RADIO & TELEVISION NEWS

SEPTEMBER
1952

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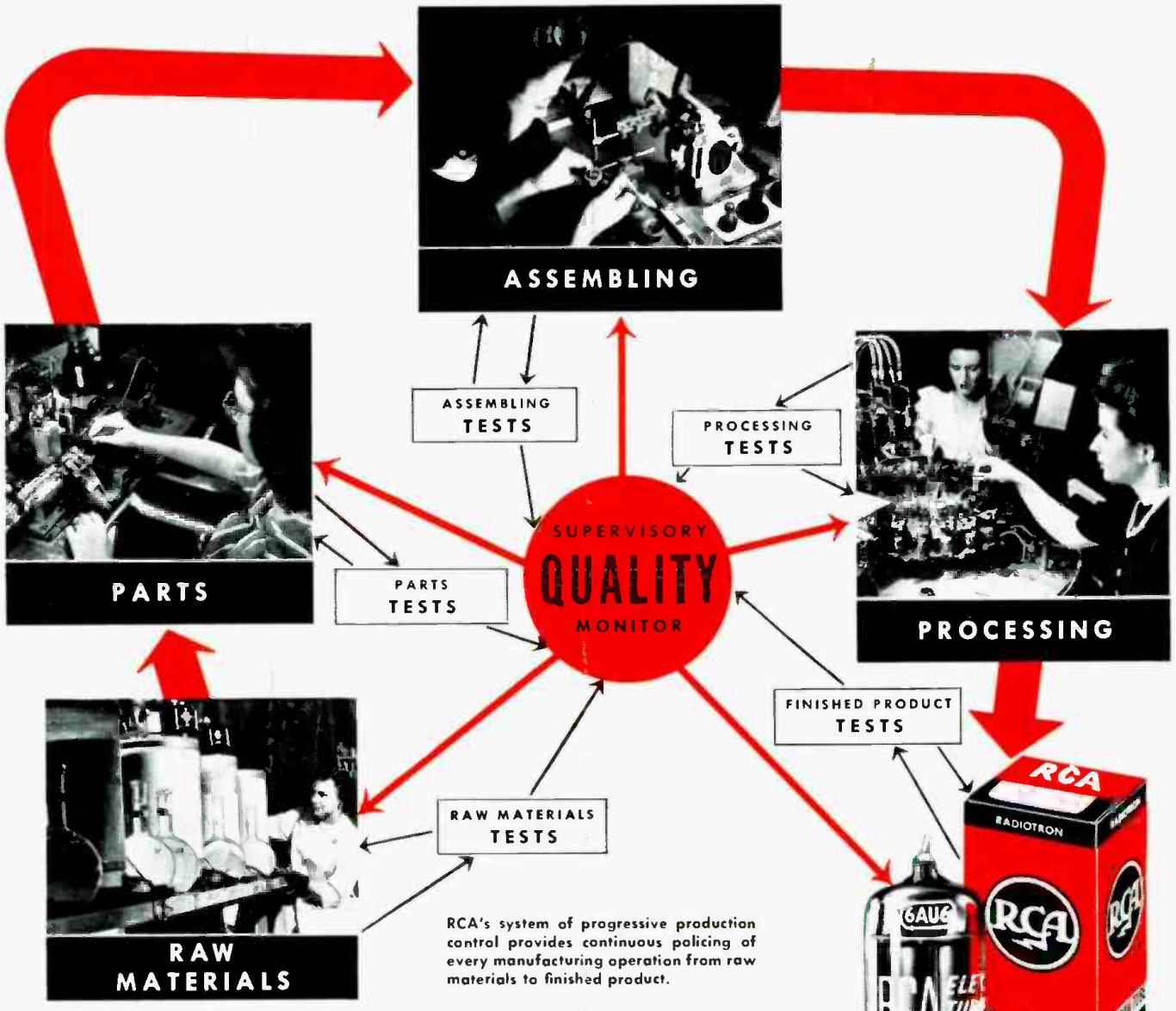
IN THIS ISSUE



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COVER PHOTO: Using a special "quick-rig" installation rack, JFD development engineers set up arrays for on-the-spot performance tests. Antennas can be oriented in any direction. (Ektachrome by Al Di Paolo)

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CONTENTS SEPTEMBER, 1952

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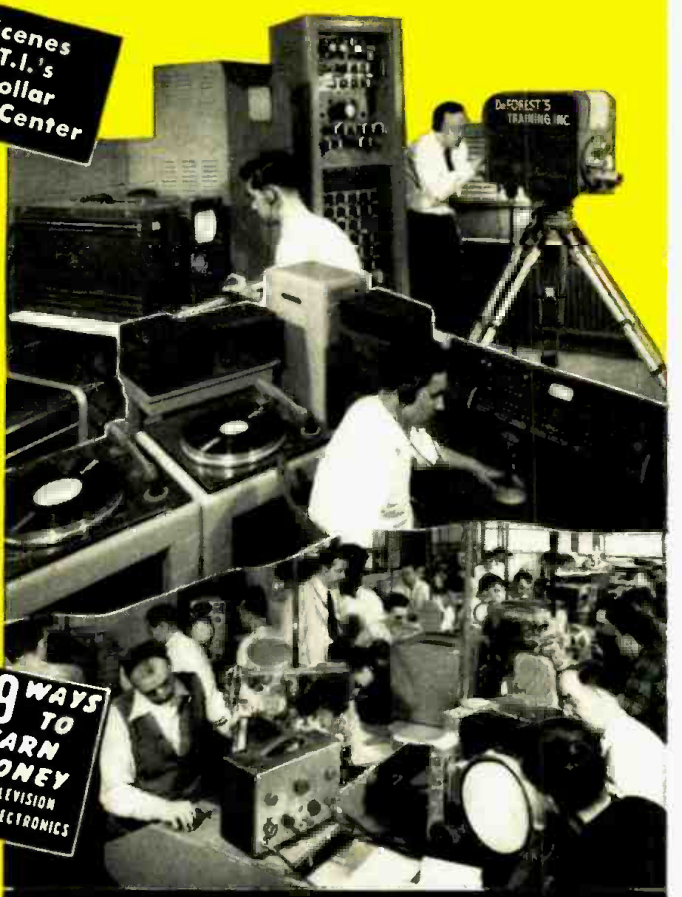

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Mac's Service Shop

(*Continued from page 68*)

"People are funny, to coin a phrase; but I know from experience that at least four out of five customers will not take the set away when the facts are presented to them in this fashion.

"Even if he doesn't leave it, you have suffered no real loss. For a service shop to gain a reputation for doing good work at reasonable prices is a good thing, but to get a reputation for 'working cheap' never really helped any shop—not in the long run."

"You know, I think the toughest thing of all to handle are requests for credit," Barney offered. "In spite of signs all over the place saying that service work is strictly cash, we still get these. What makes it really hard is that quite likely, in many cases, there is no intent to chisel. A lot of people just ask for credit sort of automatically."

"Yes, I know what you mean," Mac said: "but a strictly cash policy must have no exceptions if it is to be effective. In this case, the exception proves there is no rule—not really. You notice that new customers seldom give us any trouble in this respect. It is easy for them to understand that we cannot be asked to trust them since they are unknown to us. But when an old customer or, worse yet, a friend says, 'How about my paying for this Friday?' that really puts the pressure on the strictly cash policy."

"Yeah, but I've seen you handle that one more than once," Barney remarked.

"That's right. I explain quite truthfully that our bookkeeping system is set up for a strictly cash operation and that there is absolutely no provision for a credit arrangement. Then, if it is a friend or someone in whom I have confidence, I suggest that I will make them a personal loan so that they can pay Miss Perkins for the set and keep our records straight. I have never lost a dime this way. It's kind of funny, but people who would let a bill owed the shop drag on and on will show up promptly Friday to pay back the money I let them have out of my own pocket."

"Do you think we lose some business because we don't do service work on tick?" Barney asked.

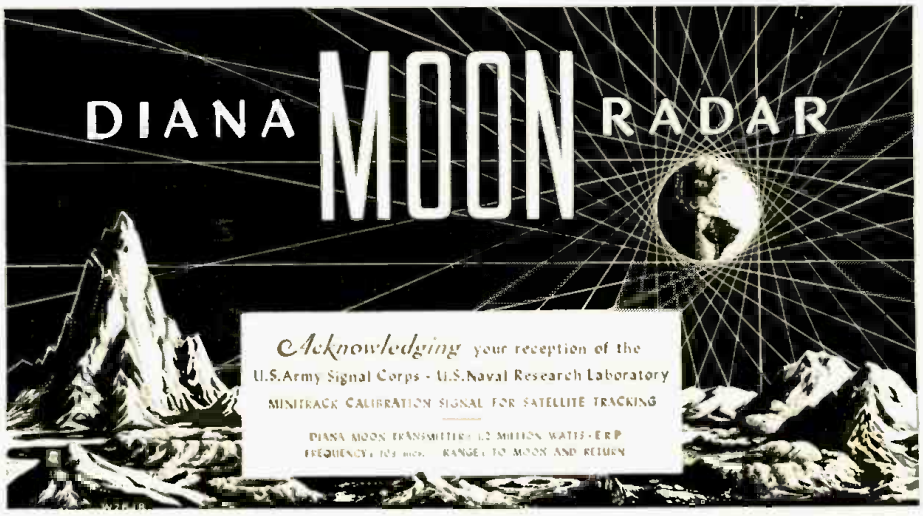
"Certainly I do, but I'm not worried about it. Maybe I'm wrong, but I think in the long run we come out ahead. I've talked to lots of technicians who tried to make a go of independent service and failed. Invariably, they closed their doors with a lot of credit on their books; and you can imagine how much of that was ever collected after the business failed. Every time someone walks out or hangs up when I say that our strictly cash policy means exactly what it says and I feel a little low about it. I just remember these failures and determine to keep right on as we have been doing. Say, what are you grinning about?"

"I was just thinking what a switch this conversation has been from some of the magazine articles I've read," Barney said. "They are always telling the readers how to keep the radio service shop from gypping them, and here we have been talking about how to keep the public from chiseling the service technician. Personally, I find it a delightful and refreshing change!"

"So do I," Mac said; "so do I!"

—30—

Amateur radio operators who successfully pick up signals from outer space during calibration of the satellite-Minitrack stations can now show cards acknowledging their reception. Before launching of U. S. satellites, the giant transmitter and antenna of the Diana moon radar at the U. S. Army Signal Research and Development Laboratory at Fort Monmouth bounce 108-mc. signals off the moon. This is done so that the far-flung Minitrack stations and amateur radio operators can calibrate their receivers for precise tuning to the transmitters aboard the U. S. satellites. When hams receive the moon-bounced signals, they notify the Laboratory at Fort Monmouth or the American Radio Relay League at West Hartford, Conn. In appreciation of their assistance, the Army sends each reporting amateur a customary acknowledgment or QSL card—the first one ever issued for picking up signals via the moon.



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It's easy to sell a product with as many plus features to talk about as the TRIO ROTATOR. In design, in construction, appearance; it is by far the outstanding TV antenna rotator in the market today!

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- 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!
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- Precision built to extremely close tolerances!

Smartly Styled

DIRECTION INDICATOR

The TRIO Direction Indicator is housed in a sturdy plastic cabinet of graceful lines. It is a beautiful instrument that will blend harmoniously with any furniture style.

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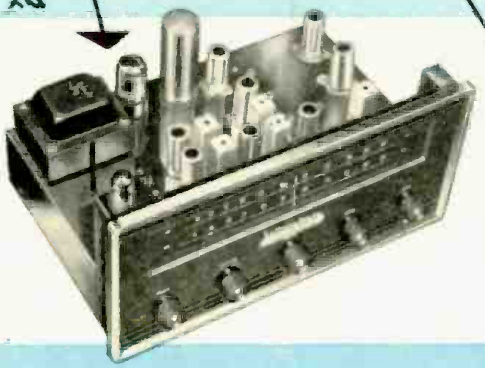

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CHICAGO 24, ILLINOIS

For the RECORD

BY THE EDITOR

AN AMATEUR'S RESPONSIBILITY

TO MANY of us, amateur radio is the greatest hobby in the world. Also, to some of us, amateur radio has grown to be a way of life. For years, dyed-in-the-wool hams have fitted amateur radio into their everyday lives more firmly than any other hobby has ever done. Life-long friendships, business associations, and even that most important partnership — marriage — have been formed through amateur radio contacts and acquaintances.

In years past it used to be that just to be a licensed ham was enough to merit a welcome in any circle, or group of other hams, anywhere. Today, the advanced state of the art has divided our interests so that there are many specialists' groups, each ardently pursuing *their* particular phase of the hobby. It is unfortunate that this has also tended to *reduce* the over-all bond that the operational and technical side of amateur radio once possessed.

There are many pleas made for tolerance but it is easier asked for than obtained. For example, an amateur vitally interested, qualified, and active on the v.h.f. bands finds it difficult to understand the motives behind the one-band operation of a confirmed 20-meter fone DX-er or an 80-meter c.w. traffic net operator.

Conversely, consider the viewpoint of an ardent and vocal "social net" operator on a 75-meter fone frequency. He may find it difficult to reconcile the enthusiasm with which a 10-meter mobile club enters into a Sunday picnic or hidden transmitter hunt.

With due consideration of the above (amateur radio does present a different facet to each licensee since we are all individuals) it must be realized that we do have, even now, one common bond—the so-called HAM spirit which has encouraged and stimulated the amateur until he is a vital force in the American scene. Through him amateur radio exerts its influence through public service and welfare, public morale and, through his contribution, has helped elevate the radio, television, and communication engineering art to its present high state.

We radio amateurs should be proud of our participation in this great hobby! True, in some isolated cases, amateurs *are* held in poor repute and their methods, results, and even their individualism have been ridiculed. Even some persons holding amateur licenses have been guilty of this type of intolerance.

There has never been a time in our history when it was so necessary that we amateurs "stand up and be counted." The complexity of modern life, the constant distraction of other endeavors, the not-inconsiderable effect of spreading amateur radio over a too-wide area of interest and activity have all combined to reduce the cohesive qualities of our common bond.

One guiding element is always necessary in any endeavor. Organization! Amateur radio has long had its very own organization—*The American Radio Relay League*. It has been the greatest contributing factor in the continuance of the hobby of amateur radio, with the exception of those most indispensable elements—the rugged individualism, persistence, and the indefatigable effort of the amateur *himself*.

The majority of radio amateurs of this country are *not* meeting their responsibility, that of support, through membership, of the amateur's own organization—the ARRL!

It is the obligation of *every* amateur to be a *member* of the ARRL regardless of his personal belief concerning any individual or any group within the structure of the vast ARRL organization. Furthermore, it is vitally important that the *future* of amateur radio be insured by a strong voting membership in ARRL plus intelligent action on the part of ARRL officials on behalf of all amateurs. Thus, the power of ARRL will increase in proportion to its numerical strength.

ARRL membership has declined in recent years until approximately only one amateur in three is a member. Many factors have contributed to this sorry state. But, regardless of *why*, the major consideration must be that it need not be so!

Membership does not imply complete agreement with *all* the actions taken by any organization. It does qualify the member, authorize his opinions, and permit him a "voice" in the conduct of the organization.

And, in amateur radio, the ARRL is the *one* organization carrying official weight and prestige gained by the efforts of the amateurs through long years of struggle. ARRL is fighting your battle, member and non-member alike. ARRL needs and must have the actual support—through membership—of all amateurs.

If you are not a member—join up and carry your weight in the effort to preserve, to continue, and to enhance amateur radio. The League must represent the *majority* of the majority—not the majority of a *minority* of the total licensees. . . . . O.R.

the greatest Yagi of them all

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***12 db** *(gain of stacked JFD BALINE over a tuned folded dipole)*

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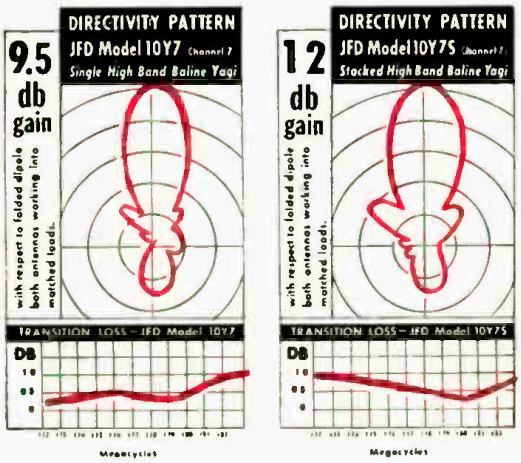

Single JFD High Band BALINE Yagis

Channels	Models	List Price
7-13	10Y7-10Y13	$13.85

Stacked JFD BALINE Yagis

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3	10Y3S	63.70
4	10Y4S	56.90
4-5	10Y45S	67.80
5	10Y5S	56.90
6	10Y6S	51.40
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Include JFD Baline matching transformers at no extra charge

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3	10Y3	31.85
4	10Y4	28.45
4-5	10Y45	33.90
5	10Y5	28.45
6	10Y6	25.70

illustrated: JFD No. 10Y2S-10Y6S Low Band Stacked Baline Yagi

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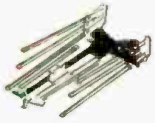
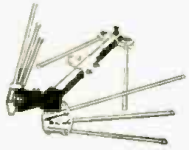
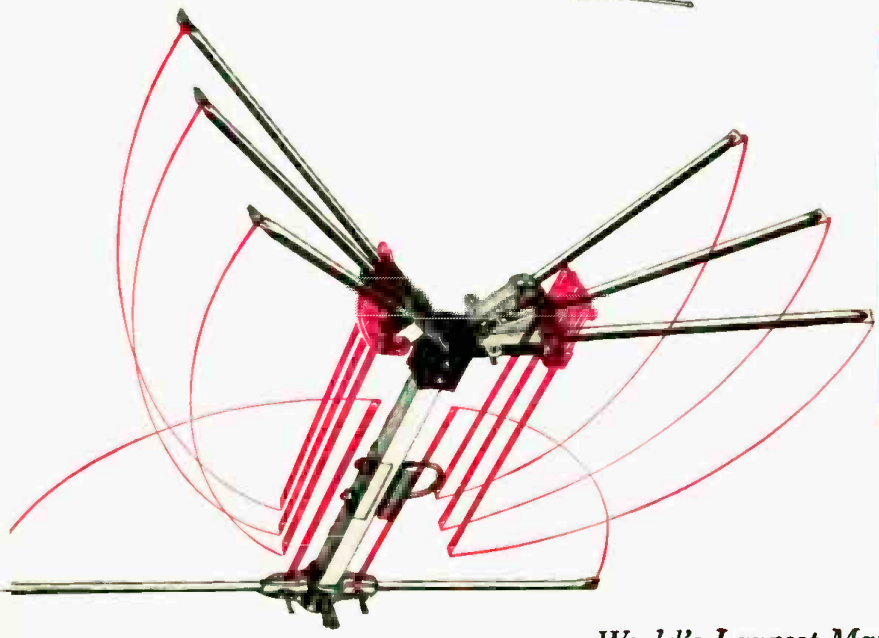


1. Pre-assembled JFD JeTenna as packaged. Note its compactness of construction and craftsmanship of design.



2. As the JeTenna swings open, dipole elements fan instantly into exact position by riding along unique fulcrum indices.

3. JeTenna elements lock into position effecting 35 forward inception angle and 40 dipole angulation for greater signal pickup. Reflectors snap into place for quick tightening by wing nuts.



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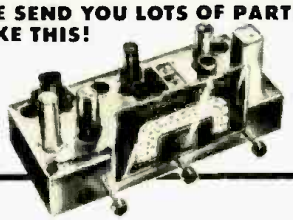

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Start saving those packages . . . get your entry in soon!

RULES OF ENTRY

1. What You Have To Do . . . Jensen Phonograph Needles are packaged two ways—on a card or in a plastic box. Every time you sell or install a Jensen Needle during this contest, save the card or colored insert in the box (*not* the instruction sheet). Collect as many as you can *during* the contest period. Prizes will be awarded to the 187 servicemen sending in the most empty Jensen Needle packages.

2. When Is The Contest . . . The Jensen "Win a Grand" Contest opens September 1, 1952 and closes at midnight December 31, 1952.

3. Who Is Eligible . . . This contest is open to every bona fide radio-television serviceman in continental United States. This includes employees as well as employers, anyone who is actively engaged in this work during the period of the contest. No employee of Jensen Industries, Inc. or its advertising agency is eligible.

4. How To Enter . . . To be eligible for one of the 187 cash prizes, you must send in one completed Official Entry Blank (available at your regular Parts Distributor) together with all the empty Jensen Needle packages you have collected during the period of the contest. All Jensen Needle packages, EXCEPT the Jensen "Symphonette" and Jensen Coin Machine Needles, are acceptable.

5. 15-Word Statement . . . On the Official Entry Blank, you will find a sentence beginning, "I Sell Jensen Needles Because . . . . . ." Just complete this sentence in 15 words or less. As a suggestion, you might say, "I Sell Jensen Needles Because *they are easier to install.*" (5 words).

6. Where To Send Entries . . . All entries to be considered for prizes must be sent, accompanied by a completed Official Entry Blank, direct to:

Jensen Contest Headquarters, 329 South Wood St., Chicago 12, Illinois

Do not send your entry to your Parts Distributor. You may hold your entry until the last day or send it in as often as you like, but be sure you have a suitable means of identification with each shipment (such as your original Official Entry Blank). REMEMBER: All entries must be postmarked before Midnight, December 31, 1952, to be eligible.

7. Duplicate Prizes . . . In the event of a tie, duplicate cash prizes will be awarded to all tying contestants.

8. Judges' Decision Final . . . Decision of the judges, chosen by Jensen Industries, Inc., will be final. All entries become the property of Jensen Industries, Inc., and none will be returned.

9. Only Entry Itself Counts . . . Only the total number of empty Jensen Needle packages, together with the completed Official Entry Blank, counts toward the prizes. Neatness, spelling, grammar or packing of entry do not count.

10. Winners To Be Announced . . . Winners in the Jensen Contest will be notified as soon after the contest closes as possible.

HERE'S ALL YOU HAVE TO DO! . . .

It's Easy! Simply save the cards and colored inserts from all the Jensen Phono Needles you sell or install from now 'til the end of the year. Pick up an Official Entry Blank at your regular Parts Distributor, complete the sentence, "I Sell Jensen Needles Because . . . ," and mail this with your packages direct to Jensen Contest Headquarters *before* Midnight December 31st. That's all there is to it . . . the radio-TV serviceman sending in the most Jensen packages wins $1000 cash. It might be you!

WHY JENSEN SPONSORS THIS BIG CONTEST!

Every radio-television serviceman can get a lot more business for himself without additional tools, equipment or labor simply by just replacing worn-out phonograph needles. That's why Jensen sponsors this unique contest—to show *you* how easy it is . . . and profitable, too. And Jensen supplies every assistance you need, with a precision made needle for every type of record player and complete easy-to-follow instructions.

Jensen INDUSTRIES, INC.
336 South Wood Street, Chicago 12, Illinois

JENSEN . . . Oldest name in Sound Engineering

Sell a JENSEN NEEDLE on Every Service Call!

BUY DIRECT AND SAVE

COLLINS OFFERS FOR YOUR

COLLINS "PRE-FAB" TUNERS and RECEIVERS

4 ALL NEW Complete Kits for Every High-Fidelity Need

ASSEMBLE YOURSELF AND SAVE

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.

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 bond 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

BUY DIRECT AND SAVE

LISTENING PLEASURE . . .

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: 11⅝" 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

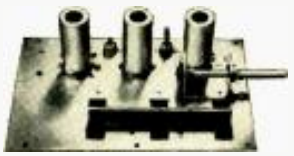
(RD-1C and Slide Rule Dial) **$28.50**

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**



Slide Rule Tuning Dial Assembly $3.85

The best for FM. The most sensitive and most selective type of "front-end" on the market. 6 to 10 microvolts sensitivity. Image ratio 500 to 1. 6J6 tuned RF stage, 6AG5 converter, 6C4 oscillator. Permeability tuned, stable and drift-free. Chassis plate measures 7" x 4½". In combination with the IF-6 amplifier, the highest order of sensitivity on FM can be ottained. Tubes included as well as schematic and instructions. Shipping weight FMF-3: 2½ lbs. Dial: 2 lbs.

AM TUNING UNIT

Tubes Included **$24.50**

Tops in AM superhet performance! A 3-gang tuning condenser gives 3 tuned stages and consequently higher sensitivity and selectivity. Assembly is completely wired, tested and aligned ready for immediate use. Frequency coverage 540 KC to 1650 KC at a sensitivity of 5 microvolts. Tubes: 6BA6 RF amplifier; 6BE6 converter and oscillator; 6BA6 IF amplifier and 6AT6 detector. Mounts on a chassis plate measuring 4" x 7⅜". Shipping weight 2½ lbs. Dial: 2 lbs.

MAIL COUPON TODAY

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

FROM:

NAME_____

ADDRESS_____

CITY_____ STATE_____

☐ FM Tuner Kit ☐ FM/AM Receiver Kit ☐ IF-6 Amplifier
☐ FM/AM Tuner Kit ☐ FMF-2 Tuning Unit ☐ RD-1C Tuner & Dial
☐ FM Receiver Kit ☐ FMF-3 Tuning Unit ☐ AM-4 Tuning Unit

Amount for Kit $_____ See weights, add shipping cost $_____ Total amount enclosed $_____ Check ☐ Money Order ☐

— THINK OF COLLINS AUDIO

Superior's New Model **82**

RAPID TESTER

The Very Best Value in Multi-Socket Tube Testers!

Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. We don't expect it to replace conventional testers but if you want to try this new type of tester, you can do no better than mail the coupon below. **Don't let the low price mislead you!** We claim Model 82 will outperform similar looking units which sell for much more—and as proof, we offer to ship it on our examine **before** you buy policy.

Primarily, the difference between the conventional tube tester and the multi-socket type is that in the latter, the use of an added number of specific sockets (for example, in Model 82 the noval is duplicated eight times) permits elimination of element switches thus reducing testing time and possibility of incorrect switch readings.

To test any tube, you simply insert it into a numbered socket as designated, turn the filament switch and press down the quality switch—THAT'S ALL! Read quality on meter. Inter-element leakage, if any indicates automatically.

FEATURES:

- ★ Dual Scale meter permits testing of low current tubes.
- ★ 7 and 9 pin straighteners mounted on panel.
- ★ All sections of multi-element tubes tested simultaneously.
- ★ Use of 22 sockets in improved circuit permits testing over 600 tube types and prevents possible obsolescence.
- ★ Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.
- ★ Employs new type 4" air-damped meter resulting in accurate vibrationless readings.

$36.50

Superior's New Model **TW-11**

STANDARD PROFESSIONAL

TUBE TESTER

- Tests all tubes, including 4, 5, 6, 7, Octal, Lock-In, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc. • 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 TW-11 as any of the pins may be placed in the neutral position when necessary. • The Model TW-11 does not use any 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. All tube listings printed in large easy-to-read type.
- **NOISE TEST:** Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE

- **SEPARATE SCALE FOR LOW-CURRENT TUBES**—Previously, on standard emission type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the standard scale. The extra scale used here greatly simplifies testing of low-current types.

The Model TW-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$47.50

Superior's New Model **TV-12**

TRANS-CONDUCTANCE TUBE TESTER

ALSO TESTS TRANSISTORS!

TESTING TUBES

- ★ Employs improved **TRANS-CONDUCTANCE** circuit. An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.
- ★ **NEW LINE VOLTAGE ADJUSTING SYSTEM.** A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.
- ★ **SAFETY BUTTON**—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.
- ★ **NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY.** Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

TESTING TRANSISTORS

A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale.

The Model TV-12 will accommodate all transistors including NPN's, PNP's, Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Model TV-12 housed in handsome rugged portable cabinet sells for only

$72.50

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

We invite you to try before you buy any of the models described on this and the following page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate. (See other side for time-payment schedule details.)

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

SEE OTHER SIDE!

Cut out and mail TODAY! ▶

All prices net, F.O.B., N.Y.C.

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Spot Radio News

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

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

V-DAY FOR THE TV world, whose early appearance did not look too promising a short while ago because of legal rows, suddenly became an exciting reality in mid-summer with the announcement that *fourteen* applicants had won authorizations for new stations, with most grants being awarded to ultra-high candidates. The surprising news was particularly thrilling to the residents of Denver (Colorado), Portland (Oregon), Springfield-Holyoke (Mass.), Flint (Michigan), New Britain (Conn.), New Bedford (Mass.), York (Pa.), Youngstown (Ohio) and Bridgeport (Conn.) who may soon be receiving TV programs from the newly authorized stations.

The west, represented by Denver, won station-approval honors, for the first new telecasters to receive permission to transmit since the freeze was clamped on, over three years ago, were in that state. Specifically, *Eugene P. O'Fallon, Inc., Colorado Television Corp.,* and the *Empire Coil Co., Inc.,* received the authorizations for Channels 2, 9, and 26, respectively. In Portland, *Empire Coil* also won Channel 27. Two high-frequency stations were approved for Springfield-Holyoke on Channels 55 and 61, to be operated by the *Hampden-Hampshire Corp.* and *Springfield-Television Broadcasting Corp.* In Youngstown, the *Vindicator Printing Co.* and WBKN received Channels 73 and 27, respectively. Channel 28 was approved for Flint and will be owned by the *Trans-American Television Corp.* Portland, Springfield-Holyoke, Youngstown and Flint, may also receive an additional allotment of very-high stations in the near future, according to the Commission.

New Britain will have a Channel-30 station, which will be operated by the *New Britain Broadcasting Co.* In New Bedford, *E. Anthony and Sons, Inc.* will place Channel 28 on the air, and in York, the *Helm Coal Co.,* and *Susquehanna Broadcasting Co.* will operate Channels 49 and 43, respectively. The ultra-high stamping ground, Bridgeport, where so many experimental tests have been and are still being conducted, will now be officially allowed to use Channel 43, and the *Southern Connecticut and Long Island Television Co.,* will control that channel's operation.

The historic grants were made just twelve days after the official deadline went into effect. On that *D*-Day, applicants poured their requests for stations into Washington, and at the end of the day, the records showed that over 500 had asked for station permits. Nearly two-hundred million dollars would be needed for building and operation of the 500-odd stations on file, with over $157-million going for station construction and over $120-million appropriated for operations.

Notwithstanding the approvals for the new stations, some attorneys were still disputing the assignments and protesting to the courts. The U.S. Court of Appeals, Third Circuit, Philadelphia, received a challenge from WWSW, Pittsburgh, who argued that Channel 4 should have been allocated to the Pittsburgh metropolitan area. The Pittsburgh situation had also been brought to the attention of the Commission by the city's mayor who declared that despite . . . "the fact that the Commission states in its Sixth Report and Order that population is the most important factor in assigning channels, 27 markets smaller (some much smaller) than Pittsburgh are assigned three or four commercial v.h.f. channels. No market of comparable size in the United States is given so few as two commercial v.h.f. stations." (Pittsburgh also received three u.h.f. channels, which it was said would not be completely effective because of the rugged terrain of the city.)

The U.S. Court of Appeals in Washington also received several appeals on behalf of WLOA, Braddock, Pa., KVOL, Lafayette, La., WISC, Madison, Wis., and WLAN, Lancaster, Pa., all concerning allocations, which the stations felt were not equitable.

Tower heights also loomed as a problem which might impede construction of new stations in some areas. According to aircraft committees assigned to a study of the situation, the 1000-foot heights suggested extend into altitudes normally used by small planes and . . . "regardless of the day and night marking placed on them, present some degree of hazard." To avoid such hazards, the committee recommended that operators should be encouraged to select sites on tall buildings or located on well-defined landmarks. The use of single-tower sites was also suggested as a solution. According to the air specialists,

102 BILLION

FREE SALES BOOSTS A YEAR FOR YOU!

NEW
CBS-HYTRON BRAND gives you:

Acceptance

1,973,326,000 times a week! 102,612,952,000 times a year! The magic letters "CBS" are seen and heard on radio and TV station breaks. Impact is terrific. An average of 13 sales impressions weekly for every man, woman and child in the country. Every one of your customers knows CBS. Knows he can depend upon CBS. Consumer acceptance of your CBS-Hytron brand grows hourly.

Engineering

As a division of the Columbia Broadcasting System, Inc., CBS-Hytron commands tremendous engineering resources for you. Because CBS embraces the field of electronic entertainment: Radio broadcasting. TV broadcasting. Radio, television, and phonograph sets. Records. Electronic research laboratories. And CBS-Hytron tubes.

Leadership

For example, CBS-Hytron originated: the GT tube . . . the subminiature tube . . . the rectangular picture tube . . . specialized, low-cost TV receiving tubes. CBS-Hytron's new picture-tube and miniature-tube plants are the most modern in the world. Such aggressive leadership guarantees you the newest and best in tubes.

YOU CAN'T BUY BETTER

Demand the CBS-Hytron brand. You get the finest electron tubes that progressive engineering skill and craftsmanship can make. You get the brand known and respected by every one of your customers. **You get the brand they see and hear the most . . . CBS-Hytron.**

MANUFACTURERS OF RECEIVING TUBES SINCE 1921
HYTRON
RADIO AND ELECTRONICS CO.
A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

CBS HYTRON RADIO TUBES

MAIN OFFICE: SALEM, MASSACHUSETTS

both the . . . "aviation and television industries must cooperate toward the end that neither industry is expected to accept unreasonable restrictions."

While the legal quarrels and aviation requirements might block some allocations, experts declared that the authorization schedule should move along and provide channels at quite a pace to many, many cities. The Commission's insistence that the younger u.h.f. service make a firm and rapid start, has been described as a strong impetus which will accelerate station assignments.

As we go to press, Washington reports that four more TV stations have been authorized to go on the air: KXLY-TV and KHQ in Spokane, Wash., using Channels 4 and 6 respectively; and the Texas Broadcasting Corp. and the Capital City Television Company, both in Austin, Texas, operating on Channels 7 and 18.

COLOR TV also became a headline item in mid-summer, although on a rather temporary basis; NPA amended the hotly debated M-90 stop-color-set order, declaring that color chassis could now be made if such production did not interfere with defense work, a condition most felt would be impossible to meet at present. One Midwest manufacturer declared that the relaxation of the curb will have . . . "little or no effect on the TV industry because all it does is give the go-ahead to something 90% of the industry is not interested in." According to another large set maker there won't be any quantity of color sets made until there is color programming and . . . "you won't have comprehensive color programming until there are lots of sets. No one is in an economic position to take the initiative in creating a market for either sets or programs."

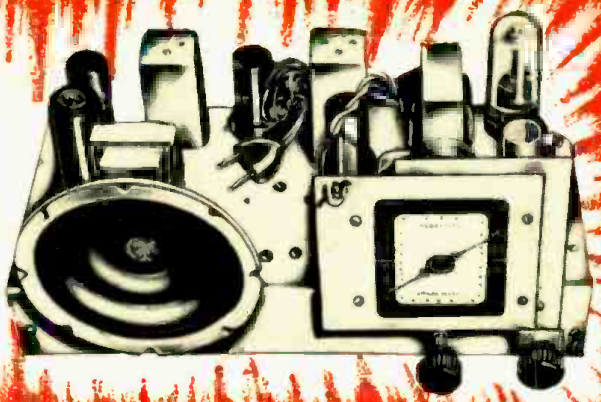
Even the sequential-system operators who won FCC approval for their disc method did not view the ruling with any enthusiasm because of the resistance or lack of cooperation from the . . . "majority of the industry."

One bright sign did appear from the movie-mogul owners of the *Lawrence* tri-color tube who said that they would file for authority to produce sets that would pick up color and monochrome. The motion-picture operators declared that only a few minor changes would be required to alter standard chassis to accept their color tubes and permit color and black and white reception.

The ban lift did bring a sigh of relief to some, the theater TV operators, who were told that larger-screen research and development could continue, if, of course, substantial quantities of scarce materials were not involved in broad-scale operations.

THE TUBE SITUATION, as viewed by members of the military, has been of considerable concern to industry since the defense program was inaugurated,

(*Continued on page* 122)



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

IN 10 MONTHS — OR LESS — FOR

RADIO-TELEVISION

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

I SEND YOU 18 BIG KITS

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

Frank L. Sprayberry
President
Sprayberry Academy of Radio

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-N, Chicago 6, Ill.

MAIL COUPON TODAY! NO OBLIGATION

I invite you to get all the facts—

FREE TO YOU 3 BIG RADIO-TELEVISION BOOKS

I want you to have ALL the facts about my new 10-MONTH Radio-Television Training—without cost! Rush coupon for my three big Radio-Television books: "How to Make Money in Radio-Television." PLUS my new illustrated Television Bulletin PLUS an actual sample Sprayberry Lesson—ALL FREE. No obligation and no salesman will call. Mail coupon NOW!

SPRAYBERRY ACADEMY OF RADIO, Dept. 25-N
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.....

CHANNEL MASTER

proudly introduces

the world's first Broad Band Yagi

the futuramic

A great new type of antenna that combines:

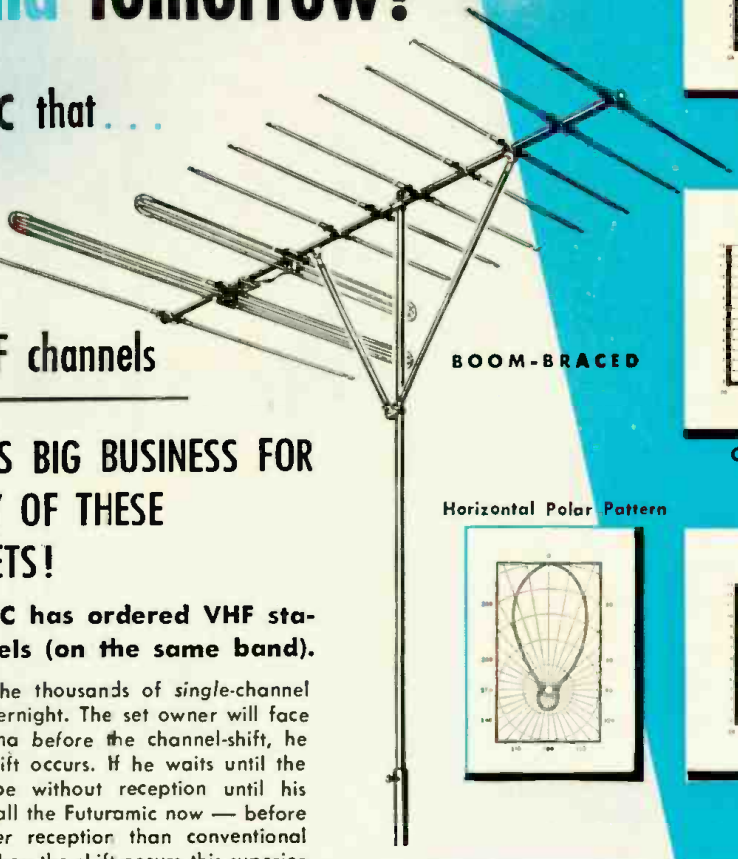
- **Broad Band coverage with the high gain and directivity of the Yagi**

Spectacular high gain! Razor-sharp directivity! In fact, all the brilliant performance that only a Yagi can deliver, is now yours with the FUTURAMIC — not on just one channel, but CLEAR ACROSS THE BAND!

For the first time in television history, here is an antenna that not only solves today's installation problems — but also provides for the new VHF channels of the future. This is the antenna you have been waiting for — the 10 Element FUTURAMIC is a true Broad Band Yagi!

the antenna designed for today and tomorrow!

The same **FUTURAMIC** that . . .
Solves today's reception problems.
Will also receive tomorrow's new VHF channels



THE FUTURAMIC MEANS BIG BUSINESS FOR YOU IF YOU SERVE ANY OF THESE 3 BOOMING VHF MARKETS!

1. 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. The set owner will face a dilemma: If he changes his antenna *before* the channel-shift, he will be without reception until the shift occurs. If he waits until the station changes channels, he will be without reception until his new antenna is installed. You can install the Futuramic now — before the rush starts! 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!

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

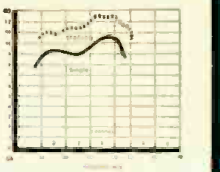
The hundreds of thousands of single-channel Yagis now in use will not bring in the new channel. This means that an additional Yagi will have to be installed and tied into the present installation with a separate lead, through an annoying switching system. However, one Futuramic will do the job of *both* antennas — at lower cost — with better results on *both* channels. Install the Futuramic now to improve your present picture. And at the same time be ready for future channels on the same band.

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

In such areas, the installation man must choose between conventional broad band antennas and separate Yagis for each channel. Each approach has important advantages. Only the Futuramic will give you the advantages of BOTH, combining highest gain, and sharpest directivity on each channel with simple, economical installation.

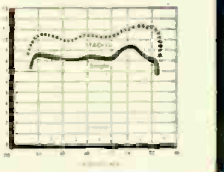
GAIN CURVES

Model 1124



Covers Ch. 2, 3, 4

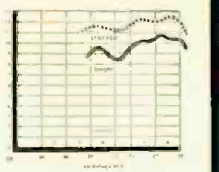
Model 1125



Covers Ch. 2, 3, 4, 5

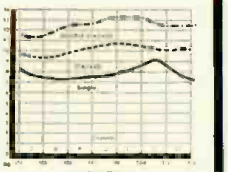
Horizontal Polar Pattern

Model 1146



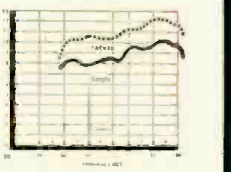
Covers Ch. 4, 5, 6

Model 1173



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

Model 1136



Covers Ch. 3, 4, 5, 6

ALL THIS AND Z-MATCH TOO!

The Futuramic uses Channel Master's famous Z-Match system which eliminates mismatch, gives maximum stacking gain, and provides stacking bars at no extra cost.

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!

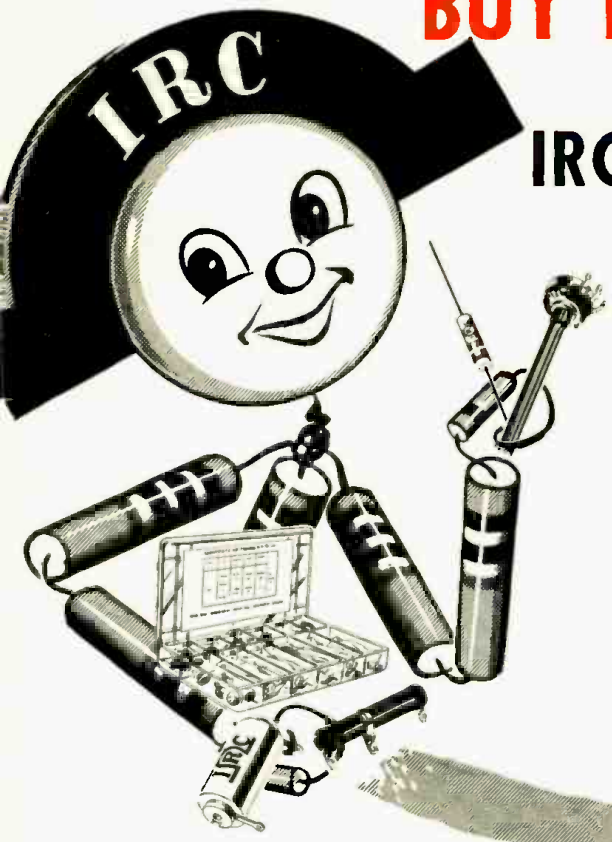
- Channel for channel, the Broad Band Futuramic will outperform any conventional SINGLE-CHANNEL Yagi!
- On each of its specified channels, one single Low Band Futuramic will outperform any 4-bay conical or fan array!
- A single High Band Futuramic will outperform any 2-bay conical or fan array on every channel from 7 to 13!
- A high-low Futuramic combination is the most sensitive array ever devised for all-channel VHF reception!

Write for complete technical literature.

CHANNEL MASTER CORP. ELLENVILLE, N.Y.

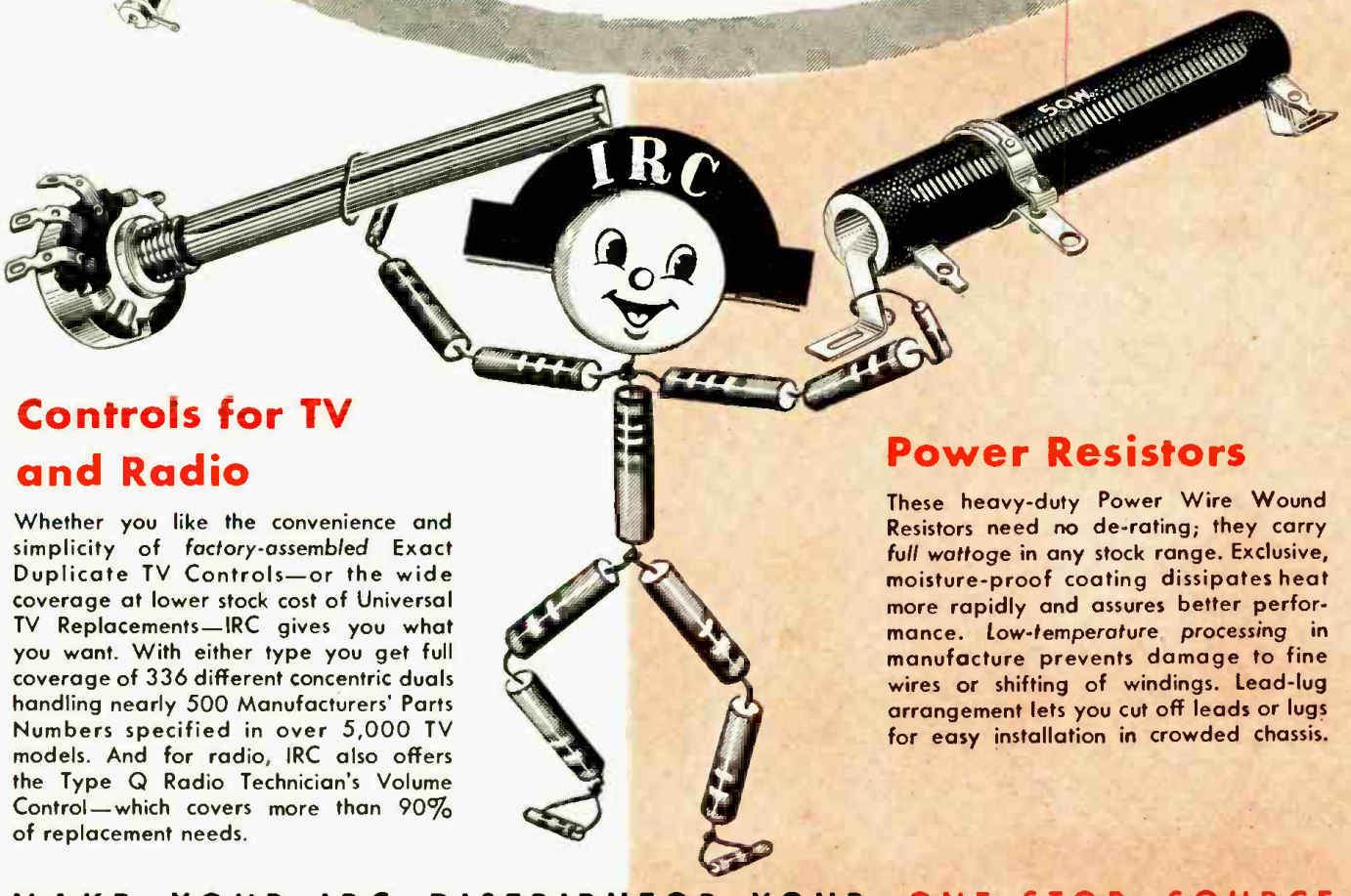
MEMBER

HERE'S YOUR WISEST BUY IN REPLACEMENTS!



IRC Gives You Widest Variety —Greatest Dependability

You know the dependability of IRC resistors. But *do* you know their full replacement coverage? It's the *widest in the industry*—and that's worth knowing. For it means you can get the exact IRC part you need for any specific job—instead of running the risk of failures-in-service, so common with makeshift parts. Take a moment to look at IRC's replacement coverage. Then, for widest variety and greatest dependability, specify IRC.



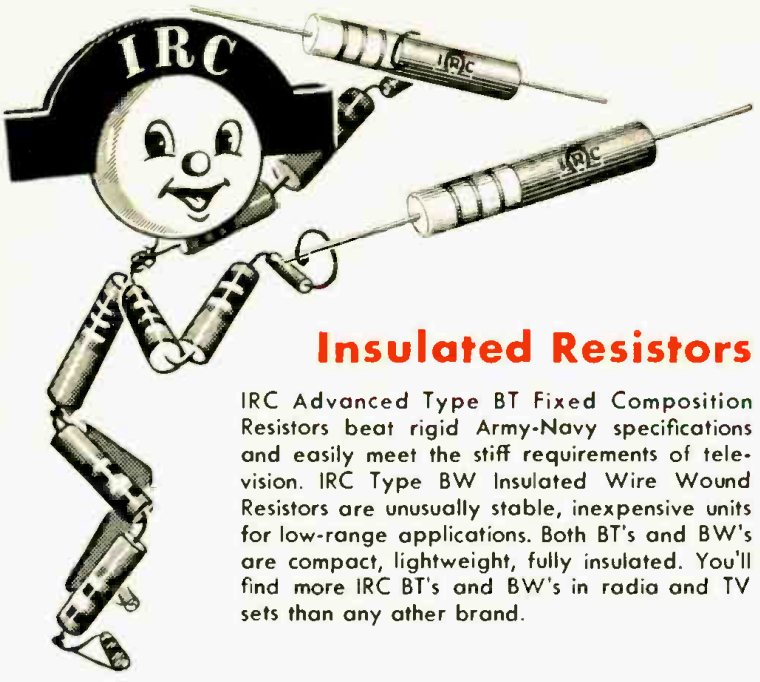
Controls for TV and Radio

Whether you like the convenience and simplicity of *factory-assembled* Exact Duplicate TV Controls—or the wide coverage at lower stock cost of Universal TV Replacements—IRC gives you what you want. With either type you get full coverage of 336 different concentric duals handling nearly 500 Manufacturers' Parts Numbers specified in over 5,000 TV models. And for radio, IRC also offers the Type Q Radio Technician's Volume Control—which covers more than 90% of replacement needs.

Power Resistors

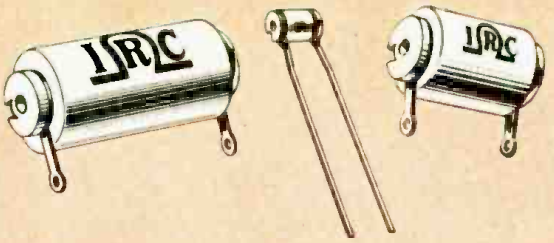
These heavy-duty Power Wire Wound Resistors need no de-rating; they carry *full wattage* in any stock range. Exclusive, moisture-proof coating dissipates heat more rapidly and assures better performance. *Low-temperature processing* in manufacture prevents damage to fine wires or shifting of windings. Lead-lug arrangement lets you cut off leads or lugs for easy installation in crowded chassis.

MAKE YOUR IRC DISTRIBUTOR YOUR ONE-STOP SOURCE



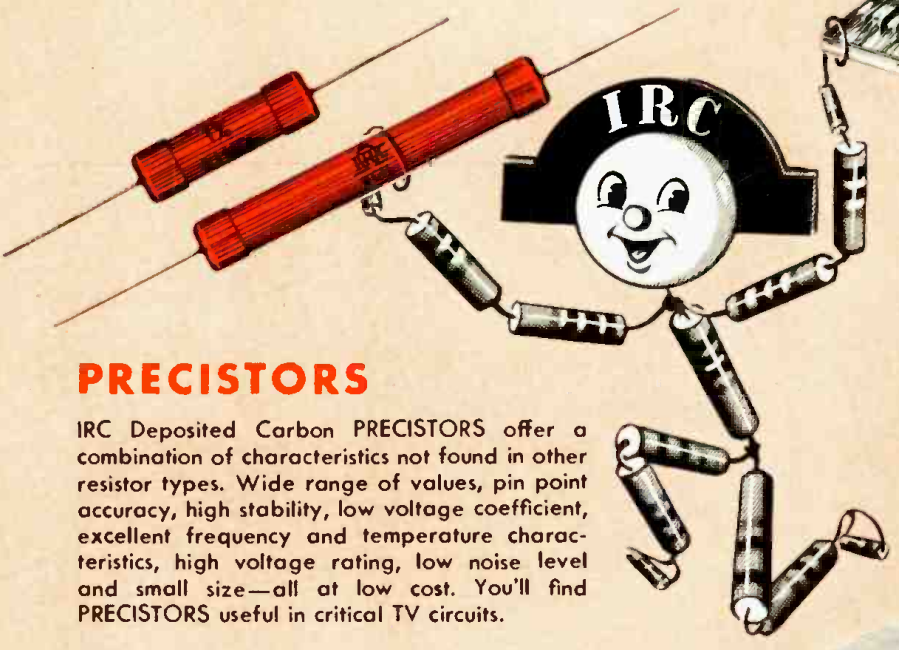
Insulated Resistors

IRC Advanced Type BT Fixed Composition Resistors beat rigid Army-Navy specifications and easily meet the stiff requirements of television. IRC Type BW Insulated Wire Wound Resistors are unusually stable, inexpensive units for low-range applications. Both BT's and BW's are compact, lightweight, fully insulated. You'll find more IRC BT's and BW's in radio and TV sets than any other brand.



Precision Resistors

These all-new, greatly improved IRC Precision Wire Wound Resistors far surpass critical Army-Navy specifications. New winding forms hold more wire for greater resistance. New winding technique eliminates shorted turns and winding strains. New insulation compound gives higher stability and freedom from noise—greater humidity resistance and longer life. New terminations provide greater strength in connections.



PRECISTORS

IRC Deposited Carbon PRECISTORS offer a combination of characteristics not found in other resistor types. Wide range of values, pin point accuracy, high stability, low voltage coefficient, excellent frequency and temperature characteristics, high voltage rating, low noise level and small size—all at low cost. You'll find PRECISTORS useful in critical TV circuits.

Practical Stock Assortments

At no extra cost, IRC's handy metal Kits and Cabinets put the parts you use most right at your finger tips. Stocked with BT and BW, resistors in the ranges most widely used in television—with Volume Controls and parts that cover more than 90% of Single Carbon Control Replacements—or with IRC Insulated Chokes, these handsome, compact kits save shopping time, eliminate clutter, improve your shop's appearance. There's even a flat, pocket-size kit for service calls or small bench stocks.

Get New Catalog Bulletins

Your name and address on a post card will bring you Catalog Bulletins on any of these parts you specify. Or, if you wish, you can examine any of the products shown above at your IRC Distributor. For more profitable servicing, get the full IRC replacement story today.

IRC

INTERNATIONAL RESISTANCE COMPANY

401 N. Broad Street, Philadelphia 8, Pa.

In Canada: International Resistance Co., Ltd., Toronto, Licensee

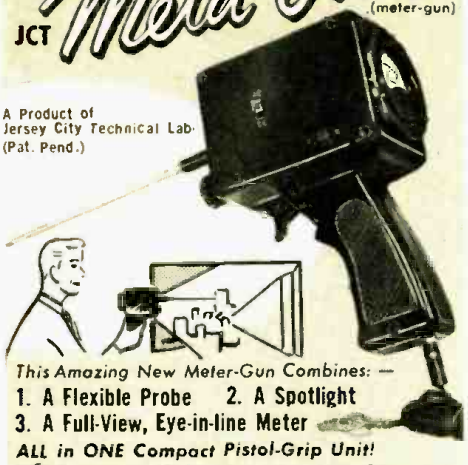
Wherever the Circuit Says ~~~

FOR ALL REPLACEMENT PARTS

First Again! HUDSON RADIO & TELEVISION CORP. Formerly Newark Electric Co., Inc., of New York for ALL THE LATEST ELECTRONIC EQUIPMENT!

AT LAST! "ON-THE-SPOT" TESTING MADE SIMPLE AND EASY WITH THE SENSATIONAL NEW JCT Méta-Gun (meter-gun)

A Product of Jersey City Technical Lab. (Pat. Pend.)



This Amazing New Meter-Gun Combines: —

1. A Flexible Probe 2. A Spotlight
3. A Full-View, Eye-in-line Meter

ALL in ONE Compact Pistol-Grip Unit!

MÉTA-GUN The Most Advanced — Most Convenient To Use Testing Instrument Ever Developed. Indispensable To Radio and TV Servicemen And Plant Maintenance Technicians.

- **Designed for ONE HAND FINGERTIP OPERATION Makes Servicing and Maintenance A Cinch!**
- **No Need to Remove Chassis — Long Flexible Probe Reaches Hard-to-get-at Places.**
- **Less Shop Work — More On-the-Spot Service.**
- **No Need To Move Head To See Meter.**
- **Saves Time and Money.**

SIMPLE AND EASY TO USE: Fasten the ground lead to Chassis. The light switch in the pistol grip handle can be switched on or off with one finger . . . illuminates area under test. The long test probe is flexible . . . bends and stays in position . . . gets around obstacles. A choice of three ranges in the trigger can easily be made with the index finger. The thumb can quickly switch from volts to ohms when needed. Ohms adjust is made with the large adjustable knob on the front.

Handsomely styled in a durable plastic case.
Overall Dimensions 5½" x 8" x 3".
Weight 2 lbs. Available in 2 models as follows:

Specifications — Model 3A	Specifications — Model 3B
•Ranges:	•Ranges:
0-10, 100, 1000 volts DC	0-10, 100, 1000 volts DC
0-10, 100, 1000 volts AC	0-10, 100, 1000 volts AC
R x 1, R x 10, R x 100 ohms.	R x 1, R x 10, R x 100 ohms.
•Meter:	•Meter:
2% 1,000 ohms per volt.	2% 20,000 ohms per volt.
•Batteries:	•Batteries:
Four self-contained 1½ V pen-lite cells	Four self-contained 1½ V pen-lite cells
Net Price — **$32.75**	Net Price — **$35.50**

Use Handy Coupon to Order or Write For Full Details

IT'S NEW and SENSATIONAL...

EBCO

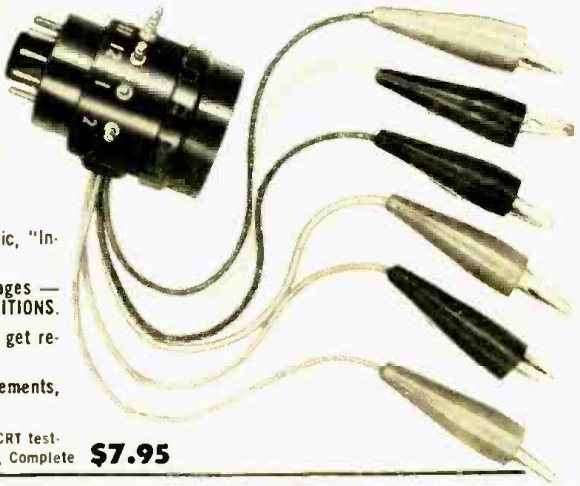
DYNAMIC ANALYZER

For Cathode Ray Tubes

CONVERTS YOUR VACUUM TUBE VOLTMETER INTO THE FINEST CRT TESTER THAT MONEY CAN BUY!

Pinpoint and eliminate elusive sources of trouble quickly, accurately, by combining your VTVM with the amazing new and efficient EBCO DYNAMIC ANALYZER. Easily attached to your VTVM for rapid, reliable readings.

It's DYNAMIC because EBCO DYNAMIC ANALYZER is the only instrument which checks BOTH the SET and TUBE during actual operation.



