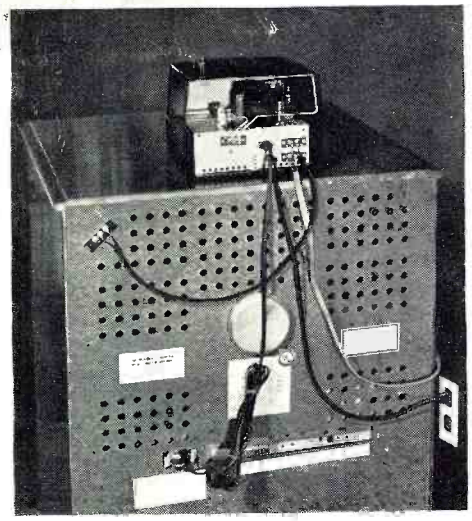

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