Now You Can Perform These Dynamic, "In-Operation" Tests:

1. Check accurately all socket voltages — UNDER ACTUAL OPERATING CONDITIONS.
2. Check emission of the tubes and get related emission reading.
3. Check picture tube for open elements, shorted elements and leakage.

FREE — Service Engineer's Manual for CRT testing with each instrument. Net, Complete **$7.95**

BIG MONEY MAKER FOR SERVICEMEN!

EBCO
PICTURE TUBE
CHECKER-REACTIVATOR

- **CHECKS picture tubes without removal.**
- **REACTIVATES and RENEWS them for longer life.**

Applied while tube is in set or still in shipping carton. Check picture tubes for shorts, cathode emission, leakage. Put new life into weak tubes by reactivation! A truly remarkable 2-in-1 servicing aid. Lightweight, portable. 110 volt, 60 cycle. Factory guaranteed. Model 10.

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EBCO "LIFE EXTENDER"

Energizes, renews and prolongs life of dim, wornout tubes. Dual heat connections for extra long life. Suitable for all size picture tubes. Often saves the cost of a new tube. Automatically operated. Just plug in!

In lots of 3 . . . **$2.95** each Single Units . . . **$3.95** each

EBCO CUSTOM QUALITY TV PICTURE TUBES AT MASS-PRODUCTION PRICES

Highest quality, tested and fully guaranteed picture tubes. Liberal glass allowance on "old tube" for new tube basis. Write for price schedule.

EBCO MULTIPLE CONNECTORS

Bypass antenna problems. Attach two or more TV or FM sets to 1 antenna with single connector. Plastic Case 4¼" x 2¼" x 1½" D.

2 Set Connector . . **$2.95** each

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Quantity		Price	Quantity		Price
.....	EBCO DYNAMIC ANALYZER	@ $7.95	.....	EBCO MULTIPLE CONNECTORS	@ $2.95
.....	EBCO CHECKER-REACTIVATOR	@ $19.95	.....	MODEL 3A JCT META-GUN	@ $32.75
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Revolutionary EV CDP

COMPOUND DIFFRACTION PROJECTOR*

*Patent Pending

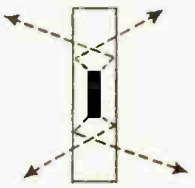
WEATHER PROOF
BLAST PROOF
SPLASH PROOF
Drain holes permit subsequent operation after complete water immersion.

INDESTRUCTIBLE
Molded of glass fibers for extra strength and improved acoustic properties.

Public Address Loudspeaker System *for perfect* VOICE PENETRATION AND FULL RANGE MUSICASTING

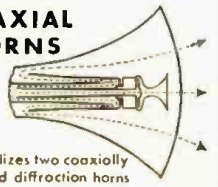
CDP is so advanced in concept . . . so efficient in performance . . . that conventional PA reentrant horns are now obsolete by comparison! The CDP COMPOUND DIFFRACTION PROJECTOR* provides a loudspeaker system with peak-free response ± 5 db to 11,000 cps . . . delivers 2½ octaves more musical range than usual PA units of even larger size. Speech articulation index is at least 20% superior. Polar distribution pattern exceeds 120° at all frequencies up to 10,000 cps. Diffraction principle, high sensitivity and power handling assure much greater sound dispersion, penetration and coverage with fewer units and at far less cost. Greatly improves public address—in all types of applications—indoors and outdoors. *Get the amazing facts about CDP now!*

DIFFRACTION PRINCIPLE



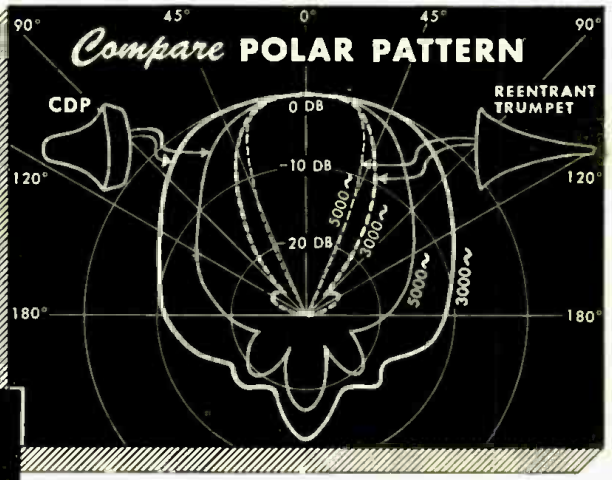
Uses the new acoustic application of optical slit diffraction for perfected smooth sound dispersion virtually independent of frequency.

COAXIAL HORNS

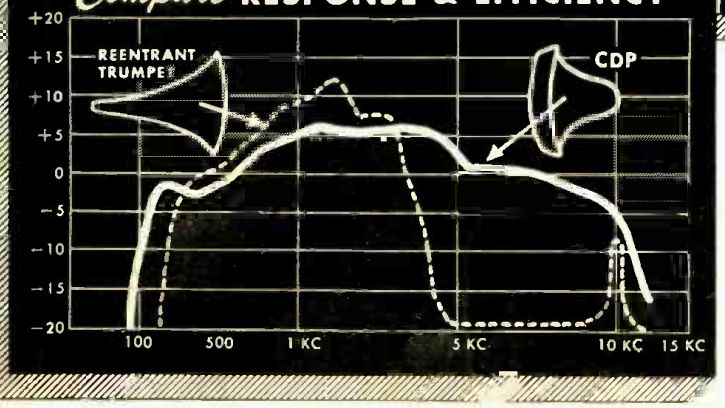


CDP utilizes two coaxially mounted diffraction horns working from both sides of a single diaphragm. Each horn is designed for optimum air loading and reproduction within its own range.

Compare POLAR PATTERN



Compare RESPONSE & EFFICIENCY



Model 848 Compound Diffraction Projector* Loudspeaker System
Conservatively rated at 25 watts. 16 ohms impedance. Finished in attractive gunmetal gray. Two mounting positions for hang-up bracket. Projectors can be installed horizontally, or vertically for augmented dispersion. Dimensions: 10½" wide at mouth, 20½" high at mouth, 20" deep over-all. Weight: Net 12 lbs., Shipping 15 lbs. List Price... **$59.00**

Send for Free Bulletin 195

Electro-Voice

410 CARROLL STREET • BUCHANAN, MICHIGAN

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Superior's New Model 76

ALL-PURPOSE BRIDGE

IT'S A

✓CONDENSER BRIDGE ✓RESISTANCE BRIDGE
✓SIGNAL TRACER ✓TV ANTENNA TESTER

SPECIFICATIONS:

CAPACITY BRIDGE SECTION—4 Ranges: .00001 Microfarad to 1000 Microfarads. Will also locate shorts, and leakages up to 20 megohms. Measures the power factor of all condensers from .1 to 1000 Microfarads. (Power factor is the ability of a condenser to retain a charge and thereby filter efficiently.)

RESISTANCE BRIDGE SECTION—2 Ranges: 100 ohms to 5 megohms. Resistance can be measured without disconnecting capacitor connected across it. (Except, of course, when the R C combination is part of an R C bank.)

SIGNAL TRACER SECTION—With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc. Provision has been made for use of phones and meter if desired.

TV ANTENNA TESTER SECTION—Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? 2 Ranges: 2' to 200' for 72 ohm coax and 2' to 250' for 300 ohm ribbon.

Model 76 comes complete with all accessories including R.F. and A.F. Probes; Test Leads and operating instructions. Nothing else to buy. Only **$26.95**

Superior's New Model 77

VACUUM TUBE VOLTMETER

WITH NEW 6'' FULL-VIEW METER!

AS A DC VOLTMETER—Will measure any voltage up to 1500 volts with negligible loading. Indispensable in receiver and Hi-Fi Amplifier servicing and a must for Black and White and color TV servicing where circuit loading cannot be tolerated.

AS AN AC VOLTMETER—Will quickly and simply measure RMS value if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers, sync pulses and saw tooth voltages are easily read.

AS AN ELECTRONIC OHMMETER—Because of its wide coverage of measurement in the resistance range (from .2 ohms to 1,000 megohms) the Model 77 will be your most frequently used resistance meter. Leaky capacitors show up glaringly when tested with the Model 77.

SPECIFICATIONS

DC VOLTS—0 to 3/15/75/150/300/750/1500 volts at 11 megohms input resistance.

AC VOLTS (RMS) — 0 to 3/15/75/150/300/750/1500 volts.

AC VOLTS (Peak to Peak)—0 to 8/40/200/400/800/2000 volts.

ELECTRONIC OHMMETER — 0 to 1000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms.

DECIBELS— —10 db to +18 db, +10 db to +38 db, +30 db to +58 db. All based on 0 db=.006 watts (6 mw) into a 500 ohm line (1.73v).

ZERO CENTER METER—For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

Model 77 comes complete with operating instructions, probe, test leads and carrying case. Operates on 110-120 volt 60 cycle. Only **$42.50**

Superior's New Model 79

SUPER-METER

WITH NEW 6'' FULL-VIEW METER!

***A Combination* VOLT-OHM MILLIAMMETER • *Plus* CAPACITY, REACTANCE, INDUCTANCE AND DECIBEL MEASUREMENTS • *Also Tests* SELENIUM AND SILICON RECTIFIERS, SILICON AND GERMANIUM DIODES.**

SPECIFICATIONS

- **D.C. VOLTS**—0 to 7.5/15/75/150/750/1,500.
- **A.C. VOLTS**—0 to 15/30/150/300/1,500/3,000.
- **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.
- **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 to +38, +34 to +58.

The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings.

- All Electrolytic Condensers from 1 MFD to 1000 MFD.
- All Selenium Rectifiers. • All Germanium Diodes.
- All Silicon Rectifiers. • All Silicon Diodes.

Model 79 comes complete with operating instructions and test leads. Use it on the bench—use it on calls. A streamlined carrying case included at no extra charge accommodates the tester, instruction book and test leads. Only **$38.50**

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. O-494, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

- ☐ Model 82 Total Price $36.50 $6.50 within 10 days. Balance $6.00 monthly for 5 months.
- ☐ Model TW-11 Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model TV-12 Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.
- ☐ Model 76 Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model 77 Total Price $42.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.
- ☐ Model 79 Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

Name .....

Address .....

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

All prices net, F.O.B., N.Y.C.

We invite you to try before you buy any of the models described on this and the preceding page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

SEE OTHER SIDE!

◀ **Cut out and mail TODAY!**

Within the INDUSTRY

SYDNEY JURIN has been named national sales manager for radio and television receivers manufactured by *Majestic Radio & Television*, Division of *The Wilcox-Gay Corporation.*

He served in a similar capacity at *Pilot Radio Corporation* and *Tele-tone Radio Corporation* prior to joining the *Majestic Radio & Television Company.*

Mr. Jurin has just completed a seven-week survey trip during which he visited the in-between television markets which are expected to develop within the next year as soon as new stations are opened. He also investigated the various fringe area markets with a view to placing the current *Majestic* line which incorporates the "fringe area" switch.

* * *

THE EXHIBITION COMMITTEE of the German Radio Industry has announced that the "Great German Radio and Television Exhibition" which had originally been scheduled to take place in Dusseldorf August 22-31 has been postponed until February 27-March 8, 1953.

Since the North West German Radio will not be able to transmit television programs throughout Western Germany until the spring of 1953, the exhibition has been postponed to this date.

The program as originally announced (see page 110 of the July issue of RADIO & TELEVISION NEWS) will be carried out in its entirety during the newly-announced exhibition dates.

* * *

GEORGE M. HAKIM has been appointed director of advertising and sales promotion for *Belmont Radio Corporation*, Chicago manufacturers of *Raytheon* television and radio receivers.

He was formerly associated with the *Allen B. Du Mont Laboratories, Inc.* in the capacity of advertising manager of the receiver division. Prior to entering the radio and television field, Mr. Hakim spent 15 years in advertising and sales promotion, including positions with several New York advertising agencies, handling many top national accounts.

* * *

GLEN McDANIEL, the Radio-Television Manufacturers Association's first full-time president, has resigned his post, effective October 1st of this year.

In making his announcement, Mr. McDaniel revealed that personal considerations which require his return to New York City were responsible for his resignation. He was elected to the post in February 1951.

The Association has greatly expanded its staff and services to members since Mr. McDaniel took office. Under his direction RTMA established a Statistical Department and broadened its statistical service to the industry. He has led the organization in promoting the interests of small manufacturers within the industry, especially in facilitating cooperation between small and large companies in meeting the responsibilities of the electronics industry in the national defense program.

No successor has been named as yet but the new chairman of the board of RTMA, A. D. Plamondon, Jr., has appointed a committee consisting of past presidents to make recommendations for a new president.

* * *

PHILLIP J. WOOD has been appointed merchandise and field sales manager for *Stewart-Warner Electric*, the radio and television division of *Stewart-Warner Corporation.*

Mr. Wood, who will make his headquarters in Chicago, will devote all of his time working with district managers, distributors, and distributor sales forces. He will also be responsible for merchandise and sales promotional activities of distributors.

He was formerly regional sales manager of the southern California and Arizona territories of the company. Ned Paine is replacing Mr. Wood in that capacity.

* * *

GEORGE B. WAYSON is the new sales manager for *Esquire Radio Corp.* of Brooklyn . . . The *Jeffers Electronics* and *Speer Resistor Divisions* of *Speer Carbon Company* has named **JOHN W. LOHNES** to the post of vice-president of sales . . . **M. A. DE MATTEO** has been placed in charge of jobber sales at *Astron Sales Corporation,* East Newark, New Jersey manufacturer of condensers and r.f. interference filters . . . *Westinghouse* Television-Radio Division has named **JAY M. ALLEN** to the post of manager of manufacturing and **RICARDO MUNIZ** as superintendent of manufacturing at the Sunbury, Pa. plant . . . **J. CALVIN AFFLECK** has been appointed advertising manager of the receiver division of *Allen B. Du Mont Laboratories, Inc.* He will also con-

Service Clinic!

Engineering information to help you better service Raytheon

VERTICAL FRAME INTERLACING

Vertical resolution is determined by the number of horizontal scanning lines contained between the top and the bottom of the picture. The interlacing of two vertical frames by ½ horizontal scan-line spacing will double the resolution. This allows the use of a "flicker-free" vertical that will produce 525 horizontal scanning lines (262.5 lines without interlace).

Vertical frame interlacing requires the vertical oscillator of the TV receiver to be "phase-locked" in frequency to that of the transmitted sync.

An integrating network is used to derive the vertical sync as shown in Figure 1 (1st frame) and Figure 3 (interlaced frame). A receiver vertical oscillator adjusted to a slightly lower frequency will be triggered into syncronization as the sync pulse (Figure 2 and 4) rises to the triggering level.

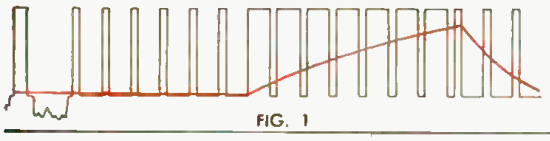


FIG. 1

FIG. 2

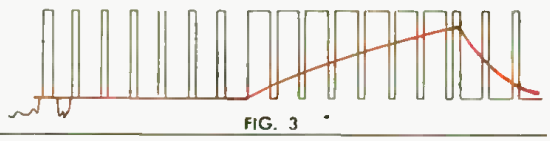


FIG. 3

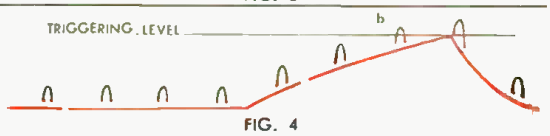


FIG. 4

Pairing or the loss of interlace will result when the alternate frames are of different time duration, even though the frequency may be exact for the combined frames. This is most commonly caused by receiver horizontal oscillator pulses coupling into the vertical oscillator. Thus causing the first field to trigger (point a Figure 2) at a different time than that of the second field (point b Figure 4). Deflection yoke interwinding coupling, chassis wiring lead dress, faulty integrating components or inadequate B filtering are the common causes for poor interlace.

It should not be necessary to adjust the vertical hold control for interlace reasons.

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

tinue his duties as sales promotion manager for the division . . . *Ultrasonic Corporation* of Cambridge, Mass. has appointed **WILLIAM M. PEASE** to the office of vice-president and director of engineering and **PAUL TRAVERS** to the post of chief engineer . . . **CLIFTON R. POTTER** has been appointed manager of commercial engineering for the electronic tube division of *Westinghouse Electric Corporation* at Elmira, New York . . . **STANLEY KRAMER** is the new chief applications engineer and **HERBERT FRIEDMAN** is the sales engineer for the newly-formed germanium products division of *Radio Receptor Co., Inc.* . . . **ROBERT H. DOLBEAR** has been named to the post of sales engineer for the instrument division of *Allen B. Du Mont Laboratories, Inc.* He was formerly field service engineer for the electronic division of the *Curtiss-Wright Corporation* . . . *Allied Radio Corporation* has made two new appointments of interest to the industry. **E. C. WHARFIELD** has been named coordinator for sales of high-fidelity equipment while **ZOLE CSOLKOVITS** is the new coordinator for sales of amateur equipment. Both men are widely-known hams and have been associated with *Allied* for many years.

* * *

J. A. MILLING has joined *Howard W. Sams & Co., Inc.* of Indianapolis as executive vice-president and general manager of the firm.

He was formerly director of the Electronic Division of the National Production Authority in Washington, on leave from his position as operating vice-president of *RCA Service Co., Inc.* of New York.

In his new position he will be in charge of the firm's expansion program in behalf of "Photofact Publications" and allied enterprises in the electronics field.

Mr. Milling has been associated with the electronics industry for twenty-five years, the last twenty-two with *RCA*. He is widely known by dealers, service technicians, distributors, and manufacturers throughout the country.

* * *

BOGUE ELECTRIC MANUFACTURING COMPANY is building a new plant on Pennsylvania Avenue in Paterson, N. J. The new facilities will provide 25,000 square feet of additional floor space . . . The **CROSLEY DIVISION** has started limited production in its new building at Richmond, Indiana. Full production will not be attained until sometime next year . . . **RAD-TEL TUBE CO.** has moved to new and larger quarters at 115 Coit Street in Irvington, New Jersey . . . **THE LAPOINTE-PLASCOMOLD CORPORATION** has moved to a new plant at 155 West Main Street in Rockville, Connecticut. The new facilities will be used for the manufacture of the company's line of "Vee-D-X" an-

(*Continued on page* 88)

NEW GENERAL ELECTRIC ALL-PURPOSE OSCILLOSCOPE

Versatile 5-Inch Model ST-2B Outperforms Competition in Laboratory and Industrial Applications

NO MATTER how broad the requirements of your laboratory, chances are you'll find most of them listed in the comparison chart below. Four well-known makes* of conventional scopes are analyzed, feature by feature, against the General Electric ST-2B. *On every point,* the G-E unit is an investment in high-quality, long-term performance.

Write us for complete new bulletin ECL-4. *General Electric Company, Section 992, Electronics Park, Syracuse, New York.*

*Names on request.

SPECIFICATIONS

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.)

TUBE COMPLEMENT

4— 6BK7
4— 5879
2— 12AU7
1— 1B3GT
1— 5Y3GT
1— OA2
1— 884

Model 4ST2B1— 5UP1
Model 4ST2B2— 5UP7
Model 4ST2B3— 5UP11

SIZE Height—15½ Inches; Depth—17 Inches; Width—10 inches; Weight—45 pounds

WHAT DO YOU LOOK FOR IN A SCOPE? STUDY THIS FACTUAL COMPARISON.

CHARACTERISTICS	G-E ST-2B	MFTR. B	MFTR. C	MFTR. D	MFTR. E
Sufficient band width for pulse work	Yes	Yes	Yes	Yes	No
High gain AC/DC amplifiers	Yes	Yes	No DC amplifier	No DC amplifier	Yes
Triggered sweep	Yes	No	No	No	Yes
Good stability	Yes	Yes	Yes	Poor	Yes—if tube selection is employed
Choice of cathode ray tube screen persistence	Yes	Cannot use long persistence C. R. tube	Yes	Cannot use long persistence C. R. tube	Yes
Low capacity probe	Yes	Yes	No	No	Yes
Direct connection to deflection plates	Yes	No	Yes	Yes	Yes
Identical vertical & horizontal amplifiers	Yes	Yes	No	No	No
Low microphonics	Yes	No	Yes	Yes	Yes
Z-axis modulation input jack	Yes	No	Yes	Yes	Yes
Convenient amplitude calibrator	Yes	Single Voltage only	Single Voltage only	Single Voltage only	Single Voltage only

You can put your confidence in—

GENERAL ELECTRIC

Thanks for the bouquets

"Unquestionably the Greatest Contribution in years to reproduced record enjoyment."

Everybody who has seen these completely new home music amplifiers has had a good word for them. We are proud to quote same of the things they had to say at the Chicago Show and Audio Fair.

..."the first really new amplifiers in years" ..."the best record reproduction I've ever heard"..."they solve many of our toughest installation problems"..."they really make installation easier"..."here are some real impravements"..."this *Audi-balance* feature really does away with tube balancing problems"..."the *Adjusta-panel* makes cabinet mounting a breeze"..."I've never seen anything in the field so beautifully designed for the home"..."women will love them"..."I find the A.E.S. response position very pleasing"..."I want the Classic 25 for myself"..."the finest coverage yet, there's something here for everyone"...

On and on like that it went, and naturally we loved it. Those of you who missed the show will want to see this complete line at once. Illustrated above is only one of these Newcomb hi-fidelity custom home music amplifiers designed for thrillingly better listening and much easier installation.

★

Send for Catalog C-20M
8 completely new amplifiers priced $39.50 to $269.50, audiophile net

★

15 years of quality leadership *Newcomb*

NEWCOMB AUDIO PRODUCTS CO.
Dept. F, 6824 Lexington Ave.,
Hollywood 38, California

Telephone Science Shares Its Knowledge

The Bell Telephone Laboratories Series of books is published by D. Van Nostrand Company. Other technical books by Laboratories authors have been published by John Wiley & Sons. Complete list of titles, authors and publishers may be obtained from Publication Dept., Bell Telephone Laboratories, New York 14.

List of Subjects: Speech and hearing, mathematics, transmission and switching circuits, networks and wave filters, quality control, transducers, servomechanisms, quartz crystals, capacitors, visible speech, earth conduction, radar, electron beams, microwaves, waveguides, traveling wave tubes, semiconductors, ferromagnetism.

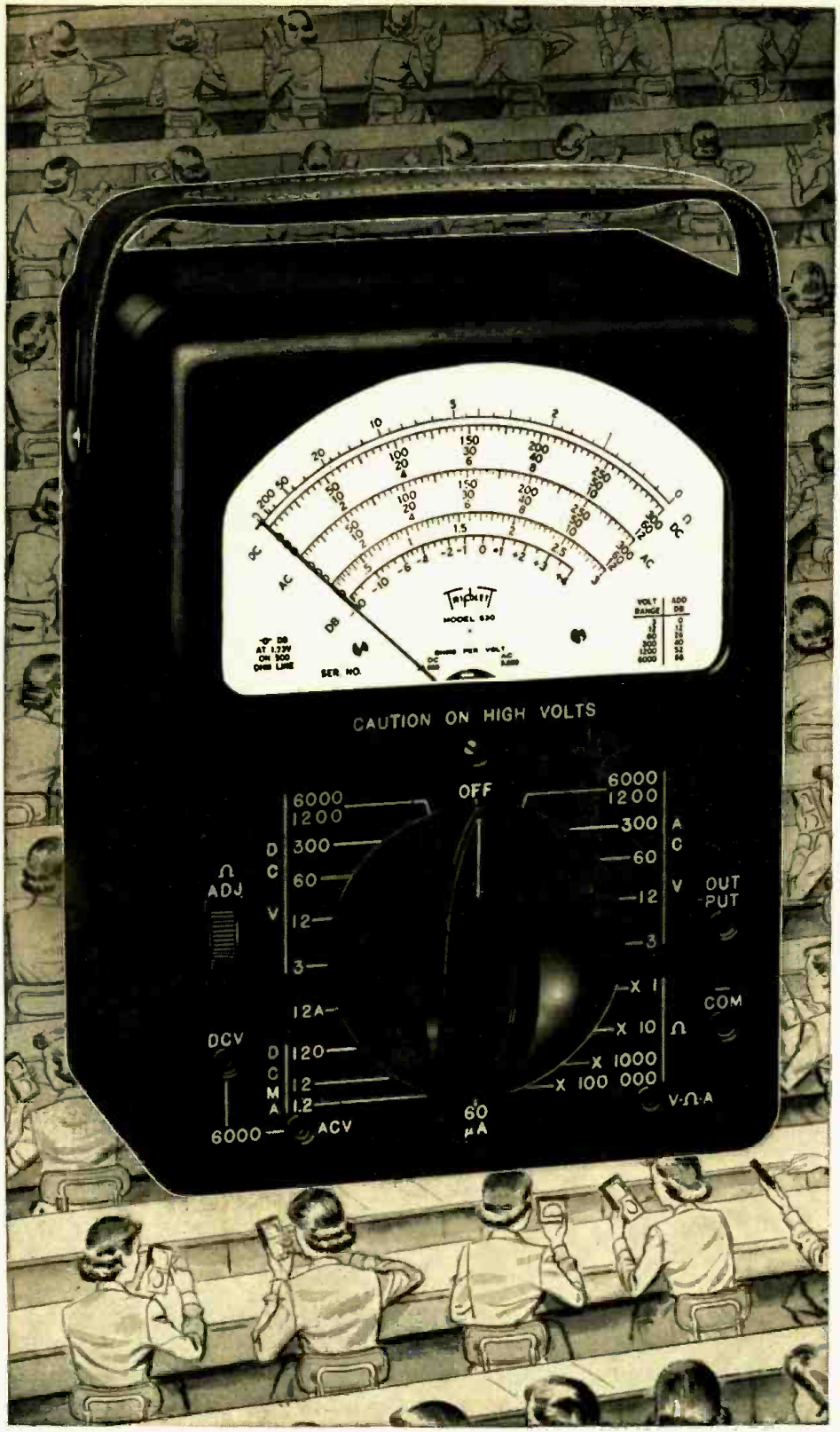
In their work to improve your telephone service, Bell Laboratories make discoveries in many sciences. Much of this new knowledge is so basic that it contributes naturally to other fields. So Bell scientists and engineers publish their findings in professional magazines, and frequently they write books.

Most of these books are in the *Bell Telephone Laboratories Series.* Since the first volume was brought out in 1926, many of the books have become standards . . . classics in their fields. Twenty-eight have been published and several more are in the making. They embody the discoveries and experience of one of the world's great research institutions.

Bell scientists and engineers benefit greatly from the published findings of workers elsewhere; in return they make their own knowledge available to scientists and engineers all over the world.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides challenging opportunities for individual achievement and recognition in scientific and technical fields.



Your dollar buys more "instrument" ...in our Model #630

Volt-Ohm-Mil-Ammeter

by R. L. Triplett
PRESIDENT

Because we build every major part of our instruments the quality is carefully controlled. For example, we know we have more torque driving our pointers because we designed and built the complete instrument. We know we have sustained dependence in the shafts and switch contacts of our test equipment for the same reason. Cycle tests for switches exceed several times the rigid requirements of the armed forces.

There is another important value to you. Because we make our own components we eliminate the profit another manufacturer would make in selling them to us. And this "profit" is passed on to you.

Consider these features of Model 630 V.O.M., for example—

One Hand Operation—One switch with large recessed knob has a single position setting for each reading. Leaves one hand free. Eliminates switching errors, trouble, saves time.

Ranges—AC-DC Volts: 3-12-60-300-1200-6000 (AC, 5000 Ohms/Volt; DC, 20,000 Ohms/Volt). 60 Micro-Amps. 1.2, 12, & 120 Mil Amps. DB scales at 1.73V on 500 Ohm line, 0-66 DB output.

Highest Ohm Reading—To 100 Meg. in steps of 1000-10,000-100,000 Ohms—100 Megohms.

Yes, with us it's a matter of personal pride to make "Triplett" stand for better construction and more service for your test equipment dollar.

R L Triplett
PRESIDENT
TRIPLETT ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

630 V.O.M. only $39.50

Suggested U. S. A. Dealer Net
Price subject to change without notice.

For service, accuracy, highest dependability, buy

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EICO TEST INSTRUMENTS

guard

CBS-Columbia Inc.

HIGH STANDARDS OF TELEVISION PRODUCTION QUALITY

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

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

KITS
WIRED INSTRUMENTS

NEW 565K MULTIMETER KIT $24.95 WIRED $29.95. 20,000 ohms/volt

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

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

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

WHY does CBS-Columbia, Inc., one of America's great headline-makers in Television set production, use *EICO* Test Instruments on *both* its new Television production lines and in its design laboratories?

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

Only EICO Test Equipment delivers All 10 EICOnomical Features!

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

NEW 377K Sine & Square Wave AUDIO GEN. KIT $31.95 WIRED $49.95

Before You buy any higher-priced equipment, look at the EICO line—*in Wired and Kit form!* Each EICO product is jam-packed with unbelievable value. *Compare, see EICO instruments today*—in stock at your local jobber—and SAVE! Write NOW for FREE newest Catalog 9-R.

FOLLOW THE LEADERS . . . INSIST ON EICO!

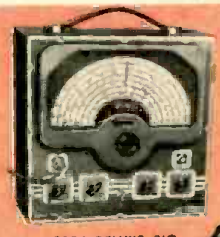
221K VTVM KIT $25.95 WIRED $49.95

HIGH VOLTAGE PROBE $6.95

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

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

NEW 214K VTVM KIT $34.95 WIRED $54.95 7½" METER



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

625K TUBE TESTER KIT $34.95 WIRED $49.95

360K SWEEP GEN. KIT $34.95 WIRED $49.95

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

NEW 536K MULTIMETER KIT $12.90 WIRED $14.90 1000 ohms/volt

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

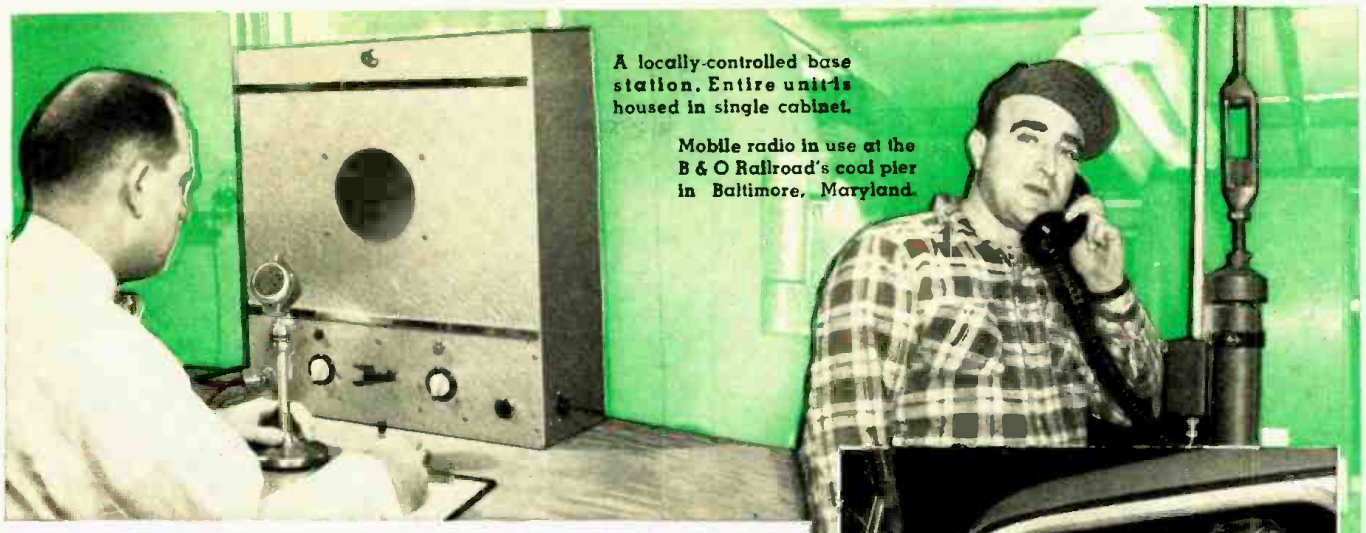
145K SIG. TRACER KIT $19.95 WIRED $28.95

NEW CRA PIX TUBE ADAPTOR for above $4.50

EICO Reg. U. S. Pat. Off.

ELECTRONIC INSTRUMENT CO., Inc.
84 WITHERS STREET, BROOKLYN 11, NEW YORK

Prices 5% higher on West Coast. Due to unstable conditions, prices and specifications are subject to change without notice.



A locally-controlled base station. Entire unit is housed in single cabinet.

Mobile radio in use at the B & O Railroad's coal pier in Baltimore, Maryland.

MOBILE RADIO

By
LEO G. SANDS
Bogue Railway Equipment Division

Part 1. A survey of the field, including frequency allocations, types of equipment, and operation data.

Two-way radio equipment installed in car.

MOBILE radio has grown into a large and highly specialized industry with annual equipment sales running into several millions of dollars. The men who sell, design, and maintain mobile radio systems are specialists who must be familiar not only with equipment and propagation but with laws, traffic, material handling, and the operational character of a large number of different industries.

Mobile radio is the term applied to the art of communicating from a fixed point to one or more mobile units and between mobile units. A mobile unit may be an automobile, truck, motorcycle, train, boat, or other vehicle, or even a man on foot, outfitted with radio communications equipment.

Thousands of vehicles have been equipped with radio apparatus that permits two-way conversation between the vehicle and fixed points and/or other vehicles. As the economic value of rapid communication is fully recognized, more and more vehicles are being and will be equipped with mobile radio apparatus.

Perhaps the largest user of mobile radio is the taxicab industry where the proof of the value of radio communications is most easy to demonstrate. The amount of "dead mileage" that has been converted into profitable miles reaches an astronomical figure. Furthermore, the public receives better service because taxicabs need not return to their bases or specific telephone-equipped stands before being dispatched on new assignments.

The public safety services were early to recognize the value of mobile radio. Today, hardly a police organization in the country would attempt to operate without radio communications.

The railroads use mobile radio to direct the switching of locomotives and to provide direct and adequate communication between the head end and rear end of trains. Several railroads have extended mobile radio facilities to permit contact between dispatchers and wayside operators and trains along the main line. The *Erie Railroad*, for example, has radio facilities all the way from New York to Chicago.

Bus lines, truckers, and other common carriers employ mobile radio to provide direct contact with drivers enroute. Manufacturers, contracting firms, and maintenance organizations utilize mobile radio to increase the efficiency of their operations. Pipe line operators and petroleum producers rely heavily on mobile radio to keep operations running smoothly.

The use of radio transmitters is licensed by the Federal Communications Commission. Licenses are issued to qualified applicants without charge. The operation of licensed radio stations is governed by the rules and regulations of the FCC.

Users of mobile radio are divided into several general classifications which include the Public Safety Radio Services, Land Transportation Radio Services, Industrial Radio Services,

Capt. Long of Bendix Plant Protection Force operates MRT-6 unit.

Realistic Profit Margins

(*Continued from page 64*)

cut-rate drugs. Let's wise up! Any fool can sell a tube over the counter.

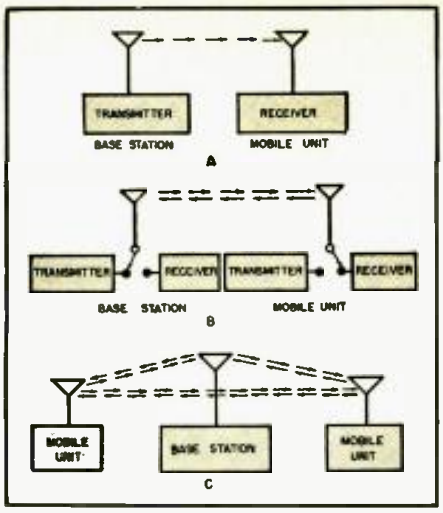
"Suppose all service shops were to sell tubes at a 65 per-cent mark-up over cost. In a competitive market for name-brand merchandise, this represents a good profit and is considered good business. But it is more important to look at what we gain.

"If tubes were available to customers locally at a 65 per-cent mark-up, the drugstores, hardware stores, and supermarkets would have to drop their prices to meet this competition. This would take away that beautiful 150 per-cent profit we have created for these operators to split between themselves and the stores and chop it down to a realistic 65 per-cent. After deducting the cost of amortizing the tube testers, the losses due to pilferage, etc., there would hardly be enough left after the split to cover the cost of shipping. As a result, the tubes and testers would disappear from the scene."

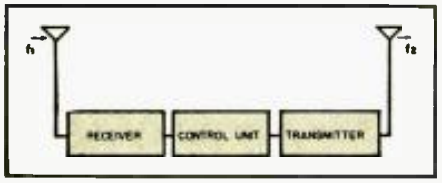
Other dealers have met the incursion of self-service tester competition head-on by making their own shops self-service centers. The more successful dealers who tried that approach went all out in promoting their self-service facilities. Their merchandising programs included store front modernization, redecoration of the shop interior to focus attention on the do-it-yourself facilities, and the addition of other products that set owners need for other home repairs.

There has not been, however, any widespread recognition in the service industry of the basic economic factors involved in the renewed trend toward do-it-yourself servicing. The challenge to service is that it must learn how to merchandise its facilities in a manner that will make the general public feel it is getting a full dollar of value for every dollar that is spent for electronic service. —30—

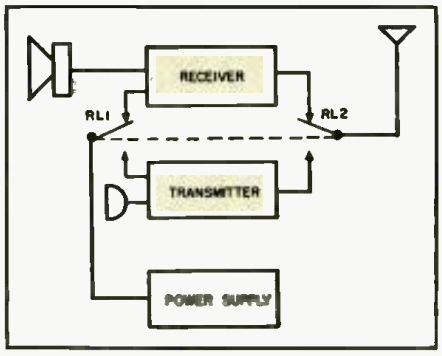
More than 4000 bits of information can be stored on this five-inch-square "memory frame" being produced by RCA for a new high-speed electronic computer used by the Atomic Energy Commission. The frame is composed of thin strands of insulated copper wire and tiny ferrite cores, 83,000 of which would weigh just a pound.



Three types of mobile radio communications systems. (A) One-way (base station to mobile unit—no talk-back), (B) Two-way communication. (C) Three-way system (base station with mobile units and communication between mobile units in the radio system.)



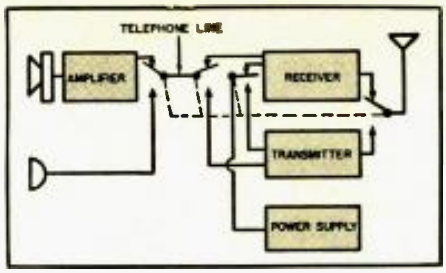
A typical relay station for mobile radio.



Functional block diagram of mobile unit or locally-controlled base station. RL_1 and RL_2 are relays actuated by the press-to-talk button on the receiver handset.

Domestic Public Radio Services, Maritime Radio Services, and the Citizens Radio Service.

Several segments of the radio spectrum have been set aside for the mobile radio services. The most popular bands are the 25 to 50 megacycle band. which was recently expanded from 30 to 40 megacycles, and the 152 to 162 megacycle band. The 450 to 460 megacycle band is getting considerable attention now that production-type equipment for this band is currently available.



Single line block diagram of a remotely-controlled base station. The relays are shown in their "Receive" positions.

Specific frequencies within a particular band are assigned and selected by an industry coordinating group. For example, a railroad applying for a radio station license will consult the Association of American Railroads as to what specific frequency should be assigned to that particular station. The Association of American Railroads, which acts as a clearing house for all of the railroads on the matter of frequency assignments, has developed an allocation plan which is intended to dole out channels in specific territories in a manner that will result in minimum interference for all concerned. Other industry groups have similar frequency coordinating groups which aid the FCC in assigning channels.

Mobile radio systems utilize several different types of stations, namely (a) mobile units, (b) base stations, (c) operational fixed stations, (d) portable stations, and (e) relay stations.

A one-way mobile radio system consists of a base station and one or more mobile units. The base station transmits only and the mobile units receive only, thus providing communication in one direction only. The base station may transmit intelligence to the mobile units, but the mobile units cannot answer back.

A two-way mobile radio system consists of a base station and one or more mobile units. The base station and mobile units transmit and receive, thus providing two-way conversations between base station and mobile units.

A three-way mobile radio system is similar to the two-way system except that the mobile units may communicate with each other as well as with the base station. The term "three-way" is not necessarily universally accepted as it is the concoction of one or more equipment manufacturers. However, it does convey the desired meaning and is popularly used.

Other variations include mobile radio systems employing more than one base station which may communicate with each other as well as with mobile stations.

A mobile unit generally consists of a transmitter, receiver, power supply, antenna, loudspeaker, microphone, and associated control equipment. The transmitter, receiver, and power supply are often combined in one unit although separate units are available.

In the case of an automobile or truck, electric power for the operation of the radio equipment is generally derived from the vehicle's battery and generator system. The power supply unit of the mobile radio equipment converts this low voltage direct current to higher voltages for plate and bias power. The tube filaments are usually activated by vehicle battery power.

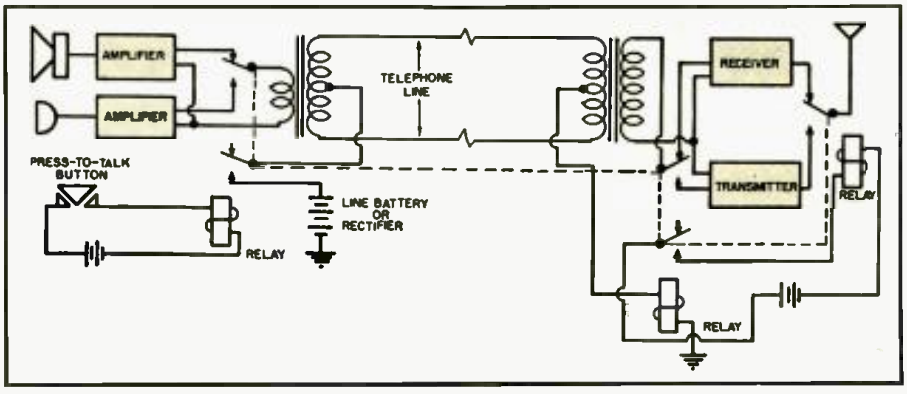
The antenna of the mobile unit may be mounted on the roof of the vehicle or on the bumper or other convenient spot, depending upon the frequency of operation and type of antenna. Roof mounted antennas utilize the metal roof as the ground plane of the antenna system.

The mobile unit is usually so arranged that the receiver is operative whenever the power is turned on. A squelch circuit prevents sound from emanating from the loudspeaker except when a signal of a certain level is picked up by the fixed-tuned receiver. The antenna is normally connected to the receiver through an antenna switching relay. When the operator of the mobile unit wishes to transmit, he picks up the microphone or telephone handset and presses the push-to-talk button when he speaks.

Pushing this button causes the antenna to be automatically switched from the receiver input to the transmitter output. Power is applied to the transmitter and the receiver is muted. Releasing the button restores the equipment to "receive" or "stand-by" service.

Special installations have been made on trains like the *B&O* "Royal Blue" and the *Pennsylvania* "Congressional" wherein two antennas are used and transmission and reception are carried on simultaneously to permit two-way conversations without using the press-to-talk technique. However, this type of installation was designed for public telephone service for use by persons without special training and is not generally used in private mobile communications systems.

A simplified diagram of a typical base station remote-control circuit.



Base stations are usually of two basic types, the locally-controlled station and the remotely-controlled station. Where local control is employed, the radio apparatus is located in the same room or building as the operator.

A remotely-controlled station is one which employs one or more remote control or dispatch points. The transmitter and receiver are located at a point separated from the operator. Remote control operation is often employed to permit taking advantage of an antenna location superior to that available at the site where the operator would be located.

For example, to attain ample communications range, the antenna and the transmitter and receiver may be located on the roof of a tall building. The operator, who may be located several miles away, controls the radio station with a remote control unit which is connected to the transmitter and receiver by a telephone line.

When telephone lines are not available for remote control purposes or cannot be justified economically, a radio link may be used for remote control of a base station.

Dispatch points are additional remote controls from which the base stations may be controlled. One of these points is designated as the remote control point. Here the operator in charge monitors all transmissions and has control of the base station, including facilities for disabling the other dispatch points. Multiple dispatch stations are sometimes used in railroad yards where several supervisors, located at different points, are afforded radio communications facilities.

Base stations differ from operational fixed stations in that *base station* is the designation for a radio station which communicates with mobile units. A fixed station is one which is used for communication with other fixed stations for point-to-point service.

A relay station, or repeater, is a radio station which receives signals from one or more stations and automatically retransmits the received intelligence to other stations. Relay stations are used for extending communications beyond the normal range of two adjacent stations.

A mobile relay station is used to extend the range of communications between mobile units. Signals from a mobile unit are picked up on one frequency and are retransmitted to other mobile units on a second frequency. This technique permits taking advantage of the greater antenna height of the relay station and can sometimes provide mobile-to-mobile communication over a range double that normally achieved between base station and mobile unit.

A base station or fixed station consists of a transmitter, receiver, and power supply plus antenna system and control equipment. As in mobile units, both transmitter and receiver are crystal-controlled and fixed-tuned to their assigned frequencies. Electric power is usually supplied from utility power mains.

Components comprising a single mobile radio unit. (A) The transmitter, receiver, and power supply. (B) Control unit for dash mounting—includes pilot lights, volume control, squelch control, and channel selector switch. (C) Loudspeaker. (D) Mounting bracket for speaker. (E) Microphone. (F) Microphone mounting clip. (G) Quarter-wave whip antenna for car-top mounting with flexible coaxial cable. (H) Multi-conductor cable to interconnect control unit and radio unit. (I) Wire for connecting hot side of battery to fuse. (J) Interference filter. (K) Fuse and mount. (L) Mounting brackets. (M) Loom for protecting cable from wear. (N) Screws and miscellaneous hardware. (O) Metering plug and cable for testing the operation of the entire unit.

Antennas used at base stations are generally mounted atop a mast or other support, usually as high as possible to achieve maximum range. The communications range when operating in the very-high-frequency (v.h.f.) and ultra-high-frequency (u.h.f.) portions of the radio spectrum is governed, to a great extent, by antenna height. As it is usually impractical to elevate mobile antennas to heights above a few feet, it is a general practice to achieve the maximum practicable range by installing the base station antenna as high as possible.

By the same token, the communications range may be controlled to a degree by adjusting the base station an-

(*Continued on page* 100)

J. C. Fowler, telephone line-repair crew foreman for Colorado Interstate, uses a G-E two-way radio to advise the main office that emergency job has been completed and request instructions for the next job. Two-way radio speeds such emergency repairs and reduces time between calls.

General Electric two-way radio equipment, installed by the volunteer fire departments of Wayne County, New York, helps speed mutual aid and civil defense assignments. The county has formed a network of volunteer departments, coordinated from Lyons.

A CONTINUOUS U.H.F. TUNER

By
KEN KLEIDON
Belmont Radio Corporation

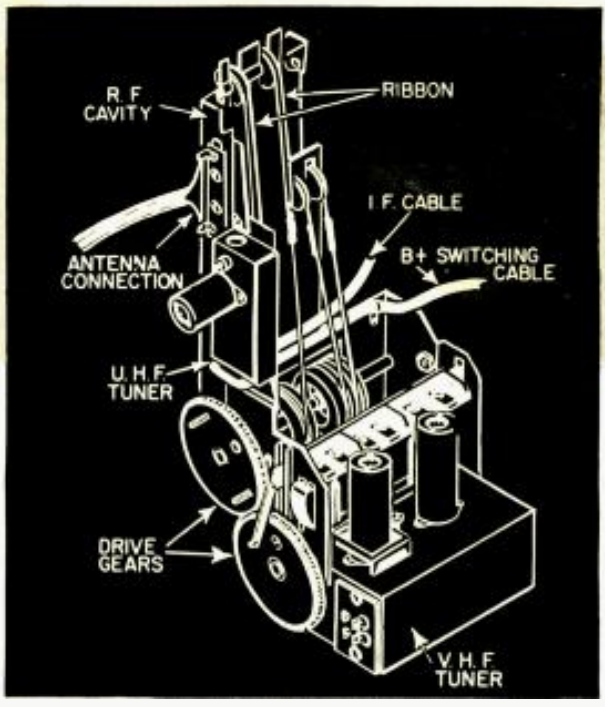


Fig. 1. Mechanical details on Raytheon's Model UHF-100 ultra-high-frequency tuner.

Details on a single-conversion, continuous-type u.h.f. tuner that is easy to mount and adjust.

SOME time ago the Federal Communications Commission allocated 70 new television channels, referred to as the ultra-high-frequency band or simply u.h.f., in a frequency range from 470 to 890 megacycles. This is a continuous frequency band, without skips as in the present v.h.f. band, and includes channel numbers ranging from 14 through 83. With the addition of the u.h.f. band 82 channels are now available for television. The u.h.f. band has the same transmission standards as the present v.h.f. band, namely, six megacycle bandwidth, horizontal scanning frequency of 15,750 cycles, etc. Therefore, all that will be necessary to receive u.h.f. transmissions on a v.h.f. receiver will be to install a u.h.f. tuner or converter. A u.h.f. converter is a device connected externally to the receiver which selects the u.h.f. station's video and sound carriers and converts them to a predetermined v.h.f. channel.

A u.h.f. tuner is a device which is added to and is part of the v.h.f. receiver. The u.h.f. tuner selects the u.h.f. station's video and sound carriers and converts them to the receiver i.f. frequency if single conversion is employed or converts them to a lower frequency which is again converted to the i.f. frequency. The latter is known as "double conversion."

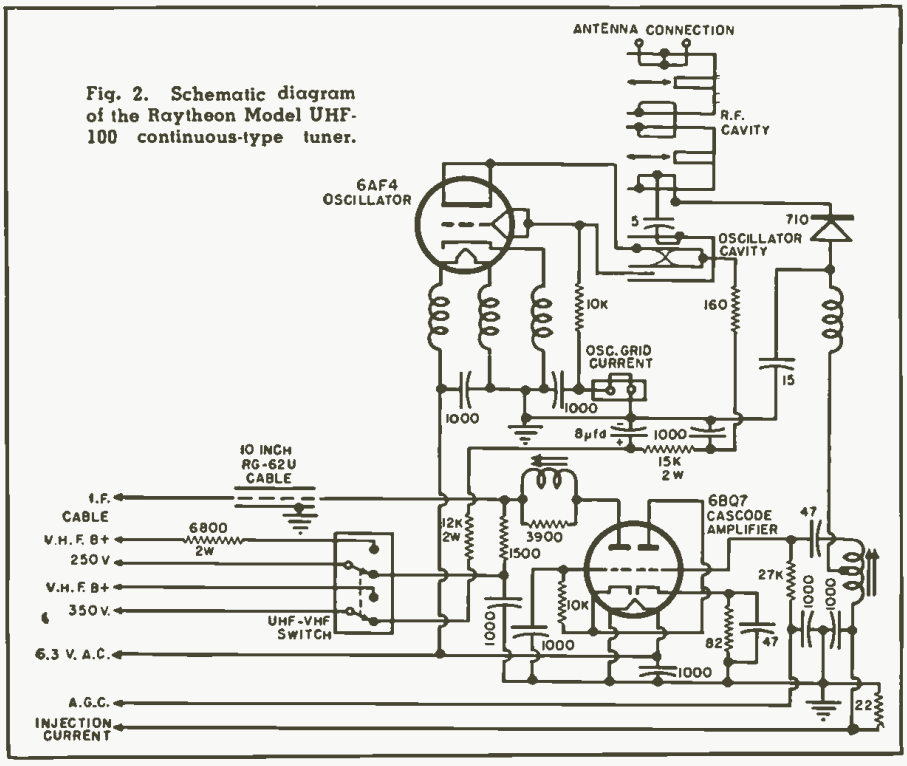
Since *Raytheon* uses a continuous tuner in its present v.h.f. receivers, it has designed a single-conversion, continuous-type u.h.f. tuner which will mechanically mount directly over and on top of the v.h.f. tuner, as shown in Fig. 1. This is *Raytheon's* Model UHF-100 ultra-high-frequency tuner which will be available for mounting on any *Raytheon* television receiver which is equipped with a continuous-type tuner.

Installation of the u.h.f. tuner is fairly simple. All that will be required is to remove the chassis from the cabinet, mount a drive gear on the v.h.f. tuner and the u.h.f. tuner over the v.h.f. tuner with four mounting screws, connect the two cables to the under side of the chassis, make a few under chassis wiring modifications, and mount the u.h.f.-v.h.f. switch at the rear of the cabinet. The u.h.f.-v.h.f. switch is provided for switching to the desired u.h.f. or v.h.f. frequency range. Referring to Fig. 1, the cables shown (RG-62/U) are for signal coupling to the i.f. amplifier section and "B plus" voltage switching to either the u.h.f. or v.h.f. tuners. Signal points and filament leads are not switched. The u.h.f. tuner is coupled to the v.h.f. tuner by drive gears; this permits the receiver's owner to tune for both u.h.f. and v.h.f. with the same tuning knob. The u.h.f., when shipped from the factory, will be pre-aligned and ready for installation.

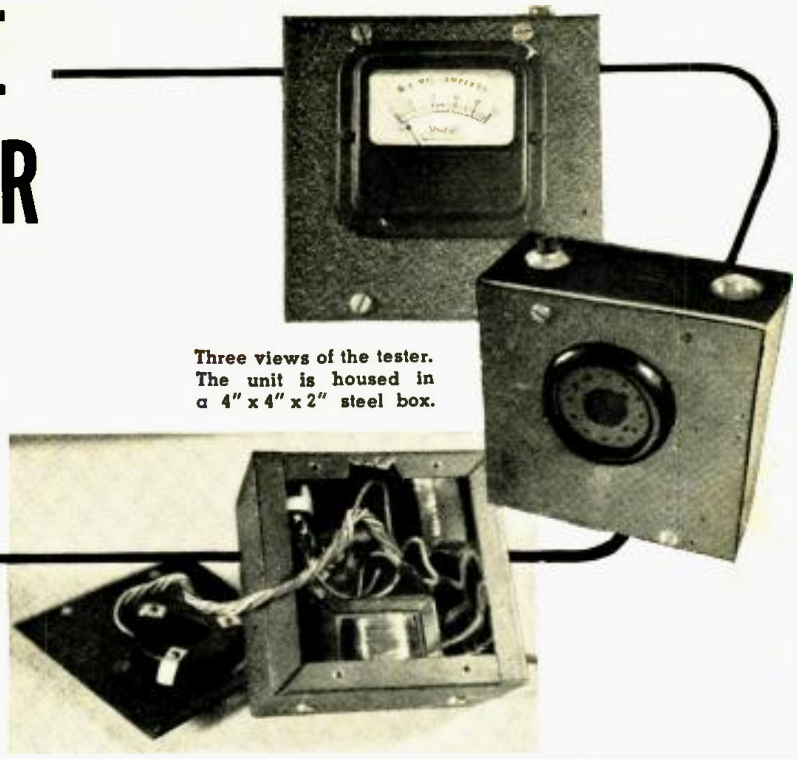
Referring to Fig. 2, it can be seen that the *Raytheon* u.h.f. tuner employs a double-tuned coaxial line or r.f. cavity preselector. The coaxial line or r.f. cavity arrangement has the advantages of high selectivity, low insertion losses, uniform bandwidth, and good shielding against oscillator radiation. The coaxial cavity is basically nothing more than a quarter-wave, shorted tuned stub. The electrical

(*Continued on page* 161)

Fig. 2. Schematic diagram of the Raytheon Model UHF-100 continuous-type tuner.



PICTURE TUBE EMISSION TESTER AND REJUVENATOR



Three views of the tester. The unit is housed in a 4" x 4" x 2" steel box.

By
A. A. GOLDBERG

Construction details on a simple device which can prolong the life of weak or inactive CR tubes.

TELEVISION picture tubes eventually go bad. Some time or other we have appraised the huge mass of glass and wished for methods to bring back the tube's lost vigor. Having had this experience, the author set out to investigate picture tube rejuvenation.

As the tube ages, the image gradually loses brilliancy; the first one hundred hours of operation normally results in a 50% decrease in brightness. Later, the decrease tapers off to a gradual light loss for the balance of the tube life. This change is a normal phosphor characteristic.

Table 1 is a list of common troubles in cathode-ray tubes and their symptoms.

The list given in the table may seem discouraging—and it is. Only troubles 2, 3, and 4 appear to have possibilities of correction from outside the glass envelope. (How nice it would be to crawl inside the tube and solder the open grid.) Trouble 4, gassy tubes, can be attacked with the use of an r.f. bombarder to reflash the getter. The expense of a high-powered r.f. generator, however, makes this approach unattractive. This leaves troubles 2 and 3, no or weak emission. Immediately the old scheme of cathode rejuvenation comes to mind.

Fig. 1A shows the circuit used for picture tube cathode rejuvenation. An excessive heater voltage of 8.5 volts r.m.s. is applied which brings the cathode up to above normal operating temperatures. Simultaneously, a heavy cathode-control grid current is caused to flow which further increases the cathode temperature. The rare earth oxides then either boil to the surface or the topmost surface boils away exposing new emitting material.

Results were promising enough to encourage the author to build a practical model. A standard 4" x 4" x 2" steel box encloses the entire circuit. A duodecal socket is loosely mounted on one side plate; this allows the socket to rotate and keeps the box upright irrespective of picture tube orientation. On the other removable plate is mounted an inexpensive moving-vane type 0-10 milliampere meter. A .001 μfd. paper or ceramic condenser is connected across the meter. This acts as a filter and prevents the meter pointer from vibrating due to the unidirectional 60-cycle ripple. The balance of the parts are mounted on the box proper.

The heater transformer is a standard 6.3 volt, 1.2 ampere unit rewound to deliver 8.5 volts. Make certain the low voltage is on top of the primary. Remove the laminations and unwind the secondary, keeping note of the number of turns. Rewind the secondary with slightly smaller wire and increase the turns by a factor of 1.35.

If it is so desired, the transformer can be omitted entirely and a resistance-type line cord substituted. (Fig. 1B) *Caution:* if the line-cord resistor is the only voltage dropping element in the heater circuit, the tube heater will flash open. Protection is afforded by inserting a negative temperature coefficient resistor in series with the resistive line cord. The one used here is a 17 ohm unit, Model L5507-17

(*Continued on page* 98)

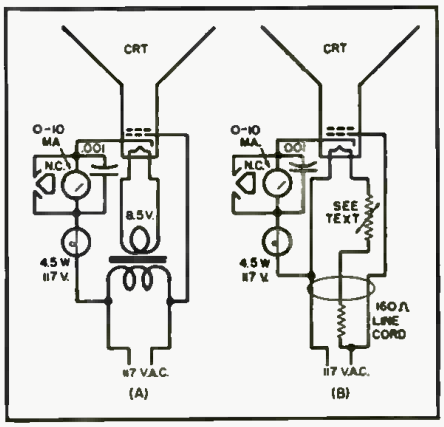


Fig. 1. Two versions of the tester circuit.

Table 1. Common faults encountered in cathode-ray tubes and their symptoms.

TROUBLE	SYMPTOM
1. Open heater	No raster
2. No cathode emission	No raster
3. Weak cathode emission	Weak picture with blooming
4. Gassy	Blooming and poor focus
5. Open grid	Raster but no video except some high frequency components. No control of brightness
6. High voltage breakdown	Intermittent flashing
7. Bent electron gun	Raster cannot easily be centered, shadowing troubles
8. Bad phosphor	Low light output
9. Enlarged electron gun apertures due to incorrect ion trap alignment	Poor focus

THREE TUBES ON 2 METERS

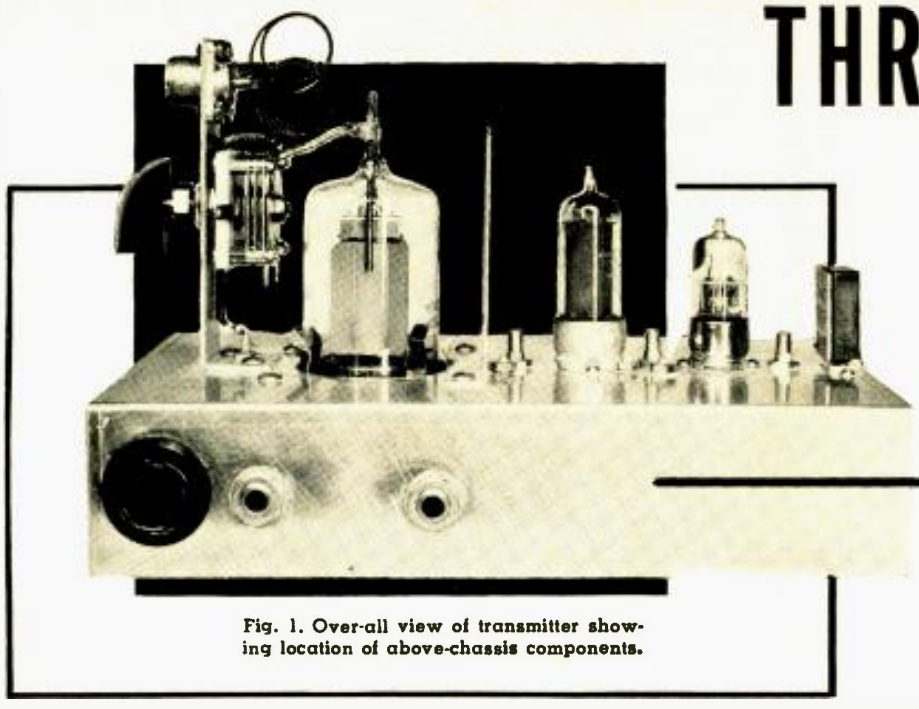


Fig. 1. Over-all view of transmitter showing location of above-chassis components.

By
MERRITT F. KIRCHHOFF, W2FAR*
and
DAVID D. BULKLEY, W2QUJ†

Construction details on a simple, compact unit suitable for home station or emergency operation.

THE varied activities of amateur radio require more and more radio equipment in the "shack." For many hams this poses a problem, inasmuch as many of us have a limited amount of space available for the installation of this type of apparatus. The trend, therefore, has been toward more compact units that utilize miniature tubes and components in simple straightforward circuits. Further, Civil Defense activities, which occupy such an important place in amateur radio, require equipment that is as reliable as it is easy to operate.

The two-meter transmitter described here was designed for practical home station operation in addition to its possible enlistment in emergency communication network operation should the need ever arise. The selection of miniature tubes for use in the exciter stages of the transmitter was not a difficult task, as modern tried-and-proven circuits are available for the tubes chosen. The question of the final amplifier tube, however, posed somewhat of a problem. A tube was needed which required very little drive power; one which would operate at reasonably low d.c. plate voltages, yet was of small physical size. Various types were considered and the *Amperex* type AX 9903 was finally selected for a number of reasons. A dual-beam tetrode, this tube has characteristics similar to those of the familiar 829B. However, the AX 9903 embodies features that surpass the 829B in many respects. It is smaller physically than the 829B yet it has an output capacity less than half that of the 829B. Other interelectrode capacities are correspondingly lower and the screen grid is common to both halves of the tube which assures more stable operation at very high frequencies. In addition, the *Amperex* type AX 9903 has internal neutralizing condensers that are connected directly to the control grids, eliminating the bother of external neutralizing circuits.

Reference to Figs. 1 and 3 will show the efficient use of the space on the chassis. Although the transmitter is constructed on a standard aluminum chassis 5½ by 9½ by 2 inches, it might very readily be built on a smaller chassis without crowding components or making construction difficult.

The transmitter circuit consists of a 6J6, one section of which is used as a harmonic crystal oscillator and the second section used as a frequency tripler. The output from this tube is fed to a type 5763 employed as a frequency doubler which drives the *Amperex* type AX 9903 push-pull final r.f. amplifier.

Layout

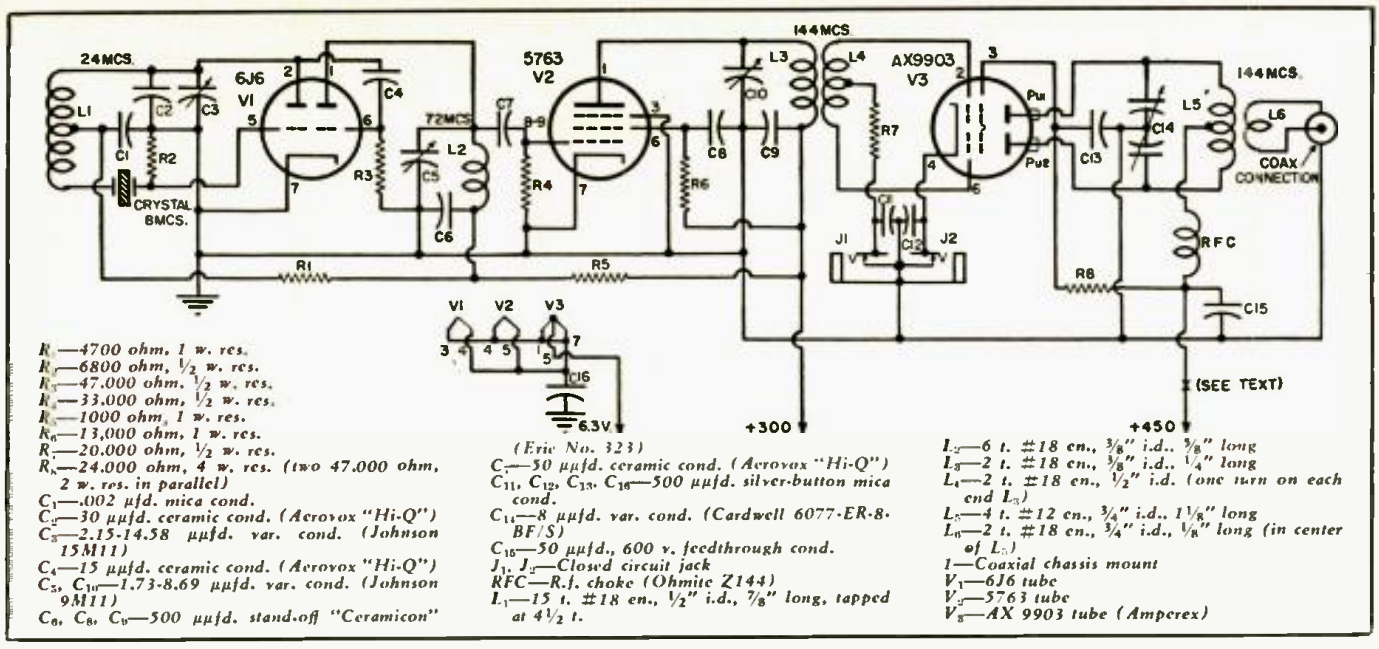
Fig. 1 shows the general view of the top and the front of the chassis. The 6J6 harmonic crystal oscillator/frequency tripler is located at the right-hand side of the photograph, to the left of the crystal. In the approximate center of the chassis will be seen the type 5763 frequency doubler. This efficient pentode provides more than enough drive to excite the type AX 9903 to its left. The final amplifier tuning condenser with its coil are seen immediately to the left of the final amplifier tube, mounted on a small bracket. In order to obtain short leads to the plate pins of the final amplifier tube, the final amplifier tuning condenser is mounted at right angles to the front of the chassis. If a front panel is contemplated, or if the transmitter is to be mounted in a cabinet of some sort, it would be a simple matter to mount a right-angle drive assembly on a second small bracket to permit tuning this condenser from the front panel.

The power supply plug is mounted on the front of the chassis at the extreme left-hand side of the photograph. The jack for metering the cathode circuit of the final r.f. amplifier is next in line, followed by the jack to meter the grid current to the final r.f. amplifier.

As operating in the two-meter amateur band seldom requires change of frequency, no meter was included in the circuit. This not only simplifies the circuit, but also adds to the economy of the design. Any test meter will provide the necessary means to adjust the transmitter when changing crystals. The final amplifier is metered in the cathode circuit. This is done so that it will not be necessary to have high voltage on the meter proper with its attendant danger of shock to the operator. If it is desired to read the plate current, it would be a simple matter to place J_2 at the point indicated by "X" in the circuit diagram. However, care should be taken to provide adequate insulation between the meter body and the chassis or panel.

The exciter stages of the transmitter employ conventional coil and condenser circuits tuned by miniature variable condensers. However, no retuning should be required when shifting from one frequency to another within the band; only when shifting from the extreme low end of the band to the extreme high end of the band

* Columbia Broadcasting System.
† International Telephone and Telegraph Corporation.



R_1—4700 ohm, 1 w. res.
R_2—6800 ohm, ½ w. res.
R_3—47,000 ohm, ½ w. res.
R_4—33,000 ohm, ½ w. res.
R_5—1000 ohm, 1 w. res.
R_6—13,000 ohm, 1 w. res.
R_7—20,000 ohm, ½ w. res.
R_8—24,000 ohm, 4 w. res. (two 47,000 ohm, 2 w. res. in parallel)
C_1—.002 μfd. mica cond.
C_2—30 μμfd. ceramic cond. (Aerovox "Hi-Q")
C_3—2.15-14.58 μμfd. var. cond. (Johnson 15M11)
C_4—15 μμfd. ceramic cond. (Aerovox "Hi-Q")
C_5, C_{10}—1.73-8.69 μμfd. var. cond. (Johnson 9M11)
C_6, C_8, C_9—500 μμfd. stand-off "Ceramicon" (Erie No. 323)
C_7—50 μμfd. ceramic cond. (Aerovox "Hi-Q")
C_{11}, C_{12}, C_{13}, C_{16}—500 μμfd. silver-button mica cond.
C_{14}—8 μμfd. var. cond. (Cardwell 6077-ER-8-BF/S)
C_{15}—50 μμfd., 600 v. feedthrough cond.
J_1, J_2—Closed circuit jack
RFC—R.f. choke (Ohmite Z144)
L_1—15 t. #18 en., ½" i.d., ⅞" long, tapped at 4½ t.
L_2—6 t. #18 en., ⅜" i.d., ⅜" long
L_3—2 t. #18 en., ⅜" i.d., ¼" long
L_4—2 t. #18 en., ½" i.d. (one turn on each end L_3)
L_5—4 t. #12 en., ¾" i.d., 1⅛" long
L_6—2 t. #18 en., ¾" i.d., ⅛" long (in center of L_5)
1—Coaxial chassis mount
V_1—6J6 tube
V_2—5763 tube
V_3—AX 9903 tube (Amperex)

Fig. 2. Complete schematic diagram of the two-meter transmitter designed for either home station or emergency operation.

will it be necessary to retune any of these stages. The tuning shafts of the variable condensers may be seen in the photograph (Fig. 1), between the crystal and the 6J6, between the 6J6 and the 5763, and between the 5763 and the final amplifier shield. A butterfly-type tuning condenser is used in the final amplifier plate circuit in order to take advantage of the higher "Q" obtainable with this type of unit.

The underside of the chassis, Fig. 3, shows the accessible yet compact layout which assures short leads. The coils are self-supporting and are mounted directly into the circuit.

In constructing this transmitter, it will be found advantageous to carefully lay out the chassis as shown in Fig. 1. This is particularly true if the transmitter is to be built on a smaller chassis than that shown in the photograph.

Stand-off bypass condensers are specified at several places in the circuit. Referring to the photograph, it will be readily seen that these stand-offs make convenient tie-points for components in addition to performing their task in the circuit. Button-type condensers are used in the grid, cathode, screen grid, and filament bypass circuits of the final r.f. amplifier. These tiny components lend themselves admirably to application at these points in the circuit for they may be soldered directly to the tube pin connection and bypass directly to ground with no lead whatsoever necessary.

The bracket which mounts the final amplifier condenser and its coil was made from a piece of discarded aluminum chassis. However, it may easily be made from a strip of aluminum 4¾ by 1 inch. A ¾-inch lip is bent on the bottom to permit mounting the bracket on the chassis. A coaxial fitting is mounted above the tuning condenser on this bracket, so that short leads may be used to connect the antenna coupling coil (L_6) to the antenna output.

No provision need be made for neutralization for, as stated previously, the type AX 9903 has small neutralizing condensers mounted within the tube envelope.

Care should be exercised when winding the coils; the exact dimensions as contained in the coil specifications should be used to insure that the proper frequency will be covered.

Operation

Initial tuning operations should be carried out with a grid dip oscillator or an accurately-calibrated wavemeter embodying an r.f. indicating meter, to make certain that the correct harmonic is being used. Once tuned correctly, it is merely necessary to mark the settings of the various miniature tuning condensers to assure correct retuning with the aid of a small neon lamp, should it become necessary to peak up the exciter stages of the transmitter due to making large frequency changes, etc.

Tuning of the preliminary stages of the transmitter should be accomplished with the plate voltage removed from the final amplifier tube to insure that the tube will not be damaged. A dummy load must always be used when tuning the type AX 9903 final r.f. amplifier to resonance to assure stable and safe operation of the tube as well as to avoid interfering with other stations on the air. The dummy load may consist of a 40 or 50 watt incandescent lamp connected to a coaxial plug and attached to the antenna output socket.

The appropriate crystal should be placed in the crystal socket and the plate voltage applied to the 6J6 and the 5763. With the grid dip oscillator or calibrated wavemeter tuned to 24 megacycles, place the pickup coil of the instrument close to L_1, which is the plate coil of the harmonic crystal oscillator section of the 6J6. C_3 should be

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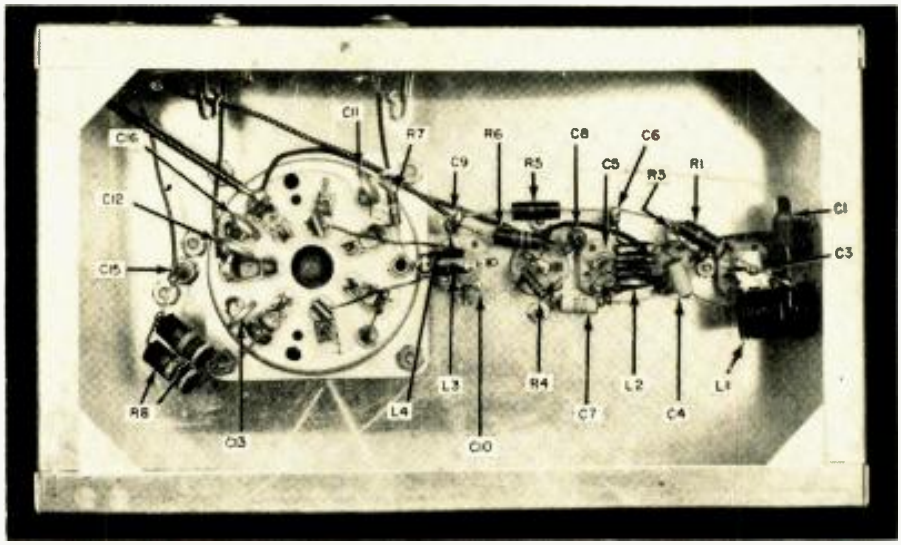
Fig. 3. Under-chassis view of unit. The simplicity of the layout is evident here.



TRENDS In Large Screen TV Circuits

By
E. P. MUELLER
Instructor
De Forest's Training, Inc.

Details on some of the important circuit changes which have been made in late-model TV receivers.

PERHAPS the most important trend in the design of television receivers is the increased size of their direct-view screens. Starting with 7" and 10" cathode-ray tubes a few years ago, today 20" and 24" tubes are the most popular and 27" and 30" tubes have been introduced. The scarcity of copper has led to several interesting developments in the structure of the electron guns, eliminating the electromagnetic focus coil.

Basically, these new, larger tubes operate the same as the old, smaller types but, in practice, a number of circuit changes are necessary to provide larger picture tubes with the clarity and brilliance of the smaller sizes. In general, the new circuits and features are associated with the cathode-ray tube and can be divided into the following five classes: Second anode high voltage, sweep voltages, linearity, centering, and focus. Figs. 1, 2, and 3 are simplified diagrams of various horizontal deflection, high voltage systems found in some of the modern TV receivers.

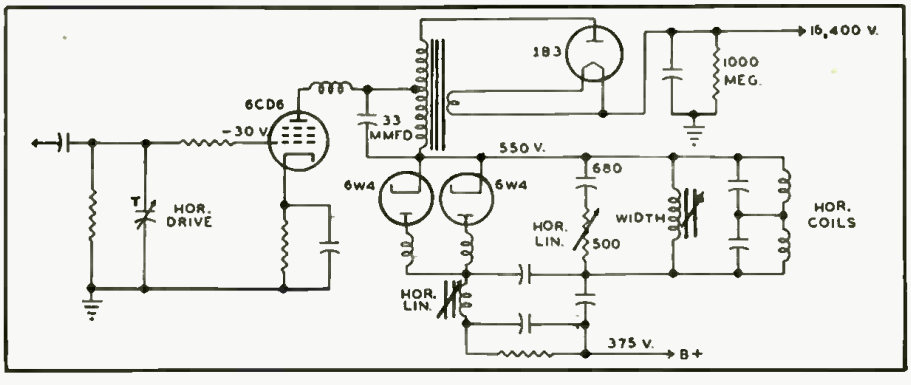
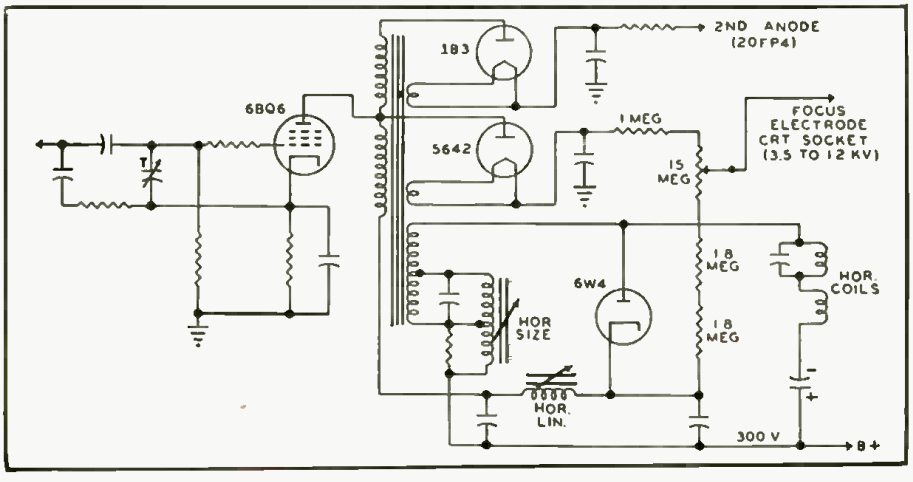


Fig. 1. Simplified high-voltage schematic of the RCA Model KCS68 21-inch chassis.

Fig. 2. The Zenith Model 21J20 high-voltage circuit. See text for circuit details.



High Voltage

Picture tubes in the 20 to 24 inch group require an operating voltage of approximately 14 to 16 kv. for sharp pictures and a minimum of "blooming" (change of picture size as the brightness control is advanced). These higher voltages are secured mainly through the use of a flyback transformer having a higher step-up winding to the high voltage rectifier. Also, the pulse voltage supplied to the transformer by the horizontal amplifier tube or tubes is greater in order to deliver the required pulse to the rectifier.

Sweep

Greater sweep currents are required through the yoke with the larger tubes. The higher anode voltage provides an electron beam which is more difficult to deflect and hence the magnetic flux produced in the yoke must be stronger.

Larger pulse voltages are generated in the horizontal oscillator and applied to the amplifier. The greater pulse at the amplifier plate is applied to the yoke through more efficient output transformers. Some of these transformers are designed so that the deflection yoke is in the primary circuit rather than connected to a secondary winding (Figs. 1 and 3). This system is known as "direct drive." Besides giving greater efficiency and more sweep, the linearity is more easily controlled, and "ringing" or halo effects are greatly reduced.

With a greater pulse delivered to the transformer, the boost voltage at the damper cathode is higher. In most sets, this voltage serves as a plate supply to both the horizontal and vertical amplifier and allows greater sweep currents. At the same time, the increased pulse requires more damping action and so several of the newer circuits incorporate two damper tubes connected in parallel. To attenuate Barkhausen oscillations, a suppressor choke coil or coils may be connected at the plate connections of the damper tube or tubes. See Fig. 1.

Linearity

High sweep currents in the deflection coils make the over-all linearity more important. The reason is that small deviations, hardly noticeable in the smaller tubes, are objectionable to the viewer of large tube screens. Only minor modifications are apparent in

(*Continued on page* 90)

SURVEY OF TRANSISTOR DEVELOPMENT

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

Part 1. Details on a component which may change the radio industry. This article covers the basic crystal types, their preparation, and fabrication.

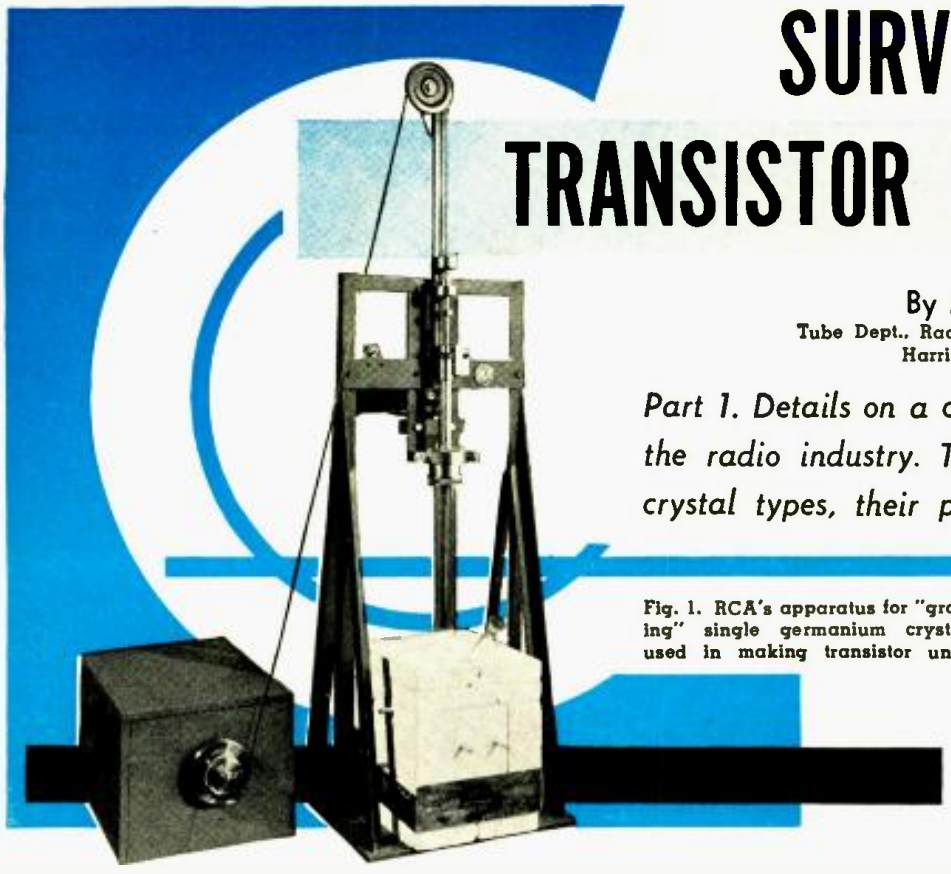


Fig. 1. RCA's apparatus for "growing" single germanium crystals used in making transistor units.

AS A RESULT of the progress made in the design and manufacture of the transistor, a germanium-crystal triode, this electronic device looms today as a desirable supplement to the electron tube in many applications. The development of the transistor may make possible new types of electronic equipment which will use not only transistors, but also electron tubes, and other electronic components in increasing quantities. In fact, the commercial application of transistors appears to be not too distant, although a considerable amount of time is probably still required before these units become commercially available on any sizable scale.

The intense interest in the transistor shown by electron-tube research and development engineers may be attributed to the fact that the transistor performs functions similar to those of triode-type electron tubes, although the mechanism of conduction is quite different. The transistor is of particular interest to equipment designers, who see many circuit possibilities in its characteristics. It is very small in size, and the power requirements for its operation are extremely low. When suitable circuits are developed, space and power requirements for complex electronic equipment may be simplified to a large degree by the use of transistors. Another promising feature is that the operating life of certain types of transistors shows indications of being very long, thus minimizing replacement problems. The physical ruggedness of the transistor offers other obvious advantages. In addition, the transistor requires no "warm up" time but will operate instantaneously upon application of voltage to its electrodes.

The limitations of the present developmental transistors, however, must not be overlooked. Transistor characteristics vary with ambient temperature changes, the noise is high compared with that of electron tubes, and the power output is relatively low. Nevertheless, when the favorable characteristics of the transistor are weighed against its limitations, it appears that this device, even in its present developmental stage is destined for use in many applications. Further improvements in its characteristics undoubtedly will create new and expanding fields for its use. At the same time, the principles of semi-conduction in solids may be expected to play an increasing part in the development of many new electronic devices, of which the present transistor is but the first.

Two types of transistors, the point-contact type and the junction type, will be discussed in this series. The point-contact transistor will be discussed first, and at greater length, because the development of this device has reached a more advanced stage and more is known about its performance with respect to frequency of operation, life, and uniformity of characteristics. However, the junction transistor promises to be at least as important as the point-contact transistor in many applications.

The heart of the transistor is the germanium crystal. Germanium is a semi-conductor, a metallic-like substance having conductivity greater than that of an insulator but less than that of a conductor. Its resistance, in contrast with that of metals, decreases as its temperature is raised. Other types of semi-conductors, such as silicon, lead sulphide, and selenium, have been used in transistor work, but, to the present time, germanium has proved the most successful.

Germanium is known mostly for its use in point-contact diode rectifiers which have been available commercially for several years. These devices have achieved widespread use in many present-day applications.

In the United States germanium is obtained most frequently as a by-product of zinc mining. It has also been obtained in considerable quantities in Great Britain from flue dust residue. Manufacturers of germanium products receive this substance in the form of a germanium dioxide powder. The conversion of the dioxide into crystals for use in transistors involves some of the most important and critical processes in the manufacture of germanium devices. The electrical characteristics of the transistor are dependent to a considerable degree upon the characteristics of the germanium. The control of transistor characteristics to acceptable tolerances depends upon the uniformity of the germanium.

The resistivity of the germanium, an important factor in transistor operation, is dependent upon the presence in the germanium of minute quantities of certain impurities. If no impurities are present in the germanium crystal, no transistor action takes place. If too many impurity atoms are present, however, the germanium becomes too conductive and transistor action is adversely affected. The impurities which enhance the transistor operation should be present in the ratio of less than one atom to every 10,000,000 germanium atoms. Because of their exceedingly low concentration, it is quite difficult to detect the quantity of impurities present in the germanium crystal. Some of these

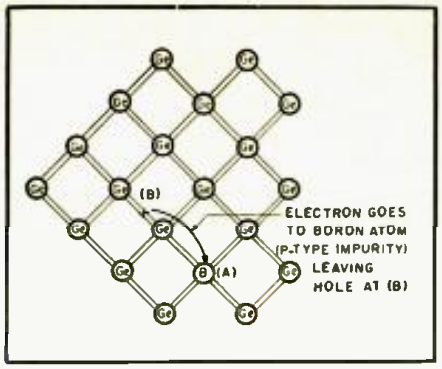


Fig. 2. The effect of "p"-type impurities on the conductivity of the germanium.

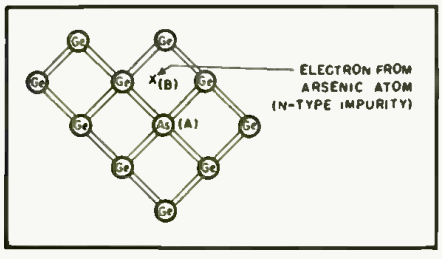


Fig. 3. The effect of "n"-type impurities on the conductivity of germanium crystals.

MATERIAL	RESISTIVITY (ohms per cm³)
Semi-conductor:	
Germanium	60
Insulator:	
Glass	9×10^{13}
Mica	9×10^{15}
Conductor:	
Copper	1.7×10^{-6}
Platinum	10×10^{-6}

Table 1. Resistivity of pure germanium, insulators, and conductors compared.

impurities are actually present in the germanium dioxide as it is delivered to the manufacturer. It is desirable, however, to remove as many impurities as possible by purification techniques so that controlled amounts of them may be added to obtain the desired values of resistivity.

The initial process in the conversion of germanium dioxide to the final crystals for transistor use is the reduction of the dioxide to a germanium metallic powder. This process is performed in a hydrogen atmosphere at a temperature of approximately 650 degrees Centigrade. The powder is then melted at a temperature of approximately 960 degrees Centigrade and is formed into ingots. After the ingots are formed, they may be subjected to one or more stages of purification. In one type of purification process, the germanium ingot is placed in a furnace in an inert-gas atmosphere, is melted, and then is progressively cooled from one end to the other. During this cooling process, impurities present in the germanium tend to concentrate at each end of the ingot. The inner portion of the ingot, therefore, has a higher purity than the ends where the impurities are concentrated. The low-purity ends of the ingot may be cut off and the process repeated if additional purification is needed.

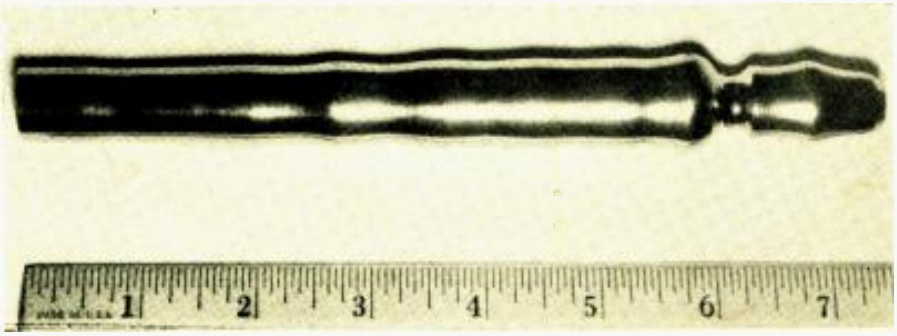
The germanium ingot formed by these purification techniques is polycrystalline. Greater uniformity is obtained in a further process in which a single crystal is formed from this polycrystalline ingot. In this process the polycrystalline germanium is placed in a graphite pot and melted. A small single crystal of germanium is dipped into the surface of the melt, then withdrawn very slowly, pulling with it some molten germanium which solidifies on the crystal seed. The speed of withdrawal may be about ¼ inch per minute. The temperature of the germanium is controlled very closely during the crystal "growing," with a permissible variation of no more than ±1 degree Centigrade.

Fig. 1 is a photograph of a crystal-growing apparatus. Single crystals ranging in diameter from 0.050 inch to one inch and having lengths up to many inches have been formed using this method. Fig. 4 is a photograph of the part of a single crystal which subsequently is to be cut into pellets for assembly into transistors.

At the present time the price of the germanium dioxide powder is about 300 dollars per kilogram. The quantity of germanium used for each transistor, however, is very small (about 0.002 gram). The single crystal pictured in Fig. 4 can provide as many as 7000 pellets for as many transistors, and many single crystals of this size can be obtained from one kilogram of germanium dioxide. Although a portion of the germanium is scrapped during the processing from powder to final crystal form, much of this germanium may be reclaimed for further use.

The finished crystal specimen is tested electrically to determine whether it has the proper impurity concentration, resistivity, and physical characteristics for use in transistors. The crystal is then sliced into wafers about 0.020 inch in thickness and diced into small pellets approximately 0.050 inch square. The pellets are chemically etched before the transistor is assembled to insure the absolute cleanliness of the crystal surface so necessary for good transistor operation.

Fig. 4. A single germanium crystal grown in the crystal-growing apparatus (Fig. 1).



Conductivity in Germanium

The germanium crystal is composed of millions of germanium atoms, each consisting of a positively charged nucleus and a number of negatively charged electrons. All but four of the electrons are tightly bound to the nucleus and cannot enter into chemical reactions with electrons of other atoms. The remaining four electrons, which are able to enter into chemical processes, are called valence electrons. In the pure germanium crystal, however, the atoms are arranged in such a fashion that the valence electrons are fixed in place and contribute only slightly to electrical conductivity. The resistivity, which is the reciprocal of conductivity, of the pure germanium, therefore, is higher than that of germanium containing impurities.

Fig. 5 is a photograph of a model of the atomic structure of a tiny portion of the germanium crystal. Each round ball represents the nucleus of an atom, and each bar connecting two nuclei represents two valence electrons, one from each of the two atoms joined by the bar. Each of the four valence electrons of an atom forms a bond with a valence electron from an adjacent atom. Electrons which are fixed in these electron-pair bonds cannot contribute to the conductivity of the crystal except under the influence of an applied force. This condition is similar to that existing in an insulator, where there are no conduction electrons and, consequently, there is little or no conductivity. If sufficient electrical or thermal energy is exerted on the germanium crystals, however, the forces holding the electrons in their bonds can be overcome, and a few electrons may be released from their bonds. Because of the release of electrons by thermal energy at room temperature, germanium does have some conductivity even in its pure state. The resistivity of pure germanium, a semiconductor, is 60 ohms per centimeter cube at room temperature. The resistivity of insulators is much higher than that of semi-conductors; that of metal conductors is much lower. In a metal conductor, there are a large number of conduction electrons which are not bound in a fixed position but are free to flow throughout the metal, thus contributing to a very low resistivity. Table 1 gives a comparison of resistivities at room temperature of pure germanium, insulators, and conductors.

The normal conductivity of germanium must be increased to obtain

transistor operation. This additional conductivity is obtained by adding impurities to the crystal, as was mentioned previously. The impurities which may be present in germanium are of three types. Fig. 3 illustrates how one type of impurity can add conduction electrons to the crystal. If impurities having five valence electrons per atom are added, each impurity atom (A) takes the place of a germanium atom and four of the five valence electrons form bonds with four electrons of adjacent germanium atoms. The fifth electron (B) from the impurity atom is free to wander about the crystal and contributes to its conductivity in a manner similar to that of free electrons in a metallic conductor. As more impurity atoms of this type are added, the conductivity of the germanium increases and the resistivity decreases. Germanium having an excess of electrons due to the addition of such impurities is known as "n"-type germanium, that is, germanium having an excess of negative charges. "N"-type impurities are also known as "donor" impurities because they donate electrons to the crystal conductivity. Typical donor impurities are arsenic, antimony, and phosphorus.

Conduction in germanium may also be increased by adding a second type of impurity such as aluminum, boron, or indium. Fig. 2 illustrates how these impurities, known as "p"-type impurities, create a deficiency of electrons. If impurities having three valence electrons per atom are added, each impurity atom (A) takes the place of a germanium atom and its three valence electrons form electron-pair bonds with electrons of neighboring germanium atoms. In order to fit completely into the valence bond structure of the crystal, the impurity atom borrows an electron from an electron-pair bond from somewhere else in the crystal (B), thus leaving a net positive charge in the half-empty bond. This positive charge is known as a "hole"; these holes contribute to the conductivity of the crystal in much the same manner as electrons because they also can move from atom to atom. As more "p"-type impurities are added, more holes are formed and the conductivity of the crystal is increased. The main distinction between the two types of germanium is that the "n"-type has an excess of electrons while the "p"-type has an excess of holes. Both "n" and "p" types are used in transistors; in certain types of transistors both exist in different parts of the same crystal. The "n"-type germanium is used predominantly in the present point-contact transistors.

The third type of impurity includes those which do not have three or five valence electrons. These impurities, which are present in very small quantities, may not affect the conductivity of the germanium, but may disturb the crystal structure and adversely affect transistor properties.

The role which "p"-type and "n"-type impurities play in determining the resistivity of germanium may be appreciated by noting the change in resistivity which occurs with a change in the ratio of impurity atoms to germanium atoms. The density of germanium atoms in pure germanium is approximately 4.5×10^{22} atoms per cubic centimeter; there are approximately 3.7×10^{19} germanium atoms in the average pellet used for a transistor. If 4.5×10^{14} "n"-type impurity atoms are added to each cubic centimeter of pure germanium, or one impurity atom for every 100,000,000 germanium atoms, the resistivity of the germanium drops from 60 ohms per centimeter cube to approximately 3.8 ohm per centimeter cube, a value which is satisfactory for use in a point-contact transistor. If 4.5×10^{15} impurity atoms are added to the germanium, however, the resistivity drops to 0.38 ohms per centimeter cube, a value which is too low for transistor use. This example illustrates how critical are the quantities of impurities which must be added. The problem is further complicated by the fact that "p"-type impurities may be present in the germanium ingot when the "n"-type impurities are introduced, and the holes and electrons furnished by the two types of impurities may cancel each other out. If both types of impurities were present in equal amounts, the resistivity would be the same as if no impurities were present.

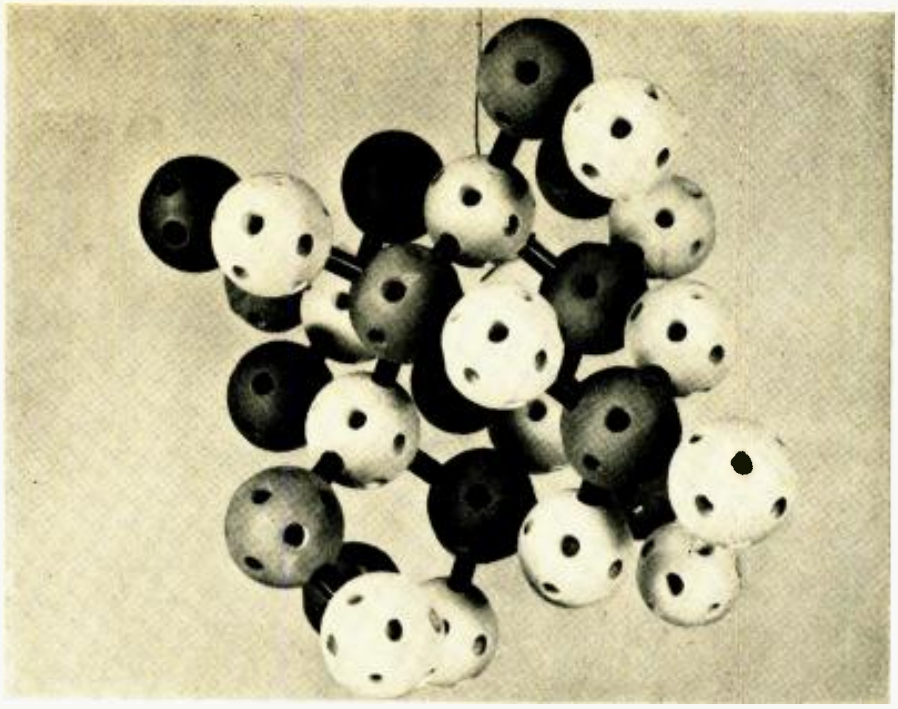


Fig. 5. A three-dimensional model of the atomic structure of germanium crystal.

Fabrication Process

An appreciation of some of the unique characteristics of the transistor may be obtained from an examination of its construction. A photograph of an *RCA* developmental point-contact transistor is shown in Fig. 7. Fig. 6 is a diagram of its construction. This transistor consists essentially of two rectifying point electrodes which make contact with a small pellet of germanium. These electrodes are known as the emitter and the collector. A third electrode, the base, is in low-resistance contact with the germanium crystal. The emitter, collector, and base form the three electrical connections to this germanium-crystal triode. The com-

(*Continued on page* 170)

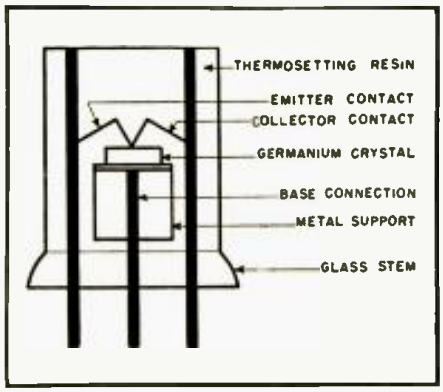
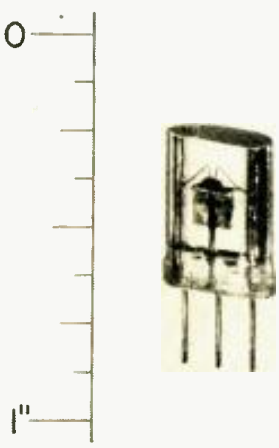


Fig. 6. Construction details of the RCA developmental point-contact transistor.

Fig. 7. RCA's developmental transistor.



Hi-Fi-Audio Product Review

REAR-SEAT SPEAKER KIT

Oxford Components, Inc., 556 W. Monroe St., Chicago 6, Ill. is now

marketing a low-priced rear-seat speaker kit which has been tradenamed the "Satellite."

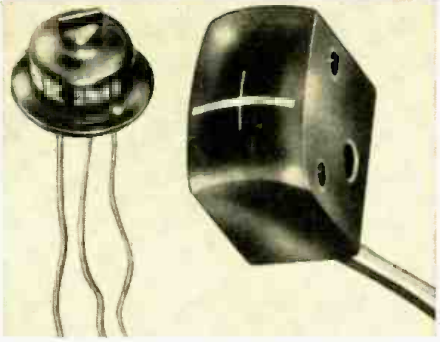
The kit comes individually boxed in a multi-colored container which is designed to be used as a display unit as well. The kit includes a 6" x 9" or 5" x 9" speaker of rugged construction, chrome-plated switch plate and grille, and three-position slide switch. The speaker kit comes complete with all mounting hardware.

The "Satellite" is a universal model which will fit all makes and models of cars.

D.C. ERASE HEAD

Michigan Magnetics, Inc. of Vermontville, Mich. is now in production on a new d.c. erase head which provides 50 db erasure with 5.5 ma. of current through the coil.

This head is currently being manufactured in a 20 mil track width configuration. A mating playback-record head will be available shortly. For



details on this unit, shown above beside a transistor for size comparison, write the manufacturer direct.

"NEOPHONIC" UNIT

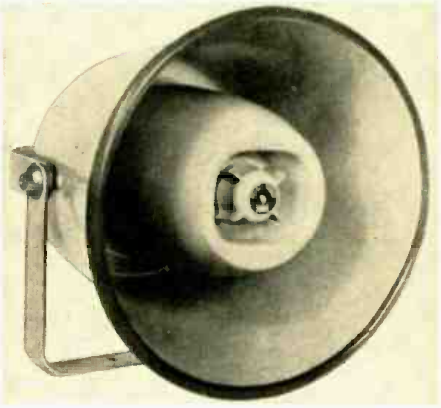
The Electronic Sales Corporation of America (TESCOA), 1820 W. Ganson St., Jackson, Mich. is now marketing a compact unit which is designed to provide a stereo effect from a monaural program source when connected between two separate amplifiers and their associated speakers.

Tradenamed the "Neophonic," the new device is designed to operate from a 12-watt (max.) amplifier. When connected into a hi-fi system as directed, the device allows the volume control on amplifier No. 1 to control the volume on both channels. Balancing is handled by the volume control on the second amplifier.

For additional details on this device, write the distributor direct.

WEATHERPROOF SPEAKER

Atlas Sound Corporation, 1449 39th Street, Brooklyn 18, N. Y. is now



marketing a rugged hi-fi weatherproof speaker for voice and music, as the "Coax-Projector" Model WT-6.

Two individual drivers and two individual horns, with built-in electronic crossover, are combined in a single weatherproof housing. The low frequencies are reproduced by a high efficiency woofer properly loaded with a folded exponential horn. The high frequencies are reproduced by a wide-angle tweeter completely protected against all climate and humidity conditions.

The unit will handle 15 watts and has a depth of 11" and a bell opening measuring 15". For full information, write the manufacturer.

HARMAN-KARDON STEREO LINE

Harman-Kardon, 520 Main St., Westbury, N. Y. has announced a series of stereo units which will be available for the fall market.

"The Duet" (Model T-224) is a stereo tuner with separate channels for the reception of AM and FM signals in stereo broadcasting. A jack in the rear makes the unit readily adaptable for multiplex reception. The companion stereo amplifier is being marketed as

USING THE 6U8 IN A HIGH-QUALITY AUDIO SYSTEM

By
GEORGE ELLIS JONES, JR.
Instructor in Chemical Engr.
The University of Pittsburgh

Fig. 1. Over-all view of the power amplifier and control unit which was designed around the new miniature, 9-pin 6U8 combination triode and pentode.

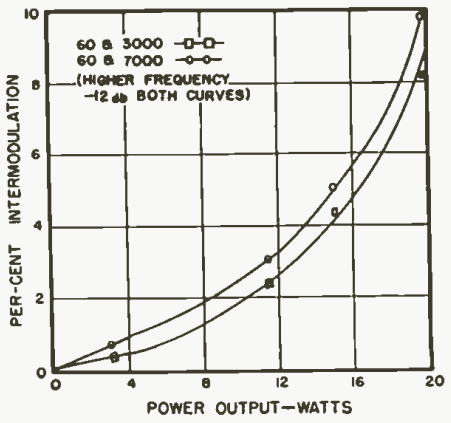
Construction details on a unique power amplifier and control unit whose circuit features the use of a recently-introduced 9-pin miniature tube.

THE development of a miniature 9-pin envelope containing both a triode and a separate pentode has resulted in the design and construction of the power amplifier and control unit pictured in Fig. 1. This new tube, the type 6U8, is intended for local oscillator and mixer applications at radio frequencies. Here it provides a voltage gain pentode direct-coupled to a triode phase inverter. One tube thus includes the elements for driving an output stage comprising two 6L6 beam pentodes. The main amplifier schematic diagram is shown in Fig. 4. A potentiometer, R_{25}, in the cathode and grid circuits of the output stage serves to adjust the balance of the 6L6 plate currents. The output transformer selected by the author has well-balanced primary windings. When the balancing potentiometer is adjusted to obtain a zero reading on a d.c. voltmeter connected from one 6L6 plate to the other 6L6 plate, the plate currents are equal. There is no reason to believe that this adjustment is essential, and unless an output transformer with equal resistances in both primary halves is used, this handy scheme for balancing an output stage will not work. To eliminate the balancing circuit, connect the 6L6 grid coupling resistors (R_{23} and R_{27}) to ground and connect the two cathode resistors (R_{24} and R_{26}) together at both ends, grounding the junction opposite the cathodes.

The output transformer, T_3, used by the author is a "universal" type, a *UTC* LS-57. The primary should be connected for a 5000 ohm plate-to-plate impedance, while the secondary should be connected to match the voice coil impedance of the speaker used. To select the proper terminal, should you use a universal output transformer, you will have to refer to the manufacturer's instruction sheet.

The feedback circuit from the secondary of the output transformer to the input stage through resistor R_{18} is a very critical part of the design. There may be considerable variation depending, of course, on the secondary tap that is used. Actually you can use any of the secondary taps of the output transformer providing that the value of R_{18} is chosen accordingly. Should you use an output transformer having a single-winding secondary which matches the voice coil impedance, the feedback circuit will be taken off of the same point as the speaker.

Fig. 2. Graph showing the results of intermodulation distortion tests on power amplifier and associated control unit.



To determine the proper value for resistor R_{18} use the following formula:

$$R_{18} = 3600 \sqrt{\text{voice-coil impedance}}$$

If, like any feedback circuit, oscillation occurs reverse the plate connections of the output transformer.

The power transformer, T_2, as specified in the parts list of Fig. 4 is a little underrated for "B+" and overrated for the filament. This is not serious in this case. The transformer specified will work without any difficulty. The ideal power transformer would be one having the following ratings: 375-0-375 v. @ 165 ma; 5 v. @ 3 amps.; 6.3 v. @ 3 amps. In the author's unit the "B+" voltage of 280-290 at the input of the filter choke will give satisfactory operation.

The power amplifier is flat at 10 watts of output power from 50 to 15,000 cycles-per-second within plus or minus 1 decibel. At an output of one watt it is similarly flat from 10 to 100,000 cycles-per-second. A graph of an intermodulation distortion test is shown in Fig. 2. A low frequency signal of 60 cycles-per-second and either a 3000 or a 7000 cycle-per-second high frequency signal were combined at a relative level of four to one. Since harmonic distortion at equivalent power levels can be expected to run about one fourth of the intermodulation distortion, we may expect about 1.5% harmonic distortion at 15 watts

and about 3% harmonic distortion at 20 watts.

It is realized that much more power output could have been obtained had the output stage been operated class AB_1. However, by maintaining class A_1 operation the "notch effect" is avoided. This form of distortion is inherent in any transformer-coupled, push-pull stage operating class AB_1. High frequency transients which develop when either of the output tubes cuts off or again starts conducting produce spurious responses across the leakage reactance of the output transformer primary sections. This form of distortion can be reduced by special transformer design; however, an economical compromise is to accept the reduced power output and efficiency of class A_1 operation.

The control unit to be used with this amplifier combines a maximum of flexibility consistent with a minimum of tubes. As shown in the schematic diagram (Fig. 3), a *General Electric* type preamplifier for magnetic phonograph pickups has been used. Either this preamplifier's output or a radio tuner output, as chosen with the combination power switch and input selector, is fed to a voltage gain triode (V_2). Volume control action is obtained from an adjustable negative feedback loop around this stage. This inverse voltage feedback serves two very useful purposes. First, any hum and noise generated in the stage is greatly reduced, especially since low level output is obtained by increasing the feedback. Second, the tone control sections which follow this stage look back at the low source impedance produced by the feedback action. The tone control sections provide independent boost or cut for both treble and bass frequencies. Since the output impedance of the tone control network at high frequencies is about 10,000 ohms, it is not essential to place a cathode follower between the control unit and the main amplifier. A four to six foot shielded microphone cable is quite feasible. The main amplifier can then be placed conveniently for heat dissipation while the control unit remains accessible to the user.

If the general layout indicated in the picture is followed a compact but easily constructed unit will result. Heater wiring is omitted on the schematic diagrams to emphasize essential circuit features. All the heaters are, as expected, connected in parallel, with the center tap going to the 6L6 cathodes. This arrangement, together with the parts layout and the fact that the cathodes of all low level stages are connected directly to a ground bus, provide a very low hum level for the entire unit.

While there are obviously better high fidelity setups, it is doubtful if greater flexibility could be achieved with fewer of those non-linear, distortion producing, but ever-present vacuum tubes.

Of course, the final quality test for any high-fidelity amplifier system consists in listening to the sound you get out of the system. With a reasonably good loudspeaker (at least eight inches) having a power handling capacity in excess of 10 watts, and a frequency range of from 50 to about 12,000 cycles, this amplifier will faithfully reproduce all musical instruments from the bass viol to the triangle.

The use of a triode in the input stage of the control unit helps to keep the noise level down. Although the first section of the 6U8 is a pentode, the small amount of noise it introduces is outweighed by the advantage of having direct coupling between it and the triode section, thereby eliminating a coupling condenser and thus decreasing the phase distortion of the control unit.

This amplifier is recommended to those who are interested in a unit with relatively low power consumption, ease of construction, and fidelity of reproduction.

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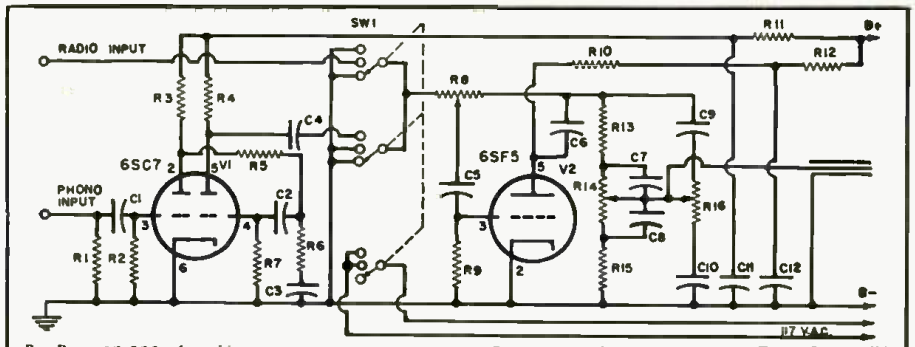
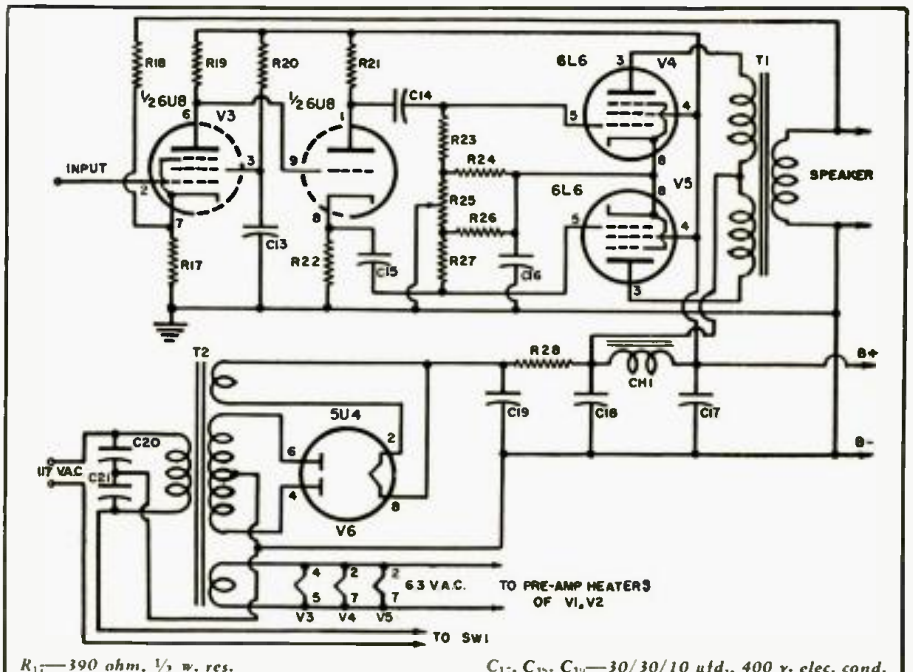


R_1, R_{15}—10,000 ohm, ½ w. res.
R_2, R_7—3.3 megohm, ½ w. res.
R_3—68,000 ohm, ½ w. res.
R_4—33,000 ohm, ½ w. res.
R_5—220,000 ohm, ½ w. res.
R_6—27,000 ohm, ½ w. res.
R_8—2 megohm pot. ("Volume Control")
R_9—10 megohm, ½ w. res.
R_{10}, R_{12}—100,000 ohm, ½ w. res.
R_{13}—100,000 ohm, 1 w. res.
R_{14}—68,000 ohm, 1 w. res.
R_{16}—1 megohm pot. ("Bass Tone Control")
R_{17}—1 megohm pot. ("Treble Tone Control")
C_1, C_2, C_5—.02 μfd., 400 v. cond.
C_3—.01 μfd., 400 v. cond.
C_4, C_6—.05 μfd., 400 v. cond.
C_7—.003 μfd., 400 v. cond.
C_8—.03 μfd., 400 v. cond.
C_9—1500 μμfd. mica cond.
C_{10}—7500 μμfd. mica cond.
C_{11}, C_{12}—50/50 μfd., 400 v. elec. cond.
SW_1—3-pole, 3-pos. switch
V_1—6SC7 tube
V_2—6SF5 tube

Fig. 3. Schematic of the control unit. A G-E type preamplifier is incorporated in the circuit for magnetic phono pickups. A tuner input is also provided in unit.

Fig. 4. Complete schematic of the main amplifier unit used in the audio system.



R_{17}—390 ohm, ½ w. res.
R_{18}—See text
R_{19}—68,000 ohm, 1 w. res.
R_{20}—150,000 ohm, 1 w. res.
R_{21}, R_{22}—18,000 ohm, 2 w. res.
R_{23}, R_{27}—100,000 ohm, ½ w. res.
R_{24}, R_{26}—270 ohm, 2 w. res.
R_{25}—200 ohm wirewound pot.
R_{28}—750 ohm, 20 w. wirewound res.
C_{13}—30 μfd., 400 v. elec. cond.
C_{14}, C_{15}—.25 μfd., 400 v. cond.
C_{16}—50 μfd., 25 v. elec. cond.
C_{17}, C_{18}, C_{19}—30/30/10 μfd., 400 v. elec. cond.
C_{20}, C_{21}—.05 μfd., 400 v. cond.
CH_1—Filter choke, 10 hy., 50 ma., 100 to 150 ohms
T_1—Output trans. push-pull 6L6's, 5000 ohms plate-to-plate to v.c. (UTC-LS-57) (See text)
T_2—Power trans. 375-0-375 v. @ 150 ma.; 5 v. @ 3 amps.; 6.3 v. @ 4.7 amps. (Thordarson T-24R06-U) (See text)
V_3—6U8 tube
V_4, V_5—6L6 tube
V_6—5U4 tube

UNIVERSAL DESIGN CURVES

FOR TONE-CONTROL CIRCUITS

By

M. B. KNIGHT

RCA Victor Division, Harrison, N. J.

Part 3. Two variations of a bass tone-control circuit which gives either boost or attenuation.

THIS is the third article in this series on practical *RC* tone-control circuits. These articles describe simple circuit arrangements suitable for particular types of tone control and include frequency-response curves obtained with each circuit. The curves permit rapid evaluation of the ability of a circuit it fulfill specific design requirements. They also indicate the preferred potentiometer taper and facilitate the choice of component values.

The preceding articles and the author's article in the November 1951 issue presented universal design curves for several bass and treble tone-control circuits, some for boosting and some for attenuating. This article includes two variations of a bass tone-control circuit which can be adjusted to boost or to attenuate with a single control.

Bass Boost and Attenuation

A circuit which is adjustable for either boosting or attenuating the bass is shown in Fig. 2 and its "constant-voltage generator" equivalent circuit in Fig. 5. This circuit is similar to the bass-boosting circuit discussed in the August article (shown in Figs. 1 and 2) and is identical analytically to the bass-attenuating circuit presented in the same article (shown in Figs. 7 and 8). When using the circuit of Fig. 2, it is usually advisable to use a medium-mu triode. The use of other types of tubes may result in relatively low values of load impedance and cause distortion.

The universal design curves for this circuit are given in Figs. 1 and 3. These curves show one peculiar characteristic in that the boost and attenuation do not occur in quite the same frequency range. This characteristic may be desirable for designs in which the provision for bass attenuation is made solely to permit reduction of hum or of phono-motor rumble. The usual tone-control requirement, however, is for a fairly symmetrical boost and attenuation characteristic. The circuit of Figs. 2 and 5 can be modified to satisfy this requirement by inserting an additional condenser and rearranging the components, as shown in the equivalent circuit of Fig. 6. The relationship indicated between the values of the two condensers is essential in order to make it possible to adjust the control for flat frequency response. Three design curves for this modified circuit are given in Figs. 4, 7, and 8.

These circuits are considerably more complicated than those given in the previous articles of this series, and a difficulty arises from the presence of too many variables when we attempt to derive universal design curves. Fortunately, practical considerations make many assumptions possible in the derivations. For example, the relationship between the condensers in the circuit of Fig. 6 was selected to permit adjustment for flat response, as mentioned previously. Furthermore, the universal design curves were drawn for particular relationships of resistor values which yield approximately the same maximum boost and attenuation. For either circuit, the maximum boost and attenuation are exactly equal when the ratio between the potentiometer, R, and the resistor R_2, equals $a^2 - 1$. When this relationship is satisfied, the maximum boost or attenuation in db is equal to $20 \log a$.

The more analytically-minded reader may be interested to know that the circuits can be designed for any value of boost and any value of attenuation. The first step in such a design is to determine the proper ratio for R/R_2. The sum of the desired maximum boost in db and maximum attenuation in db (both considered as positive values) equals $20 \log (1 + R/R_2)$. When the ratio of R/R_2 has been determined from this formula, the value of a may be found, using the relation that the attenuation in db (expressed as a positive number) is equal to:

$$20 \log \left[1 + \frac{R}{R_2} \left(\frac{1}{a+1} \right) \right]$$

We might mention at this point that flat response is obtained when the pot. is adjusted so that y, which denotes the setting of the tone control and is defined to mean the fraction of the total resistance of R included between the wiper of the pot. and the junction of C with R_2, is equal to $1/(a + 1)$. This latter formula is correct irrespective of the relationships selected for the resistors.

It is not usually advisable to design the circuit to give more maximum boost than maximum attenuation, because such a design results in a needless sacrifice in gain. The boost ob-

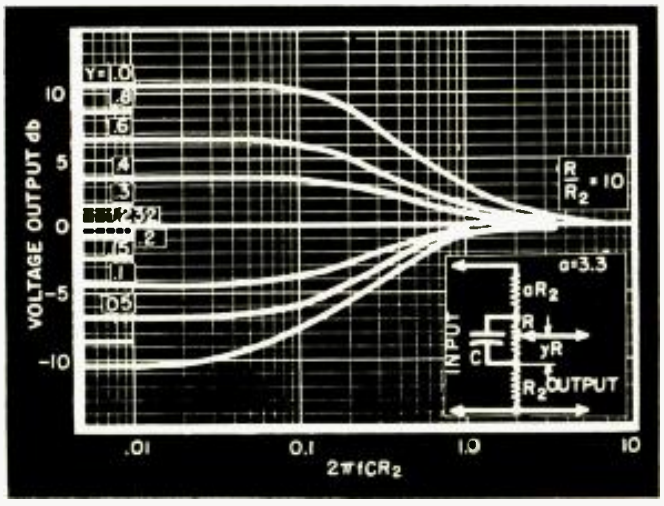


Fig. 1. Design curve for circuit of Figs. 2 and 5 with $R/R_2 = 10$ and $a = 3.3$.

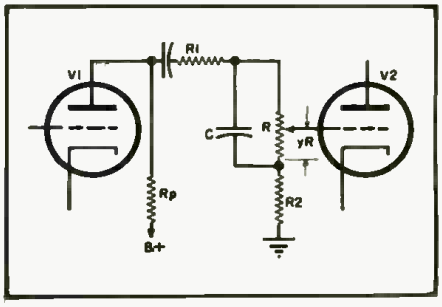


Fig. 2. Circuit for variable bass boost and attenuation.

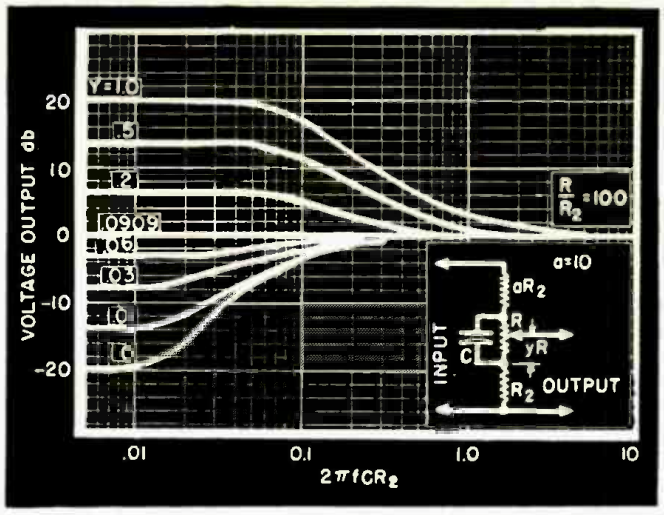


Fig. 3. Design curves for Figs. 2 and 5 with $R/R_2 = 100$, $a = 10$.

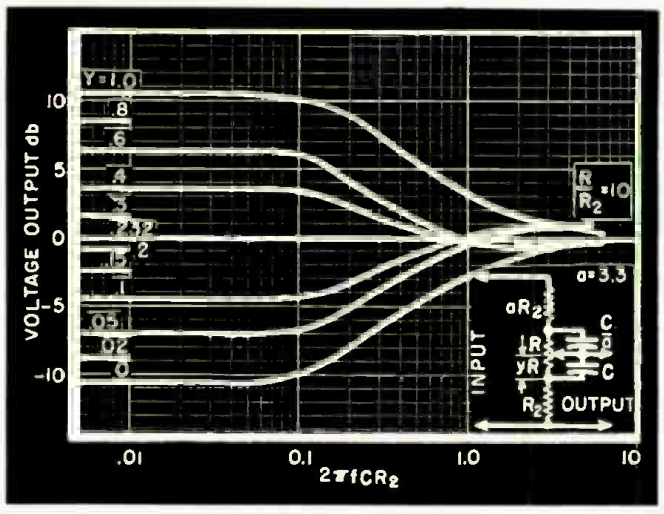


Fig. 4. Design curves for Fig. 6 with $R/R_2 = 10$ and $a = 3.3$.

tainable from these circuits never quite equals the loss in mid-frequency gain, but it is desirable to design the circuit so that the loss of gain is not excessive. In order to obtain maximum boost from the circuits, the ratio of R/R_2 must be relatively large. Under these conditions the maximum attenuation is also large. The preferred method of limiting the attenuation is to add a fixed resistor in series with the potentiometer as shown in Fig. 9. The loss of mid-frequency gain in these circuits is equal to 20 *log* $(1 + a)$ (in db, as a positive value). The maximum boost can be determined from the formulas given previously.

Sample Design

As an example of the use of the curves we may select a design problem that actually confronted us recently. A friend had a high-quality phonograph amplifier which had no tone controls. He wanted to add a bass adjustment and a treble-attenuating control. The amplifier used a 6J5 triode as the first stage and had just adequate gain for the pickup being used. We decided to replace the 6J5 with a 6SN7GT twin-triode, a change requiring no chassis alteration for another socket. The extra triode section provides both isolation between the tone controls and the extra gain required to compensate for the loss in the bass tone control. The treble tone control was patterned after the circuit given in Part 1 of this series (Fig. 8A) and was placed in the plate circuit of the first triode section of the 6SN7GT.

It was decided that the bass tone control should supply about 20 db of boost, but that less attenuation would be required. The curves of Fig. 7 and the circuit of Fig. 9 were selected to meet the requirements of the design. Since potentiometer R should be large, one megohm was selected for its value. The value of resistor R_1 was selected to limit the attenuation to about 14 db. In Fig. 7, the curve for $y = 0.01$ levels off at 14 db of attenuation, so the value of R_2 is equal to 0.01 x one megohm or 10,000 ohms. (R should properly be considered 1,010,000 ohms, but the correction is negligible in this case.) In Fig. 7, the ratio of R/R_2 is 100; therefore, R_2 is 10,000 ohms. If a value of 10 is used for a, as shown in Fig. 7, the value of the resistor aR_2 is 100,000 ohms. However, a value of 100,000 ohms was used for resistor R_1 in Fig. 2, and calculations for the treble tone control (see Part 2, August issue) show that the source impedance of the 6SN7GT and its plate load resistor $1/(1/r_p + 1/R_p)$ was about 10,000 ohms. Therefore, aR_2 (which is equal to

(*Continued on page* 106)

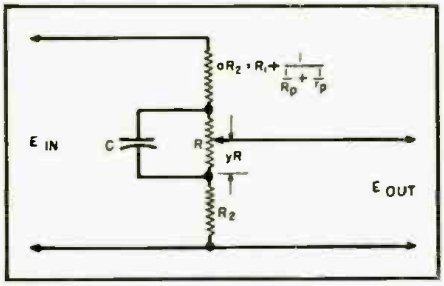


Fig. 5. Equivalent circuit for Fig. 2.

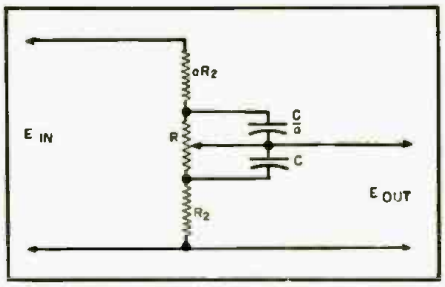


Fig. 6. Equivalent circuit for a variable tone control which provides both symmetrical bass attenuation and bass boost.

Fig. 7. Design curves for Fig. 6 with $R/R_2 = 100$ and $a = 10$.

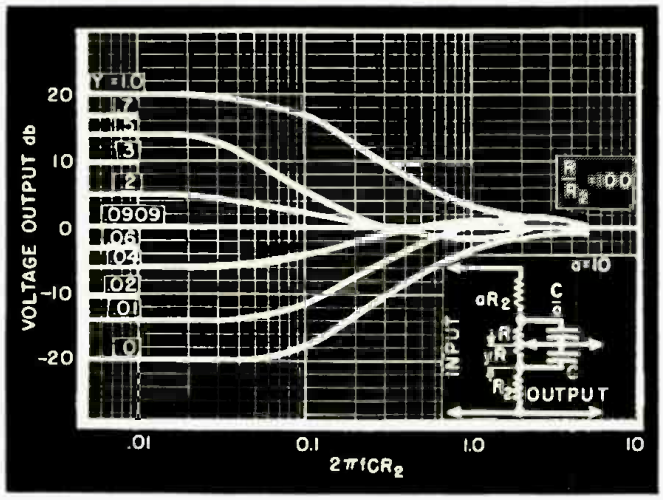
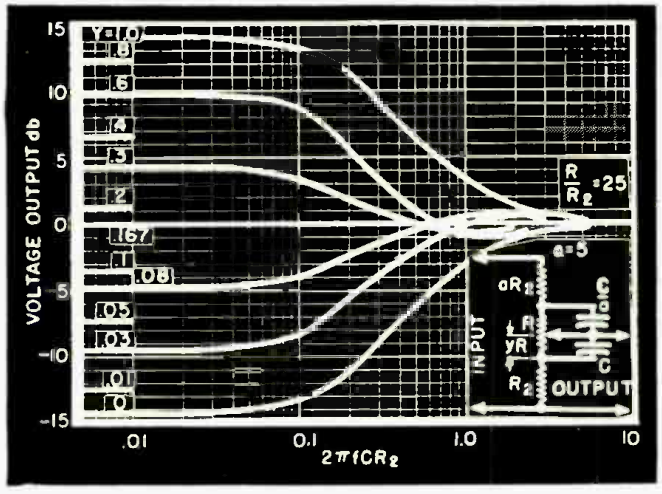


Fig. 8. Design curves for Fig. 6 with $R/R_2 = 25$, $a = 5$.



TV CONVERSIONS FOR LARGE TUBES

By
WALTER H. BUCHSBAUM
Television Consultant,
RADIO & TELEVISION NEWS

When used with this month's "Data-Print", this article provides all of the necessary data to permit the technician to convert small screen sets to large-tube operation.

TO REPLACE a 10-inch tube by a 12-inch picture tube requires no major electrical changes. In most cases a new, wide-sweep deflection yoke will be the only change required and often even that is not necessary. The bulk of conversion jobs deal with the substitution of 14-, 16-, 17-, 19- and 20-inch round and rectangular picture tubes for 10- and 12-inch ones. When such a conversion is contemplated, the job should be divided into two parts—the mechanical and the electrical conversion. The mechanical part involves changing the picture cut-out or mask, or installing the receiver in a new cabinet, mounting the tube on new or raised brackets, and extending all leads to suit the new arrangement.

The 10- and 12-inch picture tubes have deflection angles ranging from 52 to 57 degrees, while all rectangular and most large round picture tubes have deflection angles of from 60 to 70 degrees. In addition to a wider deflection angle, the larger tubes also require a higher second anode voltage. To obtain more sweep and a higher voltage, major changes must be made in the horizontal flyback section of the receiver. To obtain sufficient height, changes in the vertical sweep section may be required, and to obtain good focus a change in the focus device is also necessary.

Picture Tube

Selecting a particular picture tube for a conversion job is often quite a problem. Size, availability, mounting, and circuit requirements all enter into it. The following things should be considered.

1. Cabinet fit. Is the tube to be mounted in the same cabinet? Can a larger cabinet be obtained? Maximum screen height and width. Maximum length. Check these physical dimensions against the data given in "Data-Print" 4 appearing in the August issue of RADIO & TELEVISION NEWS.

2. Metal or glass. The metal envelope requires a special plastic mounting ring and apron.

3. Required high voltage. This will determine the electrical changes necessary and thus, to a major extent, the cost of the conversion.

4. Deflection angle and neck length. This determines the type of deflection yoke required.

5. Focusing. Magnetically focused tubes require either the 247-ohm type of coil or the 470-ohm type. Consult the "Data-Print" in last month's issue. Low voltage electrostatic tubes or self-focusing types are more expensive, but may save the price of a new focusing coil.

6. Ion trap. Avoid tubes that don't use ion traps since they are often subject to ion spots. Either a single or double magnet type trap is available.

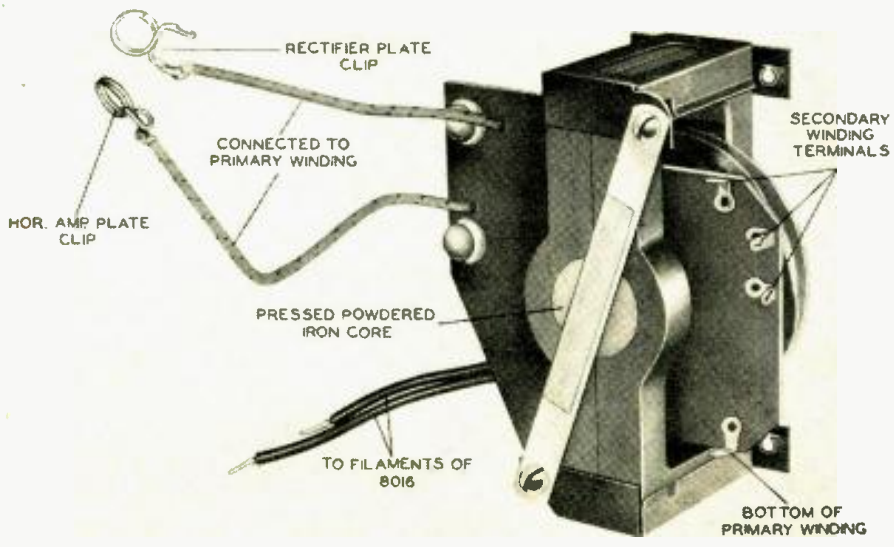
7. Screen. Screens are available in filterglass, etched, and cylindrical types to reduce glare. In each case the choice depends on price, availability, and individual preference. In general, the filterglass and etched types suffer from a slight loss in brightness over the clear types. Cylindrical face tubes are more subject to "pincushioning" or bulging than the other types.

8. Cost. The cost of the picture tube as well as the new conversion components increases by almost the same percentage as does the size. If a new cabinet is required the cost is still further increased.

9. Complexity of conversion. This depends on the type of receiver. If it already uses a flyback circuit and performs well, less work will be required. If more than ample vertical sweep is present before conversion, little difficulty can be expected in that section. In some cases, the picture tube voltages will be the same as those required

(*Continued on page* 55)

Fig. 1. RCA's No. 211T5 horizontal flyback transformer. A transformer of this type is used in the conversion diagram (Circuit A) included on this month's "Data-Print."



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

FLASHING SERVICE DISPLAY
A 6-color display featuring your ability to "Clear Up The Picture."

PLEXIGLO ILLUMINATED SIGN
A bright and colorful service selling sign.

To help you increase your profits...

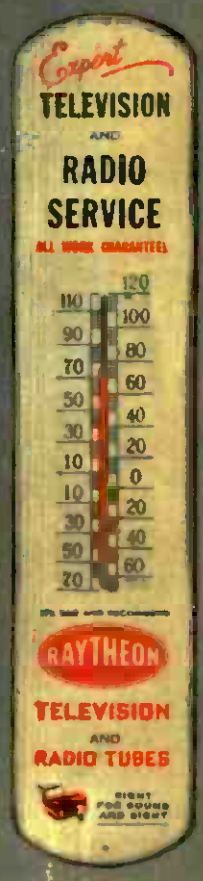
To help you work more efficiently...

RAYTHEON

has made these useful

NEW SALES AND SHOP AIDS AVAILABLE TO YOU!

SHOP JACKETS and COATS
Expertly designed, sturdy, long wearing, comfortable garments. Full length or jacket style.



OUTDOOR THERMOMETER
A [illegible] gauge, jumbo size ([illegible] x 39") outdoor unit.

SCOTCH TAPE AND DISPENSER
¾" Scotch Acetate Tape bearing your name. Handy Dispenser.

POLITICAL WINDOW STREAMER
You can use this effectively from now 'til November.

ILLUMINATED TEST PATTERN CLOCK
A Telechron motored beauty.

DISPLAYS
Colorful displays that sell your service.

Write for FREE BOOKLET!

It's chock full of these and many other useful shop aids and sales promotion items that are musts for every service dealer — imprinted stationery, job tags and record cards, ad mats, post cards, shipping labels, decals, etc. Some are free, others available at less than cost. Ask your Raytheon Tube Distributor for them or write for booklet to Department A

RAYTHEON®

RAYTHEON MANUFACTURING COMPANY

Receiving Tube Division

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

Excellence in Electronics

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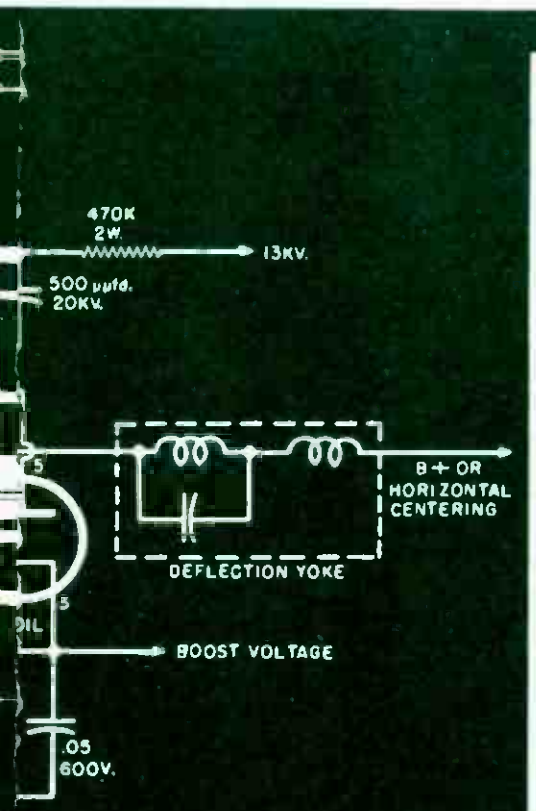
RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

VERSION GUIDE

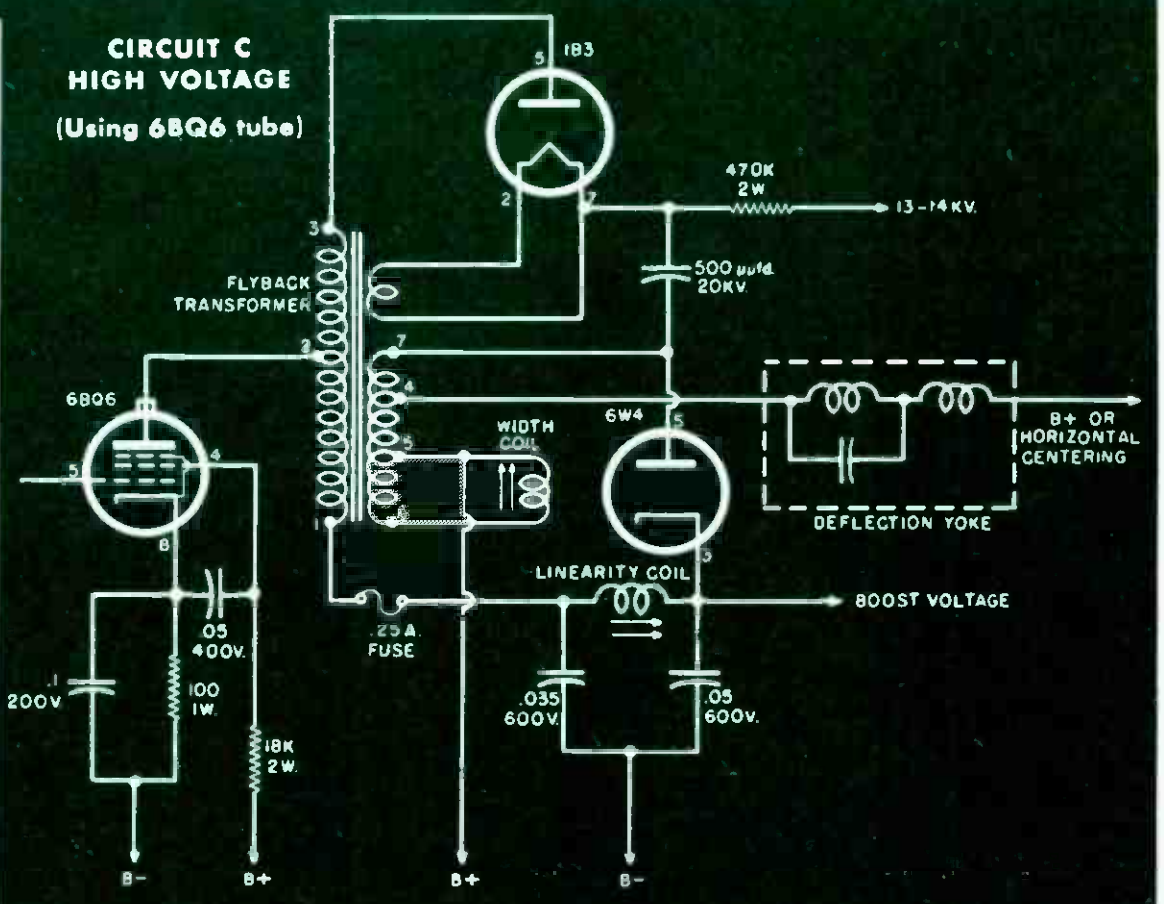


DEFLECTION YOKE
(60-70 degrees)

Chicago TY-2 (8 mhy.)*
Chicago TY-3 (13 mhy.)*
Du Mont Y2A1 (10 mhy.)
G-E RLD-024 (8 mhy.)
G-E "Truefocus" (18 mhy.) short*
Merit MDF-70 (11 mhy.)*
RCA 211D2*
Ram Electronics Y70F14 (14 mhy.)
Stancor DY-7 (8 mhy.) short
Stancor DY-8 (8 mhy.)*
Stancor DY-9 (13 mhy.)*
Triad Y12 (8 mhy.)*
Triad Y17 (13 mhy.)*
Triad Y10 (23 mhy.)*

*a winding for a.f.c. feedback pulse

CIRCUIT C
HIGH VOLTAGE
(Using 6BQ6 tube)



FLYBACK TRANSFORMER

Du Mont H1A1
Ram Electronics X032 (13 kv.)
Ram Electronics X035 (14 kv.)
Stancor A 8129

LINEARITY COIL

Du Mont L1A1
Merit MWC-2
RCA 201R3
Ram Electronics 201R3
Stanwyck S-958

WIDTH COIL

Du Mont W1A1
Merit MWC-2
RCA 201R1
Ram Electronics 201R1
Stanwyck S-957

DEFLECTION YOKE
(50-60 degrees)

Merit MD-12 (8 mhy.)
RCA 205D1 (8 mhy.)

DEFLECTION YOKE
(60-70 degrees)

Chicago TY-2 (8 mhy.)*
Chicago TY-3 (13 mhy.)*
Du Mont Y2A1 (10 mhy.)
G-E RLD-024 (8 mhy.)
G-E "Truefocus" (18 mhy.) short*
Merit MDF-70 (11 mhy.)*
RCA 206D1 (10 mhy.)*
RCA 209D1 (10 mhy.)*
Ram Electronics Y70F14 (14 mhy.)
Stancor DY-7 (8 mhy.) short
Stancor DY-8 (8 mhy.)*
Stancor DY-9 (13 mhy.)*
Triad Y12 (8 mhy.)*
Triad Y17 (13 mhy.)*
Triad Y10 (23 mhy.)*

*Extra winding for keyed a.g.c.

...iew tube to be
...). Select the cir-
...e circuit chosen
...riginal receiver.

...osen for the fly-
...ers listed may
...ailability, price,
...y of the other
...holes of all the
...e a good idea to
...at the mounting
...on the receiver

...ge transformer,
...btain the proper
...ponents for each

...circuits lists two
...oup is required
...ge picture tube

requiring an electromagnetic deflection angle between 50 and 60 degrees. Most large size tubes, however, have a deflection angle between 60 and 70 degrees (this is true of all rectangular tubes). Therefore, for most conversions, whether the previous tube used electrostatic or electromagnetic deflection, a new deflection yoke will have to be chosen from the "60 to 70 degree" group. Those with cosine windings provide more even deflection over the complete sweep. Short deflection yokes are for use with such short-necked tubes as the 16GP4, 16VP4, etc. The horizontal coil inductance is listed for each yoke—the higher the inductance, the wider the sweep. Choose the yoke which satisfies the sweep requirements of the tube chosen.

5. ION TRAPS. Be certain to use the ion trap (single or double) recommended for the new tube. In many cases, either one will work, but the recommended one will give better results.

6. FOCUS COILS. Most of the larger picture tubes using electromagnetic focus require the RTMA-JETEC #109 focus coil. If an old #106 coil does not focus the beam sufficiently, use a #109 type coil.

7. VERTICAL SWEEP. To increase the vertical sweep of the receiver (when necessary) it will be sufficient in most cases merely to substitute a new tube type for the vertical oscillator-output amplifier tube. Such tubes as the 6BL7, 12BH7, and 6V6 may be used in place of the 6SN7, 12AU7, and 6K6 types, respectively. When substitutions will not give the vertical sweep required, the plate voltage on the tube may be increased by lowering the value of the plate load resistor or using the boost voltage from the horizontal output transformer.

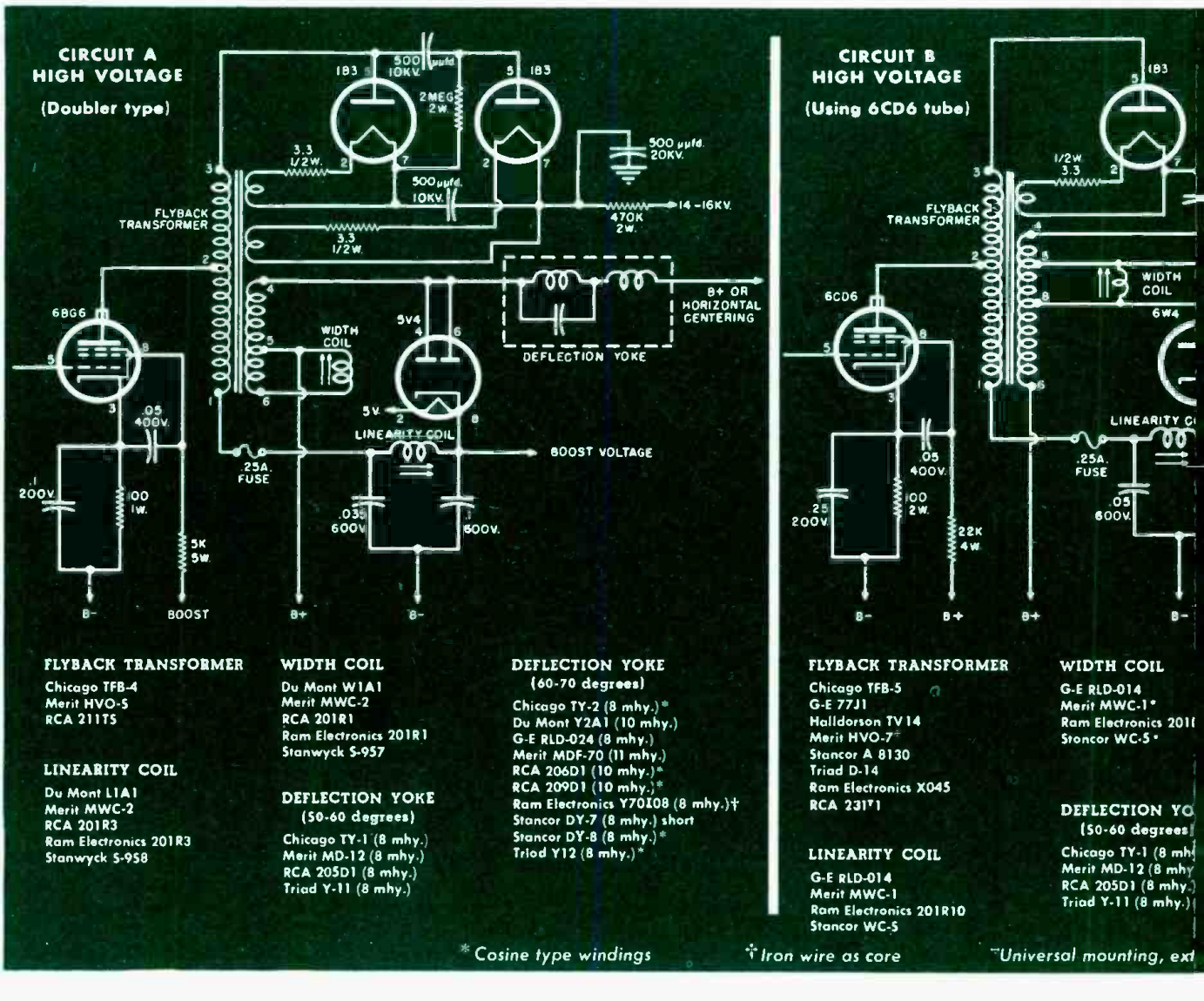
FOCUS COILS

MANUFACTURER	RTMA-JETEC #106 (247 ohms)	RTMA-JETEC #109 (470 ohms)
Chicago	TC-1	TC-2
Merit	MF-1	MF-2
RCA	202D1	202D2
Stancor	FC10	—
Triad	B247	B470

DATA—PRINT #5

RADIO & TELEVISION NEWS

TELEVISION CONT



FLYBACK TRANSFORMER
Chicago TFB-4
Merit HVO-5
RCA 211T5

LINEARITY COIL
Du Mont L1A1
Merit MWC-2
RCA 201R3
Ram Electronics 201R3
Stanwyck S-958

WIDTH COIL
Du Mont W1A1
Merit MWC-2
RCA 201R1
Ram Electronics 201R1
Stanwyck S-957

DEFLECTION YOKE
(50-60 degrees)
Chicago TY-1 (8 mhy.)
Merit MD-12 (8 mhy.)
RCA 205D1 (8 mhy.)
Triad Y-11 (8 mhy.)

DEFLECTION YOKE
(60-70 degrees)
Chicago TY-2 (8 mhy.)*
Du Mont Y2A1 (10 mhy.)
G-E RLD-024 (8 mhy.)
Merit MDF-70 (11 mhy.)
RCA 206D1 (10 mhy.)*
RCA 209D1 (10 mhy.)*
Ram Electronics Y70108 (8 mhy.)†
Stancor DY-7 (8 mhy.) short
Stancor DY-8 (8 mhy.)*
Triod Y12 (8 mhy.)*

FLYBACK TRANSFORMER
Chicago TFB-5
G-E 77J1
Halldorson TV14
Merit HVO-7‡
Stancor A 8130
Triad D-14
Ram Electronics X045
RCA 231T1

LINEARITY COIL
G-E RLD-014
Merit MWC-1
Ram Electronics 201R10
Stancor WC-5

WIDTH COIL
G-E RLD-014
Merit MWC-1*
Ram Electronics 201I
Stancor WC-5*

DEFLECTION YO
(50-60 degrees
Chicago TY-1 (8 mh
Merit MD-12 (8 mhy
RCA 205D1 (8 mhy.
Triad Y-11 (8 mhy.)

* Cosine type windings † Iron wire as core ‡ Universal mounting, ext

Converting a small picture-tube television receiver to use a larger picture tube involves two operations. One, the old cabinet and chassis must be changed mechanically—by using new brackets and straps, cutting a larger hole in the cabinet, mounting a new mask, etc.—to accommodate the new tube. Two, the circuit must be changed electrically to satisfy the operating requirements of the new, larger tube. This "Data-Print" gives the circuits and new component parts necessary to effect the electrical changes.

In general, picture tubes of the 14- to 21-inch class require a higher second anode voltage, greater horizontal and vertical sweep deflection, and a different focus coil than those required by smaller tubes. Sometimes a different ion trap is also required. In some cases, the high voltage available in the receiver will be sufficient to operate a larger picture tube and its associated components. For example, the 15AP4, 15CP4, 16HP4, and 16JP4 require a maximum voltage of 11 or 12 kv. for the second anode. This voltage is available in many 12-inch receivers and some 10-inch ones, so that the high voltage circuit need not be changed when converting these receivers to the above-mentioned tubes. However, this does not hold true for most conversians.

To convert any television receiver to higher voltage, Circuit A, B, or C, shown above, may be used. The high voltage obtainable from any of these circuits depends upon the "B+" voltage available in the receiver; the higher the "B+" voltage, the greater will be the high-voltage output. If the "B+" fed to each of the three circuits above is the same, Circuit A will give the highest second anode voltage. To convert a receiver to a higher second anode voltage and a larger picture tube, the following steps should be taken:

1. HIGH VOLTAGE. Check the high voltage requirements of the
installed. ("Data-Print" #4 may be consulted for this information,
cuit which will supply the high voltage required by the tube. Th
should be the one that most nearly matches the circuit used in the
and the one that uses the most readily available components.

2. FLYBACK TRANSFORMERS. Refer to the table under the circuit ch
back transformer to be used in that circuit. Any of the transfor
be used in that particular circuit—the one chosen depends on its av
and the buyer's preference. This same thing holds true for a
components listed in conjunction with the circuit. The mounting
transformers in the same group are exactly alike, hence it would b
make certain, when selecting a high voltage conversion circuit, th
holes on the conversion transformer will match those already
chassis, otherwise new mounting holes may have to be drilled.

3. LINEARITY AND WIDTH COILS. After installing a new high-voltc
it is usually necessary to install new linearity and width coils to ol
impedance match for optimum circuit operation. The correct com
circuit are listed under that circuit on this "Data-Print."

4. DEFLECTION YOKES. The component chart under each of the
groups of deflection yokes. A yoke from the "50 to 60 degree" g
when a receiver with electrostatic deflection is converted to a lar

CONSTANT K TYPE LOW-PASS FILTER DESIGN

By SEIZO YAMASITA

The constants of a "T" or "pi" type constant K low-pass filter may be determined rapidly with acceptable accuracy with the aid of this chart.

TWO types of the constant K type low-pass filter are shown in Fig. 1. The equations for determining the constants of either type of filter are as follows:

$$L = R/\pi f_0$$
$$C = 1/\pi R f_0$$

where f_0 is the cutoff frequency in c p s and R is the image impedance in ohms.

The chart may be used to determine the constants to an acceptable degree of accuracy. If the desired cutoff frequency is above 100 kc., the chart may still be used. The desired value of f_0 is divided by some multiple of ten to give a value which can be read on the chart. The values of L and C determined from the chart are then divided by the same multiple of 10 to give the correct values of L and C. For example, if the f_0 is 500 kc., the constants are determined from the chart for a value of 50 kc. and then the values of L and C are divided by 10.

If any two of the four variables L, C, f_0 and R are known, the chart may be used to determine the other two.

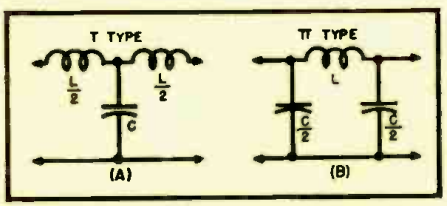
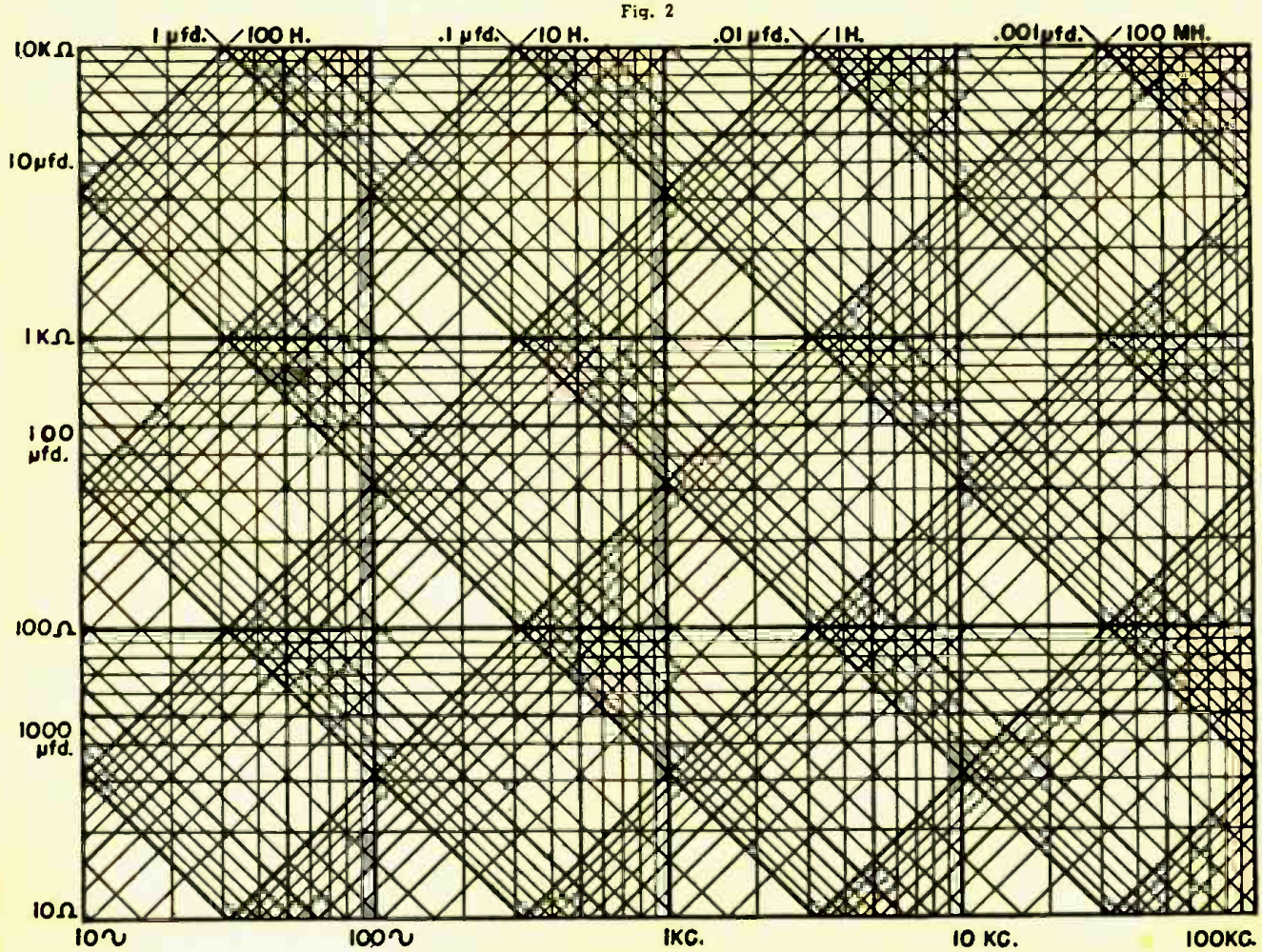


Fig. 1. (A) "T" type and (B) "pi" type constant K low-pass filter.

Fig. 2



for the new tube. If it is necessary to change the high-voltage circuits, the "B plus" and filament voltages should be correct for the conversion circuit, with the "B plus" and filament voltages as high as possible. The higher the "B plus" voltage, the larger the picture tube that can be operated.

10. Tube reliability. Picture tubes are made by many manufacturers and it is often hard to decide on anything but a name brand. One important consideration for the technician is the type and length of guarantee that goes with a particular tube. Be sure to check this with your jobber before deciding on a tube.

Horizontal Flyback Section

Most TV receivers use a flyback transformer to provide both the horizontal sweep signal and the high voltage for the picture tube. When a set is converted for use with a tube requiring either a higher anode voltage or more sweep power or both, the flyback section must be changed. Small screen receivers generally employ the earlier type flyback circuits which were less efficient in converting "B plus" power into sweep and high voltage. In such cases it is usually possible to get a higher voltage and more sweep from the "B plus" power already provided in the set simply by using high efficiency components. Changing the flyback transformer, deflection yoke, and sometimes the width and linearity coils requires some circuit changes. In some instances it is desirable to change the horizontal output amplifier to a different tube type in order to get more sweep with the same or less "B plus" power.

Although a wide variety of flyback circuits are used in new TV receivers, for conversion purposes only three types of circuits have proven practical and efficient. These three are shown in Circuits A, B, and C on the "Data-Print." Circuit A is the most commonly used schematic for converting 630 type receivers when a high-voltage doubler circuit is desired. Circuit B represents an entirely different scheme based on a high-efficiency flyback transformer and deflection yoke using ferrite instead of powdered iron as the core material. Originally developed by *G-E*, Circuit B uses the *G-E* type 77J1 or similar flyback transformer and requires different width and linearity coils than does Circuit A. The physical appearance and method of mounting the transformer are also completely different. Fig. 1 shows a typical flyback transformer of the type used in circuit A, while Fig. 2 (right) shows a transformer similar to the *G-E* type 77J1. In the latter, the core is not grounded and its efficiency depends partly on keeping the core and coil away from the chassis. The flyback transformer shown in Fig. 2 (left), is a compromise between the mounting and appearance of the Circuit A type transformer and the performance of the Circuit B transformer. Its circuit is shown as Circuit C on the "Data-Print." This flyback mounts in the same holes and occupies the same amount of space as the *RCA* 211T5 and practically all of the other powdered iron core transformers. Its core is grounded and it operates with the same width and linearity coils (see Fig. 3) as the 211T5 and earlier powdered iron flybacks. The performance of this transformer is similar to the Circuit B transformer in that a single rectifier tube provides up to 13 kv. and a ferrite deflection yoke is required.

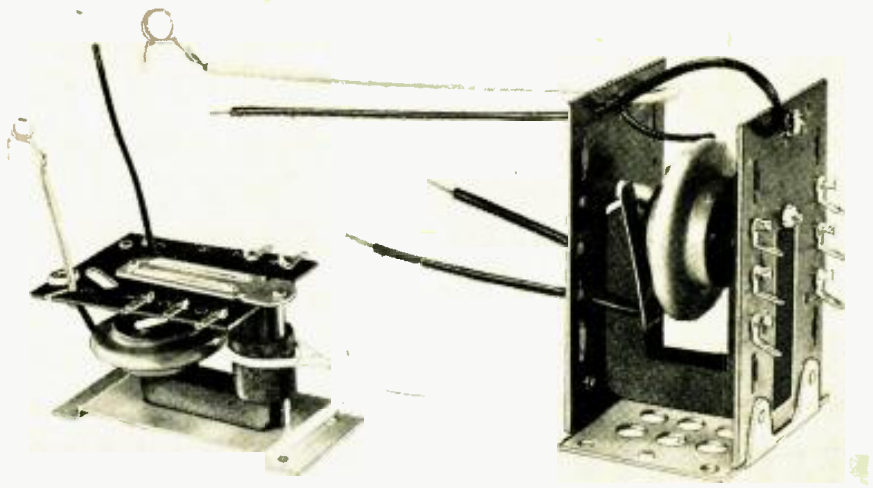


Fig. 2. (Left) RAM X030 horizontal transformer. A unit of this type is the prototype of the transformer used in Circuit C. (Right) A horizontal flyback transformer, made by RAM, patterned after the G-E Type 77J1 which was used as the model for Circuit B.

On comparing Circuits A, B, and C it will be noticed that three different horizontal output tubes are used for each. In practice it is possible to use other types than those shown. Many variations of these three basic circuits are possible, but the components indicated have proved most satisfactory in the greatest number of successful conversions. The "B plus" and "B minus" voltages represent the highest available in the set and will usually be the same as for the original sweep circuits. The point marked "Boost voltage" is the take-off point for the vertical sweep or the horizontal oscillator should these sections require more than the regular "B plus" voltage. In Circuit A the boost voltage will be approximately 20% higher than the voltage applied between "B minus" and "B plus." In Circuits B and C the boost may run as much as 30% higher than the applied voltage. Loading down the boost voltage by connecting the vertical output section to it will lower the voltage somewhat and will also affect the high voltage and sweep. In all instances it is best to use a decoupling resistor between the boost voltage point and the circuit to which it is connected.

Deflection Yokes

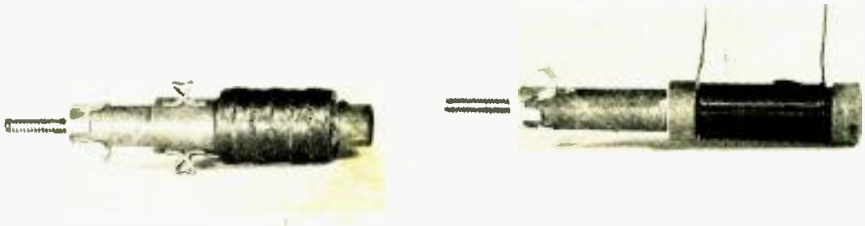
Each of the three circuits shown on the "Data-Print" operates satisfactorily only when used with the correct deflection yoke. There are three considerations which govern the selection of the correct yoke.

1. Deflection angle and length. The angle of deflection and the length of the yoke depend upon the picture tube type with which it is to be used. Most yokes made for a 70 degree angle tube come in short and medium length. The short yokes can be used for all tubes while the medium length yoke will fit most new tubes but will not work correctly on such short-necked tubes as the 16GP4. The short yoke is 2⅜ inches long while the medium type is about 3/16 inch longer.

2. Inductance. Deflection yokes range in inductance from 8.3 mhy. to 30 mhy. for the horizontal coils. Typical values are 8.3 10, 13, 18, and 30 mhy. The latter two inductances are usually used with circuits other than those presented here. A 30 mhy. yoke is not suitable for conversion work since it usually has a very low inductance in the vertical coils and this requires extensive changes in the vertical sweep section. Depending on yoke inductance, select the tap on the flyback secondary which will give the correct voltage. The available voltages can be determined from the specification sheet accompanying the part.

(*Continued on page* 150)

Fig. 3. The RAM 201R3 linearity coil (left) and 201R1 width coil (right).



"The Trio" (Model A-224). Its circuit incorporates a stereo preamp and two separate 12-watt power amplifiers on a single chassis. There are separate ganged treble and bass controls, a balance control, mode switch, speaker selector switch for local and remote speaker systems, contour control, tape output for recording applications, and a rumble filter.

The units are housed in matching enclosures with brushed copper escutcheons and black cages.

Other equipment in the stereo line includes a dual stereo preamp, two AM/FM monaural tuners for providing the second channel for those already

owning a monaural tuner, a stereo amplifier with dual 25-watt power channels, and a single unit which incorporates both an FM and AM stereo tuner and dual stereo preamps on a single chassis.

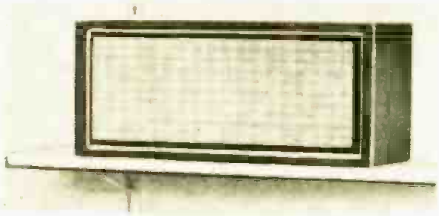
Complete details on any or all of these units are available from the manufacturer. A data sheet on the "Dual" and "Trio" models is available on request.

E-V "WOLVERINE" SERIES

Electro-Voice, Inc. of Buchanan, Mich. is now offering a series of popular-priced components which is being marketed as the "Wolverine" line.

The line includes hi-fi speakers, enclosures, and mid-range and high-frequency kits. There are 8- and 12-inch coaxial speakers, three enclosures, a mid-range driver and crossover, and a high-frequency driver and crossover to allow the customer to expand to two- or three-way systems, now or in the future.

The enclosures are offered in along-the-wall, corner, and bookshelf models. Two of the complete systems can be



used for stereo applications at a price of many single systems, according to the company. The "Lindon," a bookshelf model, is shown in the photograph.

The company will supply a complete data sheet on the entire "Wolverine" line to those making a direct request.

"STEREO-PHASER SELECTOR"

Vidaire Electronics Mfg. Corp. of Baldwin, N. Y. has recently added a stereo-phaser selector to its line of hi-fi and audio accessories.

A FREQUENCY-COMPENSATED ATTENUATOR

Fig. 1. Front and rear views of the frequency-compensated attenuator.

By
LOUIS E. GARNER, JR.

Unit is essentially flat from d.c. to 5 mc. and can be used as an accessory with meters, scopes, etc.

ELECTRONIC lab technicians, engineers, experimenters, and service technicians sometimes find it necessary to apply a signal or voltage to an instrument which exceeds the maximum input rating of the device. The instrument may be a voltmeter, distortion meter, frequency measuring device, oscilloscope, or just a special amplifier.

Where d.c. is involved, the problem is simple—a multiplying resistor with a resistance of $(n—1)$ times the input resistance of the device may be used in series with the input. See Fig. 3. R_i is the input resistance of the instrument and R_m is the multiplying resistor, "n" is the multiplying factor. In such a case R_m and R_i form a simple voltage divider, with the voltage division proportional to their respective resistances.

Where a.c. signals are involved, on the other hand, the problem becomes more complex and more difficult to solve. If the input capacity of the instrument (C_i in Fig. 3) is negligible so that the reactance of the condenser is high compared to the resistances used, the same method may still be employed. In the majority of cases, unfortunately, the input capacity will be appreciable, particularly where a wide range of frequencies is considered.

In such a case R_m and C_i form a frequency-conscious voltage divider which increases the attenuation with frequency. This condition not only causes inaccuracy due to a changing multiplying factor at higher frequencies, but may also cause severe distortion of complex waveforms. In this way R_m and C_i may be considered to form a low-pass filter or an integrating network.

However, these difficulties may be avoided by using a specially-designed frequency-compensated attenuator ahead of the instrument. Such an attenuator is shown in Fig. 1, while the schematic diagram is given in Fig. 2.

Any competent technician should be able to assemble, adjust, and calibrate the attenuator shown within two hours, using standard, easily available parts. Yet this attenuator is essentially flat from 0 cps (d.c.) to more than 5 megacycles (assuming reasonable care taken in assembly) when properly adjusted! In addition to providing multiplication factors of 1, 10, and 100, this attenuator actually reduces the *effective input capacity* of the instrument when used in the X10 and X100 positions.

The frequency-compensated attenuator is essentially a group of resistance and capacitance voltage dividers combined in such a manner that the same voltage division occurs for d.c. or low frequency a.c. as occurs for higher frequency a.c. Referring to Fig. 2, there are three positions of the attenuator switch, S_1, to consider.

In position X1, the *Input* and *Output* terminals are directly connected, and any signal applied to the *Input* appears across the *Output* without attenuation. Except for the very slight distributed wiring capacity, using the frequency-compensated attenuator in the X1 position is the same as connecting the signal source directly to the input of the test instrument.

In position X10, the *Input* terminal is connected across a voltage divider consisting of R_1 and R_2 and condensers C_1 and C_3. The *Output* terminal is connected to the junction of R_1, R_2, C_1, and C_3 so that only that portion of the signal appearing across R_2 and C_3 appears across the *Output* terminals of the attenuator (to be applied to the input of the instrument with which the attenuator is to be used). C_1 is adjusted so that the ratio $C_3:C_1$ equals the ratio $R_1:R_2$. In addition, C_3 is large enough to "swamp" the input capacity of the instrument connected to the *Output* terminals of the attenuator.

The resulting combination forms a voltage-divider which is flat over extremely wide frequency ranges.

In the X100 position, the circuit operation is the same as that for the X10 position, except for the ratios involved.

When the attenuator is in either the X10 or X100 position, either C_1 or C_2, respectively, is in series with the *Output* as far as the *Input* terminals of the attenuator are concerned. Since C_1 and C_2 are comparatively small, this action essentially reduces the input capacity of the instrument.

Construction Hints

The entire attenuator circuit may be easily assembled to fit on a piece of sheet metal measuring four inches square, and so may be made to fit a standard 4" x 4" x 2" metal utility box. If the attenuator is placed in a separate shielded case or box, holes should be provided in the back so that condensers C_1 and C_2 may be adjusted after the construction is finished.

Only good quality condensers should be used for C_2 and C_4—preferably silver micas or tubular ceramics. Heavy bus

bar should be used for making direct wiring connections and for the ground bus connecting the two "Ground" terminals.

Trimmer condensers C_1 and C_2 should be solidly mounted so they might be easily adjusted without shifting position.

Particular care should be taken, when wiring the unit, to keep distributed wiring capacities to ground to a minimum. In addition, care should be taken to keep the *Input* and *Output* leads and connections well separated.

Although the author used a single-gang d.p. 3-pos. selector switch, better results (flatter over a greater frequency range) may be obtained by using a two-gang switch. With the single-gang switch, the unit is flat over the range mentioned, but with a two-gang switch (permitting better layout) it is easily possible to obtain an attenuator flat to well over ten megacycles!

Adjustment and Calibration

Once the wiring is completed and checked, the unit should be placed in its cover or box. Condensers C_1 and C_2 should now be adjusted. For this adjustment a square-wave generator and a wideband cathode-ray oscilloscope should be used.

Connect the attenuator between the output of the square-wave generator and the input of the CRO as shown in Fig. 4. Turn to the X1 position.

Adjust the square-wave generator to deliver a signal between 10 and 25 kc. Any frequency in this range is satisfactory, although a frequency of 15 kc. may be considered optimum.

Next, adjust the controls on the CRO until two or three complete cycles of the square-wave signal can be observed as in Fig. 5A. Adjust for reasonable amplitude using the vertical gain control of the CRO or the output control of the square-wave generator.

Switch the attenuator to the X10 position, readjusting the scope gain control or output control of the generator for reasonable deflection. If the signal appears as in Fig. 5A, C_1 is properly adjusted and need not be touched.

If the leading edge of the square wave is rounded, as in Fig. 5B, condenser C_1 must be adjusted for increased capacity. Do this carefully, using an insulated fiber alignment tool.

On the other hand, if the leading edge of the square wave is peaked, as in Fig. 5C, the capacity of C_1 must be reduced. Again, take care when doing this, and use a fiber alignment tool.

To adjust condenser C_2 for proper compensation, switch the attenuator to the X100 position and again carry out the procedure outlined above for adjusting C_1. With practice these compensating adjustments may be made quite rapidly.

If it is found to be impossible to adjust for a good square wave in the X10 or X100 positions, check the electrical sizes of C_1, C_2, C_3, and C_4, as well as the sizes of the resistors used.

The adjustments outlined are for frequency compensation and do not appreciably affect the exact multiplication (or attenuation) obtained. If exact values of attenuation are desired, it may be necessary to "juggle" the electrical sizes of the resistors used until the desired attenuation is reached. With the values given, attenuations of 10 and 100 will be obtained (approximate only).

To check the calibration, leave the attenuator and other equipment connected as for the frequency compensation adjustment. Turn the sweep range control of the CRO to a higher frequency so that two parallel lines rather than a square-wave signal are observed on the screen of the CRO. See Fig. 5D.

Turn the graph scale of the CRO until the horizontal lines are exactly parallel with the two lines on the screen so that direct comparisons can be easily made.

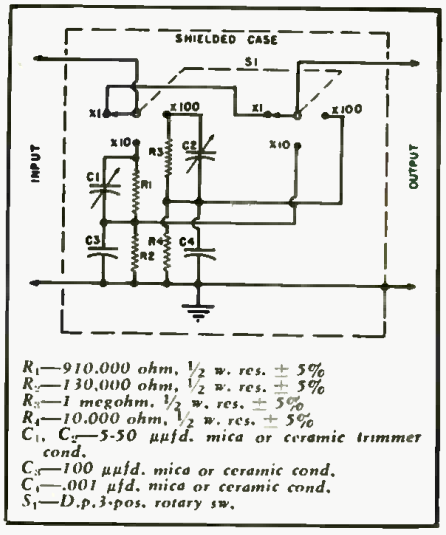
With the attenuator in the X1 position, adjust the output of the square-wave generator and the vertical gain control of the CRO until exactly ten or twenty units of the graph scale appear between the two horizontal lines.

Now switch to the X10 position. The two lines should appear closer together on the screen of the CRO (Fig. 5E), with the exact separation depending on the preceding separation—either one or two units of the graph scale, respectively.

If the line separation is less, R_2 should be increased in value. If more, R_2 should be reduced in value.

Once the calibration in the X10 position is satisfactory, leave the attenuator set in this position and again readjust the vertical gain control of the CRO or output of the square-wave generator until the two horizontal lines appearing on the CRO screen are again separated by ten or twenty units. Now switch to the X100 position.

As before, the separation between the two lines should drop to either one or two units. If less, R_1 should be increased in value, and, if more, R_1 should be reduced.



R_1—910,000 ohm, ½ w. res. ± 5%
R_2—130,000 ohm, ½ w. res. ± 5%
R_3—1 megohm, ½ w. res. ± 5%
R_4—10,000 ohm, ½ w. res. ± 5%
C_1, C_2—5-50 μμfd. mica or ceramic trimmer cond.
C_3—100 μμfd. mica or ceramic cond.
C_4—.001 μfd. mica or ceramic cond.
S_1—D.p.3-pos. rotary sw.

Fig. 2. Circuit diagram of the attenuator.

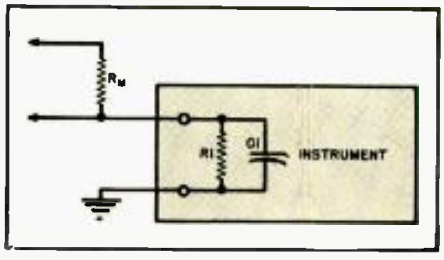


Fig. 3. Correct method of connecting unit.

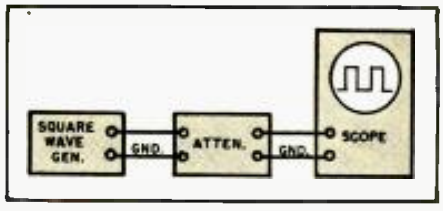


Fig. 4. Hookup for calibrating attenuator.

The frequency-compensated attenuator described may be used as a multiplier for almost any type of test instrument—voltmeters, distortion meters, cathode-ray oscilloscopes, frequency

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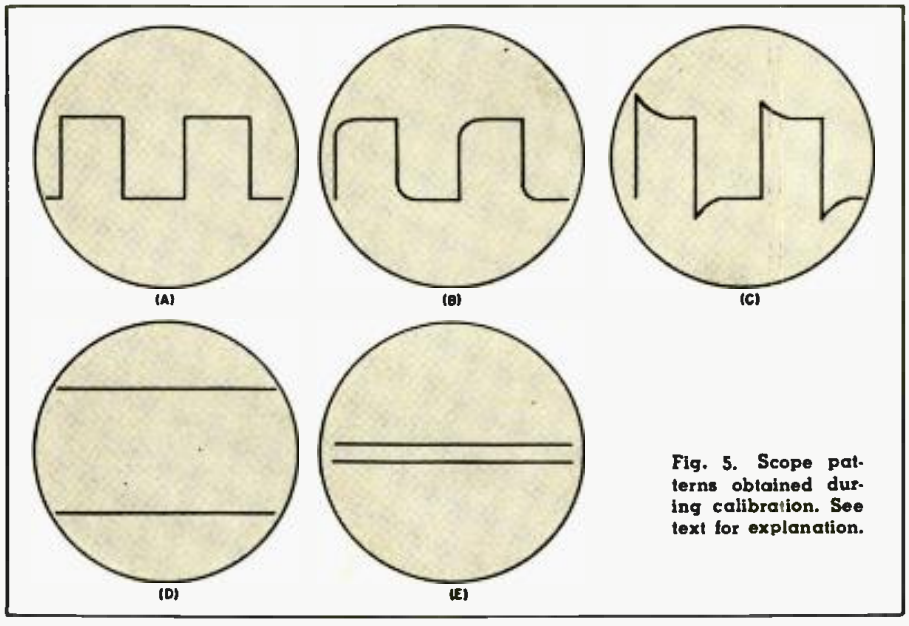
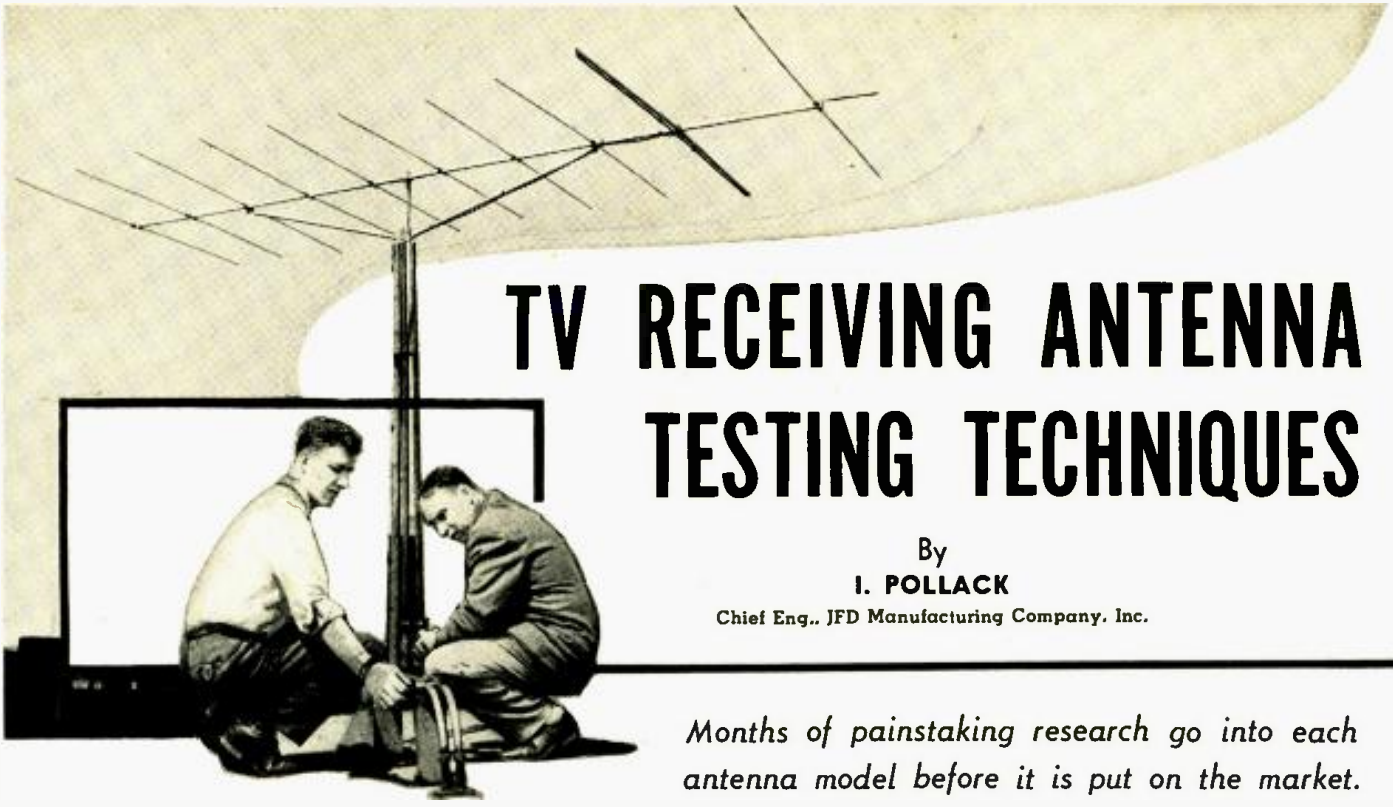


Fig. 5. Scope patterns obtained during calibration. See text for explanation.



TV RECEIVING ANTENNA TESTING TECHNIQUES

By
I. POLLACK
Chief Eng., JFD Manufacturing Company, Inc.

Months of painstaking research go into each antenna model before it is put on the market.

The author, with Hazeltine engineer, points to shielded down-lead connecting antenna to lab instruments.

ANY antenna which is to be used for the reception of television signals must, if its performance data is to be complete and honest, be subjected to the most exacting tests available to electronic research. Recognizing this, officials of the *JFD Manufacturing Company, Inc.* when drawing up rough plans for a new 10-element yagi antenna, enlisted the services of *The Hazeltine Corporation* to study the potentialities of such an antenna.

First considerations were, of course, impedance, directivity, and gain, these not being listed, necessarily, in order of their importance. To achieve the best possible transfer of power to the load (the receiver), the antenna and receiver impedances must match. The second factor, directivity, when good, cuts down the antenna's response to spurious signals and noise. Gain is of obvious importance in DX reception.

Interestingly enough, prior to actual testing, it was carefully noted that gain and directivity, in such parasitic arrays as this yagi, are mutually dependent factors. Various combinations of both reflector-director lengths and spacing between elements will favor either maximum gain or maximum front-to-back ratio. However, both of these qualities cannot be obtained concomitantly.

In order to accurately test this 10-element yagi for gain, a reference level had to be employed. A half-wave folded dipole was selected by the development engineers for this purpose.

To convert the relative gain of an antenna, with reference to a dipole, to absolute gain, about 1.75 db must be added. This figure represents the gain of a dipole relative to a hypothetical non-directional antenna.

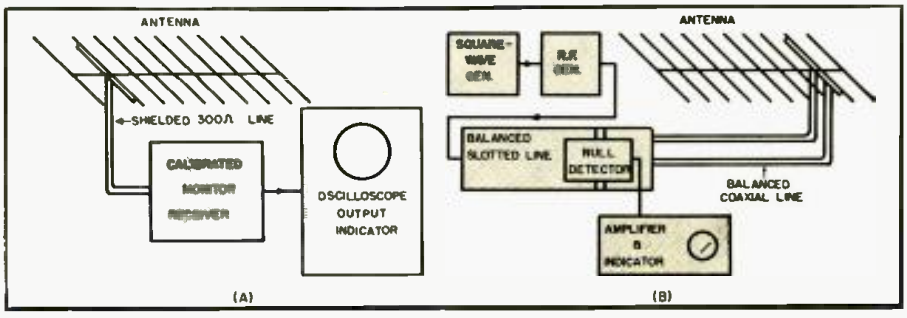
The first test antenna, the *JFD* 10Y7 (a 10-element yagi cut to Channel 7), was set up for study under actual field conditions by the research men. It was fixed on a mast in a position where optimum gain, when receiving signals transmitted from the Empire State Building's tower, could be expected. Using balanced, shielded 300-ohm twin-lead wire, the antenna (comprised of one collector, one reflector, and eight director elements of aluminum, mounted on a seamless aluminum cross-boom) was connected to a special calibrated monitor receiver.

This monitor receiver was, in turn, tuned to the channel being tested. It recorded the antenna's output voltage. When this had been noted by the engineers, the tuned reference dipole was substituted for the test antenna, being fixed in precisely the same position the yagi had held, to avoid the slightest error. Following this, the output voltage of the tuned dipole was fed to the monitor receiver, to which it had been hooked. This output voltage was noted and the ratio between this figure and that of the test antenna was recorded and converted into decibels. This gave the test antenna's db gain figure in relation to the tuned dipole. (To obtain the absolute gain, a purely hypothetical figure, add 1.75 to the relative gain in decibels.)

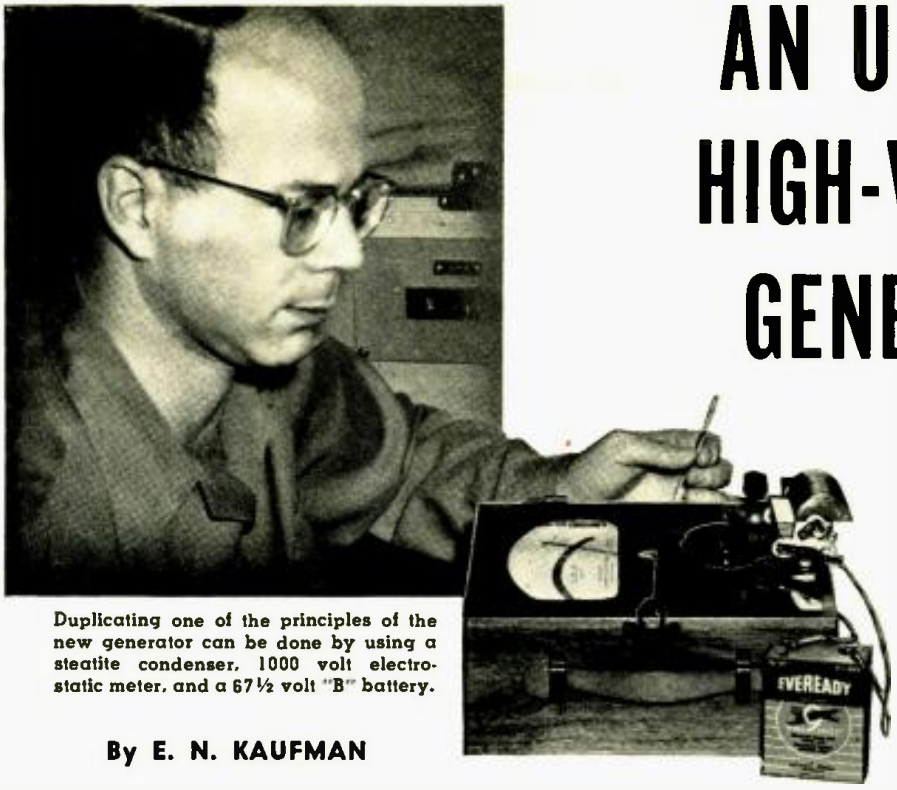
According to the measurements, the gain for both the single and stacked versions of the test antenna approached the mathematically calculated theoretical limit. The gain of the single array was 9½ db while the gain of the stacked array was a full 12 db. The use of a balanced line step-up transformer, in the stacked 10Y7, made available to the down lead 2½ db of the theoretical limit of 3 db gain afforded by stacking the bays.

(*Continued on page* 166)

(A) Simplified breakdown of the circuit employed in testing the JFD "Baline" 10-element yagi for gain and directivity. (B) In examining the unit for impedance, a square-wave modulated signal was used. In other studies, signals transmitted from Channel 7 in New York, via the Empire State Building tower, were used.



AN UNUSUAL HIGH-VOLTAGE GENERATOR



Duplicating one of the principles of the new generator can be done by using a steatite condenser, 1000 volt electrostatic meter, and a 67½ volt "B" battery.

By E. N. KAUFMAN

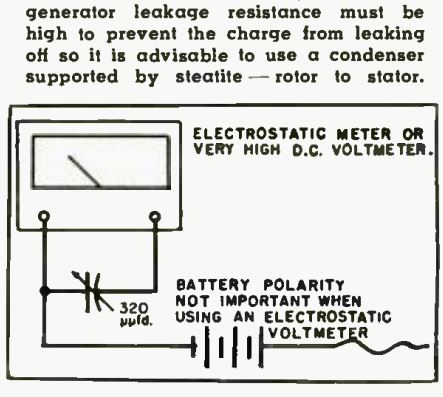
Details on a new type electrostatic generator capable of providing 50,000 v. d.c. at 4 ma.

TWO FRENCH scientists, N. J. Felici and R. Morel, have developed a new type of electrostatic high voltage generator that promises to be of importance in many fields of science and engineering because of its small dimensions, light weight, and mechanical simplicity and ruggedness. A generator with an output of 4 milliamperes direct current at 50,000 volts (200 watts) is entirely contained, including the driving motor, in a pressurized cylinder 2½ feet long and 1½ feet in diameter. The efficiency is rated at 80%. Generators developing 25,000 watts at 200,000 volts d.c. are at present under test.

Calculations indicate that a generator with a 1,000,000 volt output can be built. The principle is simple and fairly well-known. If a variable condenser while in the closed position has an electrical potential placed upon it and then the condenser is rotated to minimum capacity the voltage will rise based on the ratio of maximum to minimum capacity. When the condenser rotor is part way out of the stator and the potential on the rotor has risen to the desired voltage the rotor is connected to the output load and the charge is drawn off at a rate determined by the load and the rotation speed. The actual generator has a succession of multi-pole rotor and stator plates that can be arranged in relative phase so as to give a direct current output requiring very little smoothing. In order to keep the output voltage constant under varying load conditions a voltage regulator system should be used. Either a spark gap, thyrite resistor, or corona voltage regulator tube will suffice.

It was probably noted by most readers that without some method of commutation the output would be, effectively, a sine wave. Thus the generator is capable of an a.c. output as well as d.c. This effect can be demonstrated quite easily by taking any amateur radio condenser with steatite separators, such as a *Hammarlund* MC-325-M (320 μμfd.), a 1000 volt electrostatic meter, and a 67½ volt "B" battery. With the condenser at maximum capacity the battery leads are placed momentarily across the condenser. Then the condenser is rotated to minimum capacity. The voltage on the condenser will rise to about 400 volts. With an electrostatic voltmeter as the only load considerable time will pass before the charge leaks off.

Electrostatic generator test arrangement. The meter used with a 67½ volt battery should have a range of from 500 to 1000 volts. All leads in this circuit must be kept short or leakage resistance may drain off the charge. In operating this circuit, do not use a switch in applying potential to the condenser rotor as leakage resistance of the switch will drain circuit. Touch lead momentarily to condenser rotor then rotate condenser to minimum capacity. Note: If electrostatic voltmeter has the condenser attached across the terminals as shown, the minimum to maximum capacity possible will be reduced. Use the largest generator condenser possible. The generator leakage resistance must be high to prevent the charge from leaking off so it is advisable to use a condenser supported by steatite — rotor to stator.



In the actual generator the exciting voltage is supplied by another rotary electrostatic generator of exactly the same type which, however, need only be of small size. The output brush of the small exciter generator is connected to the stator of the large generator; and the exciter generator stator to the output of the large generator (rotor). The system is self starting as soon as rotation occurs. The cause of the self starting is believed to be the presence of residual electrostatic charges. The voltage in the exciter and generator build up at a rate depending upon the external load. Depending upon the initial residual charge the generator may start either positive or negative. A heavy external disturbance may reverse the polarity during rotation. Inserting a small rectifier in the exciter circuit will cause positive starting polarity and operation. Either hand drive or motor drive can be used. The fluctuations in hand drive speed are reflected in output power and not in output voltage.

These generators should find many applications such as power supplies for x-ray machines, diffraction apparatus, particle accelerators, electrostatic dust precipitators, and nuclear instrumentation. An adaptation of this generator has been used for the ignition systems of automobiles. Another design uses a hand driven model for electrostatic precipitation of insecticide dusts on plant foliage. From these varied applications it can be seen that these generators can be used for many different purposes only limited by the mind of the engineer. Further information on these generators can be obtained from "Annales de l' Universite de Grenoble," *Sec. Sci. Math. et Phys.* Vol. 23 (1947) written in French or from an Office of Naval Research report ORNL-61-50 which is unclassified and written in English. —30—

CONVERTER RECEIVES BOTH PHONE AND C.W.

Top view of converter chassis. The 10 meter coils are in place. Notice how the trimmer condensers and 50 $\mu\mu$fd. silver mica condenser are mounted on plug-in form.

By
STAN JOHNSON
WØLBV

A unit which transforms any a.c.-d.c. midget into a full-fledged "communications" receiver. Ideal for the Novice or as standby unit for Old Timer.

A CONVERTER capable of receiving both phone and code—and of such a design that it is entirely self-powered and hence can be used with any radio, including a.c.-d.c. midgets—is an extremely useful set even for an Old Timer to own, since it provides a low-cost "second" set to use when the regular communication receiver is on the blink or too heavy to take along on a trip. And for the Novice with a lean pocketbook, the set is just about what the doctor ordered: for less than one-half the price of even the cheapest "store boughten" communication set, it will transform an ordinary broadcast band set into a short-wave receiver with high over-all sensitivity—enough sensitivity to give many a $100-plus set a run for its money.

The set was designed primarily for two bands—the 80 meter band (including the Novice band) and the 10 meter phone band. With minor modification (see coil data) the set will tune the 11 meter Novice band and, of course, with suitable coils, will tune *any* ham band between 10 meters and 160 meters.

The unit is self-powered, having a built-in a.c.-d.c. power supply. This makes it possible to use the converter with a set without having to "steal" voltage from the set itself—a procedure which gets a bit "sticky" in the case of a.c.-d.c. sets, which invariably have series-connected heaters and hence provide no easy method of supplying heater voltage.

The receiver uses a 6BA7 converter (mixer) tube as the initial r.f. tube. This tube was chosen because it is an excellent mixer and virtually eliminates "pulling" effects and injection troubles, both of which can be pretty difficult to handle if not much test equipment is available.

The 6BA7 is a "hot" tube and in many cases it, alone, will provide sufficient output to "convert" the set to which it is attached into an acceptable short-wave receiver. However, for conservative design, an i.f. stage was added. This greatly increases over-all gain and insures that the converter will work with *any* set, even the very low priced a.c.-d.c. midgets which do not boast an i.f. stage of their own.

To make the set complete, it includes something which is rare indeed in converters—a beat frequency oscillator. This oscillator provides the "beat" necessary for the reception of code on the 80 meter Novice and other code bands.

The power supply section of the receiver requires no tube because it uses a selenium rectifier. If you have any misgivings about an a.c.-d.c. power supply for a unit of this type—forget them. With the filter network shown, the hum level is very, very low.

For ease of construction and to avoid "ganging" troubles, which can give even an old hand a bad time, the tuning arrangement is such that ganging is unnecessary. This is accomplished by using the oscillator section for main tuning, then simply "peaking" with a knob on the front panel which is connected to the tuning condenser across the mixer coil. One setting of the "peaking" knob will hold for a considerable range of frequencies for example, the entire Novice band.

The converter is built up on a standard 7 by 7 inch chassis with a front panel which measures 7 by 8½ inches. The chassis can be either aluminum or steel, since no connections are soldered to it.

Looking at the top of the chassis, the 6.3 volt filament transformer is in the bottom right-hand corner. Next to it is the selenium rectifier, then the filter choke. The last-named is perhaps a luxury but probably worth its modest cost in order to insure hum-free operation.

The tube closest to the rear is the beat frequency oscillator tube. Slightly forward and on the other side is the 6BD6 i.f. stage. Then, in the center, directly behind the tuning condenser, is the 6BA7 converter tube.

The tubes all use miniature tube sockets—and the writer likes the new zip-in "ethylon-A" type developed for TV sets. These mount easily in ¾" holes drilled or punched into the chassis.

Mounting the two variable condensers is a bit tricky in that *both* must be insulated from the chassis. This is necessary because of the a.c.-d.c. circuit, otherwise the chassis would be "hot" with 117 volts and dangerous to the user. Exactly how you will go about mounting the condensers will

depend upon the design of the condensers you buy. In the model illustrated, the condenser above the chassis was insulated by mounting it on a small piece of clear plastic. The condenser below the chassis happened to be of a type in which the mounting bracket is insulated from the metal parts of the condenser, so mounting is easy. There isn't too much space for the latter condenser, so pick a small one.

The two antenna binding posts are likewise insulated from the chassis, this being accomplished by using small pieces of clear plastic on either side of the metal, with the machine screw mounting the binding post running through holes in the plastic. Of course, the hole drilled into the chassis is much larger than the screw—so that the plastic insulates the machine screw from the chassis.

Wiring of the set is straightforward, although there are a couple of things to watch. First of all, all wiring is "above ground" as far as voltage is concerned, an important safety feature. This does make wiring a bit more difficult, though, than the common method of tying everything normally grounded to convenient spots on the chassis. Instead, all of the grounds are made to a heavy, bare wire lead running along the center of the set. The end of this lead is grounded to the chassis *only* through C_{17} as shown in the diagram. Pick a good condenser for this one as it provides the isolation between the chassis and the 117-volt power line.

The rest of the wiring is point-to-point, keeping leads short. Notice that where the two leads from the variable condenser "dive" through the chassis large holes are drilled, so that the leads go through with plenty of "air" on both sides. This is important both for good insulation and in order to insure that the r.f. stays on the wire instead of using the surface of the chassis as a roundabout way to reach the coil.

The two i.f. coils are mounted along one side of the chassis so that they are easy to adjust from the outside. These coils are slug-tuned and easy to adjust. The b.f.o. coil is similarly slug-tuned. It may be a coil like the i.f. coil (with 40 turns removed and a 30 turn tickler coil added) or, as was done in the original set, a slug-tuned antenna coil of the standard broadcast-band variety was modified: the smaller of the two windings being removed completely, and 40 turns peeled off the larger winding. Then a 30-turn "tickler" was "scramble-wound" about a quarter of an inch away on the same form. In mounting this coil the writer ran into a peculiar kind of trouble—the b.f.o. would not oscillate until the coil form was mounted on a strip of polystyrene. The *Cambridge Thermionic* slug-tuned coils can be mounted directly on the chassis, however.

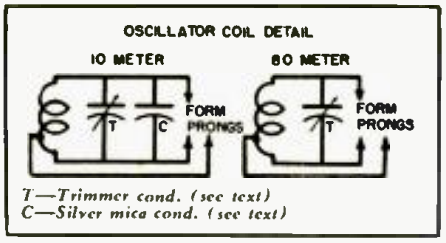
The r.f. coils of the set are home-made and easy to build. For 80 meters, both coils are wound on standard forms. The only unusual thing is the trimmer condenser, which is mounted on stiff wire leads, soldered to the proper prongs and then anchored in place with a couple of drops of china cement between the ends of the trimmer and the sides of the coil form.

The 10-11 meter coil is a bit more unusual. In this case, a coil form (4-prong) is sawed off with a hacksaw to provide a base for the coil. The mixer coil is self-supporting, consisting of 10 turns of number 18 enameled wire, ¾" inside diameter, spaced to occupy ½ inch. The smaller oscillator coil is also self-supporting. and consists of 7 turns of number 18 enameled wire, spaced to occupy ¾ inch, and ½" inside diameter. Duplicate this coil exactly, as its dimensions are fairly critical.

You are now ready to try the converter and the first thing to do is to select a suitable set to use with it. The better this set, the better the over-all performance of the system. However, the converter *can* be used, and with surprisingly good results, even with a midget.

Let's assume that the set chosen is an extremely simple midget, like the "Hopalong Cassidy" *Arvin* shown in the photographs. This set has no i.f. stage at all. Antenna pick-up is provided by a flexible wire attached to the set.

Because we want as little pick-up by the set as possible except for the signal provided by the converter, the



T—Trimmer cond. (see text)
C—Silver mica cond. (see text)

Details for wiring the oscillator coils.

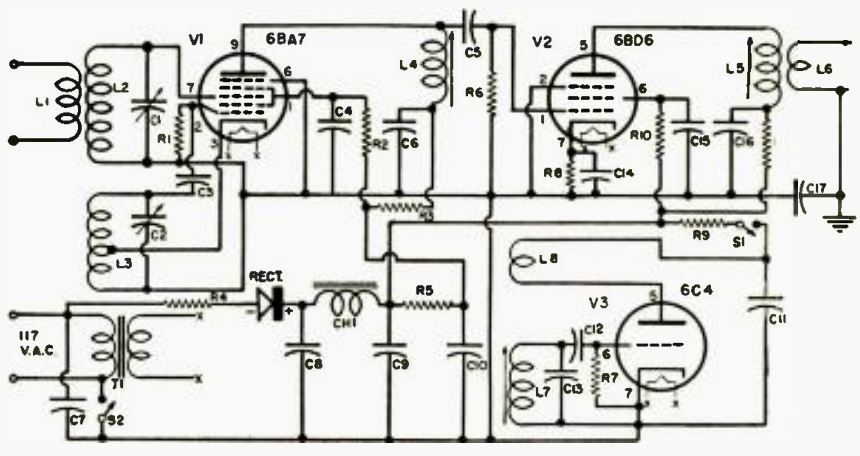
"antenna" wire on the set is coiled up and kept close to the set. The end of this wire (or the "antenna" clip on most sets) is connected to the flexible coax lead from the converter. The inner lead of the coax is. of course, the "hot" lead carrying the signal.

Next, the little *Arvin* is tuned to approximately 1650 kilocycles, or any clear spot *above* the standard broadcast band. (The tuning condenser in the set should be almost all the way open.) The idea is to get as high a frequency as possible for the converter and still not tune in some station which will interfere with the output of the converter.

Since no "ground" terminal is provided on the midget, we simply ignore the "ground" (braid) connection of the flexible coax. Actually, of course, a ground is simulated by the power line connected to both the radio and to the converter.

Next, plug in all of the tubes (ex-

Complete circuit diagram of converter unit to be used with an a.c.-d.c. midget.



R_1—22,000 ohm. ½ w. res.
R_2—12,000 ohm, 1 w. res.
R_3, R_5—1000 ohm, 1 w. res.
R_4—47 ohm, 1 w. res.
R_6—1 megohm, ½ w. res.
R_7—25,000 ohm, ½ w. res.
R_8—330 ohm. ½ w. res.
R_9—250,000 ohm, ½ w. res. (controls strength of b.f.o. signal. If signal is not strong enough use a 100,000 ohm unit)
R_{10}, R_{11}—1000 ohm, ½ w. res.
C_1—30 μμfd. var. cond.
C_2—See L_8 and diag. at top of page.
C_3—50 μμfd. mica or ceramic cond.
C_4, C_6, C_{11}, C_{15}, C_{16}—.01 μfd. disc ceramic cond.
C_5—100 μμfd. mica or ceramic cond.
C_7—.01 μfd., 400 v. cond.
C_8, C_9—50/30 μfd., 150 v. dual-elec. cond.
C_{10}—8 μfd., 150 v. elec. cond.
C_{12}, C_{13}—250 μμfd. mica cond.
C_{14}—50 μμfd. silver mica cond.
C_{17}—.01 μfd.. 600 v. cond.
Rect.—65 ma. selenium rectifier
CH_1—5.5 hy. (or larger), 50 ma. filter choke
S_1—Toggle sw. (b.f.o. "on-off" switch)
S_2—Toggle sw. ("standby" switch to silence converter during transmitting periods. Note: No "on-off" switch provided. If needed, insert in series with 117 volt input)
T_1—Fil. trans., 6.3 v. @ 1 amp.
L_1, L_2—80 m. mixer—L_1. 19 t. #30 en.; L_2, 44 t. #30 en. Both on 4-prong 1¼" coil form, closewound.
10 m. mixer—L_1, 4 t. ½" i.d. insulated hookup wire. Coil self-supporting on own leads. Coupling with L_2 is adjusted for best signal strength from weak. local station. L_2, 10 t. #18 en., ¾" i.d. All turns (L_1 and L_2) spaced diam. of wire.
L_3—80 m. osc.—22 t. #26 en. tapped 4 t.. wound on 1¼" form, closewound. Coil tuned with 45-380 μμfd. mica trimmer (see diagram).
10-11 m. osc.—7 t. #18 en., ½" i.d. spaced to fill ¾". Tapped at 1¾ t. For 10 m. reception coil tuned with 3-30 μμfd. mica trimmer plus 50 μμfd. silver mica cond. If 11 m. reception is desired substitute 4-80 μμfd. trimmer—retain same size silver mica.
L_4, L_5—1 mc. slug-tuned coil (Cambridge Thermionic Corp.)
L_6—20 t. #26 d.c.c. wire, scramble-wound on L_5, close to existing winding
L_7, L_8—See text
V_1—6BA7 tube
V_2—6BD6 tube
V_3—6C4 tube

While this picture was being made, the converter pulled in Guam on an antenna which consisted of an 8-foot wire tossed behind the davenport.

cept the 6C4) and switch on both the converter and the midget set. When both are warmed up, adjust the slug-tuned i.f. coil at the rear of the chassis by turning the screw so that it is as far out of the coil as possible.

Now, listen to the speaker, and slowly turn the screw on the i.f. coil closest to the front panel until a "hiss" is heard. Next peak both coils on the "hiss" (you'll probably find that the rear coil was close to being right to begin with) and when this has been done the simple i.f. stage is "lined up."

An antenna (which may be a 60 foot or longer wire) and a ground should be connected to the two posts on the converter. (If a two-wire feeder is used, it goes, of course, to the two terminals and the ground connection is omitted.)

With this antenna you are ready to get the set working on 80 meters, where it is easy to "hit the band."

First, set the main tuning dial at about half way on the scale. Then with an alignment tool tune the set screw in the trimmer condenser on the coil very slowly. You should hear a lot of signals. As you tune, eventually you should pick up the amateur 75-meter phone band. This band is full of strong signals and you can identify it by hearing hams calling "CQ 75 meters."

Adjust the trimmer until this band (the low frequency end of it) falls at about 50 on the dial. This will insure that the nearby Novice band will tune from approximately 30 to 40 on the dial, the exact spot depending upon the type of variable condenser used, etc.

Now, tune in the station wanted by means of the main tuning dial. Finally, "peak" the signal, using the knob on the front. As mentioned previously, one setting of this knob will hold over quite a range of frequencies.

With the coils "perking" on 80 meters, the next step is to get the 10-meter coils in operation. At this point it is a good idea to make certain that there is someone on the band—10 meters can be quiet as a tomb—so, if practical, give a nearby ham friend a ring on the phone and ask if there are some strong signals coming through.

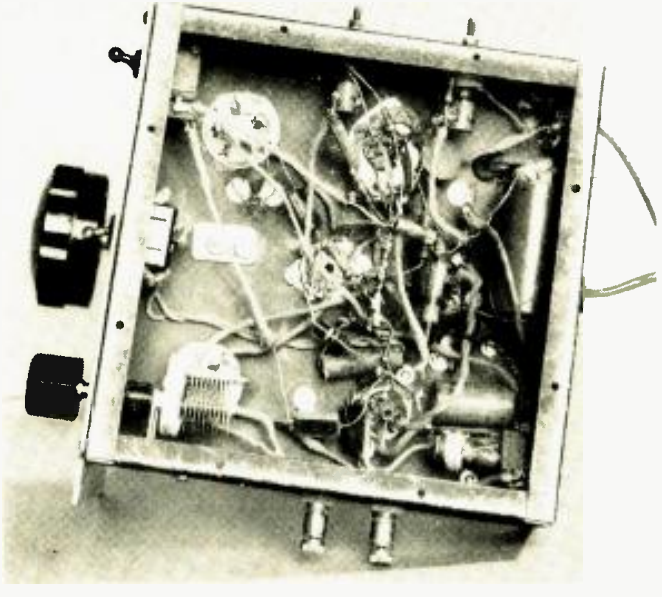
You may want to do some touching up later and, if so, keep this in mind: the greater the capacity used on the trimmer (the further the screw is in the condenser) the more the 10 meter band is spread across the dial. But at any rate, just as on 80 meters, "find" the band by adjusting this trimmer. Then "peak" with the mixer tuning condenser.

So much for reception of phone signals—now for code. Plug in the 6C4 and throw the b.f.o. switch on the panel so that the b.f.o. is on. Now tune in a signal and adjust the slug in the b.f.o. coil until a whistle is heard. Then you are all set for code reception.

With a set like the little *Arvin* you don't need to worry much about a.v.c. action and reception of code signals will be satisfactory. However, with larger sets having active a.v.c. systems a very minor modification of the set is desirable, since the b.f.o. in the converter acts like any other signal and depresses the a.v.c., reducing the over-all sensitivity. The answer is to provide a switch for shorting out the a.v.c. section in the set with which the converter is used. If you will study over the a.v.c. layouts and also receiver circuits in any of the amateur handbooks you will see how to do this.

What can you receive with a converter of this type? That will depend upon a lot of things, including the set with which the converter is used and the available antenna. However, the over-all sensitivity should be fairly high with almost any set. For example, the writer hooked up the set, connected an 8 foot wire to one antenna post on the converter and grounded the other post to the chassis, tossed the wire behind the couch, and got the converter working. —30—

Under chassis view of converter. The power supply wiring is kept to the rear of the chassis wherever possible. The i.f. coils may be seen at the top, the antenna posts on the bottom.



Front panel view. Controls include the variable condenser across mixer coil, standby switch, and b.f.o. "on-off" switch. Main tuning is accomplished by large vernier dial in the center.

AN ANTENNA TUNING UNIT

By
HAL BUMBAUGH
W6HI

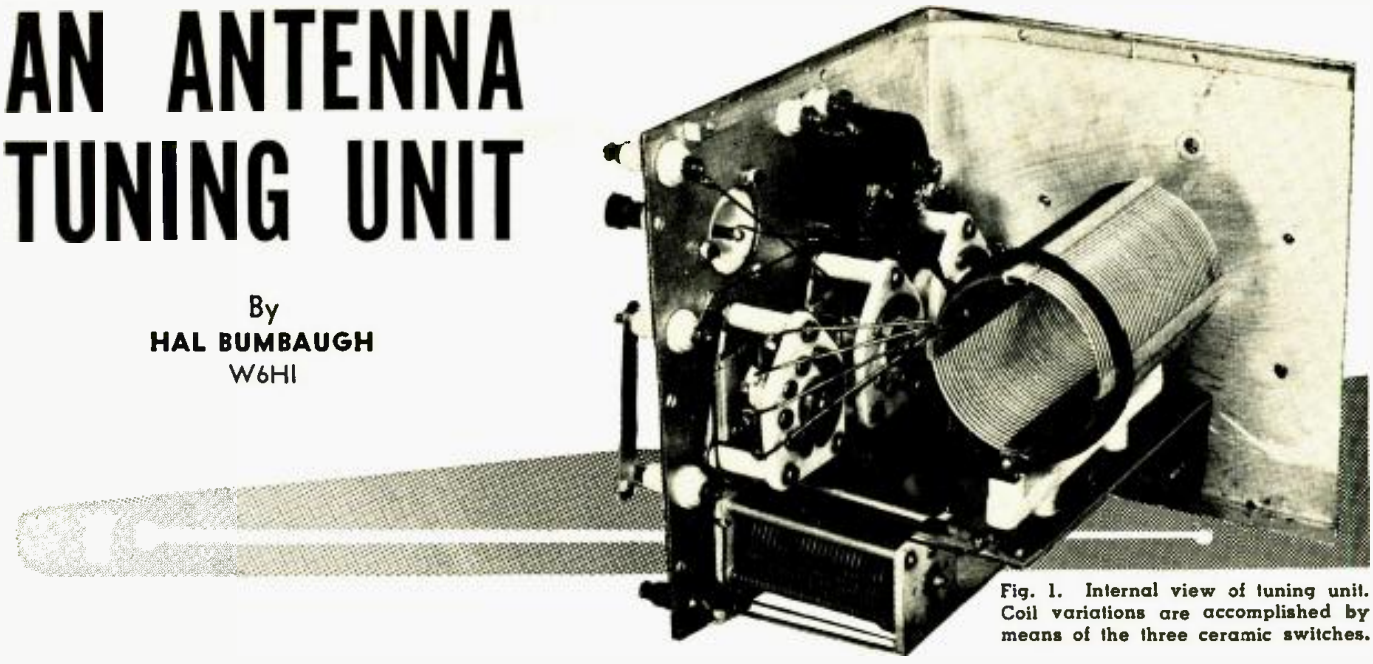


Fig. 1. Internal view of tuning unit. Coil variations are accomplished by means of the three ceramic switches.

A correct antenna match can increase radiated signal without increasing transmitter power.

MANY an otherwise excellent transmitter renders mediocre service because the antenna to which it is hooked does not represent optimum loading conditions for the transmitter. The result is that the radiated signal power represents but a small proportion of the potentially available power.

There are, of course, conditions under which a radiating system will not put out the energy it should, even if properly matched to the transmitter, but this is generally representative of conditions over which the operator has little control, such as having to resonate six feet of wire to a transmitter working on 75 meters, etc. However, it may be said with certainty that if resonance is established between the transmitter and the antenna under such a condition, all has been done that lies within the power of the operator.

For the ordinary conditions under which emergency antennas of almost any type and physical dimensions or haywire antennas strung up at a portable location must be used, any device which will insure a match between the transmitter and the radiating system will pay off handsomely in increased signal strength and efficieney.

With the idea of building up a gadget that would accomplish a match between a transmitter and almost any piece of wire or any type of configuration, and which could be connected to the transmitter in several different ways, a matching unit was purchased on the surplus market for a little over a dollar—and promptly wrecked—not because it wasn't good, but because it was conventional and the gadget we had in mind was to be anything but that!

All the parts, except the variometer, were used, and with the addition of three small condensers and a 2-ampere meter from the surplus market we built the instrument shown in Fig. 3.

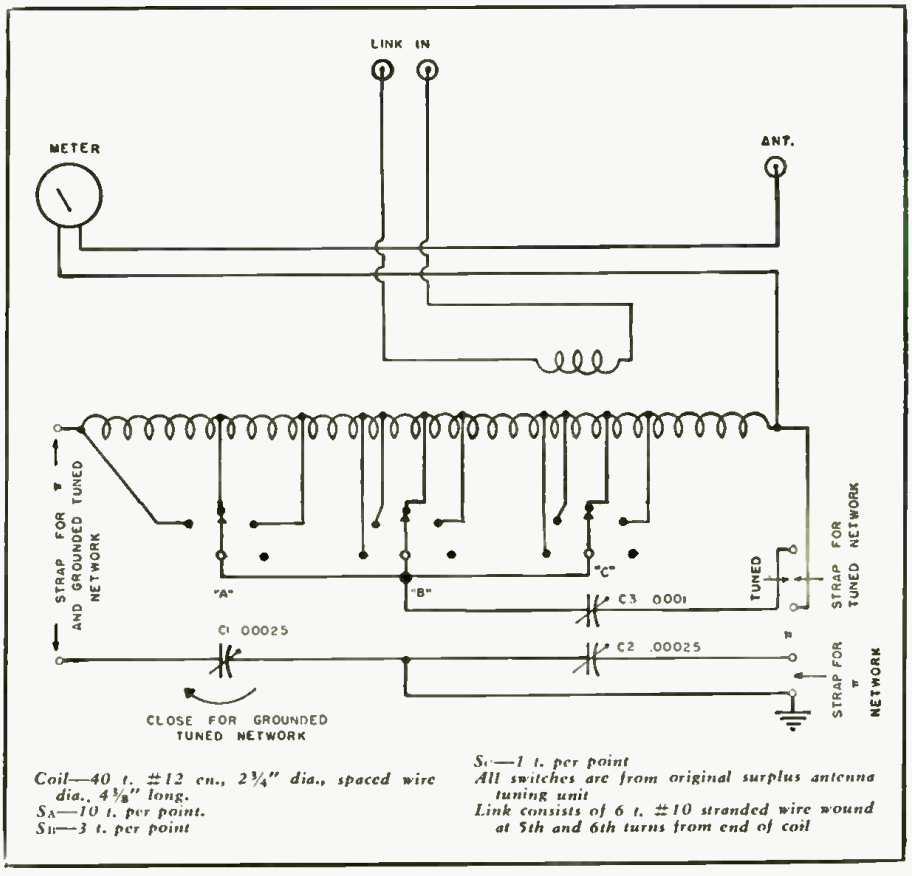
Fig. 2 is the wiring diagram and it will be seen that the arrangement functions either as a tuned circuit, grounded or ungrounded, for feeding half-wave antennas, etc., or as a pi network to match random lengths of wire or other radiators to the transmitter.

The two pi-network condensers C_1 and C_2 are each 250 $\mu\mu$fd. while the tuned circuit condenser is 100 $\mu\mu$fd.

Attention is called to the left-hand condenser associated with the pi network in the diagram. This condenser has the tip of one rotor blade bent over

(*Continued on page* 169)

Fig. 2. Wiring diagram. The unit functions as a grounded or ungrounded tuned circuit.



Coil—40 t., #12 en., 2¾" dia., spaced wire dia., 4⅜" long.
S_A—10 t. per point.
S_B—3 t. per point
S_C—1 t. per point
All switches are from original surplus antenna tuning unit
Link consists of 6 t. #10 stranded wire wound at 5th and 6th turns from end of coil

A Low-Capacity INSTRUMENT PROBE

By
E. G. LOUIS

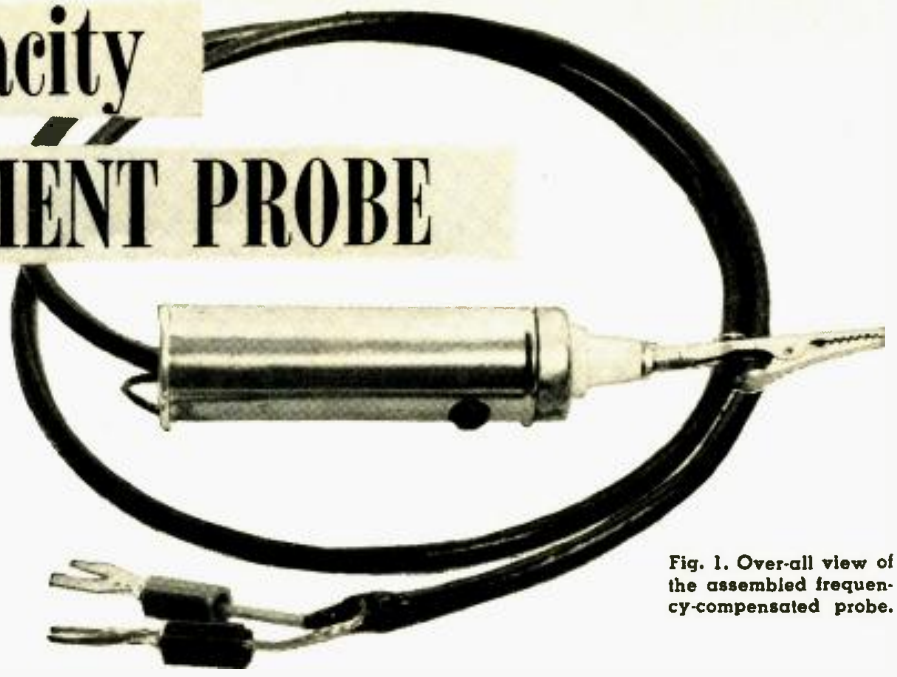


Fig. 1. Over-all view of the assembled frequency-compensated probe.

This easy-to-build probe can be used with any scope, v. t. v. m., frequency meter, or other similar types of test equipment.

MANY electronic test instruments, though possessing a comparatively high input resistance have, at the same time, a moderate-to-high input capacity. While this, ordinarily, is not a disadvantage when the instrument is used in low impedance circuits or to check signals of narrow bandwidth, severe waveform distortion, with resulting inaccuracy of measurement, may result when the instrument is used either in high impedance circuits or to check signals of broad bandwidth. A steep double pulse, as shown in Fig. 4A, may become distorted as shown in Fig. 4B when the instrument is connected to the circuit under test. Not only is the waveshape severely distorted, but the peak amplitude is reduced. If used in high-frequency circuits, an instrument having high input capacity may cause severe detuning and loss of gain.

The input capacity of a test instrument is made up, generally, of distributed wiring capacities, while the input resistance may be the grid resistance of a tube, the total resistance of a tapped voltage divider, or the resistance of an input potentiometer. In Fig. 2A, we may refer to the input capacity as C_i, and the input resistance as R_i. The *instrument* may be a v.t.v.m., a CRO, a frequency meter, or similar test device.

To minimize the effects of high input capacity, the technician or engineer will generally connect an "isolating" resistor in series with the "hot" input lead of the instrument, as shown in Fig. 2B. In some cases a small capacity condenser will be used instead of a series resistor. The resistor is shown as R_s in Fig. 2B. If a small condenser is used instead, it may be represented as C_c in Fig. 2B.

Either expedient may give satisfactory results, *provided* signals of a single frequency and approaching a sine wave in form are being checked, and *provided* the voltage division action which occurs between the series resistor (or condenser) and the input impedance of the instrument is taken into account when interpreting results.

However, where complex signals exist, either method will result in more severe, rather than less, distortion and inaccuracy.

Should R_s be used alone, this series resistance will form an integration or low-pass filter network in conjunction with C_i, causing severe attenuation at higher frequencies and considerable rounding of sharp wavefronts.

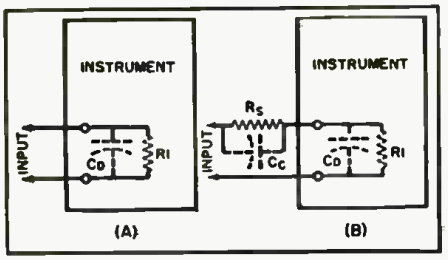
On the other hand, if a series condenser, C_c, should be used alone, and its impedance is high compared to the input resistance of the instrument, R_i, these two components may well form a differentiation or high-pass filter network. Such a circuit will cause excessive "peaking" of complex signals and severe attenuation at lower frequencies.

To overcome the difficulties encountered when either a series resistance or capacitance is used alone, a combination of the two may be employed to form a frequency-compensated low-capacity test probe. The schematic diagram of such a probe is given in Fig. 3, while the assembled instrument is shown in Fig. 1.

Circuit Description

The low-capacity probe consists simply of a resistor and condenser connected in parallel and mounted in a shielded container, with a shielded coaxial lead between the probe and the test instrument with which the probe is used. The capacity of the shielded lead is added to the input capacity of the test instrument, C_i, and this is compensated for by the probe itself. Although this precludes the "ideal" in reduction of input capacity, it is a mandatory step if the effects of body capacity and stray coupling are to be eliminated.

Fig. 2.



Basically, C_i (Fig. 3) and C_p (input capacity of the instrument *plus* the capacity of the coaxial lead to the probe) form a simple capacitive voltage divider which is shunted by a resistive voltage divider made up of probe resistance R_2 and the instrument input resistance R_i. Thus, the low-capacity probe acts to reduce or attenuate the input signal as well as to reduce the input capacity of the test instrument. However, this attenuation may be easily calculated, and, *more important, is constant for all input frequencies.* In addition, the low-capacity probe does not change the waveshape of the signal, so that the signal applied to the input of the test instrument, though smaller in amplitude, is an exact replica of the signal applied to the input of the probe.

In addition to reducing the input capacity of the test instrument, the use of the low-capacity probe also increases the input resistance, providing a true "high impedance" input.

The reduction of input capacity and increase in input resistance are directly proportional to the degree of attenuation. As an example, if the test instrument alone has an input resistance of 1 megohm and an input capacity of 50 $\mu\mu$fd., the use of a low-

capacity probe giving an attenuation of 10:1 permits an input resistance of 10 megohms with an input capacity of *only 5 μμfd.*

Construction Hints

Condenser C_1 may be a 3-30 μμfd. or 5-50 μμfd. mica or ceramic trimmer. The exact size is not important as an adjustment will be made after the probe is assembled. Resistor R_2 may be either a ½ w. or 1 w. non-inductive (carbon) resistor. The size is determined by the input resistance of the instrument with which the probe is to be used and the reduction in input capacity desired. It may be determined by using the following formula:

$$R_2 = R_1 (C_p/C_1)$$

where R_1 is the input resistance of the instrument, C_p is the input capacity of the instrument, plus the capacity of the coaxial lead, and C_1 is the desired input capacity.

As an example, let us suppose that two feet of a coaxial cable having a capacity of 10 μμfd.-per-foot is used between the probe and the instrument, and that the instrument has an input capacity of 25 μμfd., with an input resistance of 1 megohm. C_p becomes 2 × 10 plus 25, or 45 μμfd.

If the input capacity desired is 5 μμfd., then R_2 becomes:

$R_2 = R_1 (45/5) = 1(9) = 9$ megohms.

The degree of attenuation achieved with the probe may be determined by using another simple formula:

Attenuation Ratio $= (C_p + C_1)/C_1$ or
Attenuation Ratio $= (R_2 + R_1)/R_1$.

In the example given, the attenuation ratio becomes 10:1.

From this it can be seen that a coaxial cable having low distributed capacity must be used, and that the length should be kept as short as practicable if maximum reduction in capacity together with a minimum degree of attenuation is to be achieved. Often, however, it is necessary to make a compromise between attenuation and desired input capacity.

The shielded housing for the probe

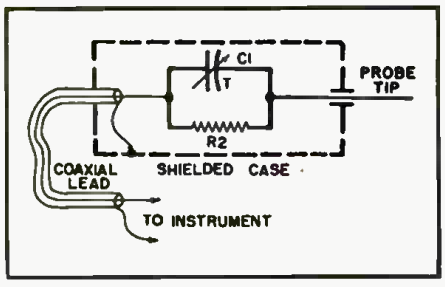


Fig. 3.

(C_1 and R_2) may be a metal tube or box. A hole should be provided in the side of the case so that C_1 may be adjusted with a small screwdriver or alignment tool after the probe is assembled.

In the model shown in Fig. 1, an old bouillon cube box was used for the case. A cylindrical metal pill box could also be used. Printing and paint may be removed by using solvent, steel wool, cheese cloth, and liberal quantities of elbow grease.

If a suitable trimmer condenser is not available for use as C_1, a small fixed mica or ceramic condenser may be used instead, shunted by two pieces of insulated wire twisted to form a "gimmick" condenser whose value can be easily varied (either by reducing the length of the wires or changing the "tightness" of the twist).

Adjustment and Calibration

After construction of the probe unit is completed, connect the coaxial lead from the probe to the input terminals of a CRO. Shunt the input terminals of the CRO with sufficient additional capacity and resistance to simulate the input capacity and resistance of the instrument with which the probe is to be used. If it is intended to use the probe with the CRO, do not use any additional resistance or capacity.

Connect the probe tip to the output terminal of a square-wave generator and run a ground lead between the square-wave generator and the CRO.

Adjust the square-wave generator to deliver a signal having a pulse repetition rate of from 15,000 to 75,000 pps. The exact frequency is not important. Adjust the CRO controls until two or three complete cycles of the square wave can be observed.

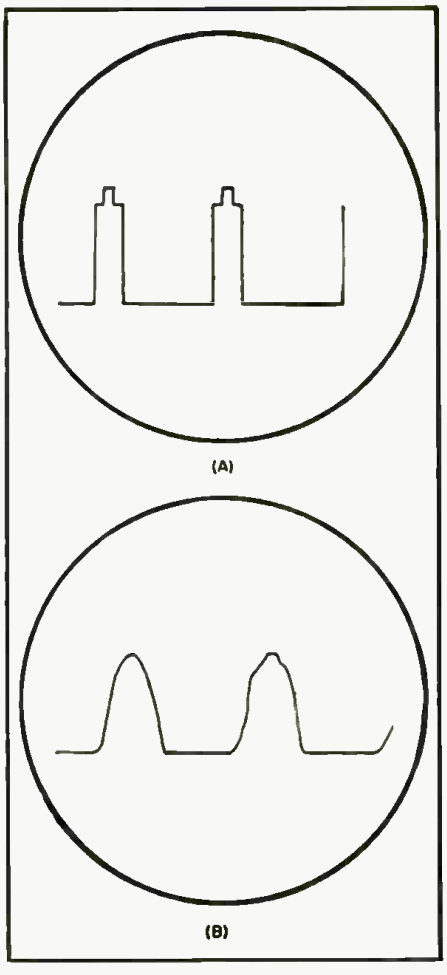


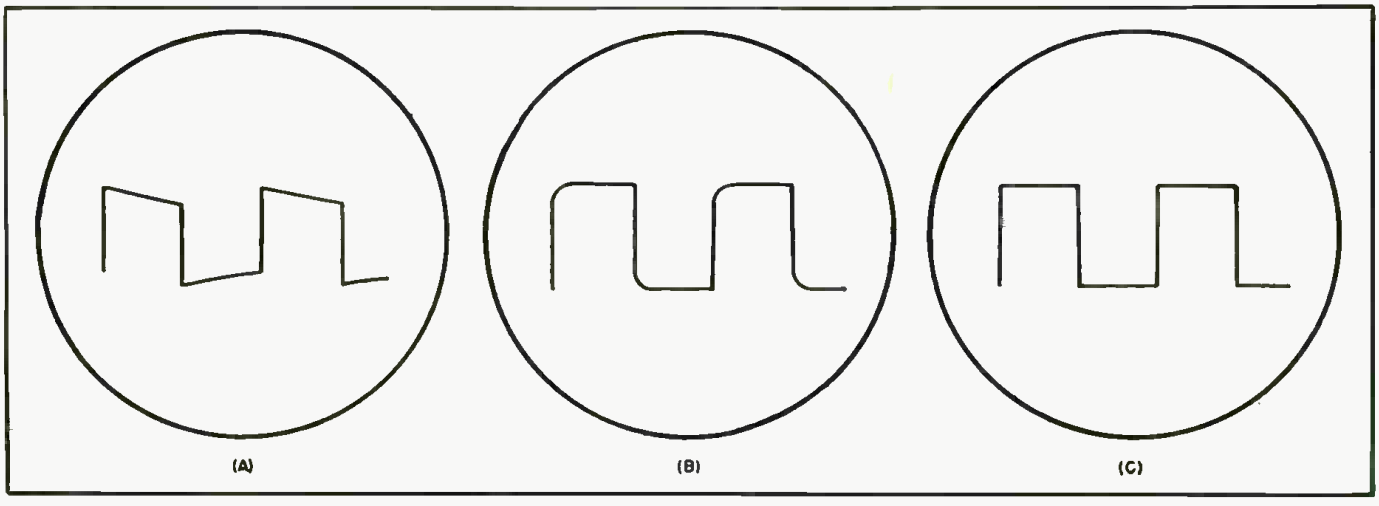
Fig. 4.

Should the square-wave signal appearing on the screen of the CRO be peaked, as shown in Fig. 5A, the capacity of C_1 must be reduced. Use an insulated alignment tool for this adjustment.

If the square-wave signal is badly rounded, as shown in Fig. 5B, the capacity of C_1 must be increased. Again, an insulated alignment tool must be used.

(*Continued on page* 168)

Fig. 5.



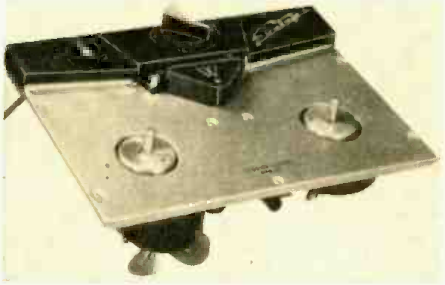
The Model SP-5 was designed to simplify phasing each speaker in a multiple speaker installation. In addition, it will perform the following functions: switch monaural and stereo signals into the same amplifiers and speakers; switch broadcast stereo and stereo tape or disc signals into the same amplifiers and speakers; and switch broadcast stereo, stereo tape or disc and monaural signals into the same amplifiers and speakers.

The unit plate is gold embossed brass for mounting on the hi-fi panel. It comes complete with matching hardware and installation instructions.

STEREO TAPE DECK

Webster Electric Co. of Racine, Wis. has just introduced a new stereo tape deck which was developed for the "do-it-yourself" enthusiast as well as for audiophiles who wish to modernize their present hi-fi setups.

The "Ekotape 340" is controlled by means of two knobs. With accessories, the unit can record or play back stereo as well as monaural program material. The circuit features the company's special "monomatic" central control which eliminates tape loops. The "on-off" switch and speed control have been



combined to neutralize the drive mechanism when the machine is turned off.

The company is also offering a companion stereo record-playback preamp for use with the new tape deck. It provides a tone and volume control center, with knobs and meters for each channel.

For full specifications on the deck and its preamp, write direct to the manufacturer.

"KNIGHT-KIT" 18-WATT AMPLIFIER

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill. has just released a new 18-watt amplifier in its "Knight-Kit" line.

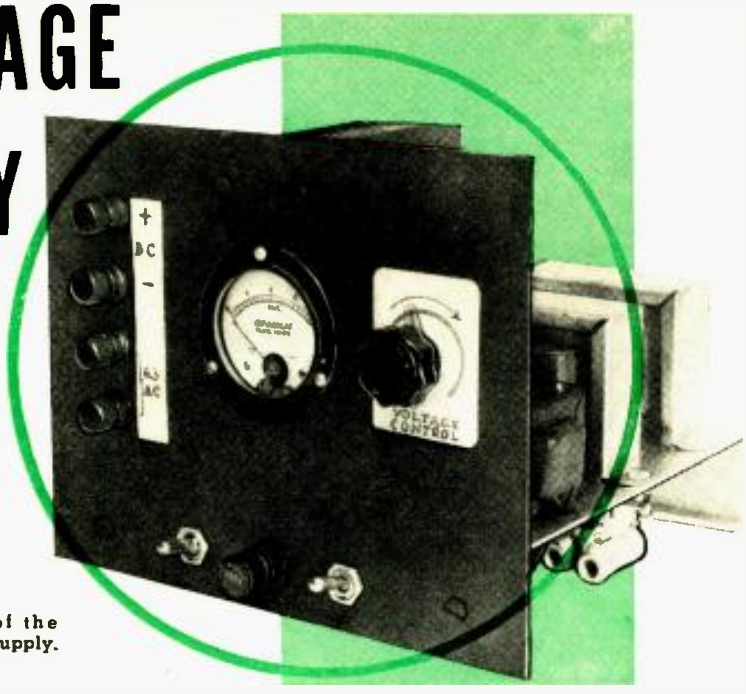
Featuring the use of an exclusive printed-circuit switch and two printed circuit boards, construction is greatly simplified for kit builders since most of the complex wiring is already completed.

Employing *RCA's* new 6973 audio output tubes, the amplifier delivers a full 18 watts output at only .5 per-cent distortion. Hum level is better than 60 db below rated output and frequency response at 18 watts is ± 1 db from 20 to 30,000 cps.

Eight inputs are provided on the amplifier for every possible signal source, including NARTB-equalized tape head input. A total of seven record equalization settings are offered plus tape head

A VARIABLE-VOLTAGE POWER SUPPLY

By
RICHARD GRAHAM



Over-all view of the variable-voltage supply.

Build this handy service unit which uses a pair of 2D21 thyratrons to control the output voltage.

A VARIABLE-voltage power supply is one of those basic pieces of equipment which every experimenter and ham can use to good advantage. Such a device needs no introduction or build-up concerning its utility. However, for reasons of economy, time, and perhaps a little ignorance, the author has struggled along for years putting resistors in series with a 400-volt supply to get the desired voltage drop to a piece of equipment under test. The net result of all this is a box of charred and burned resistors whose value, both monetary and ohmic, is dubious! This needn't have happened since a variable-voltage power supply can be built both easily and economically. The power supply described is capable of delivering any voltage up to 650 volts d.c. at any current up to 100 ma. and the cost is actually only pennies more than the equivalent fixed voltage power supply. Except for the 2D21 thyratrons which can be purchased for approximately three dollars for the pair, most of the components will probably be found in the junk box.

The use of these small thyratrons for the dual purpose of control and rectification is undoubtedly the most economical and efficient method of obtaining a varying voltage output. This fact has long been known in industry where thyratrons, and their big brothers—ignitrons, have been used for years in applications requiring an easily-controllable output current or voltage.

There are two other general methods of obtaining a variable voltage, namely, through the use of a variable transformer such as a Variac and the series-tube method. The former is a very convenient and efficient method; however, its cost is rather high. The latter method, which uses a tube in series with the high voltage to drop the voltage according to the bias on the tube, has the disadvantages of high cost, increased complexity, and inefficiency.

This leads us back to the grid-controlled gas tube or thyratron. As a gas tube it has all the advantages of the gas rectifiers such as the 83, 816, and 866. Its low internal drop provides better regulation, higher efficiency, and a higher current-carrying capacity for a given tube size. The 2D21 has a glass envelope the same size as the seven-pin miniature 6J6 or 6AU6 tubes.

The 2D21 thyratron used in this power supply is classified as a gas tetrode, however the functions performed by the grids in this tube have no counterpart in the tetrode vacuum tube. For example, the second grid, commonly known as the screen grid in a vacuum tube, is called the shield grid in a gas tube. This element actually surrounds the cathode and plate and, in the 2D21, looks very similar to the plate construction in the ordinary vacuum tube. The shield grid is connected directly to the cathode so that the electrons collected by the shield can return to the cathode without affecting the control grid.

The control grid in the gas tube does not have the ability to control the plate current as in a vacuum tube. Instead the control grid determines, according to its voltage, the plate voltage at which the tube will suddenly conduct. Once the tube is set into conduction the plate current is determined solely by the external

Fig. 1. (A) The a.c. applied to plate of 2D21. (B) Grid voltage. (C) Waveform across one of 2D21's. (D) Waveform from cathode-to-ground.

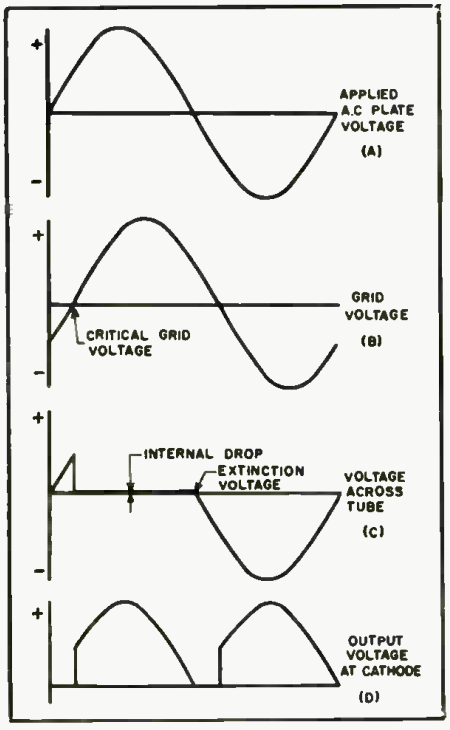


Fig. 2. Comparison of a rectifier fully conducting and one partially conductive and their respective direct-current levels.

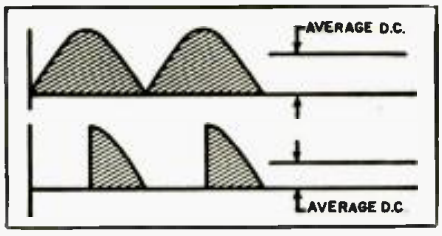
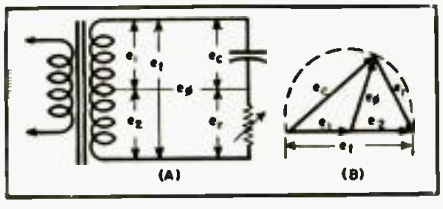
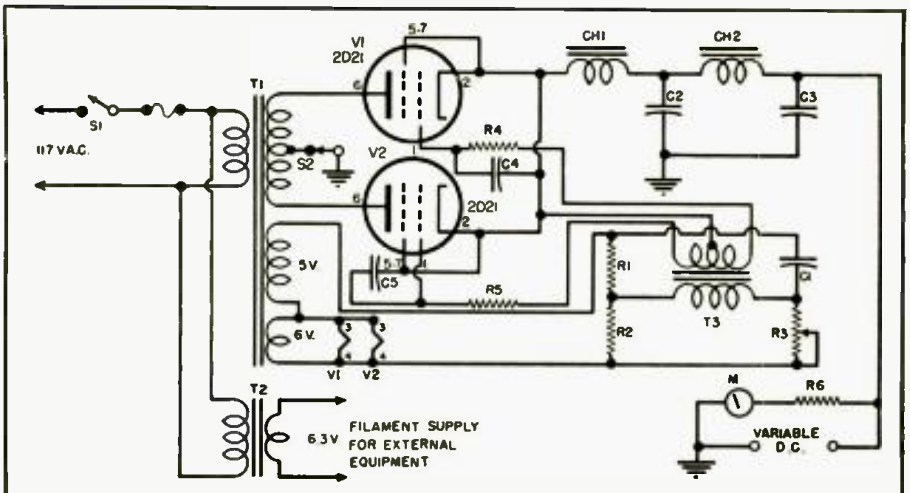


Fig. 3. (A) Basic circuit of the phase shifter. (B) Vector diagram of phase shifter.



load and the plate voltage. The grid loses all control. Thus the tube acts as a switch or, more exactly, like a high speed relay. If a.c. is applied to the plates as in rectifier service, then conduction through the tube must cease when the plate voltage drops to zero and goes through the negative half of the cycle. Thus, control is restored to the grid on the positive portion of the next half cycle; control in this case meaning the ability to determine whether the tube conducts fully or not at all. There is no "in between" with gas tubes.

By varying the point on the applied a.c. plate voltage cycle at which the grid voltage causes conduction, the average d.c. voltage at the thyratron cathode can be varied. This can be more clearly seen by studying Fig. 1. The a.c. applied to the plate of the 2D21 is shown in Fig. 1A. The grid voltage is shown in Fig. 1B. Note that the grid voltage is actually a sine wave, the same as applied to the plate, but the phase is different. Using the plate voltage as a reference, the grid voltage is depicted as lagging. If we assume that the tube will fire at zero grid volts, then by keeping the grid negative until it is desired to fire the tube, we can control the amount of time during the plate-voltage cycle that the tube will conduct. The grid can be kept negative until the desired time by simply shifting the phase of the grid signal in relation to the plate voltage. By varying the phase relationship of the grid and plate voltages from 0° (when both are in-phase) to 180° (when grid and plate voltages are in exact opposite phase) the point along the a.c. plate voltage at which the tube will conduct can also be varied. This basically is what is done in the power supply described. Fig. 1C shows the waveform across one of the 2D21's (from plate to cathode). Here we see that the plate voltage rises across the tube, *i.e.*, it is not conducting, until the tube is fired. The plate voltage then drops to a very low value, as determined by its internal resistance. Fig. 1D depicts the waveform from cathode to ground at the 2D21's. This waveform is the result of two thyratrons in a full-wave circuit, therefore the frequency of the d.c. pulses is twice that of the a.c. voltage applied to the plates. The average d.c. is proportional to the area of these "pulses" over a cycle. A comparison of a rectifier fully conducting and one only partially conducting and their respective average d.c. levels is shown in Fig. 2.



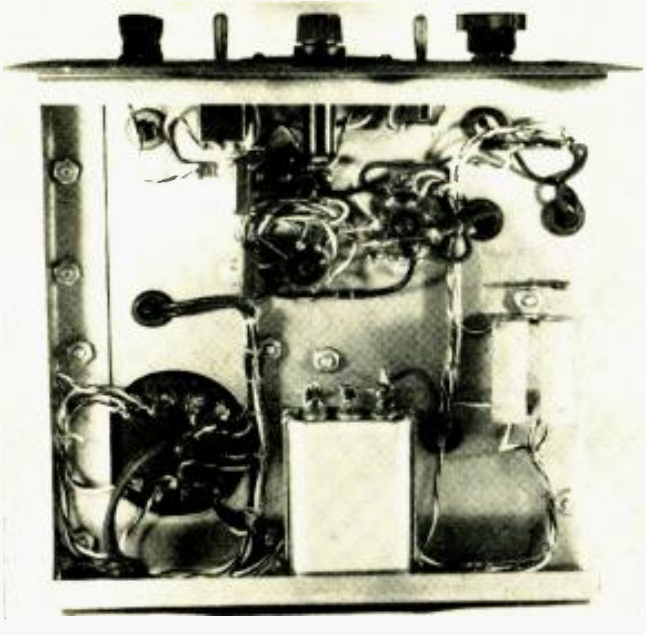
R_1, R_2—68 ohm, 5 w. wirewound res.
R_3—25,000 ohm pot.
R_4, R_5—1 megohm, ½ w. res.
R_6—100,000 ohm, 4 w. wirewound res.
C_1—2 μfd., 200 v. cond.
C_2, C_3—10 μfd., 450 v. elec. cond.
C_4, C_5—.002 μfd., 400 v. cond.
M—4 ma. d.c. meter
S_1, S_2—S.p.s.t. sw.
CH_1, CH_2—5 to 7 hy., 200 ma. filter choke
T_1—Power trans. 400-0-400 v. @ 200 ma.; 5 v. @ 2 amps. (only .1 amp. required); 6.3 v. @ 2 amps.
T_2—6.3 v. fil. trans. (current depends on builder's requirements)
T_3—Push-pull midget audio input trans., 1:3 ratio (Thordarson T-20A19 or equiv.)
V_1, V_2—2D21 thyratron

Fig. 4. Complete circuit diagram and parts list covering the variable-voltage supply.

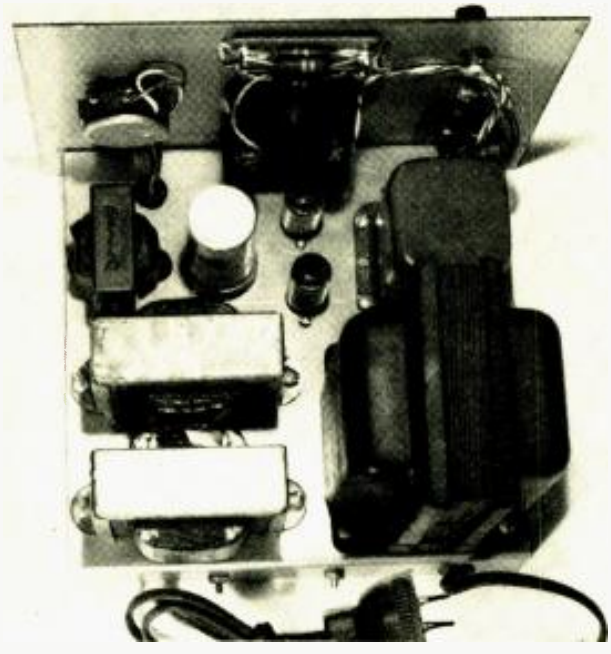
The method of phase shifting the voltage on the grids of the 2D21's is not basically new, however it is still quite unique. The basic circuit of the phase shifter is shown in Fig. 3A. The transformer is center-tapped, therefore e_1 equals e_2 and $e_1 + e_2 = e_t$. The voltage e_t is also impressed across the capacitance and resistance in series, thus vectorially $e_t = e_c + e_r$. Since e_c is 90° out-of-phase with e_r, the vector diagram shown in Fig. 3B can be drawn. The variable-phase voltage e_v is then the voltage appearing between the center-tap of the transformer and the junction of the resistor and condenser. This is shown in Fig. 3B. Thus by varying the resistor in this circuit, any angle of phase shift from 0° up to

(*Continued on page* 120)

Bottom view of the home-built variable-voltage power supply.



Top view shows the uncrowded chassis layout of power supply.



A TWO-STATION INTERCOM

By

J. P. WENTWORTH

Build this handy two-way "conversational" system for your home. No push-to-talk switch is needed.

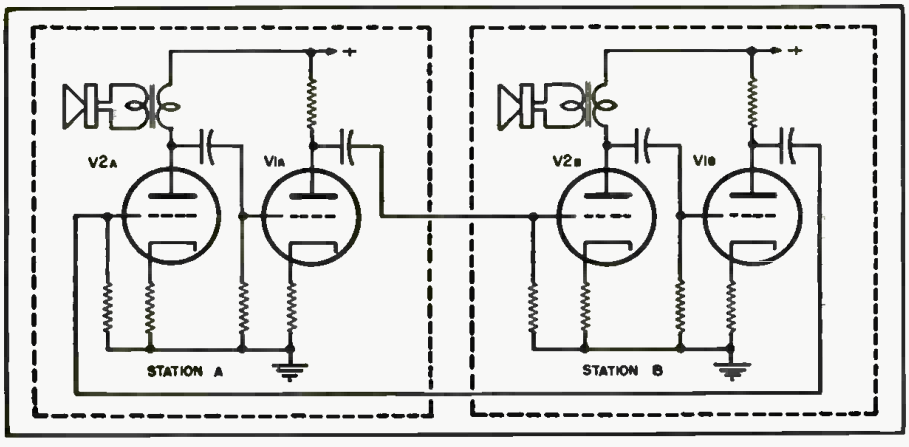
AN intercommunication system has proved itself a valuable addition to many homes. It is a great convenience, for instance, for the housewife to be able to answer the doorbell, "eavesdrop" on the nursery, or talk with her husband in the garage or workshop, without leaving the kitchen. The utility of an intercom would be greatly increased, however, if the inconvenient push-to-talk switch could be eliminated, and the instrument made "conversational," *i.e.*, of such nature that one merely talked or listened, without having to perform any manual operation.

A basic two-station intercom circuit is shown in Fig. 1. A signal picked up by speaker A is amplified by V_{1A} and V_{2B}, and is radiated by speaker B; while sound picked up by speaker B is radiated by speaker A, after amplification by V_{1B} and V_{2A}. The only trouble with this circuit is that it won't work. The signal fed into the amplifier by speaker A will not stop at speaker B, but will continue through V_{1B} and V_{2A}, causing the system to oscillate.

Some means, then, must be provided to prevent the signal from traveling completely around the circuit and causing regeneration. This could be accomplished, of course, by including a switch in the output of each station, to complete the circuit only when a transmission is being made, but this would bring us right back to the push-to-talk switch that we are trying to eliminate. However, we can accomplish the same thing by letting the signal perform the switching function automatically, as in the circuit shown in Fig. 4.

Before analyzing this circuit, let us consider one other factor which will affect the performance of the system. It will be noticed in Fig. 1 that when the speaker is used as a microphone, it is working into a load consisting of the dynamic plate resistance of V_2 in parallel with the grid resistor of the following stage. Whereas the loading due to the tube will be negligible if a pentode or beam-tetrode output tube is used, a triode will load the circuit quite heavily. Moreover, there will be a heavy d.c. current drawn through the primary of the output transformer, regardless of the type of output tube used, and the efficiency of the transformer will be somewhat lowered. For these reasons, it would be well to interrupt the current in the output tube when the speaker is being used as a microphone.

Fig. 1. Basic circuit of a two-station intercom without the push-to-talk switch. The unit as it stands now without a switch would, of course, be regenerative, causing oscillation. The author has used this fundamental circuit as the basis of his two-station intercom unit (Fig. 4) without a push-to-talk button. The problem of oscillation has been completely eliminated in the final version of the circuit.



The circuit shown in Fig. 4 operates as follows. Normally, V_1 is conducting, with a 3-volt bias between grid and cathode, as established by the voltage divider, R_4-R_5. Since the correct value of R_4 which will provide this bias will depend on the magnitude of the voltage supplied by the negative rectifier, and since this voltage will vary, due to tolerances in R_{10}, C_8, and C_9, the value of R_4 can best be selected by trial. If desired, a 500-ohm rheostat may be used and adjusted to provide a 3-volt bias.

With V_1 conducting, the voltage at its plate and hence the grid bias voltage of V_2, will be several volts negative with respect to ground. V_2, therefore, will be cut off and the plate resistance of V_2 will not load the speaker, which is now functioning as a microphone. The network composed of R_2 and C_2 keeps the signal at the plate of V_1 from causing V_2 to conduct intermittently.

When a strong signal arrives at the station, the diodes of V_1 rectify the signal, charging C_1 in such a direction as to cut off V_1, thereby preventing the signal from passing through the station and out onto the line. At the same time, the plate of V_1 rises to ground potential, and V_2 is allowed to conduct, delivering the incoming signal to the speaker.

To insure privacy, the muting switch S_2 may be incorporated to disable the outgoing circuit until it is desired to make a transmission. It is worth noting, however, that the use of this switch is optional. Once the switch has been thrown, it does not require continual manipulation, as in the case of the conventional push-to-talk switch. Since no volume control is provided in the grid circuit of V_1, a limiting resistor R_9 is included to prevent blocking on signal peaks.

The initial cathode bias on V_1 will establish a threshold voltage which

must be exceeded before the diodes will rectify. This feature prevents operation of the circuit on hum or noise pickup on the input line. A fraction of a second time delay is introduced in incoming signals by the time required to discharge C_2 through R_2, while a small delay is introduced in outgoing signals by the combination, C_1, R_7, and R_1. For this reason, the time constants of these circuits should be kept fairly low, although the R_2-C_2 filter must have a long enough time constant to be effective in smoothing the lowest frequencies passed by the amplifier.

If desired, greater sensitivity can be obtained through the use of a push-pull output transformer, as shown in Fig. 2. The "B +" tap should be connected to the plate of the output tube, while one of the plate leads should be connected to "B +," and the other plate lead should be connected to C_1. This arrangement will provide a gain of about 6 db over the circuit shown in Fig. 4.

Since the power line is used as a return for the signal, care must be taken to use the same power line for "B —" at both stations. Of course, normal precautions should be taken not to ground the chassis, as in the case of any a.c.-d.c. equipment.

The condenser-resistor combination C_{10}-R_{11} serves to isolate the chassis from the power line, but it still is advisable not to have any exposed metal parts on the completed unit with which a person, particularly a child, might come in contact. The insulation between the chassis and the common "B–" lead can easily deteriorate with age and humidity, leading to a severe shock hazard. Make sure that electrolytic condenser cans are insulated from the metal chassis. The complete unit can be mounted in a wooden cabinet, or may be built-in at a suitable location in the kitchen, basement, or wherever the stations are to be located.

If one of the units is used to "answer" the front or back doorbell, the chassis may be placed inside the house and only the speaker mounted outside, assuming that it is adequately protected from the weather. If possible, it should be located at about the height of a normal person's head, or perhaps a little higher. Sometimes a small speaker can be incorporated with the porch light. The leads to the speaker must be kept as short as possible and should be well-insulated, since they are not only at "B+" potential but are effectively at line potential, being isolated only by an electrolytic condenser, C_6.

A more convenient, if somewhat more complicated, circuit is shown in Fig. 3A. With the filaments wired as shown in this circuit, it is possible to turn both stations either on or off by throwing the switch at either station. Since there is no pilot-light tap in the 25Z6 filament, a type NE-45 light may be used as a pilot light, connected between the cathode of the rectifier tube and the "B —" bus. This light will glow only after the filaments have heated and the intercom is ready for operation. By using a double-pole, double-throw switch, as shown in Fig. 3B, one can eliminate the need for properly orienting the power plugs, since the proper polarity is automatically selected when power is applied.

Although the output impedance of each station is fairly low, it may be found that a cathode-follower output stage is needed, if the distance between stations is great. In this case, the 6SR7 can be replaced by two 6ST7's with filaments in parallel, or the 12SR7 can be replaced by two 6ST7's with filaments in series. The circuit parameters shown in Fig. 4 would remain the same, while a cathode resistor of about 10,000 ohms would be suitable for the cathode follower.

For those who wish to experiment further, it is probable that an alternate circuit could be devised, using relays to perform the switching functions, instead of biasing the triode to cut-off.

Whether the reader builds the comparatively simple unit shown in Fig. 4 or incorporates all of the suggested refinements, this system will repay the builder many times over in added convenience and the saving of time and steps. Two-story houses or homes with basement work areas are "naturals" for this type of installation as countless trips up and down stairways can be eliminated by the strategic placement of such intercoms.

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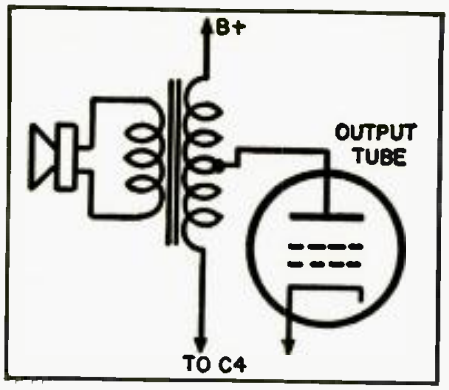


Fig. 2. Circuit using a push-pull output transformer to provide more sensitivity.

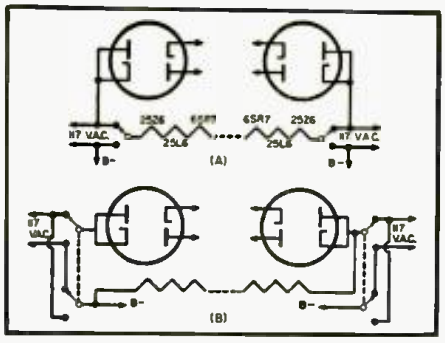
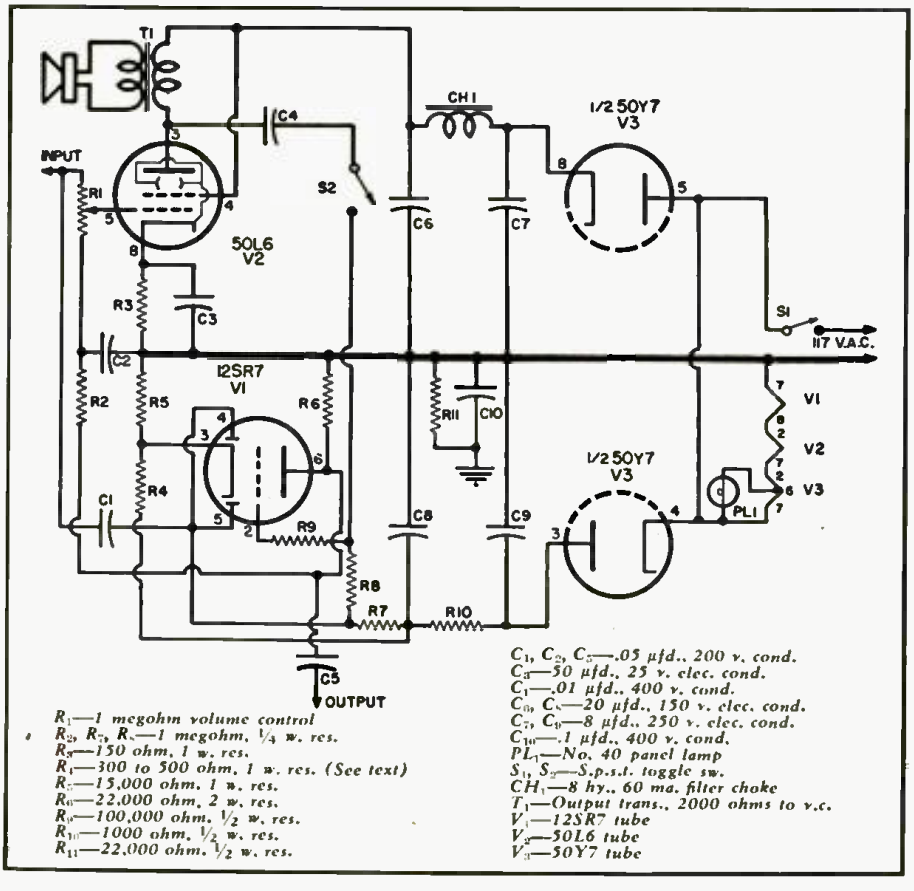


Fig. 3. Optional switching circuits for the two-station system. (A) A more elaborate system than that shown in Fig. 4 which permits both stations to be turned on or off by throwing a switch at either station. (B) Use of a double-pole, double-throw switch eliminates the need for properly orienting the power plug.

Fig. 4. Complete schematic diagram and parts list for the home-built intercom. Two of these units will be required to set up a two-way "conversational" system.



R_1—1 megohm volume control
R_2, R_7, R_{11}—1 megohm, ¼ w. res.
R_3—150 ohm, 1 w. res.
R_4—300 to 500 ohm, 1 w. res. (See text)
R_5—15,000 ohm, 1 w. res.
R_6—22,000 ohm, 2 w. res.
R_8—100,000 ohm, ½ w. res.
R_9—1000 ohm, ½ w. res.
R_{10}—22,000 ohm, ½ w. res.

C_1, C_2, C_3—.05 μfd., 200 v. cond.
C_4—50 μfd., 25 v. elec. cond.
C_5—.01 μfd., 400 v. cond.
C_6, C_8—20 μfd., 150 v. elec. cond.
C_7, C_9—8 μfd., 250 v. elec. cond.
C_{10}—.1 μfd., 400 v. cond.
PL_1—No. 40 panel lamp
S_1, S_2—S.p.s.t. toggle sw.
CH_1—8 hy., 60 ma. filter choke
T_1—Output trans., 2000 ohms to v.c.
V_1—12SR7 tube
V_2—50L6 tube
V_3—50Y7 tube

MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE

WEATHER AND FRINGE RECEPTION

SINCE Barney was a little late this September morning, he had hoped that Mac, his boss, would also be slow about getting down to work; but he had no such luck. When the boy stepped inside the shop, the first thing he saw was Mac poring over a map spread out on the service bench.

"Planning a vacation?" Barney asked brightly, hoping to divert attention from the clock.

"Not exactly," Mac said slowly as he glanced at his wrist watch. "In fact, I am thinking about taking my vacation as you do yours in the form of a half hour or so chopped off the front end of every working day."

"It won't happen again," Barney mumbled as he buttoned his shop coat collar around the tide of crimson that swelled up through his neck and spread over his freckled face; "but what kind of a funny map is that?"

"It's a daily weather map prepared by the U. S. Weather Bureau at a subscription price of sixty cents a month. I ordered it from the Superintendent of Documents, Government Printing Office, Washington, D. C. As you can see, this main map gives you the weather observations taken at hundreds of reporting stations all over the United States at 1:30 a.m. (EST). Each station gives such things as barometric pressure, temperature, dew-point, wind direction and force, precipitation, and types of clouds overhead, if any. In addition, fronts are shown, the movement of low centers are indicated, and high pressure areas are revealed. If you want to know how the weather is developing, the smaller map in the upper lefthand corner shows the position of lows and highs and fronts twelve hours before. Directly below this is another small map that is called a '700-Millibar Constant Pressure Chart.' It reveals weather conditions in the upper reaches of the atmosphere. The small map at the bottom center shows the highest and lowest temperatures recorded for the preceding twenty-four hour period at about 175 stations distributed over the country. To the right of this is still another map showing the precipitation areas and the amount of precipitation that fell during the same period. Complete instructions for reading the weather maps are given on the back."

"You going into the weather forecasting business?"

"No, but I decided about six months ago that I was going to try and discover if there was any predictable connection between weather conditions and TV reception in this ultra-fringe area. In addition to studying these maps, I have also been keeping a diary in which I record the pressure indicated by my own barometer, the temperature, whether or not there is cloud cover, other general remarks on the weather, and finally the quality of TV reception on that date. If the picture is sharp, distinct, free of snow, and cannot be shaken by ignition interference, I call it *good*. If it is occasionally blurred by snow but never actually disappears or loses sync, I call it *fair*. If it entirely disappears in the snow at times, or if the voice disappears, or if the picture rolls, I mark it *poor*. When the weather map is received, the kind of reception for that particular date is marked on the margin of the map. Then I study these maps and try to draw some general conclusions."

"Go on; let me see you draw one right now," Barney urged.

"Not so fast," Mac said with a grin. "The first thing I did was to disprove to my own satisfaction some of the theories I have heard propounded about TV reception. For instance, some people say reception is good when the barometer is high; others, when it is low. Well, I have recorded very good reception when the barometer stood at 29.26 inches and again when it was at 30.4. I have also had poor reception over a range of 29.6 to 30.5 inches. Excellent pictures have been received when the weather was cold and clear as a bell and again when it was muggy and pouring down rain—and *vice versa*."

"Then you decided that there is no connection between barometer readings, etc., and TV reception."

"I did not say that. I do contend, though, that the relation is not a simple one like, 'The higher the barometer reads, the better reception will be.'"

"No," Barney said with a sigh, "nothing, but *nothing*, connected with radio or TV is ever that simple."

"It *does* seem that way sometimes," Mac said with a sympathetic chuckle. "At any rate, I wrote the Weather Bureau and asked for some information about weather factors affecting TV signals. Mr. Harry Wexler, Chief of the Scientific Services Division, gave me some excellent pointers and recommended some books and periodicals for further reading. After wading through these, I am beginning to get a faint glimmer of what to look for in my weather maps."

"Let's not make a production out of this," Barney said impatiently; "what *do* you look for?"

"First, let's review a little," Mac suggested. "You should know from your ham background that the layer of atmosphere upward to a height of six miles from the surface of the earth is called the *troposphere*. Under standard conditions the temperature drops about 3.5 degrees for every 1000 feet you go upward until a temperature of —58° F. is reached at the top. It is in this troposphere that weather phenomena take place; and, as I'll explain later, conditions in the troposphere have the most to do with TV reception.

"The next layer of atmosphere, from six to fifty miles above the earth, is called the *stratosphere*. The temperature throughout this layer is approximately —58°. It is believed that the stratosphere has very little effect on television reception.

"Finally, extending from 50 to 190 miles above the earth is the *ionosphere*, consisting of stratified layers of gases ionized by the action of the sun. These layers, of various densities and thicknesses, tend to bend downward any radio waves entering them at an angle from below. The more dense the layer and the longer the wavelength of the signal, the greater is the bending; and in the case of the lower radio frequencies, the ionosphere returns most of them to earth. High frequency TV signals, though, are returned in strength

(*Continued on page* 158)

International SHORT-WAVE

Compiled by KENNETH R. BOORD

IT IS a pleasure to dedicate the September issue of the *ISW DEPARTMENT* to *Radio-Omroep Nieuw-Guinea (Radio Hollandia)*, at Hollandia, Dutch New Guinea. Thanks go to David A. Dary, Kansas, who secured this interesting story exclusively for us from D. Van Os, Director of Programs at the station. The piece was written by Claude Belloni, an assistant to Mr. Van Os.

"In the crystal-blue waters of the Pacific, stretching out vastly in front of the biggest island in the world, there is a tiny coral island which belongs to the western part of New Guinea—Biak. It is the birthplace of a broadcasting station.

"Every U.S. flier, marine, or soldier who fought the bloody war in the Pacific from the beginning will recall the island of Biak. Well-situated as it was for the grasshopping Allied warfare technique, it fitted nicely into the chain of stepping stones which ultimately ended in front of Japan. Here on Biak, U.S. forces built on tiny coral-polyps huge bomber runways from where the Japanese were pounded and driven back. It was one white pattern of 'endless' airstrips bordered and used by thousands of planes.

"On this island, too, *Radio-Omroep Nieuw-Guinea* was born. She was not named 'R.O.N.G.' then—just YDZ. And her studio was just a tiny shack, left behind by U.S. Forces, from where two radio amateurs—sergeants-major in the Netherlands Army—began to broadcast short musical programs with a 350-watt output transmitter.

"Then, toward the end of 1950, it became clear that something should be done about the oncoming and important conference between the Dutch and Indonesian governments about the western part of New Guinea, which was claimed by the latter. Often not too friendly propaganda was heard over the *Indonesian Radio* concerning this matter. One of the chief purposes for installing a 'real' broadcasting station was to compensate for this propaganda from the *Republik Indonesia Serikat Radio* and give Dutch New Guinea the exact information about the conference.

"Thus, in September, the Biak amateur station was moved to Hollandia, capital city of Dutch New Guinea, and YDZ became government-controlled. *Radio-Omroep Nieuw-Guinea* was the new name—since by now she had grown up to become an adolescent.

"However, although there was plenty of space, there still was the question of where to build a studio. Finally, on Sentani airstrip at the foot of 7000-ft. Cyclop Mountain, a place was found suitable for this purpose. There was a concrete foundation, though with storage building on top. Huge piles of empty gasoline drums were stacked up there and had to be removed. And they were—one by one, and by hand only!

"And so, without much material but with much will to succeed, *Radio-Omroep Nieuw-Guinea* was created; in New Guinean style, of course, no big studios with beautiful interiors and up-to-date equipment—just 'soft-board blades,' cement, and a zinc-plate roof on top did the job.

"Still other difficulties were—and are—to be dealt with: The very poorly-equipped disc-library (of only 1000 second-hand records) needs new material desperately, technical equipment, and so on. One of the main difficulties is the long way to Holland, because nothing can be obtained in New Guinea itself.

"With population increasing, however, and interest in this forgotten country mounting, it is urgent that 'R.O.N.G.' should grow, too. That's why—toward the end of this year—*Radio-Omroep Nieuw-Guinea* will be moved to Hollandia harbor where a new studio is to be built for her, and a new 3-kw. transmitter will replace the weak 350-watt job which is now in use. Then, as is sincerely hoped, there will be modern broadcasting service in a land where no more than ten years ago the Papuan population still lived in 'the stone age.'"

Additional information about *Radio-Omroep Nieuw-Guinea* from *"World Radio Handbook"* includes this: R.O.-N.G. is a division of the Government Information Service for the benefit of Dutch and native inhabitants of the western half of the island. Announcement is "Hier Radio-Omroep Nieuw-Guinea te Hollandia." Verification is by letter; program schedule is sent to overseas listeners free on request. Future plans call for extension of power and broadcasting hours with special programs to Indonesia and Holland. Opens with the "Washington Post March" and closes with the Dutch national anthem.

When this was compiled, R.O.N.G. was operating on 7.126 around 0415-0705A; overseas sources report the station soon will test on approximately 6.000.

If anyone has some good (*not necessarily new*) recordings (made at 78, 33, or 45 rpm), to donate to a worthwhile cause, please mail them direct to Radio-Omroep Nieuw-Guinea, Hollandia, Netherlands New Guinea. Your cooperation will be appreciated.—K. R. B.

New Guinea long has been known as the "second largest" island in the world, but more recently laid claim to

(*Continued on page* 114)

(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.

A broadcast service in an old land is provided by Radio-Omroep Nieuw-Guinea, located at the foot of 7000 ft. Cyclop Mountain, near Hollandia, Dutch New Guinea.

A REMOTELY-CONTROLLED AM TUNER

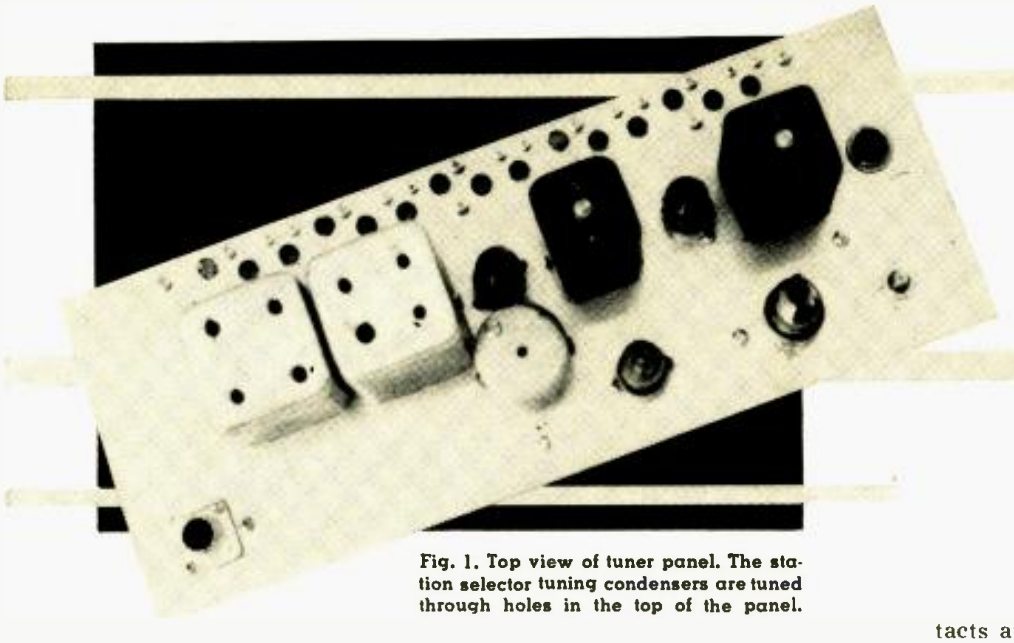


Fig. 1. Top view of tuner panel. The station selector tuning condensers are tuned through holes in the top of the panel.

By
C. RICHARD ELLIS
Government Engineering
General Electric Company

Five relays are used to permit the remote selection of five different stations. This same idea can be expanded to provide operation of other type units.

A CUSTOM installation of radio, phonograph, and television equipment may be desired by a prospective customer because he appreciates the finer quality reception such an installation can give him. However, there may not be space available in his living room for the necessary audio amplifier, AM, FM and TV tuners, speaker enclosure, record player, and power supplies that a complete system demands. In the small apartment, probably the only solution is to limit the amount of equipment and to conceal it in expensive furniture which blends with the balance of the room's furnishings. Where basement or attic space is available, however, it may be more convenient to the owner to have only the speaker, TV screen, and record player in the living room, and place the rest of the equipment in a remote location.

The audio amplifier can be remotely located by running the inputs to it through low-impedance lines. The power supply can be placed near the amplifier and controlled by wiring to the living room. The tuners present a more difficult problem, and this article describes a solution for the AM case.

Continuous tuning of the remote receiver would perhaps be the ultimate to be desired. Some sort of motor tuning and repeat back indication would be necessary, leading eventually to a selsyn system. Since there are rarely more than a few AM and FM stations in any one locality, continuous tuning is an unnecessary luxury.

Several objectives were established for the AM tuner before construction began: It should receive five stations, remotely selected by means of relays, and it should be designed primarily for selectivity, with less resulting interference than broadband operation would give. It should be a superhet to reduce relay switching problems, and finally, it should be small physically.

The Circuit

A schematic of the tuner built to meet the above objectives is shown in Fig. 3. To minimize hum problems in the detector and first audio stage, d.c. relays should be used. In addition, d.c. relays have less contact chatter than a.c. relays, and when the contacts are in the r.f. portion of the circuit, as these are, chatter cannot be tolerated. It is possible to obtain low capacity d.c. relays designed for use in r.f. circuits, and at some surplus stores, five such relays might be obtained. None was available to the author, however, so the relays shown in Fig. 2, mounted on the shelf, were used. They are small d.c. relays with a coil resistance of 10,000 ohms. Originally, the relays were double-pole, double-throw, but with a soldering iron and hack saw they were converted to double-pole, single-throw. The two contacts cut off were then bolted on the relay so that the final version was a triple-pole, single-throw unit. The three movable contacts are grounded on each relay, and the three fixed contacts are connected to the three condensers, which tune each station, by bus wire, as can be seen in Fig. 2.

The variable condensers, C_1 to C_{15}, are ceramic trimmer types having capacities of 7 to 45 $\mu\mu$fd. each. Three are used for each channel, one tuning the antenna coil, one tuning the mixer grid coil, and one tuning the oscillator coil. These coils are all standard broadcast band coils. The oscillator coil is of the tapped type for use with the 6SA7 or 6BE6 tubes. The tuning condensers are mounted on stand-offs along the top of the panel and are screwdriver adjusted through holes in the panel. Since these condensers have a maximum capacity of only 45 $\mu\mu$fd., they will tune the broadcast band only from 1600 to 1000 kc. The tuner described here receives three stations in this range. The other two stations for which it is set up are between 500 and 700 kc. and this range is covered by placing 200 $\mu\mu$fd. fixed mica condensers across the 7 to 45 $\mu\mu$fd. variables. The range between 700 and 1000 kc. can be covered by placing 100 $\mu\mu$fd. fixed micas across the ceramics. These are not shown in Fig. 3.

No r.f. amplifier tube is used, because of the oscillation troubles arising when it is attempted to tune an r.f. stage with common relays. Instead, the same coils are used as in a normal r.f. amplifier stage, but condenser C_{16} is substituted for the r.f. tube. No gain is obtained in this way, but selectivity and image rejection are improved.

Referring to Fig. 1, the antenna and mixer grid coils are in the square aluminum cans on the left. The mixer tube is just to the right of these cans. Directly below the mixer tube is the oscillator coil, housed in a round aluminum can. To the right of the mixer

is the i.f. input transformer, the i.f. amplifier tube, and the i.f. output transformer. The transformers are iron-cored, and give high gain and selectivity.

The detector circuit, involving the 12AU7 located at the lower right in Fig. 1, is somewhat unusual. The circuit was suggested by Builder[1] and uses positive feedback of the audio modulation to reduce detector distortion. The audio is taken from the detector across R_{16}, Fig. 3, and the a.v.c. voltage from the junction of R_9 and C_{26}. Listening tests indicate that this circuit works satisfactorily. No distortion measurements were made, however, and the constructor may desire to simplify this circuit by using the standard diode detector.

The final tube, V_4, is a 6AS6 dual control grid pentode located just below the i.f. input transformer in Fig. 1. Audio is fed from R_{16} in the detector circuit to one grid of V_4 in the normal manner, and the amplified audio is taken off across R_{19} and fed to the audio amplifier. The other control grid of V_4 is used to provide remote audio gain control. A d.c. voltage of from 0 to -10 volts is applied to this grid by varying a potentiometer at the speaker location. When this voltage is zero, V_4 acts as a straight-through audio amplifier and the speaker volume depends on the setting of R_{16}. As the grid voltage of V_4 is made more negative by turning the remote potentiometer, the gain of V_4 decreases until, with -10 volts, it is almost cut off, and passes very little audio signal. Thus, the audio gain is controlled remotely by a d.c. control lead which can be any reasonable length. The audio output jack is located just to the right of the i.f. output transformer in Fig. 1. The tuner audio is cabled from this jack to the audio amplifier. Other circuit details are shown in Fig. 3.

[1] Builder, Geoffrey: "The Application of Modulation-Frequency Feedback to Signal Detectors," Proceedings of the IRE, March, 1946.

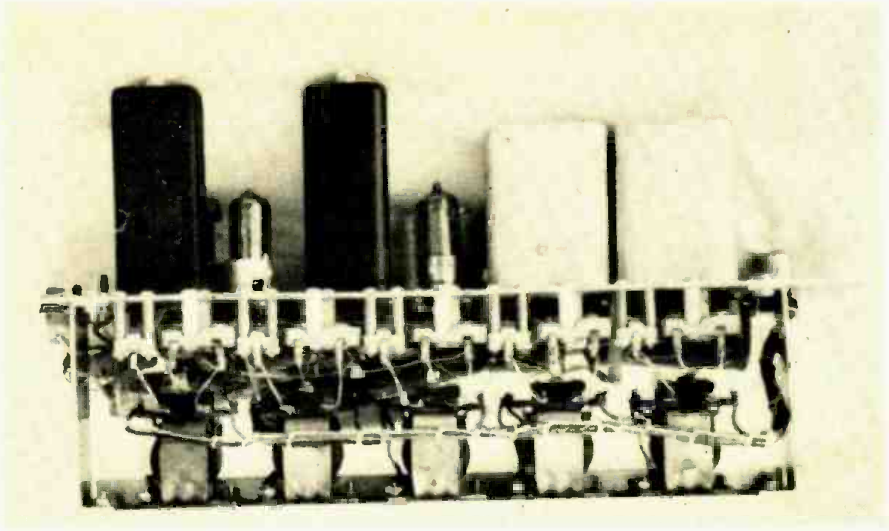
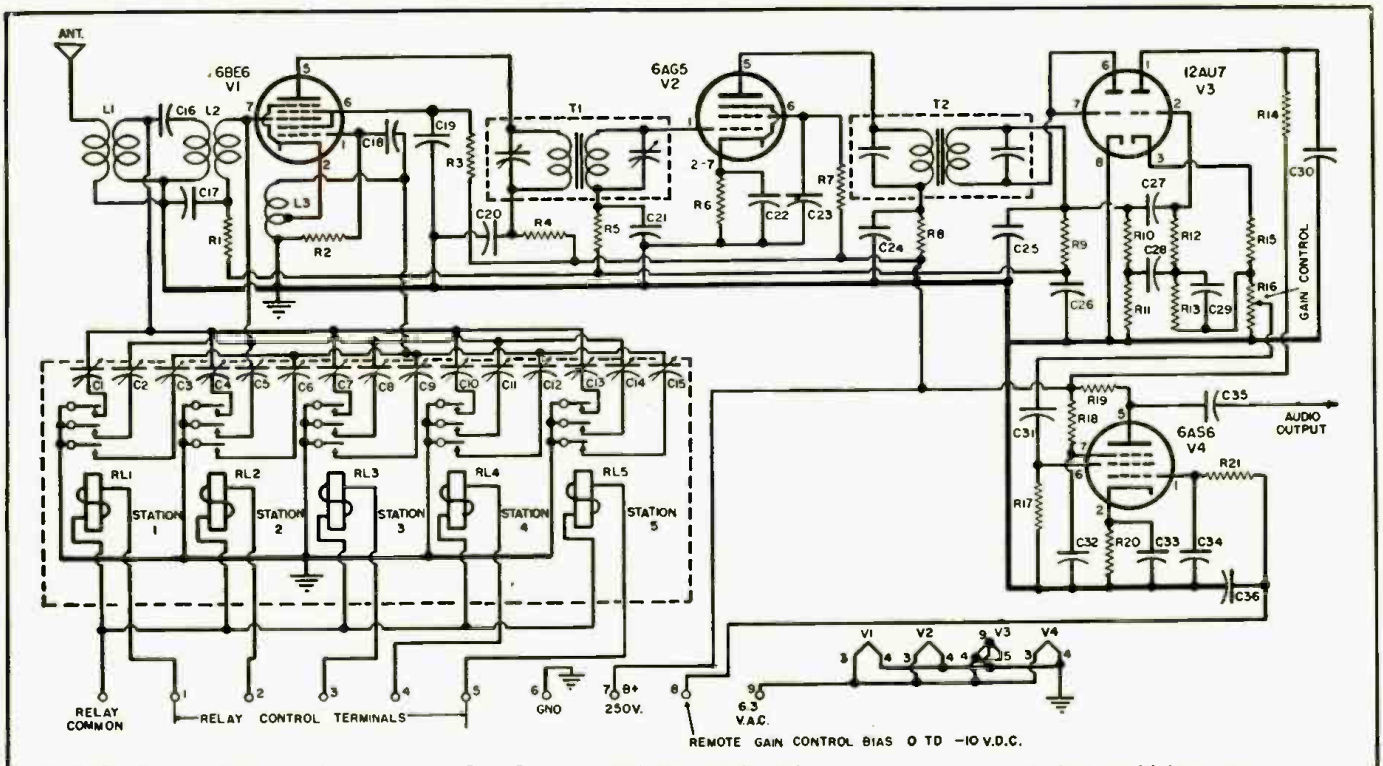


Fig. 2. Side view of AM remote tuner. Note the five station selector relays at bottom.

Control System

In Fig. 4 is shown the simplest method of controlling the tuner from a remote location. The control panel is only large enough to mount a single-deck, five-position wafer switch, an "on-off" toggle switch, and the audio gain control potentiometer. This potentiometer receives -10 volts d.c. from the power supply to vary the bias on V_4.

Fig. 3. Complete schematic diagram and parts list covering the remote control circuit and the AM tuner with which it is used.



R_1, R_5, R_{11}, R_{17}—100,000 ohm, ½ w. res.
R_2, R_{14}—22,000 ohm, ½ w. res.
R_3, R_7, R_{18}—47,000 ohm, ½ w. res.
R_4, R_6, R_{15}, R_{21}—4700 ohm, 1 w. res.
R_8, R_{20}—220 ohm, ½ w. res.
R_9—1 megohm, ½ w. res.
R_{10}, R_{12}—500,000 ohm, ½ w. res.
R_{13}—820,000 ohm, ½ w. res.
R_{16}—220,000 ohm, ½ w. res.
R_{19}—3300 ohm carbon pot.

C_1 to C_{15}—7-45 μμfd. var. ceramic cond.
C_{16}, C_{18}, C_{25}—100 μμfd. mica cond.
C_{17}, C_{23}, C_{34}—.01 μfd., 400 v. cond.
C_{19}, C_{20}, C_{22}, C_{24}, C_{26}, C_{27}, C_{28}, C_{29}, C_{31}, C_{35}—.1 μfd. 400 v. cond.
C_{21}, C_{32}—25 μfd., 450 v. elec. cond.
C_{33}, C_{36}—25 μfd., 50 v. elec. cond.
RL_1, RL_2, RL_3, RL_4, RL_5—3-pole, s.t. relay (see text)

T_1—455 kc. iron-core i.f. input trans.
T_2—455 kc. iron-core i.f. output trans.
L_1—Ant. coil, standard b.c. band unit
L_2—R.f. coil, standard b.c. band unit
L_3—Osc. coil, standard b.c. band unit
V_1—6BE6 tube
V_2—6AG5 tube
V_3—12AU7 tube
V_4—6AS6 tube

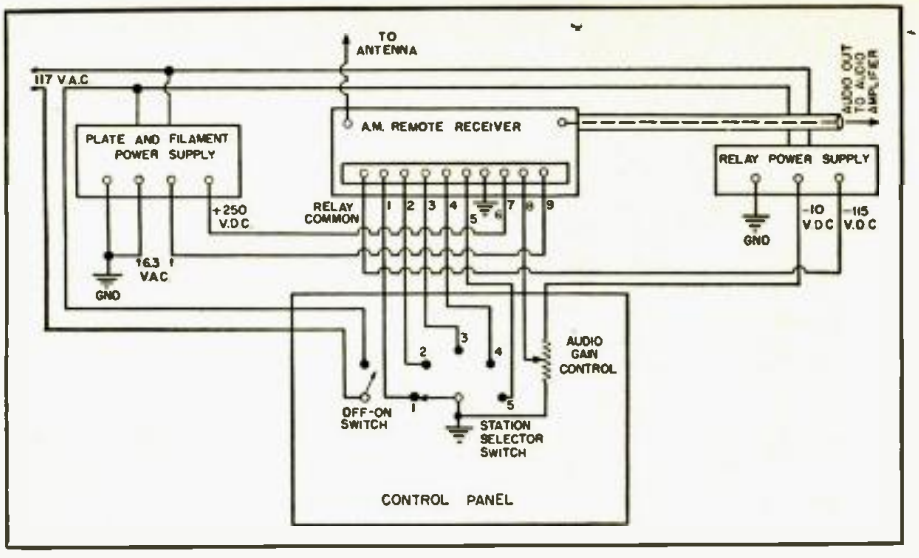


Fig. 4. Method for interconnecting the receiver, power supplies, and control panel.

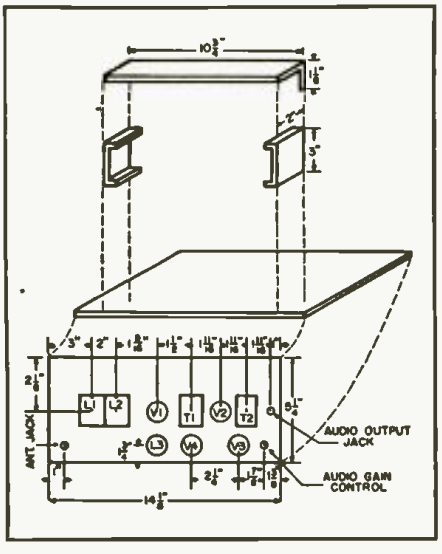


Fig. 5. Exploded view of chassis and front panel dimensions. Material is 1/16" thick.

as previously discussed. The relay power supply furnishes 117 volts d.c. to the control panel station selector wafer switch. The relays all have one terminal wired in common and connected to –117 volts d.c. The plus side of the relay power supply is grounded, and the arm on the station selector switch is also grounded. Turning this switch then places, in turn, 117 volts d.c. on the desired relay, and the desired station is selected. There are other methods of control using fewer connecting wires, such as the stepping switch system, but they are more complicated. The toggle "on-off" switch supplies 117 volts a.c. to the power supplies.

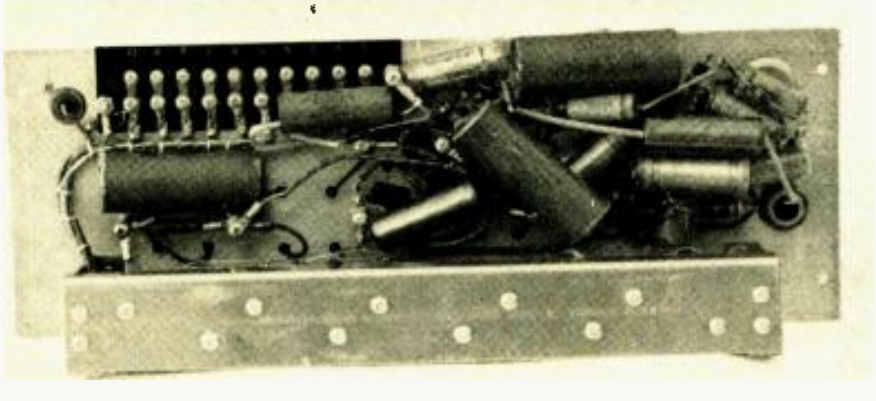
Power Supplies

The tuner plate power supply is of the conventional full wave rectifier type, and also provides the necessary a.c. filament voltages. The relay supply uses a selenium disc rectifier in a bridge circuit to provide both the relay power and the negative voltage for the remote audio gain control.

Construction

A front panel component dimension plan of the tuner and an exploded view of the four pieces making up the complete tuner chassis are shown in Fig. 5. All pieces are 1/16 inch aluminum. Steel or brass would also be suitable. The dimensions given for the front panel apply if standard 2-inch shield cans are used for the antenna and mixer grid coils and if regular 1⅜ inch square i.f. transformers are used. The brackets and relay shelf may vary in a particular construction depending on the type of relays used. The same applies to the holes drilled along the top of the front panel through which the condensers are tuned, in that the hole diameter and spacing depend on the type of variable condenser used.

Fig. 6. Rear view of the AM remote tuner chassis. Point-to-point wiring is used throughout the construction to maintain shortest possible leads.



Wiring

A rear view of the tuner is shown in Fig. 6. Point-to-point "layer" wiring was used to maintain short leads and save time in wiring. The only care exercised in wiring was to keep the bus wires connecting the variable condensers an inch or so from the other components in the circuit. No oscillation or feedback was encountered. All connecting wires were brought out to the terminal board shown in the upper left of Fig. 6. A jack was placed to the left of this board for the antenna connection.

Operation

After the tuner is wired and connected to the power supplies and the audio amplifier, it is ready for alignment. First, tune up the i.f. transformers with a signal generator. Then connect the antenna and turn the selector switch on the control panel to position 1. It would normally be desired to receive the lowest frequency broadcast station on this position, and the highest on position 5 of the switch. Tune the oscillator condenser associated with relay 1 until the desired station is heard, and then tune the antenna and mixer grid tuning condenser connected to the same relay for maximum volume and minimum interference. Then throw the station switch to operate relay number 2 and repeat this tuning process for the next higher frequency broadcast station. Continue the process for the other three stations. Now, with zero voltage on terminal 8, the remote audio gain terminal, adjust R_{16} to give the maximum desired audio volume from the speaker. The remote audio gain control will then decrease this volume to the desired level for particular listening conditions.

Conclusion

The tuner, audio amplifier, and power supplies can be rack mounted in an out-of-the-way place and the owner will then have an excellent AM radio system together with high fidelity audio, and use no more of the living room space than is occupied by the speaker, record player, and control panel. In the future, an FM tuner and possibly even a TV tuner can be added to the same rack, while still having only the speaker, record player, and TV screen in the living room. In addition to the space saved in the living room, the author finds that such a remote control system is a source of fascination to most guests and a source of pride to the owner.

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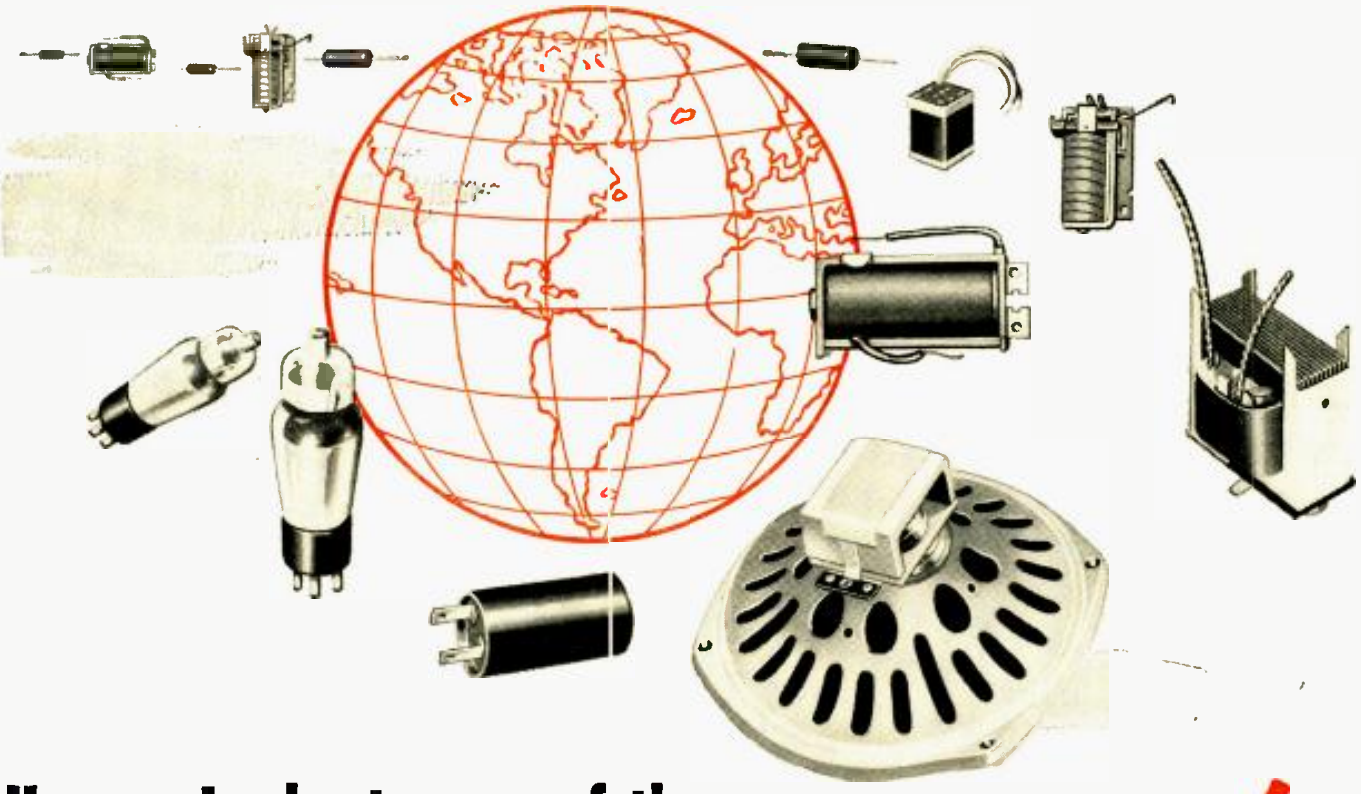

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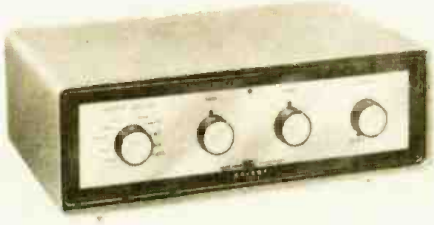
equalization. Other controls include separate bass and treble tone controls and "on-off-volume."

The metal case housing is styled in French gray and ebony black and



measures 4" high, 13" wide, and 8" deep. The kit comes complete with case, all parts, wire, solder, tubes, and "step-and-check" assembly instructions.

CROSSOVER NETWORK

The Electronics Division of *Van Norman Industries, Inc.*, 186 Granite St., Manchester, N. H. has developed and is marketing a new crossover which is designed to be used with separate bass and treble amplifiers in a hi-fi system. The Model XO-1000 divides the frequency spectrum to eliminate noise and hum.

The crossover point is at 800 cps, dividing the spectrum into two regions most compatible with the characteristics of modern electromagnetic and electrostatic speakers.

The "Vantron" crossover is tubeless, simple to install and to use. The outputs are connected directly to the

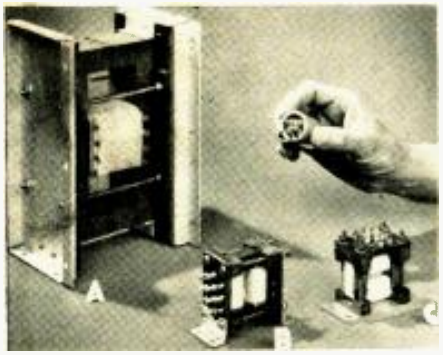
(*Continued on page* 126)

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.

TRANSFORMER LINE

Utilizing new design techniques based on ferrite magnetic cores and tetrafluoroethylene insulation, *Sierra Electronic Corporation* of 813 Brittan Avenue, San Carlos, California has re-



cently introduced a line of transformers for specialized applications.

The line, which includes grid-driving transformers, push-pull output transformers, line-balancing transformers, etc., is designed to be used in cases where r.f. circuitry requires impedance matching over a wide impedance and/or frequency range or where r.f. or audio applications require electrostatic shielding between windings, extremely high voltages, or especially small dimensions.

Complete data on the line is now available from the company.

FISHER AMPLIFIER

The *Fisher Radio Corporation*, 41 East 47th Street, New York, N. Y., is currently marketing a new amplifier which has been designated as the Model 50-A.

The new unit features a high output with less than .5% harmonic distortion at 40 watts (.05% at 5 watts; .08% at 10 watts; and .25% at 40

watts). Frequency response is uniform within ± .1 db from 20 to 20,000 cycles and within 1 db from 5 to 100,000 cycles. The power output is constant within 1 db at 40 watts, 15 to 50,000 cycles. Hum and noise are better than 92 db below full output. Internal impedance is .53 ohm at the 16 ohm tap, producing a damping factor of 31. Efficiency is said to be in excess of 55% at full output compared to the 25% to 30% of typical class A circuits.

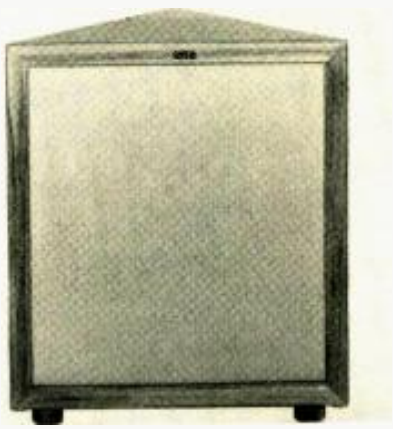
The amplifier has nine tubes. A jack is provided in the output tube circuit to measure the plate current. There is also a separate and accessible bias control to adjust the plate current on the output tubes.

The chassis is constructed of 16 gauge steel and includes a bottom plate. The unit measures 8"x14½"x9".

"SUPER HORN"

Gately Development Laboratory, P.O. Box No. 2, Clifton Heights, Pa. has recently announced a new speaker enclosure, the "Super Horn."

The new line of enclosures features a non-resonant speaker baffle for the



accurate reproduction of both high and low frequencies. Cabinets incorporating the "Super Horn" principle are available for direct radiating 12- and 15-inch speakers in either blonde or mahogany finishes.

A data sheet which provides full details on this enclosure line is available upon request.

FREQUENCY METER

Lampkin Laboratories, Inc. of Bradenton, Florida, is currently introducing a new micrometer frequency meter, the Type 105-B.

The new instrument measures center frequency deviation on any number of FM or AM transmitters, throughout a continuous range of frequencies from .1 mc. to 175 mc.

A stage of audio amplification and a function selector switch provide greatly increased sensitivity when measuring the frequency of v.h.f. transmitters; higher output for feeding into v.h.f. receivers for alignment purposes; and a strong headphone signal when calibrating against the internal crystal standard, permitting settings to better than 1 part in a million.

A data sheet giving complete specifications on the Type 105-B is now available on request.

REGULATED SUPPLY

A continuously variable 0-325 volt electronically regulated d.c. power supply has been developed by the *Perkin*

Engineering Corporation of 345 Kansas Street, El Segundo, California.

The new unit, the Model M30, has a d.c. current rating of 150 ma. and is also equipped with a low-voltage a.c. output of 6.3 volts at 6 amps.

Voltage regulation is within ½% for voltages between 30 and 325 volts from no-load to full-load and the ripple is less than 2 mv. The unit has two 3" rectangular meters and is housed in a blue-gray wrinkle cabinet.

R.F. CHOKES

A regular production line of miniature r.f. chokes has been announced by *Condor Radio Mfg. Co.*, 116 N. Montezuma Street, Prescott, Arizona.

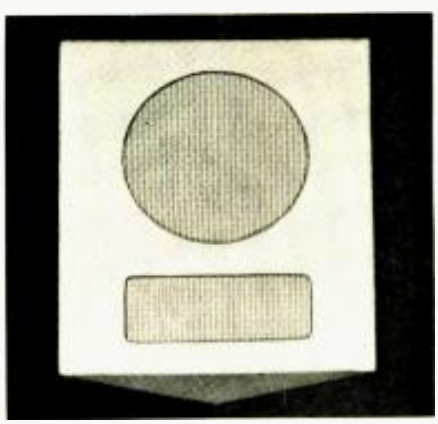
Believed to be the smallest standard-catalogue chokes on the market, they range in inductance from .25 to 100 microhenrys. They are labeled and insulated for 500 volts.

The company will supply any additional details that are required.

SPEAKER BAFFLE

A new bass-reflex speaker baffle for corner mounting is the latest unit to be added to the *Argos Products Co.* line of enclosures.

Available in either mahogany or blonde leatherette, the new baffle fea-



tures ⅜" wood sides and back plus ½" cellufoam acoustic lining to assure resonant tone.

(*Continued on page* 108)

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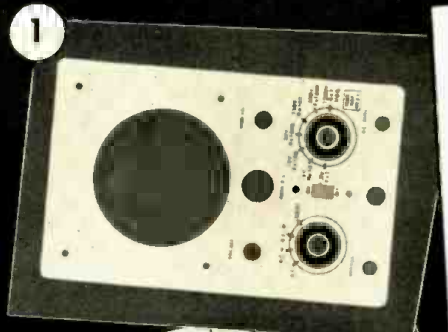

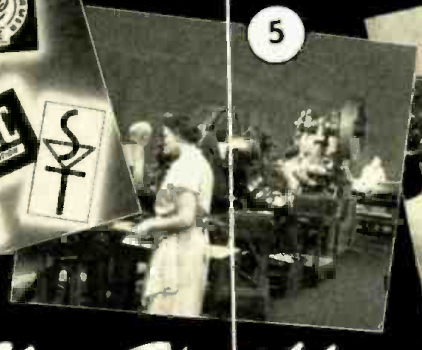

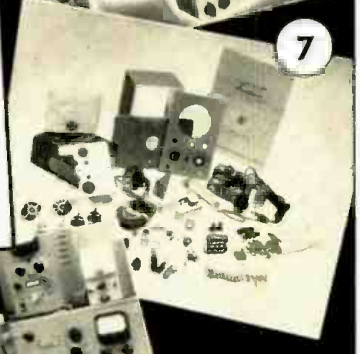

✔ **1. Baked Enamel Lifetime Finish Panels** — Oven baked finishes for maximum durability and freedom from mars, scratches and discoloration. Panels that can really take service shop and laboratory abuse.

✔ **2. Save Money** — You save all expensive factory wiring costs when you build your own. And, direct factory to customer sales eliminate all middle man profits. You can have a complete Heathkit laboratory or service shop for what one or two pieces of ready built equipment cost.

✔ **3. Modern Styling** — New "fitted panels" and formed cabinets with rounded corners present a smart, professional appearance. Dignified appearance for prestige.

✔ **4. Quality Components Used Throughout** — Heathkits use well known, time and quality tested components such as Simpson, Chicago Transformer, Wilkor, Allen-Bradley, Altec-Lansing, Centralab, Cinch, Oak, Grigsby-Allison, Mallory and many others.

✔ **5. Extensive Factory Facilities** — Shearing, punching, forming, spot welding, etc. is done right in our own plant — controlled production for highest quality and less cost to you.

✔ **6. Extensive and careful engineering** — A staff of engineers working in a modern, well equipped laboratory carefully develop Heathkits according to highest engineering practices. Your assurance of accurate, up to the minute instruments.

✔ **7. Complete Kits** — All the parts are right in the kit — you get all tubes, controls, transformers, meters — everything — no other components to buy. And no cutting, punching, or painting necessary — it's all done for you. Heathkits go together easily and smoothly.

✔ **8. Only Complete Line** — Over 30 kits available — Heathkits form the only complete line of kit-form test equipment on the market. Kits for hams, engineers, service men, schools and audio enthusiasts.

✔ **9. Detailed, Complete Instruction Manuals** — Comprehensive manuals tell you exactly how to build your Heathkit. Manuals contain easy-to-follow instructions, clear, large pictorials, schematic, detail drawings, etc. They make construction easy, fun, and educational.

Nine New Heathkits This Year!

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CABLE ARLAB, N.Y.

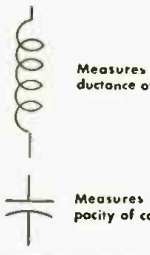
The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* "Q" METER KIT

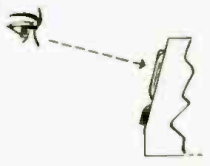
• A HIGH QUALITY Q METER AT LOW COST.

MODEL QM-1
SHIPPING WT. 12 LBS.
$39.50



Measures Q and inductance of coils.

Measures Q and capacity of capacitors.



Slant face cabinet for ease in reading the meter.

- First Q METER within the price range of all.
- Read Q's of 0-500 directly on calibrated scale.
- Stable oscillator supplies R.F. frequencies of 150 kc to 18 megacycles.
- Calibrated capacitor with range of 40 mmf to 450 mmf with vernier of ±3 mmf.
- Simple, easy operation.
- 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.

MODEL DC-1
SHIPPING WT. 4 LBS.
$16.50

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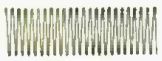
. . . BENTON HARBOR 15, MICHIGAN

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 stylec 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.

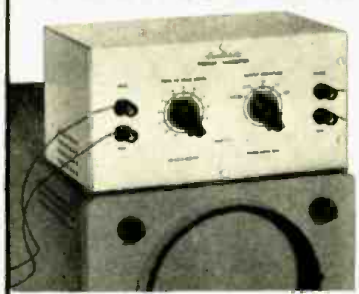
INTENSIFIER KIT: For extreme trace brilliance in special applications such as photography, group demonstrations or operation in brightly lighted areas an optional Intensifier kit providing 2200 volt operation of the CR tube is available. Kit includes high voltage filter condenser, high voltage selenium 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
SHIP WT. 1 LB.
$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.
$19.50

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. . . BENTON HARBOR 15, MICHIGAN

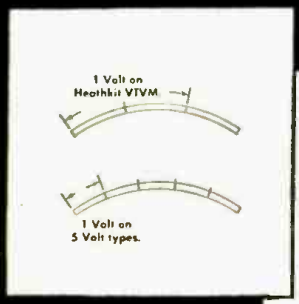
Heathkit VACUUM TUBE VOLTMETER KIT

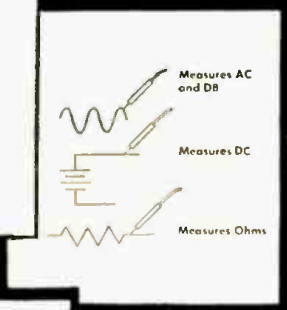
• NEW 1½ VOLT RANGE ON 1953 VTVM.

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 meg-ohm 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. 33B

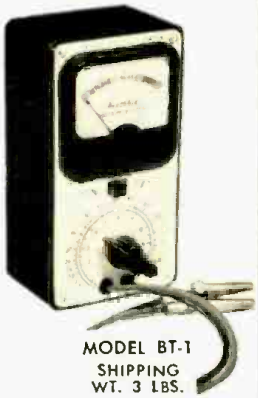
Reads on DC scale of any 11 megohm VTVM 5 kc to 5 megacycle range.

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.



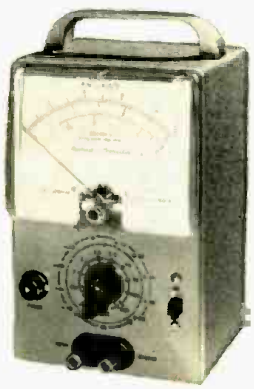
MODEL BT-1

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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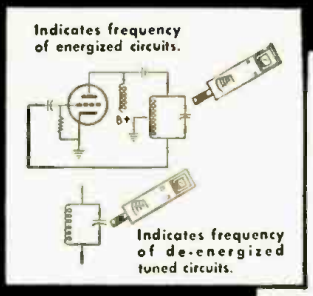
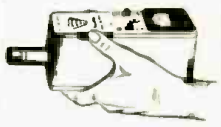
The HEATH COMPANY

. . . 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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. . . BENTON HARBOR 15, MICHIGAN

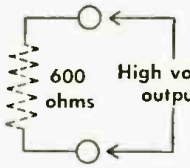
NEW *Heathkit* AUDIO GENERATOR KIT

• 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.

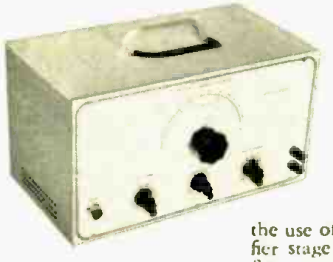
Heathkit AUDIO FREQUENCY METER KIT

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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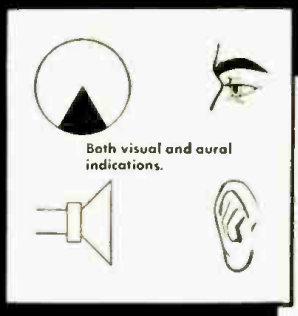
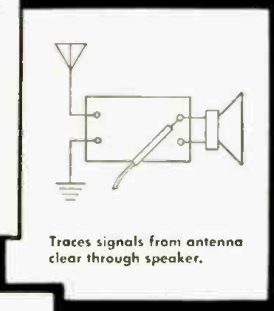
The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

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

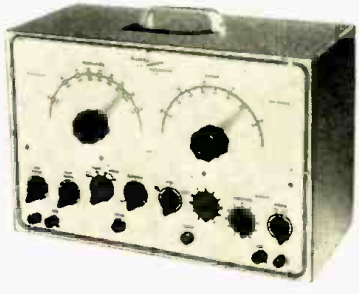
Announcing the new improved Model C-3 HEATHKIT CONDENSER housed in a new smartly styled professional appearing cabinet featuring rounded corners and snug fitting drawn panel. Adequate provisions for ventilation insures longer instrument life through cooler operation. Use the C-3 to accurately measure 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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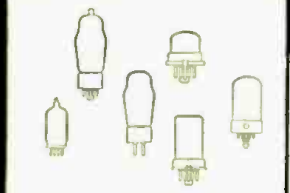
Heathkit TUBE CHECKER KIT

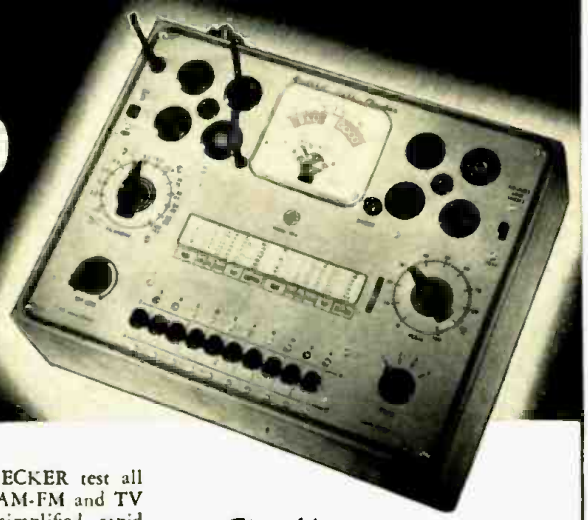


Checks 7, 8, 9 prong tubes, octals, loctals, 7 and 9 prong miniatures, 5 prong Hytrons, pilot lights.

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.

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 monirored 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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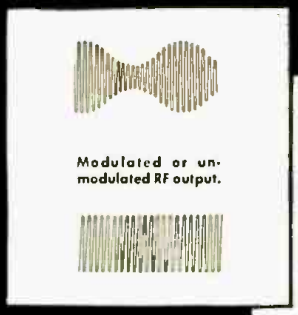
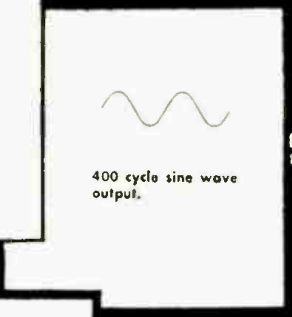
Heathkit SIGNAL GENERATOR KIT



Modulated or unmodulated RF output.



400 cycle sine wave output.

MODEL SG-7

SHIPPING WT. 7 LBS.

$19.50

- Step attenuated RF ouput.
- 6 to 1 vernier dial ratio.
- Turret mounted coil sub-assembly.
- 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.

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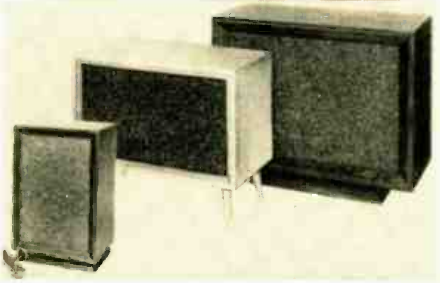
woofer and tweeter main amplifiers, the input to the preamplifier. Simple adjustment of the bass and treble controls can then be made to achieve aural balance.

For complete specifications, write the manufacturer direct.

NEW NORELCO SPEAKERS

North American Philips Company, Inc. 230 Duffy Ave., Hicksville, N. Y. has a new line of enclosures on the market that feature a removable base which permits the cabinets to be placed horizontally or vertically to fit in with any room arrangement or decor.

While primarily designed for use with the firm's speakers, the FRS enclosures work equally well with most other speakers. The enclosures are of the



ducted-port type and each model is decorator styled in a choice of walnut, blonde, or mahogany. All cabinets are lined with sound absorptive materials for correct damping.

The Models FRS I and FRS III come with a removable base while the Model FRS II is supplied with legs. The Model I is designed to handle 12" speakers while the Model II comes with an insert baffle for 8" speakers and will handle both 8" and 12" units.

Further information on any or all of these enclosures is available from the High Fidelity Products Division of the company.

"POW-R-CHECK" METER

The Electronics Division of *Van Norman Industries, Inc.,* 186 Granite St., Manchester, N. H. is now offering a power output meter designed especially for the hi-fi enthusiast.

The "Vantron" Model PC-1000 monitors power output while reproducing music or speech on a precision logarithmic scale which makes 1/10th watt as readable as a 10-watt indication. It incorporates an accurate db scale suitable for use with a standard tone-modulated phonograph record to check such intrinsic sound values as treble and bass control positions, flat over-all operation, loudness-control frequency response, relative speaker system efficiency, and response of the phono cartridge.

TAPE CONVERSION KITS

The Nortronics Co., Inc., 1011 S. Sixth St., Minneapolis 4, Minn. has announced the availability of two new stereo kits for the conversion of existing tape recorders to stereo.

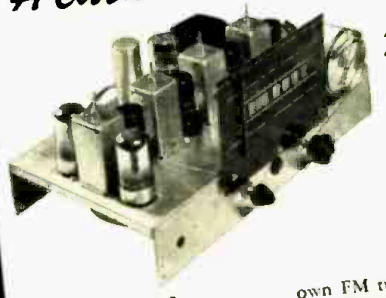
The Model SK-100 allows reproduction of standard half-track, 2-channel stereo tapes on present tape recorders

Heathkit WILLIAMSON TYPE AMPLIFIER KIT

The HEATHKIT WILLIAMSON TYPE AMPLIFIER performance has been verified on the basis of critical listening tests and laboratory measurements by both music lovers and audio experts. Use this outstanding amplifier as the heart of your audio system for the fine musical reproduction that is the goal of every audio enthusiast. A new Peerless output transformer with additional primary taps permits ultra linear type circuitry, affording a peak power output of well over 20 watts. Quality of reproduction is instantly apparent and measurements actually bear out the superb performance. Frequency response ± 1DB from 10 cycles to 100 kc allows reproduction of the highs and lows with equal crispness and clarity. Harmonic and intermodulation distortion both less than ½ of 1% at 5 watts eliminate the harsh unpleasant qualities which contribute to listening fatigue.

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.

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

WA-A1 Amplifier kit — Combination 1 — (Main amplifier and Power Supply) complete with WA-P1 Preamplifier kit.
Total Shipping Weight 39 lbs. (Shipped Express only) **$69.50**

WA-A1 Amplifier kit only — Combination 4 — (Main Amplifier and Power Supply). Less WA-P1 Preamplifier.
Total Shipping Weight 29 lbs. (Shipped Express only) Price **$49.75**

WA-P1 Preamplifier kit only. (less power supply) Tubes included.
Total Shipping Weight 7 lbs. (Shipped Exp. or P.P.) Price **$19.75**

PLEASE BE SURE TO STATE COMBINATION NUMBER WHEN ORDERING.

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**

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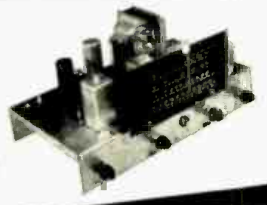
Heathkit SUPERHETERODYNE RECEIVER KITS

- 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

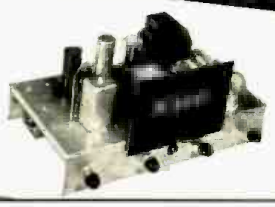
$23.50



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 the Express Agency at the time of delivery.

ORDERS FROM CANADA must include full remittance for merchandise.

Orders processed on the same day received. Customers notified in event 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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ORDER BLANK

From _____

_____

_____

SHIP VIA
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- ☐ Express
- ☐ Freight
- ☐ Best Way

Enclosed find ☐ Check ☐ Money Order for _____ *Please ship C.O.D. ☐ Postage enclosed for _____ lbs.

	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			**WA-A1 Amplifier Kit**—Comb. 1 (Incl. main amplifier, power supply and WA-P1 preamplifier) (39 lbs.) Shipped express only	69.50	
	Heathkit Vibrator Tester Kit—Model VT-1 (7 lbs.)	14.50					
	Heathkit Audio Generator Kit—Model AG-8 (16 lbs.)	29.50			**WA-A1 Amplifier Kit**—Comb. 4 (Main amp. and power supply) (29 lbs.) Shipped express only.	49.75	
	Heathkit Audio Oscillator Kit—Model AO-1 (14 lbs.)	24.50					
	Heathkit Audio Frequency Meter Kit—Model AF-1 (15 lbs.)	34.50			**WA-P1 Preamplifier Kit** (7 lbs.) (Shipped exp. or p.p.)	19.75	

Within the Industry

(*Continued from page 28*)

tennas and accessories . . . **ZENITH RADIO CORPORATION** has opened a new manufacturing plant at 1500 North Kostner Avenue in Chicago. The new factory will be used to produce speakers, coils, transformers, and other radio-television components in addition to hearing aids and government defense materials . . . **FURST ELECTRONICS** has moved its plant and general offices to new and larger quarters at 3322 West Lawrence Avenue, Chicago 25, Illinois . . . The rectifier division of **SARKES TARZIAN, INC.** has added approximately 3000 square feet to its present facilities for research and engineering work . . . **RMS** has acquired a new plant at 2016 Bronxdale Avenue, New York 60, New York which will provide approximately 45,000 square feet of space for the firm's production of electronic products. The antenna division will remain at West Farms Road in the Bronx and the company's former plant building and general offices will be retained as a warehouse . . . **RAYTHEON MANUFACTURING COMPANY** recently dedicated a new building on Seyon Street in Waltham, Mass. The plant, which will be used by the research division in carrying on a major portion of the company's transistor program, will also be utilized for engineering and manufacturing activities by the company's equipment divisions.

* * *

ROBERT A. PENFIELD is the new advertising manager for the radio and television picture tube division, electronics, parts, and tungsten and chemical divisions of *Sylvania Electric Products Inc.*

He joined the company in March, 1947, as editor of *"Sylvania News."* In July, 1951, he was named advertising supervisor of the company's tube divisions in New York.

Mr. Penfield is the chairman of the Exhibitors' Advisory Committee for the 1953 annual convention of the Institute of Radio Engineers which will be held in New York City.

* * *

RAYTHEON MANUFACTURING COMPANY has set up a new international division to handle its rapidly-expanding foreign business. Ray C. Ellis will head the new organization . . . **THE GABRIEL COMPANY** has established a new division, **THE GABRIEL LABORATORIES,** which will serve as the research and development center for all of the company's divisions . . . A new firm of manufacturers representatives and sales consultants specializing in electronic accounts has been organized under the name of **ADOLPH L. GROSS ASSOCIATES, INC.** Principals in the firm are Adolph L. Gross and Robert Hertzberg. Offices are at 45 West 45th Street, New York 36, New York . . . **TENNA-TRAILER COMPANY** has undergone complete reorganization of both personnel and production facilities. The factory and offices have been moved to Pontiac, Illinois. Kenneth B. Price is now the sole owner and president of the firm . . . **FAIRCHILD CAMERA AND INSTRUMENT CORPORATION** has set up a new division which will be devoted to the development and manufacture of precision potentiometers.

* * *

MACDONALD GOODWIN has been appointed sales manager of government and export sales for the *Bogue Electric Manufacturing Company* of Paterson, New Jersey.

He will also serve as manager of the company's Washington office. Prior to joining *Bogue,* Mr. Goodwin was the Washington representative for the *Bendix Radio Division* and has also been associated with the *Arnold Company* of Richmond, Va. and the *Link Radio Corporation.* From 1946 to 1949 he was vice-president and general sales manager of *Continental Electric Company.*

Mr. Goodwin will maintain offices at 2430 Pennsylvania Avenue, N.W. in Washington. —30—

NEW G-E DYNAMIC ANALYZER HELPS SOLVE YOUR TOUGHEST TV SERVICE PROBLEMS

★ When 20 crack service teams hit the road this month from Electronics Park, General Electric television headquarters, they'll be packing profit information for you. Be sure to take advantage of their clinics scheduled for your area.

Equipped with the new Dynamic Analyzer, these technicians will demonstrate quick, simple ways to diagnose TV troubles and correct them. They will answer your questions on circuits, picture tubes, components, replacement parts. Attendance at these clinics will prepare you for profitable follow-up on service requirements this fall and next year.

Get in touch with the TV service manager at your G-E distributor now. Tell him to sign you up for the first clinic that hits town. It'll be worth your while!

You can put your confidence in—

GENERAL ELECTRIC

GET THESE SERVICE NOTES—

FREE

● Just printed—this 30-page illustrated bulletin lists complete RF and IF alignment details, circuit analyses, trouble shooting, replacement parts list—for latest G-E Stratopower receivers. Mail coupon below for your copy.

General Electric Company, Section 992
Electronics Park, Syracuse, New York

Rush my copy of your new Stratopower Chassis service notes.

NAME.....

TITLE or COMPANY.....

ADDRESS.....

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

Large Screen TV

(Continued from page 42)

most schematic diagrams but changes in part values and construction have been necessary.

Centering

Raster positioning in electrostatic focus tubes is readily accomplished by a permanent magnetic device located directly behind the yoke. Two ring magnets, which can be rotated independently, are used. By lining up the two magnets, maximum displacement is obtained. When the magnets are positioned 180 degrees apart, their fields cancel and minimum displacement results.

Focus

For tubes using standard electromagnetic focusing the circuits are essentially the same as those for 16" and 17" tubes.

Three types of electrostatic focus tubes are being used. These are classified by the voltage applied to the focusing electrode.

The first of these tubes is the high voltage electrostatic focus type which requires, on the focusing electrode, a voltage of about one-fifth the second anode high voltage. A separate rectifier is usually incorporated and operated in the same manner as the high-voltage rectifier. A separate filament winding is added to the flyback transformer and the pulse at the plate of the horizontal amplifier becomes the plate supply. A voltage divider, including a focus pot., is added to the filtered output. See Fig. 2.

The second type tube uses low voltage electrostatic focus and does not require any special source. Usually a high resistance pot. is connected to the boost supply. In both the high and low voltage electrostatic type tubes the focus adjustment is not critical since it is very broad in its action.

The third and newest type to be developed is the automatic electrostatic focus type tube. The focus element is connected internally to the first anode or the cathode through a resistor.

Irrespective of their gun structures, these large tubes require the usual ion trap. The "distributed winding" or "cosine" type yoke is required to give full deflection with good focus over the entire screen.

Fig. 1 is a simplified circuit of part of an *RCA* 21" chassis. The horizontal coils of the yoke are in series with part of the high voltage transformer primary and, in the main part, constitute the plate "load" for the 6CD6 horizontal amplifier tube. This arrangement is known as "direct drive." The yoke impedance is high when compared with present types.

The parallel damper tubes are required for the peak current which is present when the tubes are conducting. The 1.5 microhenry chokes in the plate circuits are Barkhausen oscillation suppressors and are mounted at the plate terminal of each tube socket. (Other sets may use a single suppressor choke common to both tubes.) The usual parasitic suppressor resistor at the 6CD6 plate has been replaced by a small choke which serves the same purpose but is probably more effective.

The width control, connected across the entire horizontal section of the yoke, operates in the same manner as in conventional circuits of the past in that it absorbs energy from the circuit to reduce the scanning current in the horizontal coils.

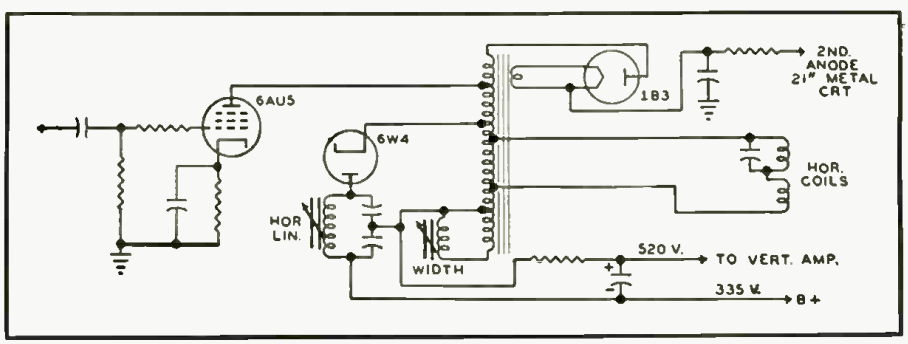
While two linearity controls are shown, later models do not have the resistive control parallel to the yoke winding. Basically, this control changes the circuit impedance and hence the waveform of the sweep current. It has been found that adequate control of the linearity can be obtained with the regular linearity control in series with the dampers.

The 33 $\mu\mu$fd. condenser in parallel with part of the high voltage transformer "tunes" the transformer and increases the picture width. By controlling the flyback time the high voltage pulse is reduced. With reduced high voltage there will be greater deflection of the scanning beam.

The 1000 megohm resistor from the 1B3 filament to the chassis allows the high voltage condenser to discharge when the set is turned off. This keeps the spot from lingering on the picture tube which, in time, can cause an ion burn. In addition, the metal cone of the picture tube ceases to be "hot" and a hazard to the technician.

Fig. 2 is a partial schematic of a late-model *Zenith* chassis. The circuits are approximately the same as previous models except that the voltage present at the plate of the horizontal amplifier is rectified and the fil-

Fig. 3. High-voltage schematic of the Hallicrafters Model 21393 21-inch receiver.



tered output is available for use at the focusing electrode.

Fig. 3 is a circuit diagram of the latest *Hallicrafters'* horizontal sweep circuit. The various components are connected to taps on the transformer primary winding rather than to a secondary winding. Other than this, the circuit closely resembles those found in the smaller screen receivers.

New CR Tubes

New tubes for the larger screen receivers include the 20CP4, 20DP4, 21AP4, 21EP4, 22AP4, and 24AP4 for conventional magnetic focus applications; the 17FP4, 17GP4, 20FP4, 20GP4 for high voltage electrostatic focus receivers; 17HP4, 17TP4, 20HP4, 24BP4, and 27QP4 for low voltage electrostatic focus sets; and 16ACP4, 17KP4, 17RP4, 17SP4, 20JP4, 21KP4, and 21LP4 for the automatic electrostatic focus receivers. —30—

INTERNATIONAL TV

A WEEK-LONG series of television programs from Paris has been seen by British viewers by means of an international hookup between Paris and London.

Transmitted by means of microwave links at 5 points in France and two towers between the British coast and London, the programs included Paris street scenes and coverage of traditional Bastille Day ceremonies.

The problem of converting from the French 819-line system to the British 405-line image was solved by means of a special BBC converter. —30—

ECONOMICAL CORDS

By ARTHUR TRAUFFER

A FOUR-FT. length of ordinary POSJ electric lamp cord retrieved from the scrap box will provide a satisfactory cord for that surplus single earphone unit, as shown in the photo. Various single earphone units are available at bargain prices; some have cords and some do not, and for experimental purposes or children's crystal sets a piece of scrap POSJ is entirely satisfactory.

Solder a pair of phone tips to one end of the cord, and solder a pair of tips, soldering lugs, or spade lugs on the other end, depending on the type of phone unit. For small phone units, such as shown in the photo, it's better to use small lightweight soft rubber-covered POSJ such as made for small table lamps, as these cords are more flexible. —30—

Make a pair of lightweight headphone cords.

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 6HK7 or 6HQ7 and a 6J6. Scoop price, $19.95 ea.

THE ORIGINAL STANDARD COIL TV TUNER $12.95 ANOTHER McGEE SCOOP

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 3⅛" length insulated shaft. Used on Emerson Model 650D, 655, etc. Filaments connected in series for 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 3", 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, $9c extra.

GENERAL INST. T.V. TUNER $7.95

This popular General Instrument TV tuner has been used on thousands of late model TV sets. It has built-in fine tuning and 12 channel selector control. This tuner differs from other tuners in that it is built around a tuning condenser instead of a coil switching arrangement. A convertor coil is not mounted on this tuner. Priced complete with 3—6J6 tubes. Shipping wt., 3 lbs. Stock No. GI-WT3, with tubes. Net price, $7.95. Specify shaft length desired, either 1¾" or 7".

$2.95 SPECIAL. GI-312, same as above GI Tuner only less tubes and in repairable condition. 1¾" and 7" shafts available.

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-in convertor coil, built in fine frequency control. Sarkes-Tarzian TV tuner, with 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".

WIRED VIDEO I.F. STRIP $3.95

This wired video I.F. strip is a perfect replacement for several model Crosley TV sets, such as Model No. 11-442MU, 11-446MU and many others. Offered at less than the factory production cost. 5 tubes are required. 2 6AU6, 1st and 2nd video, 6AL5 video detector and either 2 6AG5 or 2 6BC5 3rd and 4th video, 1st I.F. 22.9 mc, 2nd 26.55 mc, 3rd, 22.2 mc, 4th 23 mc. This strip has dozens of resistors, ceramic capacitors and slug tuned I.F. coils. Ideal for set builders, or perfect to rob parts from for TV servicing. Stock No. CR-51F. $3.95 each. Kit of 5 tubes for this I.F. strip, $3.50 extra.

SARKES-TARZIAN—SPEC. $2.95

Type 4, Sarkes-Tarzian 12 channel TV tuner. Requires 2 6AG5 or 2 6BC5 and a 12AT7. Has ¼" diameter shaft, 2¾" long. Screwdriver slot fine tuning adjustment. It differs from other tuners in that it has no concentric fine tuning shaft over the channel selector shaft. Very fine for experimental use, building field strength meters, etc. Sarkes-Tarzian Type 4, TV tuner less tubes, $2.95. Set of 3 tubes for this tuner, $1.80 extra.

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 horizoutal 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.

MEISSNER TV TUNER WITH 3-6J6 $5.95

Meissner 12-channel television tuner. Ready wired and with 3—6J6 tubes. A 12-channel rotary switch type with separate coils for each channel. Built-in fine frequency control. Ideal for builders, experimenters. Stock No. 13-7624. Sale price, $5.95 each, with tubes.

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° 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 6½x4⅞x4¾" 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 4½x6¼x4½". 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.

SALE OF 14-17-20-INCH CONVERSION

20-INCH CONVERSION KIT $37.95

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-MP4. Net price, $37.95.

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 $29.95

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-MP4. Net price, $29.95.

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 30", 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 ¾" 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, 5½x9¾x8". Receives broadcast 550 to 1650 KC. A conventional 2-gang superhet circuit with 456 KC iron core IF's. Incorporates the new super gain stick loop antenna. All plated chassis. Lab. approved circuit—matched parts. Price includes all parts, tubes, diagram, Alnico V PM speaker. A factory quality kit. Stock No. PN-4T, shipping weight 7 lbs. The complete kit, less batteries, $15.95. 67½V. B, $1.59; 1½V. A, 39c extra.

Build Your Own Phono-Mike Broadcaster $7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio, within your home, (about 75 feet) from 1000 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes. Kit Model DE-6R. Net price, $7.95. DE-6RWT, wired and tested. Net price, $9.95. Crystal mike and desk stand, $4.95 extra. Concealed microphone unit, only 1" in diameter and ¼" thick. Specify hidden mike when ordering. Stock No. T-001. Net, $3.95 extra.

8-Tube Hi-Fi Amplifier Kit $29.95

A complete kit, including tubes: 3-7E5, 2-7F7, 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 and tapped 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-10H, 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. Output matches 3 to 8 ohm voice coil speakers. Inputs for G.E. variable reluctance or crystal phono pickup and crystal mike. Heavy duty power transformer. Model BK-R10 kit less speaker, shipping weight 18 lbs. Net $29.95.

17, 20" T.V. Kit $59.95 Less Tubes

A complete kit of parts to build an AC transformer operated television chassis for use with a 16", 17" or 20" rectangular picture tube. The 12 channel Sarkes-Tarzian tuner is ready wired, as is the 4 tube video IF strip. Circuit is of the conventional design. Do not buy this unless you understand Television. It is difficult to wire. We furnish schematic. Kit model WH-20. Ship. wt. 40 lbs. less all tubes. Net $59.95.

Kit of 22 tubes, less picture tube $16.95. 17" 17HP4A, $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 instruction manual. Factory quality, cabinet size 13"x6¾"x8¼". 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 a 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-20/20, TM-16 or 7X5 amplifier kits. Chassis size, 9½x4x4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, $12.95.

AMPLIFIERS—CHANGERS—FM-AM CHASSIS ON SALE 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 5V4GT 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 (C-11Y and VM-050 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-11Y, **$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.**

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 fidelity 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 3". Stock No. PR-2X, with tubes 7F7 and 7N7. Net price **$12.95** ea.

25-WATT HORN 25-Watt Driver and 31½-foot air column re-entrant Trumpet. The standard type trumpet and driver you see the most. Drivers are 100% weatherproof, horn is sprayed aluminum, offered to you at a considerable savings. Stock No. MA-33. Shipping weight 20 lbs. Net price **$28.95.**

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 15" 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, $24.95
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 5 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 **$24.95; 2 for $47.95.**

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 ohms 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", 14½ oz. Alnico V magnet PM speaker, 8 ohm voice coil. Will take 25 watt audio. You save dollars on this speaker. Just 100 to sell. Shipping weight 8 lbs. Stock No. P-12P. Sale price **$15.95; 2 for $30.00.**

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 Fitt-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, 12¾x13". Shipping weight 12 lbs. VM-406. Net price **$22.95.**

TERRIFIC COMBINATION CABINET SALE

39.95

Modern design walnut combination Radio-Phono cabinet. Size, 32" wide, 35½" high and 20" deep. Offered to you at less than it cost the large Radio-TV factory that it was made for. Upper left door swings down to open changer compartment. 14½"x13⅜" high. Changer pull-out hardware is included. Radio compartment 14½"x15" high, has blank panel and hinged door. Record storage compartment is 14½"x14" high. Baffle will take a 12" speaker. Polished mahogany finish with brass hardware and matching grill cloth. Stock No. A-320, shipping weight 240 lbs. Net price, **$39.95.** 12" coaxial PM speaker, **$12.95,** extra, when purchased with cabinet.

CAPEHART CABINET FOR 1000 SET—ONLY $99.95

99.95

EITHER WALNUT OR MAHOGANY

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 up. Cabinet cost 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 stand chassis vertically. Changer compartment is 14" high by 26½" wide. Large enough to hold any record changer or recorder mechanism. Front 10" 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.

25-WATT 6-110 VOLT MOBILE AMPLIFIER, $115.95
REGULAR $190.00 LIST—1952 MODEL
25-WATT TRUMPETS AND DRIVER $28.95 EACH EXTRA

25 watt Mobile Amplifier has built-in phono unit, illuminated control panel, separate volume controls for microphone, and phono and tone control. Power output 25 watts at less than 5% distortion. Peak power 38 watts. Frequency response: Plus or minus 2 db, 30 to 15,000 cps. Overall gain: Microphone channel 115 db.; phono channel 82 db. Hum level: 60 db. below rated output. One microphone and one phono input. Input impedance: 10 meg. microphone channel, ½ meg. phono channel. Controls: Microphone volume, phono volume, tone with AC switch, standby switch and phono motor off-on switch. Output impedance: 2.5, 4, 8, 16, 250, 500 ohms and 70 volt constant voltage tap. Operates on 117 volts 60 cycles AC or 6 volts DC. Draws 24 amps on DC operation. Tubes: 7B4, 6C5, 6SN7GT, 2—6V6G, 2—6X5GT. Overall size, 11½" deep, 10" high and 16½" wide. Shipping weight, 40 lbs. Stock No. 2370, 25 watt 6-110 volt amplifier. Net price, **$115.95.**

Use either 2, 3, or 4 of our MA-33, 25 watt trumpet and driver combinations, pictured at top of this page. Net price, **$28.95** each; or any combination of PM speakers and baffles shown below. Astatic JT-30 crystal mike and desk stand. $9.95 extra.

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 self-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.** 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-12Q. **$9.95** ea.; lots of 3, **$8.95** ea. 12" Baffle only, #SEG-12, **$4.95** each.

MIKES AND STANDS

40-T, high impedance dynamic mike with 12 feet of cable. Sale price, **$10.95.** 35" to 64" chrome floor stand for mike, **$5.88.**

McGee's Super High Fidelity *Best Value In U. S. A.*

OUTPUT TRANS. 20-20,000 CPS. **$7.95**

Model A-403 High fidelity output transformer. Why pay $20 or $30 for an output, when our A-403 is available at $7.95? Impedance, 6600 ohms plate to plate (for PP 6L6 or 6V6, 10:7 feedback winding, 4-8-15-250 and 500 ohm secondary. Housed in a potted case. Net weight 6 lbs. Recommended for all amplifiers up to 34 watts.

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"x6½" 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.**

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 pickup 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 may be conveniently located. One half of the dual triode input is left unwired, so that you will 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. VARIABLE RELUCTANCE TURN-ABOUT CARTRIDGE $22.95

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"x12⅜". 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, **$20.95** each.

BIAS BOX FOR TV ALIGNMENT

By FRANCIS R. BARLETT

Details on a compact test unit which uses rectified filament voltage to provide bias.

TO PREVENT overload and to set up near-normal operating points for television r.f.-i.f. stages during alignment, a fixed a.g.c. bias source is needed. Aside from the requirement of periodic battery replacement there are certain mechanical difficulties in the conventional dry cell bias set-up. To provide a source of bias relatively independent of electrical or mechanical maintenance the bias box described here was devised.

Fig. 1 shows how we may use the filament voltage of the receiver itself. The 6AL5 is wired in a voltage doubler rectifier circuit to deliver a negative d.c. voltage nearly two and one half times the r.m.s. input. This will be adequate for most applications. The *RC* filter removes all objectionable a.c. ripple. From the 6.3 volt filament circuit up to 15 volts d.c. can be obtained.

Current is limited by the ratings of the 6AL5 as well as by the 5000 ohm filter resistor. However, this is relatively unimportant as the a.g.c. bus normally has high resistance to ground. With as low as a 40,000 ohm load the output voltage will be very close to the no-load value.

Many circuit configurations could be used. The one illustrated here is simple, requiring only a few inexpensive parts and has proven quite satisfactory in practice.

Construction details are not given as the layout is not critical and will

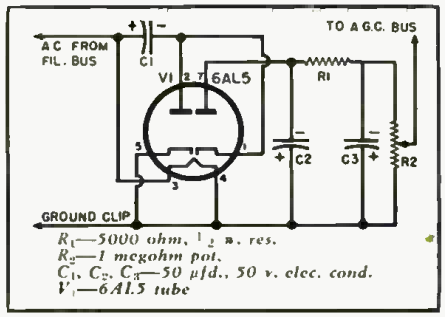


Fig. 1. Circuit of TV alignment bias box.

suggest itself to the builder, depending on what is on hand. If the unit is made small and compact, it will be readily portable and will occupy less valuable bench space.

To use, simply clip the ground lead to the TV chassis, the a.c. input lead to a hot filament pin, and the bias lead to the a.g.c. bus. Remove normal a.g.c. by any practical means. Adjust the voltage divider potentiometer for desired bias as read on a high impedance voltmeter and proceed with alignment.

Do not overlook other possible uses of the bias box. There are many applications in radio and TV troubleshooting as well as for the experimenter. It will suit any purpose calling for a low d.c. voltage where current requirements are small.

—30—

LUNAR REFLECTIONS

FOR the first time, a radio message has been transmitted by lunar reflection during a recent cooperative experiment conducted by the National Bureau of Standards and the Collins Radio Company.

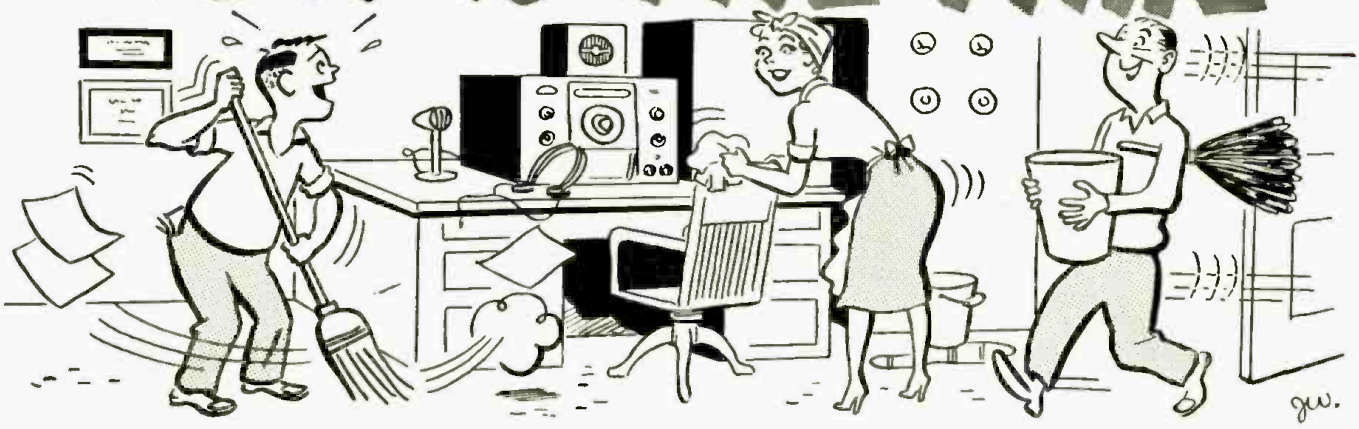
Ultra-high-frequency signals that had been reflected from the moon were received by the NBS field station at Sterling, Va., after having been transmitted from Cedar Rapids, Iowa.

Although radio waves had been reflected from the moon before, they were usually received at or near the point of origin. In the NBS-Collins Radio experiment, the signals were transmitted so as to be received at the site 775 miles from the transmitter after reflection from the moon. The operating frequency was 418 megacycles, generated by a 20 kw. transmitter. Because the transmitting antenna in Cedar Rapids was a fixed structure, lunar reflection could be accomplished only while the disc of the moon was in the beam of radio energy (approximately one-half hour). The antenna at Sterling could be rotated and turned in the direction of maximum signal strength.

Reflection of the signals apparently began as soon as the leading edge of the lunar disc entered the radio beam. As the moon moved across the radio beam, the received signal strength increased. About 10 minutes after the initial contact, the signal strength reached its highest value. The operators in Cedar Rapids then hand-keyed the signal in Morse Code and transmitted the historic message "What hath God wrought." The intensity remained at this maximum level for another ten minutes and then began to decrease as the moon passed out of the radio beam. The greatest signal strength received was about one-millionth as strong as the signal received by most commercial television receivers.

—30—

NOW IS THE TIME



Yep, time to get ready for fall DX . . .

Clean house of all that old, outdated equipment and replace at a tremendous saving with a "SURPRISE" Trade-In deal. As always, the newest and best is available here and bigger-than-ever bargains are yours when you take advantage of the one and only "SURPRISE" Trade-In allowance on your used (factory built) test and communication equipment. So get your trade-in deal working today. Wire, write, phone or use the handy coupon below.

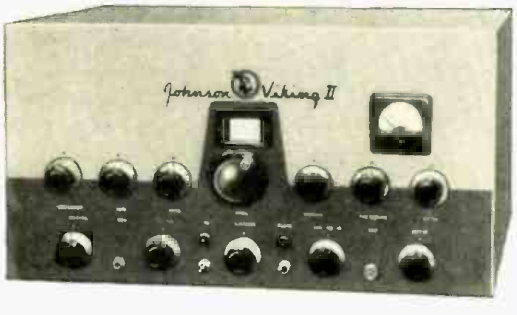
NATIONAL 183D
Less speaker. Only $369.50.
Matching Speaker, $16.00.

THE NEW NATIONAL HRO-60T
Less speaker. Only $483.50.
Matching Speaker, $16.00.

COLLINS 75A-2 RECEIVER
Less speaker. Only $420.00.
Matching Speaker, $20.00.

COLLINS 32V-3 TRANSMITTER
Only $775.00.

HALLICRAFTERS S-76
Less speaker.
Only $169.50.



THE NEW VIKING II 100-WATT PHONE-CW TRANSMITTER KIT. Features effective TVI suppression. Kit complete with tubes. Only $279.50.

HALLICRAFTERS R-46 SPEAKER, $19.95.

HALLICRAFTERS SX-71
Less speaker.
Only $199.50.

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☐ Rush "Surprise" Trade-in-offer on my _____

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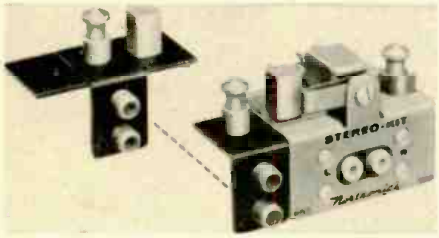
of the monaural variety while the Model SK-50 provides for the newer quarter-track, 4-channel tapes. Either



unit may be used for the playback of monaural tapes. Both units come completely assembled and wired.

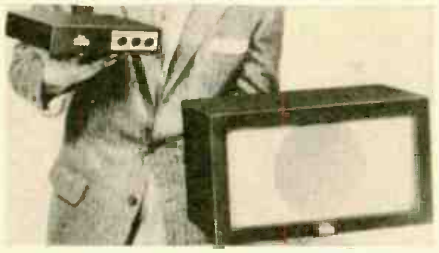
Both of the "Stereo-Kits" contain a factory aligned TLD magnetic head. Erase-Kits for either of the heads are available as the Model EK-100 (2-channel) and Model EK-50 (4-track) at extra charge.

The manufacturer will supply additional details on these kits on request.

STEREO DISC CONVERSION

Electrovox Co., Inc., 60 Franklin St., Orange, N. J. is now offering its "Walco" all-purpose stereo conversion kit for present mass-market phonographs.

The kit comes with a four-watt push-pull auxiliary amplifier for the stereo



channel, two tone controls, a separate auxiliary loudspeaker in a specially baffled cabinet, and a four-wire ceramic stereo pickup cartridge which readily adapts to most existing tone arms and replaces the monaural cartridge used in the conventional record player.

AUDIO SYSTEM ANALYZER

Winston Electronics, Inc., 4312 Main St., Philadelphia 27, Pa. is now in pro-

duction on a portable audio system analyzer which is being marketed as the "Win-Tronix Model 800."

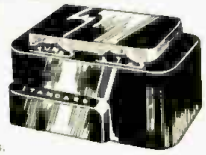
The instrument is designed for testing and servicing all hi-fi, stereo, and other audio systems. It incorporates the functions of six instruments, including an audio v.t.v.m., audio signal generator, audio output wattmeter with speaker loads, IM distortion

YOU DON'T NEED 20-20 VISION TO SEE OLSON'S BUYS IN TELEVISION

BIG VALUE STANDARD COIL TV BOOSTER

★ Latest Model ★ Brand New
★ Reg. List Price $30.00
★ While they last. Model No. B-51.

$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.

NEW! REGENCY DB-520 TV BOOSTER

$19.11

STOCK NO. RA-103

Latest model. Highly stable. More powerful than old model. Exclusive! New circuit stabilizer—gives maximum stability and picture boost on all 12 TV channels. Incorporates push-pull triode in balanced circuit for high gain. Off-on switch controls both booster and TV set. Perfect tracking accuracy. Improves both picture and sound for real TV enjoyment. Has separate inputs for 72 and 300 ohm lines. Beautiful cabinet. U.L. approved. Complete with 6J6 tube and instructions. Shpg. wt. 81 lbs.

COMPLETE TV ANTENNA

Stock No. AU-23

$8.99 Complete Set

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.

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**

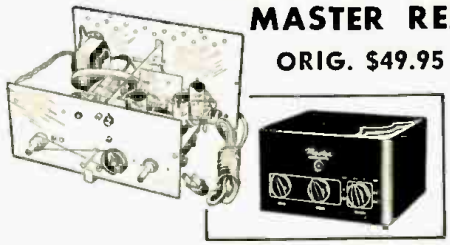
Don't Throw Away Old Picture Tubes

Stock No. T-98

You can get excellent pictures on old dim kinescopes for an additional 500 to 2500 hours by simply attaching the new Perma-Power TV Tube "Brightener". Fully automatic. Just plug onto back of old TV Tube. Not a gadget. Laboratory tested and approved. Regular retail price $9.75. Order yours now. Make big money selling TV "Brighteners" to your friends and customers. Shpg. wt. 3 lbs. Stock No. T-98. . . . . ea. **$5.73**

OLSON'S GREATEST TV BARGAIN

MASTER REMOTE CONTROL



ORIG. $49.95

ONLY $5.95 EACH

Stock No. RA-106

Olson couldn't pass up this tremendous deal and now it's passed on to you at one of the biggest price cuts ever offered. This Remote Control Unit was designed to enable TV viewers to change their sets from one channel to another, as well as adjust sound and picture from any place in room. Unit does not work with every set so that's why the manufacturer offered us this bargain. It may or may not work on your set, but it's worth more for the parts alone. Unit is complete with attractive metal cabinet 18¾" wide, 5⅛" high, 7⅜" deep, 3 bar knobs, jeweled panel lamp, AC cord and plug, selenium rectifier, coils, transformer, ceramic condensers, band switch and 3 tubes (6AK5, 6AB4, 6BC5). Parts alone have hundreds of uses. Cabinet ideal for custom installations. Original factory sealed cartons with complete instructions. Shpg. wt. 8 lbs.

300 OHM TWIN LINE LEAD-IN
AVAILABLE IN 3 LENGTHS

FINEST QUALITY

100 Ft. SPOOL	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.

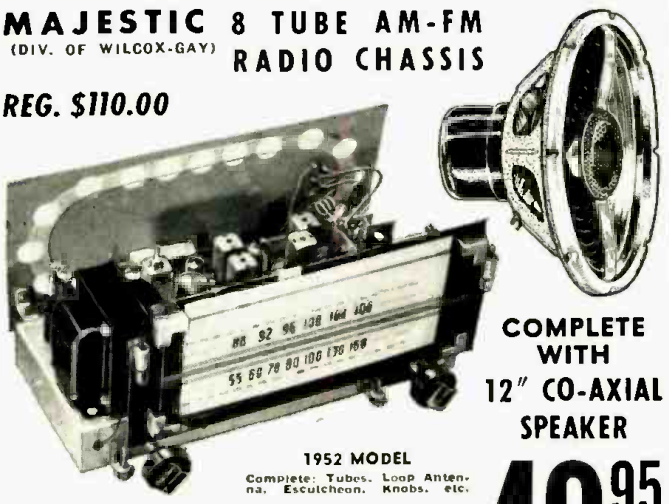
This is a real buy. We cannot continue this offer much longer—so stock up now—below jobbers price. Twin Line is highly efficient, weather resistant—genuine Polyethylene dielectric. Low loss—for use in all TV and FM installations.

SPECIAL PURCHASE SCOOP!

MANUFACTURER'S CLOSEOUT

MAJESTIC (DIV. OF WILCOX-GAY) 8 TUBE AM-FM RADIO CHASSIS

REG. $110.00



COMPLETE WITH 12" CO-AXIAL SPEAKER

1952 MODEL

Complete: Tubes, Loop Antenna, Escutcheon, Knobs, etc.

$49.95

COMBINATION DEAL!

This is one of the biggest deals we've ever offered. So big most buyers couldn't come up with the cash. Olson completed the deal and is passing this terrific bargain on to you. Naturally when our present stock is gone, we can't duplicate this offer. Olson never gave you a greater value. Order your outfit today.

BOTH FOR ONLY **$49.95**

DEAL RA-5268

Speaker is guaranteed to outperform any speaker in its price class. Equipped with two "High Concentration" Alnico 5 magnets and a high frequency diffuser. 12" section delivers bass, inner 3" tweeter section delivers treble tones, giving you "living tone." 8 ohm impedance.

Radio is not a kit or a tuner. It's a real high-powered AM-FM Radio Chassis that will pull in distant stations with amazing volume and brilliance of tone. Makes a perfect custom installation in existing cabinets, bookcases, walls, etc. Servicemen and Experimenters: Make money installing these for friends and customers.

The circuit is modern and employs 8 tubes (12AT7, 6BE6, 2-6BA6, 6AL5, 6AV6, 6V6 and 5Y3). The entire R. F. assembly and the 4-section tuning condenser is rubber mounted. Tuned R. F. stage plus two I. F. stages give this set terrific FM sensitivity. Separate FM oscillator tube for extreme stability, and triode R. F. and mixer circuits plus radio detector assure noise free, high fidelity FM reception.

Two modern dial knobs control on-off, volume and tone plus AM-FM, phone switch. Equipped with two panel lamps and edge lit dial. Phono input socket and AC receptacle at rear of chassis. Chassis size 13" wide, 7½" deep, 7¼" high. Cut out in cabinet requires 8x3¼. Output impedance 8 ohms operates on 110-125v AC, 60 cycles. Shpg. wt. 20 lbs. In factory sealed cartons.

PHONO PRE-AMPLIFIER

No. RA-101

$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"x2¼"x3½". Complete with 12AX7 tube. Shpg. wt. 2 lbs.

MOTOR and ARM

A BIG VALUE **$3.99**

STOCK NO. RA-91

COMBINATION OFFER

You get an Alliance Rim Drive 78 RPM Phono Motor with turntable PLUS a Pick-up Arm with high Output Cartridge. Shpg. wt. 6 lbs.

12" Magnavox Speaker and Baffle Close-Out

Stock No. AS-66

Get both for only . . .

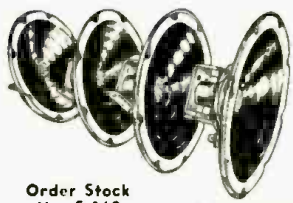
$7.95

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 dust-proofed. 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 3 or more sets and install them in restaurants, auditoriums, halls, etc.

ORDER THIS BARGAIN TODAY!

5" ALNICO 5 PM SPEAKERS



Order Stock No. S-169

1st Speaker.	$1.79
2nd Speaker.	1.79
3rd Speaker.	1.79
4th Speaker.	.01
All Four For	$5.38

1c SPEAKER SALE

- Thousands have been sold by Olson for $1.79
- We must make room in our warehouse

Buy 3 and get the 4th for only **1c**

At 1c Olson will sell plenty of 5" PM Speakers. No one else would dare make this offer. But our new Fall merchandise is coming in any day now and we need ROOM. Buy 3 speakers at our bargain price of $1.79 each and get the fourth speaker for only 1c. Order 6 speakers at $1.79 each and get 2 speakers for only 2c additional. Remember, for every 3 speakers you buy, an additional speaker is only 1c. Don't miss this offer. It CANNOT be repeated when sold out. Every speaker is brand new in original factory cartons. Full 5" diameter. Dustproofed inside and out. Alnico 5 magnet. Voice coil 3.2 ohms. The perfect speaker for extension speakers, auto sets, AC-DC radios and intercoms. Shpg. wt. per speaker 1 lb.

USE HANDY ORDER BLANK ON NEXT PAGE →

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MAIL YOUR ORDER TODAY—OLSON WILL RUSH IT RIGHT AWAY!

BIG BARGAINS IN SOUND EQUIPMENT

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

PHONO AMPLIFIER

Stock No. RA-19
$3.98 Less Tubes

A real high efficiency 3-tube amplifier of modern design. Connect to any crystal phono arm and speaker. Has volume and tone controls 7"x3¼"x2". Shpg. wt. 2 lbs.
SET OF TUBES FOR AMPLIFIER 12SQ7, 50L6, 35Z5.
No. AS-22 ..... $2.64

TELEPHONE PICKUP

Stock No. M-80

$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.

BUILD YOUR OWN RECORD PLAYER

SINGLE SPEED MODEL

This fine kit contains a 78 RPM rim drive motor with velvet finish turntable, crystal pickup arm, all purpose needle, 4" PM speaker, matching output transformer, 2 tube AC-DC amplifier and a set of tubes (35W4 & 50B5). Shpg. wt. 8 lbs.
Stock No. AS-52 ..... $8.95

DELUXE 3-SPEED MODEL

Like above except kit has 3 speed phono motor to play all 33⅓, 45 and 78 RPM Discs. Shpg. wt. 8 lbs.
Stock No. AS-53 ..... $11.95

PLASTIC RECORDING TAPE

600 Ft. Reel
Stock No. X-275
Single, ea. $1.49
LOTS OF 10, EA. $1.29

1200 Ft. Reel
Stock No. X-249
Single, ea. $2.19
LOTS OF 10, EA. $1.99

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. Frequency response 50 to 8,000 cy. Plastic Reel included with each.

PRICES SLASHED ON EMPTY PLASTIC REELS
Finest Clear Plastic—Will Not Warp
7" Diameter—1200' Size
No. X-251
Single, ea. 49c.
LOTS OF TEN, EA. 39c
5" Diameter—600' Size
LOTS OF TEN, EA. 29c
No. X-250 Single, ea. 39c.

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. RA-96.
Olson Special Price for Master Station, Substation and 50 ft. of cable only
$19.83

PRESTO—Call Intercom
The Modern Electronic Communication System

Now talk with anyone, anywhere at the mere flick of a button! All electric master station and substation give clear, powerful voice reproduction to rooms or other buildings up to 1000 ft. away. Thousands have been sold for use in restaurants, on farms, offices, stockrooms, factories and in homes. Just plug master station into any 115 V AC electrical outlet—connect 3 wires and you're operating. Modern design. Each unit measures 4½x4½x5½. Equipped with rubber feet and easy slide switches. Handsome appearance—gray crackle finish. High amplification—use 3 tubes. Power output 2½ watts. Regular list price is $17.50. You get the master station, substation and 50 ft. of 3 conductor cable. Complete with tubes. Shpg. wt. 8 lbs.

NOTICE—RADIO MANUFACTURERS

• Olson Radio has established a tremendous market among radio servicemen, amateurs, universities and industrials all over America as well as principal foreign countries. Our famous rapid mailing service is the talk of the trade.

If you have any good, clean surplus radio material which you wish to dispose of, contact Olson at once. We can use: Radios, amplifiers, condensers, chassis, phono motors, pickup arms, volume controls, test equipment, speakers. In fact any radio or electronic part or piece of equipment.

Here is your opportunity to turn idle inventory into cash. Write, wire or call Olson, the popular name in radio.

SEND FOR OLSON'S BRAND NEW BARGAIN CATALOG. GET NATIONALLY FAMOUS RADIO PARTS AND SUPPLIES AT BIG DISCOUNTS

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If you live in or near Cleveland visit our store, get these and many more bargains.

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623 W. Randolph Street
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OLSON HAS OVER 150,000 SATISFIED CUSTOMERS

10 WATT HI-FI PUSH-PULL AMPLIFIER

$32.95 with Tubes
Stock No. RA-102

- Bass & Treble Boost.
- Inputs for crystal & magnetic pickups, radio tuner and crystal mike.
- Aluminum Chassis.

Bombshell Value! It's unbelievable. A full 10 watt Hi-Fi Amplifier, completely assembled and ready to play. Has built-in PRE-AMP for G.I. 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. Everyone in factory sealed cartons. 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 ½ of 1% distortion. 5 Tubes: 1—6SL7, 1—6SC7, 1—6V6, 1—5Y3. Complete with tubes. Size 12"x6½"x5½". Shpg. wt. 12 lbs. Can be used with any phono or speaker but you should take advantage of the Combination Deal offered below.

12" CO-AXIAL SPEAKER

$12.95
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.

FAMOUS 3-SPEED AUTOMATIC RECORD CHANGER

$19.99
Stock No. RA-69

Completely automatic—one of the most famous brands in changers. Every one in original factory packing. 100% guaranteed to please or money back. It's one of Olson's most sensational bargains. The changer has a reject lever and a control for selecting 33⅓, 45 or 78 RPM speeds. Plays 7", 10" and 12" records. Equipped with a crystal cartridge and a long life needle. Records drop gently and smoothly—just like velvet. Operates on 115 volts, 60 cycles AC. Base 12x13". 5¼" above plate and 3½" below. Shpg. wt. 15 lbs. Limited quantity. When these are gone—no more.

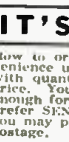
SPECIAL COMBINATION DEAL!

GET ALL 3!

$63.95
Stock No. AS-62

HI-FI AMPLIFIER
12" CO-AXIAL SPEAKER
3-SPEED RECORD CHANGER

Order this matched outfit today. You get the 10-watt Hi-Fi Amplifier PLUS the 12" Co-Axial Speaker, PLUS the 3-Speed Automatic Record Changer, all as described above. Can be built into any cabinet or bookcase—giving you a complete record playing outfit of which you can be proud. Shpg. wt. 35 lbs.



THIS COSTS YOU NOTHING
NOT A RED CENT

Just to get the ball rolling and to get your order coming our way Olson is going to send you a handy all-rubber RADIO TUBE PULLER. Made of soft rubber. Easily pulls from stubborn sockets, all regular glass tubes, metal tubes and 7 and 9 miniatures. Protects you from burns, shocks, and cuts. All you need do is to make up an order for $10 or more from Olson's ad—use handy order blank below. We will ship your order at once (Olson's service is famous from Coast to Coast) and include the RADIO TUBE PULLER—FREE.

IT'S EASY TO ORDER FROM OLSON'S

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 shipments), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

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275 E. MARKET ST., AKRON 8, OHIO
WE SHIP SAME DAY WE GET YOUR ORDER

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

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL

NAME _____ TOTAL

ADDRESS _____ ADD POSTAGE

CITY _____ ZONE ____ STATE _____ TOTAL AMOUNT

RN-952

OLSON RADIO WAREHOUSE • 275 E. Market St., Akron 8, Ohio

Emission Tester

(*Continued from page* 39)

manufactured by the *Keystone Carbon Co.*

It is not necessary to remove the picture tube from the receiver when operating the rejuvenator. With the set de-energized, remove the tube socket and plug in the rejuvenator in its place. Energize the rejuvenator and allow about 15 seconds for the heater to reach operating temperature. If the tube emission is good, the 4½ watt bulb will glow at about half brightness. If the bulb remains dark, depress the meter button and note the cathode current. Allow the tube to "cook" if the meter reads zero or low. As the tube emission improves, the meter creeps upward and the operator can take heart. Release the button as soon as the meter current reaches the upper limit and use the bulb as a visual indicator. The bulb serves two purposes, (a) protective, (b) upper current indicator.

The meter could be dispensed with entirely but one important operating advantage is lost; at low emission the operator has no way of knowing whether the tube is being helped. As long as the meter needle creeps upward, one does not mind allowing the tube to "cook" for an hour or more.

The author and others tested the rejuvenator over a period of time. Results varied, gassy tubes remained gassy but the true low emission ones were helped. Some of the improved tubes lasted only a short time but others gave long life.

It was interesting to note that those who belittled the rejuvenator during the tests were the ones most reluctant to part with it when their phase of the tests were concluded. —30—

EMERGENCY REPLACEMENT

By WILLIAM CREVISTON

In many TV sets using a 6AS7G damper tube, it is possible to substitute the cheaper and more readily available 6W4 without any wiring change. The only bad effect is a slight degradation in horizontal linearity which is often hardly noticeable. The base connections for the two types are compared in the table below.

The heater connections are the same; the plate connection for the 6W4 is the same as one plate of the 6AS7; the cathode for the 6W4 is the same as one cathode of the 6AS7; and all other pins on the 6W4 are blank.

—30—

Pin connections for the 6AS7G and 6W4 tubes.

Pin	6AS7G	6W4
1	GT_1	NC
2	PT_1	NC
3	KT_1	K
4	GT_2	NC
5	PT_2	P
6	KT_2	NC
7	H	H
8	H	H

UHF-VHF

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WARD'S radically new all-channel antenna!

Open up new fringe areas! — Bring in markets you've never been able to touch before, with WARD'S radically new, all-channel "TROMBONE" Antenna. The unique three-bay "TROMBONE" delivers high gain on all channels . . . up to 16 db . . . on 2 to 83. Best of all, "TROMBONE" protects your customers against channel changes and new stations. It's the "plus feature" antenna you can sell with confidence . . . the antenna that gets the best in VHF today and the best in UHF tomorrow.

All-aluminum construction . . . completely pre-assembled . . . streamlined vibration-proof design . . . are added features of this outstanding antenna.

Cash in an WARD'S big promotion plan. Sell the complete WARD line for sales, profits and customer protection. See the TROMBONE and other Signaline Antennas at your distributor today.

The "TROMBONE" is but one of the excitingly new WARD * Signaline Antennas; here are four more of them:

THE WARD PRODUCTS CORP.

DIVISION OF THE GABRIEL COMPANY

1523 EAST 45 STREET • CLEVELAND 3, OHIO

IN CANADA: ATLAS RADIO CORP., TORONTO, CANADA

Mobile Radio

(Continued from page 37)

tenna height up or down to extend or reduce the range as desired. Where maximum range is not required, lower antenna heights will confine transmissions to a more limited area and there is less chance of causing interference to other services.

The 25 to 50 megacycle band offers advantages to those requiring considerable communications range as in state police radio networks. Normally, this band permits communicating over maximum distances of 30 to 50 miles although greater ranges are common. Skip transmissions are encountered on this band, particularly at the low frequency end of the band. Through careful allocation of frequencies, the interference caused by skip transmissions can be minimized. This skip characteristic causes such problems as a New England base station interfering with mobile units in Texas. These skips, which occur irregularly and not necessarily often, are caused by tropospheric changes.

The 152 to 162 megacycle band is widely used for communications within a radius of 15 miles. Greater range is afforded when the base station antenna location is particularly favorable. The principal advantages of this band are its excellent reflection characteristics which extend communications into canyons, under bridges, etc., limited and controllable range because of line-of-sight characteristics, and the fact that extremely reliable communication can be provided with low power transmitters.

Although the 450 to 460 megacycle band has been available on a developmental basis to potential users for over three years, it was not until production type equipment was made available this year that this excellent band began to receive the attention it deserves.

Several 450 to 460 megacycle band mobile radio systems have been installed during the past year. Reports indicate that this band has much to offer because of the almost total absence of noise and its excellent propagation characteristics.

Because of the high frequency, the length of a 450 to 460 megacycle band antenna is but a few inches. At lower frequencies, it was impractical to build stacked omni-directional high-gain antenna arrays for mobile installations because of overhead clearance limitations. At 450 megacycles, stacked antenna arrays for mobile applications should be feasible.

Before experience proved otherwise, it was commonly considered that the communications range attainable in the 450 to 460 megacycle band would be inferior to that of the 152 to 160 megacycle band. It has been demonstrated that the 450 megacycle band, in some respects, offers advantages over the 152 megacycle band.

Tests revealed that excellent communications between base stations and mobile units operating at 450 megacycles could be maintained at some points where under the same conditions communication at 152 megacycles was impossible, erratic, or poor. This does not mean that the maximum range is greater. Instead, it demonstrates the very excellent reflection characteristics of 450 megacycle radio signals.

At the present time, equipment for the 450 megacycle band is more expensive than equipment for the 25 megacycle and 152 megacycle bands. Furthermore, it is somewhat more complex and few persons have had experience with it.

The right to use the ether for communications is licensed. This right or privilege has not been open to everyone and rightly so because uncontrolled use of the ether would surely lead to bedlam.

A radio service dealer, for example, cannot obtain a license under existing rules to operate a private mobile radio system in either of the above two bands. He can, however, obtain communications service from a common-carrier such as a telephone company providing mobile radio service or radio dispatching service if either or both are available in his community.

He can obtain a license to operate radio transmitters in the Citizens Radio Band which is located near the 450 megacycle mobile radio band. He can use standard 450 megacycle mobile radio equipment tunable to the Citizens Radio Band in his cars and trucks and regular 450 megacycle base station equipment operated in the same manner as in regular mobile radio services. Naturally the equipment must have type approval of the FCC.

The Citizens Radio Band is a part of the radio spectrum reserved for John Q. Public. It is not necessarily reserved for the housewife who wishes to keep in touch with her husband by means of a portable purse-size radio.

Instead, the Citizens Radio Band affords the radio service dealer, the grocer, the diaper delivery man, the department store, the stock broker, and others not eligible for licensing on other bands the right to operate private radio communications systems.

The Citizens Radio Band has been virtually dormant because of the lack of suitable equipment. Many laboratories have worked on the development of practical portable radio-communicators that could be sold at mass appeal prices. However, none has appeared on the market at a price that would attract large volume business.

Now that 450 megacycle mobile radio equipment is commercially available, the Citizens Radio Service has become a reality.

In subsequent articles on mobile radio, of which this is the first of a series, license applications, equipment, typical installations, and sales and service will be discussed.

(To be continued)

BUY TEST EQUIPMENT
ON THIS RADICALLY NEW
TIME PAYMENT PLAN
NO INTEREST!! - NO CARRYING CHARGES!!
USE CONVENIENT TIME PAYMENT ORDER BLANK BELOW

Superior's New
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

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.

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 NET**

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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
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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.

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  $5.40 down payment. Balance $4.00 monthly for 4 months.
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  $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.....

F-C Attenuator

(*Continued from page 57*)

meters, amplifiers, etc. It may be assembled and used as a separate instrument or may be permanently wired in as part of the instrument. In either case, care should be taken to provide adequate shielding.

Certain general precautions should be followed when using the attenuator, however. First, since ½ watt resistors and 600 volt condensers are used, if extremely high voltages are to be applied to the *Input*, substitute 1 watt or 2 watt resistors and higher voltage condensers of the same electrical value, making any readjustments necessary for frequency compensation and calibration. Also take this into account in the layout and wiring.

The attenuator may be used equally well in a.c. or d.c. circuits. If both a.c. and d.c. are present, however (as in the plate circuit of a tube), and it is desired to consider the a.c. component only, suitable d.c. blocking condensers should be connected in series with the *Input* or *Output* terminals (or both).

Since the input resistance of the attenuator is approximately 1 megohm, best results are obtained if the instrument with which the attenuator is used has a similar high input impedance. In any case the input impedance of the instrument should not be so low as to appreciably affect the size of R_2 or R_4 when shunted across these resistors. Otherwise, the degree of attenuation may be changed.

If an attenuation other than 10 or 100 is desired, an extra switch position may be used. The two resistors in the voltage divider are chosen with values having a ratio approximating the degree of attenuation chosen, and the condensers are chosen with an inverse ratio. At least one of the condensers should be made variable for proper compensation.

—30—

SERVICE TIP

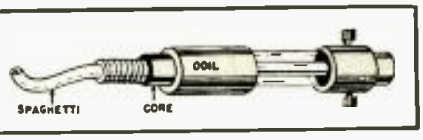
By MILTON M. SCHUMAN

WHEN replacing a conventional loop antenna with a "Ferri-Loopstick," body capacity often makes it difficult to align the core.

A good way to get around this difficulty is to put some dope on a length of spaghetti and run it in the hole in the core (see Fig. 1). When the dope is dry you can move the core in and out without the detuning effect of body capacity.

Put a thin layer of dope on the core before sliding it into the coil, set it at the best point and then when the dope is dry, cut the spaghetti off close to the core. —30—

Fig. 1



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MONEY MAKING

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Your FCC Ticket Is Recognized in All Radio Fields as Proof of Your Technical Ability

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TELLS HOW— Our Amazingly Effective JOB-FINDING Service Helps CIRE Students

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Dale E. Young, 122 Robbins St., Owosso, Mich.

GETS CIVIL SERVICE JOB

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

GETS FIVE JOB-OFFERS FROM BROADCAST STATIONS

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

GETS PUBLIC UTILITIES JOB

"I have secured the position of Radio Technician with the Toledo Edison Company. I want to thank you once more. The help you gave me was much more than would ordinarily be expected—both in obtaining my license and in finding employment." Norman W. Stokes, Jr., Rt. 11, Box 612, Toledo 7, O.

TELLS HOW— Employers Make JOB OFFERS

Like These To Our Graduates Every Month

Telegram from Chief Engineer, Broadcast Station, Pennsylvania: "Immediate opening for engineer. Automobile and First Phone a must. If graduate available, please forward name and address."

Letter from Chief Engineer, Broadcast Station, Montana: "Immediate opening for Engineer-Announcer. Basic salary $62.50 . . . real future for right man."

Letter from Chief Engineer, Broadcast Station, Tennessee: "Have opening for operators. If you have men, please have them contact us."

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

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING AT HOME IN SPARE TIME

Name and Address	License	Lessons
Lee Worthy, 2210½ Wilshire St., Bakersfield, Cal.	2nd Phone	16
Clifford E. Vogt, Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch, 38 Beucler Pl., Bergenfield, N. J.	1st Phone	38
S/Sgt. Ben H. Davis, 317 N. Roosevelt, Lebanon, Ill.	1st Phone	28
Francis X. Foerch, 38 Beucler Pl., Bergenfield, N. J.	1st Phone	38

CARL E. SMITH, E.E., Consulting Engineer, President

Ours is the only home study course which supplies FCC-Type Examinations with all lessons and final tests.

CLEVELAND INSTITUTE OF RADIO ELECTRONICS

Desk R - 926, 4900 Euclid Building, Cleveland 3, Ohio

(Address to desk to avoid delay)

Mail This Card Now

NO POSTAGE REQUIRED

Get All 3 FREE

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

☐ Tell me about your Television Engineering Course.

NAME_____

ADDRESS_____

CITY_____

ZONE____ STATE_____

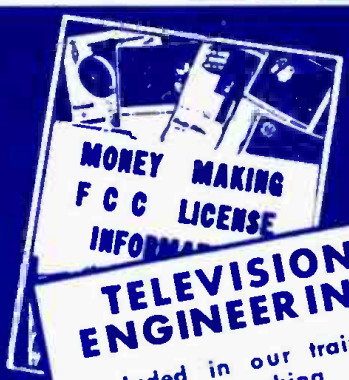
SEE OUR AD ON NEXT PAGE

Want To Double Your Pay?

I can train you to pass your FCC License Exams in a minimum of time if you've had any practical radio experience—amateur, Army, Navy, radio servicing, or other. My time-proven plan can help put you, too, on the road to success. Just fill out the coupon and mail it. I will send you free of charge, a copy of "How To Pass FCC License Exams," plus a sample FCC-type Exam, and the amazing new booklet, "Money Making FCC License Information."

EDW. H. GUILFORD, Vice President

How To Pass FCC COMMERCIAL RADIO OPERATOR LICENSE EXAMINATIONS



TELEVISION ENGINEERING
Included in our training and coaching

HERE IS YOUR GUARANTEE

Should you fail the FCC commercial license examinations after completing your course, we guarantee to continue your training, without additional cost of any kind, until you successfully obtain your commercial license, provided you first take your examinations within 90 days after completing the course.

IMPORTANT
SEE OTHER SIDE FOR MORE INFORMATION

And Here's Proof that CIRE Students Really Do Get Their FCC Licenses

"I was very pleased to receive my diploma for Nilson's Master Course, after which I took the exam for First Class Radiotelephone and the Radar exam. I am happy to say I received my First Class license, number P1-2-4361 with the Ship Radar endorsement. I experienced no difficulty at all in taking these exams, thanks to Nilson's Master Course."

RICHARD E. STREBEL, Box 589, New Providence, N. J.

"I took the license examination for 2nd 'Phone and 2nd Telegraph, in Knoxville, Tenn. I am happy to advise that I passed both in fine shape. I received my licenses this morning. Your course proved invaluable in preparing for the examination."

E. F. JONES, Jr., Gallatin, Tenn.

HOW OUR AMAZINGLY EFFECTIVE JOB-FINDING SERVICE WORKS FOR YOU

1 200 EMPLOYMENT APPLICATIONS
200 employment applications, with our letter of recommendation attached, addressed to employers of your choice, in areas you select, in broadcasting, mobile communication, manufacturing, airlines, CAA, State Highway Communication, Police Radio, and other fields of radio employment.

2 CHIEF ENGINEERS BULLETIN
Mailed every month to the chief engineers of every AM, FM, and TV broadcast station in the United States and territories. If you want a broadcast technician's or engineer's job this is an amazingly effective way to get your choice of broadcast jobs almost anywhere in the U.S.A.

3 "JOB WANTED" LIST
Mailed to all employers who telegraph, telephone, and write asking for our graduates. We regularly receive requests for our students from almost every state in the Union. No greater tribute can be paid to the high caliber of our training, coaching and Job-Finding Service!

If You're in the Armed Forces

PLAN NOW for PRESENT and FUTURE SECURITY IN CIVILIAN LIFE

1 Use your spare time, NOW, while you are in the armed forces, to prepare for the FCC license examinations, and get your FCC Commercial License.

2 Shortly before discharge, use our AMAZINGLY EFFECTIVE JOB-FINDING SERVICE to get your choice of good-pay jobs.

Stromberg-Carlson employs Ex-Army Man

"I am now working as a lab technician in the engineering department of Stromberg-Carlson Company. My CIRE course and 2nd 'phone helped a great deal in obtaining this position."

JOHN P. DALEY, P.O. Box 327, Lima, New York

Ex-Navy Man Gets RCA Job

"Since my discharge from the Navy I have been employed by RCA Service Company. Believe it or not, I owe all of my good fortune to your course of instruction, and I can truthfully recommend it to anyone."

CLARENCE JOHNSON, 730 Barron, Redwood City, Calif.

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Desk R-926 (Address to desk No. to avoid delay)

CALIBRATING PLAIN DIALS

By JOSEPH HOULE

The equipment needed to prepare dials as outlined in text. The dial face is painted.

Some practical hints for the home constructor on the preparation of instrument dial faces.

OSCILLATORS, wavemeters, and a host of other home-made instruments need direct-reading dials to realize their full utility. The only available type of dial that is designed for hand-calibration is of the elaborate vernier variety, such as the *National* ACN, which requires a large panel cut-out and considerable other metal work for installation. The space and complication involved is disproportionately great for use on a small instrument.

What is needed is a plain dial with a surface specially prepared to take markings in ink or pencil. The writer has tried cementing a paper scale to a standard dial, but ordinary cements all come loose after a year or two. Cementing a paper or cardboard scale to a crackle-finished panel is inadvisable, too. Either the glue comes loose, or the cement dissolves the paint, and the whole mess slowly soaks through the paper, producing a mottled effect. Eventually, both things happen.

Painted Surface

A very successful solution is to cover the surface of the dial with a light-colored paint. Let the paint dry for a day or two, then do the lettering and graduations with India ink.

The completed dial may be coated with clear lacquer to protect the ink, but this is usually necessary only if the instrument is to receive hard use.

A *National* Type O or similar dial responds very well to this treatment. Remove the Bakelite knob, paint the back of the metal dial plate, and let it dry thoroughly. Reassemble the knob to the plate, put the dial on the instrument, and mark the calibration lightly with pencil. Then remove the dial, take off the knob, and mark the graduation lines in with a ruling pen and straightedge, using India ink. Then apply the numbers. Use very little ink in the pen. If it is too full, it is likely to run and smear. Mistakes can often be corrected by wiping off the wet ink, if it is done immediately. If worst comes to worst, the dial can be repainted and the job started over.

If the ink tends to gather in little droplets, it is due to a greasy surface. The remedy is a little alcohol or carbon tet, wiped on with a very clean rag. The writer hasn't had this trouble on painted surfaces, however; such difficulties occur more often when one is trying to mark tube sockets with India ink on a plated metal chassis.

The writer has used grey floor enamel, flat white house paint, and automobile touch-up enamel with equal success. Flat white is the only variety that will take pencil marks well. The small bottles of touch-up auto enamel that come in various colors are particularly satisfactory. A light buff or gray can be selected to harmonize with the cabinet, and the paint is quick-drying and of very good quality.

While the procedure outlined may seem to be time-consuming, the job could easily be started at the same time construction of a unit is begun so that by the time the equipment was built, a dial face worthy of the unit would be ready to attach, giving a "custom-built" look to your work.

The dial in the photo, shown with the main materials used in the calibration, was made from a 4-inch Lucite disc and a large knob found in a surplus collection. This particular dial is being used on a resistance-tuned audio oscillator. —30—

meter, harmonic distortion meter, and db and noise meter. All tests may be made with only two cable connections.

A data sheet providing complete specifications and price is available from the manufacturer on request.

AUDIO CATALOGUES

TAPE HANDBOOK

Robins Industries Corp., 36-27 Prince St., Flushing 54, N. Y. has just issued a 24-page handbook for the professional and amateur tape recordist.

Entitled "Tape Editing and Splicing" and written by N. M. Haynes, the book outlines ways of getting more use and enjoyment from a tape recorder. The text covers splicing techniques, geometry of the splice, splice detection, localization, editing procedures, spliceless editing, etc. Line drawings and actual photographs of the material under discussion help to clarify the proper procedures.

The material included in this handy little volume was excerpted from the author's volume "Elements of Magnetic Tape Recording," published last year by *Prentice-Hall*.

For those who want a pocket-sized reference manual on tape splicing and editing, this little booklet would appear to be a bargain at 25 cents a copy from the company.

SELECTING STEREO EQUIPMENT

A useful guide to the selection and placement of stereo sound equipment has been issued by *Electro-Voice, Inc.* of Buchanan, Michigan as a service to audiophiles and music enthusiasts.

Written in easy-to-understand form, the booklet outlines five factors requisite for listening satisfaction, explains the principles of stereo reception from various sound sources, discusses the placement of speakers for maximum enjoyment, stereo discs and their reproduction, connecting and matching amplifiers, etc.

Equipment made by the company is used as examples but the principles involved are universal. Copies of this brochure are available from the manufacturer.

ENDLESS-LOOP RECORDER DATA

Amplifier Corp. of America, 398 Broadway, New York 13, N. Y. has issued a four-page folder which describes in some detail its "Magneloop" series of continuous-loop magnetic tape recorder-reproducers.

The brochure describes features of 21 basic models which are available in single- or dual-speeds as well as in single-, dual- and triple-channels. Recording characteristics are tabulated for easy reference. A complete variety of playback modes are suggested and made available to accommodate specialized uses and technical applications. Mechanical and electrical features are fully covered.

ASA TAPE STANDARDS

The American Standards Association, 70 E. 45th St., New York 17, N. Y. has copies of the new international standard on the interchangeability of magnetic tape recordings available for $2.40 each.

Recommended by the International Electrotechnical Commission (IEC) the standard is entitled "Recommendations for Magnetic Tape Recording and Reproducing Systems: Dimensions and Characteristics." The recommended standard applies to non-perforated magnetic tape and equipment used for sound recordings and sound reproduction in both professional and domestic applications. Among the specifications established are the mechanical and electrical requirements of recording and sound reproducing equipment, nominal tape speed and tolerance, position of the active surface of the tape, position and dimension of the magnetic sound track, and spools.

The IEC standards are not mandatory but are the recommendations to the 34 member countries.

AMERICAN MICROPHONE CATALOGUE

American Microphone Manufacturing Company, 412 S. Wyman St., Rockford, Ill. has issued a new 16-page catalogue which describes in detail its full line of microphones, handsets, phono cartridges and arms, mobile equipment, and accessories.

Available without charge on request. Catalogue 58 includes photographs, specification charts, and sound distribution patterns on each microphone as well as physical specifications and performance data on other items in the line. —30—

Radio Shack Corporation of Boston takes no stock in "recession rumors" for it has just announced an expansion program which will add 80,000 square feet of warehouse, office, and mail order facilities; created 50 new jobs; opened a second store in Boston; and increased its advertising and promotion budget. The new building, located at 730 Commonwealth Ave. in uptown Boston, brings to a total of 131,000 square feet the space occupied by this Boston-New Haven distributor.

Design Curves

(*Continued from page 49*)

$R_1 + 1/(1/r_p + 1/R_p)$ was actually about 110,000 ohms, and the true value of a was approximately 11. The gain of the second section of the 6SN7GT adequately compensated for the 20 db loss in the tone control, and the over-all gain of the amplifier was practically unchanged.

Our friend seemed to like music with plenty of bass so we set the abscissa

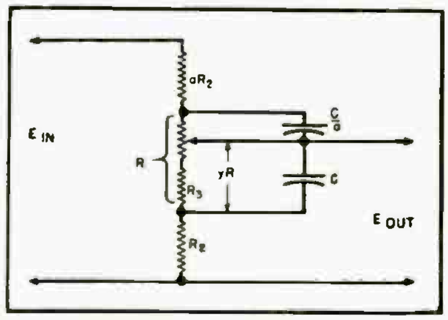

Fig. 9. Circuit for bass boost and attenuation with a fixed resistor in series with the potentiometer to limit the attenuation.

value of 0.05 equal to 50 cycles. The curve for $y = 1.0$ indicates that 19 db of boost could be obtained at 50 cycles and that there would be 3 db of boost at 1000 cycles. Because our value of a was more nearly 11 than 10, we would get slightly more boost. The value of C was determined as follows:

$$2\pi fCR_2 = 0.05$$

$$C = \frac{0.05}{2\pi fR_2} = \frac{0.05}{2\pi\,(50)\,(10^4)}$$

$$C = 1.59 \times 10^{-8}$$

$$C = 0.0159 \text{ microfarad}$$

The 0.016-microfarad capacitance was made up from 0.01- and 0.006-microfarad condensers in parallel. The

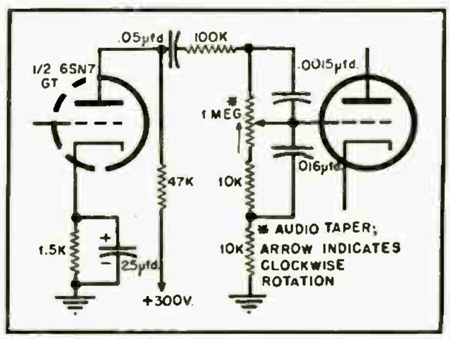

Fig. 10. Circuit for bass boost and attenuation which is capable of providing 19 db of boost at a frequency of 50 cycles.

condenser C/a would then be 0.0015 microfarad, or approximately one-eleventh of C. An audio taper pot. was used, wired for increasing boost with clockwise rotation. The complete bass circuit is shown in Fig. 10.

(*To be continued*)

FREE TELE-MIRROR

...an amazing one-two offer with your next purchase of three Teletrons

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You give *better service* at no extra cost because Teletrons *actually improve* your customer's set performance. That's the bonus Du Mont's acknowledged leadership gives you *every time* you install a Teletron.

You get the TELE-MIRROR FREE... as an *added* bonus for better service.
It's the service tool you've wanted most ... needed most... and haven't been able to buy anywhere!
A self-clamping, 8" x 10" BLACK MAGIC mirror, target-lined for accurate picture alignment.

This offer is limited, so act fast! See your Du Mont Jobber today!

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CATHODE-RAY TUBE DIVISION • ALLEN B. DU MONT LABORATORIES, INC. • CLIFTON, N. J.

What's New in Radio

(*Continued from page 76*)

The Model CB-8 is designed to accommodate 8" speakers while the CB-12 will house 12" units.

For full details write the company's sales office at 4753 N. Broadway, Chicago 40, Illinois.

AUDIO TRANSFORMERS

Standard Transformer Corporation, 3580 Elston Ave., Chicago 18, has introduced two new line-to-v.c. transformers for 70.7 volt line audio distribution systems.

The A-8102 is for 8/4/2/1/.5 watts while the A-8103 is for 16/8/4/2/1/.5 watts. Both operate into load impedances of 4, 8, or 16 ohms.

Details are available on request.

PLASTIC COATING

A clear acrylic plastic coating, packaged in a self-spraying container, has been developed by *Tru-Pine Company* of 7638 Vincennes Avenue, Chicago.

Tradenamed "Sprayway," the coating is quick drying and provides a flexible and durable finish that resists oils, alcohol, grease, acids, water, and dirt. It can be used to provide protection for electrical parts, terminals, and wiring.

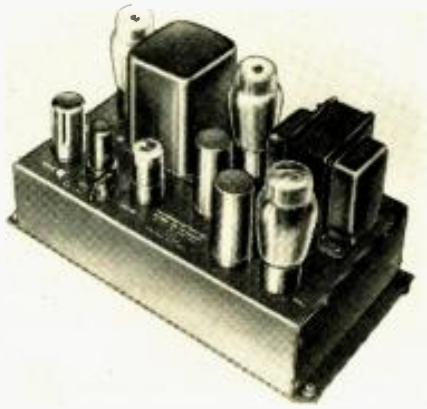
This new spray has high dielectric properties, adds life to old, cracked, and deteriorated insulation and helps prevent leakage and short circuiting.

15-WATT AMPLIFIER

The Sargent-Rayment Co., 212 9th Street, Oakland 7, California is currently marketing a 15-watt amplifier-preamp, the SR88.

Designed for custom installation work, the unit is for use in conjunction with any high quality tuner which does not provide a properly compensated phono preamp.

Specifications on the SR88 include harmonic distortion (at 15 watts) of .32 per-cent at 400 cps, with maximum distortion not more than .5 per-cent at any frequency from 30 cycles to 15,000 cycles; frequency response ± .2 db from 20 to 20,000 cycles; a hum-free magnetic phono preamp with adequate



gain for low-level reluctance cartridges; and 26 db of inverse feedback.

A specification sheet covering this new unit will be forwarded on request.

HIGH-VOLTAGE SUPPLY

Spellman Television Co., Inc., 3029 Webster Avenue, Bronx, New York has introduced a new high-voltage power supply unit which has been especially designed for laboratory work.

The Model LAB-30 is a continuously variable 1 to 30 kv. regulated d.c. power supply with regulation of ½ of 1% at 1 ma. Up to 2 ma. may be drawn from 20 kv. down. This 16-tube

DICK TRACY'S RADIO COMES TO LIFE

THE first experimental, working model of "Dick Tracy's" famous wristwatch radio has been presented to Chester Gould, creator of the comic strip detective, by Western Electric Company's Allentown plant.

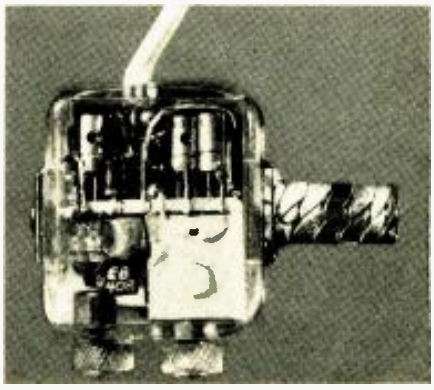
The radio, made possible by the invention of transistors, was designed and produced as an after-hours experiment by a couple of W-E engineers.

Weighing only a few ounces, the radio measures only 1½" long by 2" wide by ¾" thick. Using a fine wire antenna worn inside the coat, it is possible to receive radio stations a hundred miles away under favorable atmospheric conditions. A small loudspeaker is worn on the coat lapel.

There are two small knobs on the side of the case, one tunes in stations by means of a two-gang variable condenser while the second knob controls volume. Only two tiny hearing aid batteries are required to operate the set since the use of transistors eliminates the need for an "A" battery. One junction-type transistor is used for the r.f. stage to amplify the incoming signal. Three cartridge-type transistors are employed in the set—one acts as a regenerative detector while the other two are a.f. amplifiers. All the other components including transformers and fixed condensers are of miniature design to fit the tiny plastic case.

Although this radio was built as an experiment only and will not be manufactured as a standard item by Western Electric, it does serve to demonstrate the potential for transistors. —30—

Western Electric's version of "Dick Tracy's" wristwatch radio. The set also includes a hearing aid loudspeaker, a battery container, and an antenna worn around body.



Fast Fit for the Job at Hand . . .

MALLORY MIDGETROL®

Round-Shaft Volume Controls

START FAST . . . FINISH FAST . . .

- Because of the wide and easy adaptability of Mallory Midgetrols, it's easy to stock—or get fast from your distributor—just what you need to do your job.
- Round tubular shaft designed and built for fast, easy and accurate cutting.
- Factory-tested AC switch may be attached instantly without disassembling control.
- Speedy adaptability to both split-knurl and flatted type knobs.

CUSTOMER-PLEASING RESULTS . . .

- Longer lasting resistance elements even in extremes of temperature and humidity.
- Better and more accurate taper curves resulting from precision processing methods.
- No pigtail connections to break—thanks to Mallory's exclusive sliding contact that gives EXTRA quiet operation.
- Minimum wobble with Mallory exclusive two-point shaft suspension.

So Versatile are Mallory Midgetrols —both standard and dual—that they reduce by 40% the cost of inventory needed to service the 10 most popular makes of radio and TV sets.

Make Sure! Make it Mallory!

Every Mallory Midgetrol is packed with two shaft ends to make it easy for you to use either split-knurl or flatted type knobs. The Mallory Midgetrol line, in addition to round shaft standard controls, includes dual concentric controls that offer fast, easy assembly in five steps *without* special tools. Front and rear sections are factory assembled and inspected. AC switch attachment is easy.

P. R. MALLORY & CO. Inc.

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P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

unit is of the r.f. type consisting of a separate oscillator and buffer feeding the power oscillator into a doubler rectifier. Regulation is accomplished through feedback into a d.c. amplifier plus simultaneous output control of

the buffer. The unit is available in both rack and bench models.

SPEAKER ENCLOSURE

R-J Audio Products, Inc., 164 Duane Street, New York 13, New York has announced that production is now underway on its *R-J* enclosure which was introduced to the public at the Audio Fair in New York.

The enclosure is designed to be used with any loudspeaker. The line will be available, without the speaker, in models to accommodate 8", 12", and 15" speakers.

A data sheet on the new enclosure and a listing of the parts distributors and sound dealers who are carrying the unit are now available on request.

NEW AMPLIFIER

Newcomb Audio Products Co., 6824 Lexington Avenue, Hollywood 38, California has introduced a new amplifier which has been designated as the "Classic 25."

According to the company, every practical operational feature developed in 15 years of electronic research has been incorporated in this new unit. Frequency response extends from

below 10 to over 100,000 cycles. The newly-developed "Audio-balance" feature permits anyone to achieve perfect balance of the output tubes in seconds. A special "Adjusta-panel" extends the control shafts instantly for easy cabinet mounting through the panel if desired.

Six inputs are provided for radio, TV, tape recorder, crystal pickup, and two magnetic pickups. A "Fletcher-Munson" compensated volume control maintains perfect aural balance, according to the company. A crossover selector simplifies the attainment of correct playback response, including foreign and domestic crossovers, and the new AES standard.

CERAMIC CONDENSERS

A line of disc-type ceramic condensers is currently available from *Allen-Bradley Company* of Milwaukee, Wisconsin, manufacturers of fixed and adjustable molded resistors.

The new line ranges from .001 to .01 μfd. The basic element of these new units is a ceramic disc of high-K dielectric which is molded and sintered at the company's plant. A deposit of silver paste is then applied to the face of the disc and heat treated to reduce the paste to metallic silver.

Leads are soldered to the silver surfaces and the entire unit is insulated with phenolic resin. The condenser is then wax impregnated to resist moisture. All of the manufacturing processes on this new line are performed and controlled by the company from whom complete details on these units may be obtained.

AUDIO GENERATOR

Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, New York has announced the addition of a

new sine- and square-wave audio generator to its line of kits and wired instruments.

The new "*Eico*" Model 377 provides complete sine-wave coverage from 20 to 200,000 cycles in four individually-calibrated ranges; complete square-wave coverage from 60 to 10,000 cycles (5% overshoot at 10 kc.), read on the same scales as sine wave; a four-gang tuning condenser; response of 1.5 db from 60 cycles to 150 kc.; and distortion of only 1% of the rated output.

The instrument is housed in a rugged steel case which measures 11⅛" x 7⅝". In kit form the unit has been designated as the Model 377-K. Information on the Model 377 as well as other instruments in the company's line is available.

V.H.F. TRANSISTORS

Engineers at *Radio Corporation of America* have reported a significant advance in transistor research which, for the first time, points the way to v.h.f. applications in television, FM radio, and point-to-point radio communications.

Several developmental point-contact transistors have been made to oscillate

Here's your Opportunity

to prepare for a good job or a business of your own in TV SERVICING

There are today more good jobs open in TV Servicing than there are trained and experienced men to fill them. Yes, thousands of opportunities exist now for good-pay jobs offering employment security for years and years to come. Thousands of TV Servicing jobs are going begging. Do you want one of them?

Experts agree, that because of the critical shortage of trained and experienced TV Servicemen, and the tremendous future growth of the industry, no vocational field today offers more opportunities than TV Servicing.

The Big New Industry with a Great Future

Television is just in the beginning stages of its big industrial boom. Look at these amazing facts:

- Lifting the freeze on new TV stations will open many new TV areas and will improve the coverage of existing areas. The result will be an enormous demand for TV receivers.
- Within a few years over 1000 TV stations will be telecasting compared with 108 TV stations now on the air.
- Nearly one-half of all families living within the present TV areas do not yet own TV receivers.
- The new trans-continental video network plus better and more interesting programs plus larger viewing screens and color TV will increase the installation of new receivers, will induce present owners of 12-inch and smaller size viewing screens to buy newer model receivers.
- The power increases of many existing stations and improved reception range of current receivers will result in receivers being installed and serviced in the fringe areas of present stations.
- Under the FCC proposal, over 70 per cent of all communities will be served by UHF channels exclusively. This means TV servicemen must know UHF receivers before the new UHF stations in their area are opened.
- No one yet knows how great the industrial TV market will be.

RCA Institutes Home Study Course prepares you for a Career in TV Servicing

The addition of the RCA Institutes TV Service Training to your present radio-electronics experience will qualify you to step out and grasp the golden opportunities that now exist in television—America's fastest growing industry.

Learn at home—in your spare time—while you study the practical *how-to-do-it* techniques with *how-it-works* information. Easy-to-read and easy-to-understand lessons under the supervision of RCA engineers and experienced instructors quickly train you to qualify for the many good jobs now waiting for trained TV servicemen. Don't pass up this lifetime opportunity for financial security and a bright future in TV. Learn TV Servicing from RCA—pioneers and leaders in radio, television and electronic developments.

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

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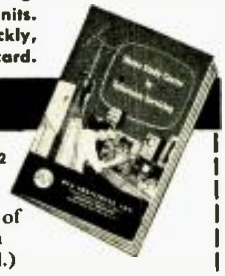
Mail the coupon—today. Get complete information on the RCA INSTITUTES Home Study Course in Television Servicing. Booklet gives you a general outline of the course by units. See how this practical home study course trains you quickly, easily. Mail coupon in envelope or paste on postal card.



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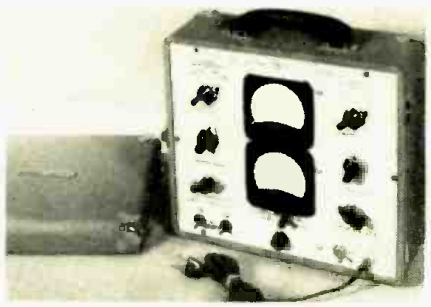
at frequencies well up in the 100-to-200 mc. band and one reached a record high frequency of 225 mc. The highest frequency value previously reported has been 50 mc.

The new developmental transistors are the result of *RCA's* continuing research program in the field.

TEST INSTRUMENT

A germanium diode checker for use in laboratories, quality control departments, service shops, and wherever a need exists for checking the static characteristics of diodes has been announced by *General Electric Company.*

In addition to its primary function, the unit may also be used for general resistance checking, as an accurately



metered power supply, for forming electrolytics, and checking d.c. leakage current.

The new unit, the Type ST-12-A, has test clips for diodes having leads and for those with pins on each end. Should the test clips be shorted on any range, the circuit is designed to prevent instrument damage.

A 3-inch voltmeter and a 3-inch current meter permit voltage and current to be metered simultaneously. All voltage ranges are continuously variable. The unit measures 10" x 11" x 6" and weighs about 8 pounds.

Further information is available from Dept. N-12, Inquiry Section, Advertising Division, Electronics Park, Syracuse, New York.

AUDIO INPUT SYSTEM

Pickering and Company, Incorporated, Oceanside, Long Island, New York is now offering a new audio input system, the Model 410.

This equalizer-preamp unit is designed to serve as an audio control center. It has three input channels—

two for high-level audio signals and one for magnetic type pickups. The pickup channel provides 40 db gain at 1000 cycles and 6 db-per-octave of bass boost below the low frequency turnover.

Used with a high quality power am-

Long Life—Low Maintenance
No Comebacks with the

New 300 OHM TRANSMISSION CABLE by BELDEN

FOR 50 YEARS *Wiremaker for Industry*

To You, Belden's Golden Anniversary Means

—product performance that can come only from a "know-how" that has grown through actual service since the inception of Radio.

—an ability to co-operate in pioneering new wires to meet or anticipate industry's growing needs.

In the years that follow

This Belden Program Is—

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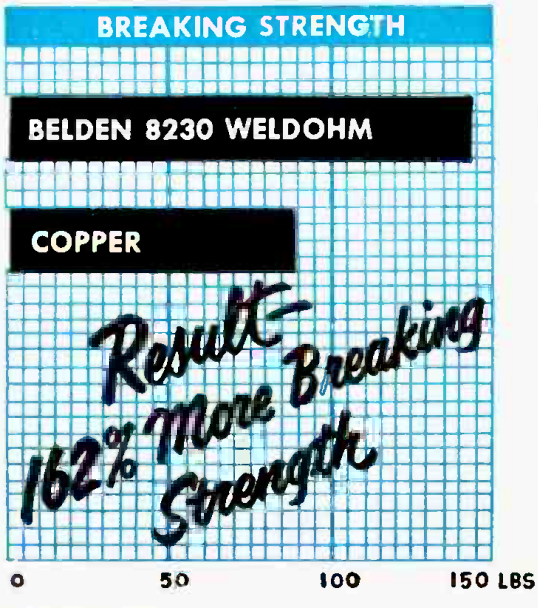

No. 8230

COPPER-SHEATHED 20-GAUGE STRANDED STEEL WIRE

Brown Polyethylene-Resists Weather and Oxidation

The new Belden Weldohm, 300-ohm Transmission Cable is the greatest advancement in television installation since television began.

Reducing TV lead-in conductor breakage to a minimum is easy. The new Belden Weldohm Cable has overcome the breakage point by 162%, that's 1½ times the strength of pure copper wire.

In actual test, Belden Weldohm Cable will withstand 254% more whipping or severe flexing than the average installation of 300-ohm copper lead-in wire.

There is no difference in the electrical characteristics between an all-copper conductor and the Belden Weldohm copper-coated steel wire. The web is 72 mils of 100% virgin polyethylene.

Replace with Belden Weldohm or make your next new installation with Weldohm and avoid expensive loss of time and labor.

Specify Belden—Weldohm Transmission Cable.

Belden Manufacturing Co., 4681 W. Van Buren St.
Chicago 44, Illinois

Belden *Radio* **WIRE**

plifier, the controls provide complete flexibility for volume and tone balance. It is self-powered, operates from a 117 volt a.c. line, and may be installed by means of a few simple tools. Three a.c. outlets on the rear of the chassis are controlled by the a.c. switch on the panel, permitting this unit to be used as a master power control for the other components of the system.

Technical specifications on the Model 410 are available from the company.

GERMANIUM DIODES

Hytron Radio & Electronics Co., a division of *Columbia Broadcasting System, Inc.*, Salem, Massachusetts is currently in production on a line of germanium diodes.

Presently available are the Types 1N48, 1N51, 1N52, 1N63, 1N64, 1N65, 1N69, 1N70, 1N75, and 1N81. The Types 1N69, 1N70, and 1N81 will be supplied to conform to the applicable JAN-1A testing specifications.

These new *'CBS-Hytron"* germanium diodes are "humidity-proof," encased in impregnating wax, and surrounded by a glass-filled plastic. Compact dimensions follow closely those specified by JAN-1A. The germanium wafer is not plated but directly soldered to the base, thus eliminating flaking.

Inquiries regarding these production units as well as special types available on order will be welcomed by the company. —30—

International Short-Wave

(Continued from page 71)

being the world's "largest" island. The area of *Dutch* New Guinea is 151,789 square miles and the estimated population (1951) is 1,018,000. Of the entire population—which is steadily growing—only 321,000 live under Dutch rule. Only a few of the inhabitants are Europeans or Eurasians. The capital city, Hollandia, in 1951 had an estimated population of 32,059. By January 1951 there were 524 village schools with 26,285 pupils; care was being taken to avoid any harm due to a sudden impact of Western civilization on a primitive society. Opening up the interior of the country and its modest agricultural resources through road-building has met with great difficulties because of the excessive rainfall—101 inches annually. Pending agricultural development, the "foreign" population must depend largely on imported food. The territory is practically undeveloped except for the extreme western coastal portion. Commerce and industry in Dutch New Guinea are almost unknown, although some oil and mineral industries are being introduced now. The people generally live in a very wild state. At least until a few years ago —and perhaps yet—head-hunting and cannibalism were all too prevalent.

Seventy-five persons can be seated in this modest studio of Radio-Omroep Nieuw-Guinea, located near Hollandia, capital city of Dutch New Guinea. More modern broadcasting facilities are now under construction for this land where not more than ten years ago natives lived "in the stone age."

Some of the natives are somewhat nomadic, others entirely so. Since they live largely on sago—which is obtainable everywhere in large quantities with a minimum amount of labor—there is no incentive to work except to hunt a few animals and to fish. The only lucrative employment followed is to hunt the Bird of Paradise; collect the wild nutmeg, the mace of which is much esteemed and marketed especially in Makassar, Celebes, Indonesia, or to prepare copra. Men and women go about almost entirely naked. There are headmen of villages but they have little power. The people of the coastal areas are often at war with the people of the scrub lands in the interior and there is en-

mity between these and the mountain folk.

Our best wishes for the future go to *Radio-Omroep Nieuw-Guinea* at Hollandia, Dutch New Guinea, located on the western end of that far-off Pacific island that now lays claim to the title of "largest island in the world!"

* * *

Radio Club Notes

Japan—Kenro Wada, co-editor for the Japanese Short-Wave Club, Kitagobancho 48, Sendai, Japan, says the club has started a monthly house organ which will carry DX news and information in *English*. The club will welcome members from anywhere in the world. Details can be had direct from Mr. Wada.

* * *

This Month's Schedules

Albania—ZAA, 7.850, Tirana, still has news 1615-1630 in parallel with 6.560A. (Pearce, England)

Angola—*Radio Clube de Angola*, 11.862A, Luanda, still noted weekdays to 1730 closedown when plays "A Portuguesa." (Pearce, England) Sunday close is 1530. (Stark, Texas) Pearce notes CR6RB, 9.165, Benguela, at 1300 with recordings and to 1400 sign-off (on Sundays may run to *after* 1430). *"DX-Radio,"* Sweden, says CR6RG, 7.070, and CR6RI, 4.977, Dundo. *Radio Diamang*, are heard in Sweden 1400-1530.

Argentina—Richmond, N. Y., comments that LRA, 17.720, Buenos Aires, has had an improved signal lately afternoons and early evenings (*English* runs now 1700-1930). Still noted over LRU, 15.29, with *English* for western North America 2300-0100. (Alcock, Ky.; Bellington, N. Y.) LRA is now using 9.69, replacing 15.345, for the all-Spanish session around 1900-0100.

Austria—Blue Danube Network, 9.617, Salzburg, noted with news 0400, 0600. (Pearce, England)

Australia—VLA15, 15.200, Melbourne, noted a recent Sunday with DX session 0035 in beam to western North America; VLB9, 9.58, noted 0115. (Hoffman, N. Y.) VLM4, 4.917, Brisbane, heard with ABC news 1500, then train information, Queensland State news, and early morning music 1510; news 1545. (Pearce, England) A *new* outlet for *Radio Australia* is VLC7, 7.220, which opens 0615 and runs to after 0900, beamed to South and Southeast Asia; is fair level in Eastern USA.

Balearic Islands—Mahon, 7.545, is noted in Sweden around 1430.

Bechuanaland—ZNB, Mafeking, sent QSL card for report of last February on the 8.230 channel but did not enclose schedule. (Pearce, England)

Belgian Congo—Bishop, Ohio, and Niblack, Ind., note OTM2, 9.38A, with French identification 0115 and signing off 0130A. Usually opens around 0000. *Radio Sweden* says OTH, 9.210, *Radio Congo Belge*, is heard in Sweden 1320.

Bolivia—CP38, "La Cruz del Sur" ("The Southern Cross"), 9.505, sent this schedule—Sundays 0655-0815, 1100-1600; weekdays, 0555-0730, 0930-1245, 1755-2115. (Casey, Ky.)

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Here is the FINEST STEREO CONVERSION SYSTEM . . . the finest BASIC HI-FI SYSTEM (just add any turntable)

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UV-35 3 speaker system with Bell Amplifier..... **$149.50** SUG. USER NET

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Model UV-33 $69.50
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Other 3 Speaker and 2 Speaker packages available, also without amplifier.
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The Nation's Largest Cabinet Specialists to the Radio, TV and Hi-Fi Industry

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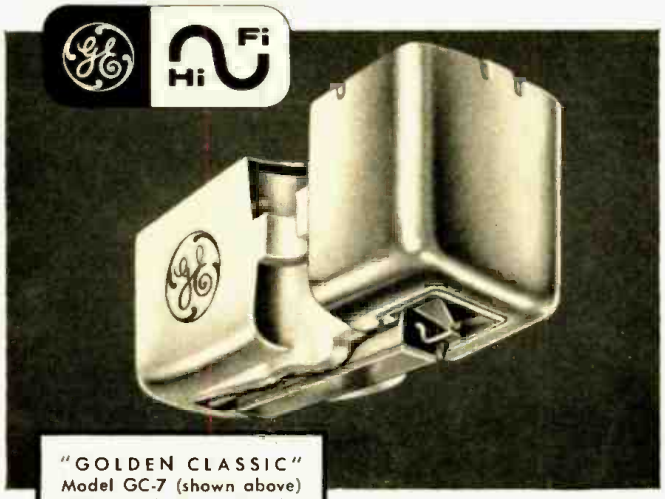

"GOLDEN CLASSIC" Model GC-7 (shown above) with .7 mil diamond stylus $23.95*
"GOLDEN CLASSIC" Model GC-5 (for professional-type tone arms) with .5 mil diamond stylus $26.95*
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For matchless reproduction, use with G.E.'s new "Stereo Classic" tone arm. Write for complete specifications. Ask for a demonstration at your dealer's soon. General Electric Company, Specialty Electronic Components Dept., Section 58, W. Genesee St., Auburn, N. Y.

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GENERAL ELECTRIC

Brazil—PRB22, 9.505, Sao Paulo's *Radio Record*, signs on at varied times between 0500-0505. (Kary, Pa.) ZYK2, 15.145, noted in Portuguese 0715, fair to good level; ZYC9; 15.370, *Radio Tupi*. heard with Portuguese 1800-2100 when is "buried" in CWQRM. (Saylor, Va.) PRA8, 6.0153 (*measured* recently at 1730 when had good level), noted in Portuguese. PRL7, 6.1467, noted here at 1850 recently with music; announced "Radio Nacional" at 1900. (Oskay, N. J.) PRK9, 15.185, Belo Horizonte, noted 1725 with relay of "Agencis Nacional." Had QRM from London, 15.180 (Catch, England) Niblack, Ind., says he believes the program in *English* "from the Midnight Room of the Copabana Palace Hotel" at 2145 over PRL7, 9.720, Rio de Janeiro, is a regular *Sunday* evening feature; it is sponsored by a commercial airline.

British New Guinea—VLT9. 9.520. Port Moresby, picked up 0115-0300 sign-off; at times has strong level in Virginia; station announcement 0230. VLT7, 7.28, noted with ABC news 0600, fair level. (Saylor)

Bulgaria—*Radio Sofia*, 6.070. 7.671, noted in *English* for British Isles 1500-1515 and 1600-1630. (Pearce, England) Has *English* for North America 2000-2030, 2300-2315 over 15.330.

Canada—CBRX, 6.160, Vancouver, B. C., noted 0015-0030. (Niblack, Ind.) Widely reported at good level is the CBC's *new* outlet CKEX, 11.090, scheduled for relay to Canadian Forces in Europe on Sundays *only* at 0720-0905 in parallel with CKLX, 15.090.

Canary Islands—EA8AB. 7.500V, was recently *measured* on 7.515, another day on 7.502 around 7.502, but later was found back on 7.515. (Oskay, N. J.)

Cape Verde Island—Praia, 7.114A. noted from tune-in 1630 to 1700 when closed with clock striking, then "A Portuguesa." (Pearce, England) Recently was *measured* 7.1147 at 1650. (Oskay, N. J.)

Ceylon—The Commercial Service of *Radio Ceylon* noted on 15.120 at 0215; closed down 0230. (Pearce, England) This one opens 2045 and relays BBC news from London 2100. (Balbi, Calif.) Strong level most days in West Virginia.

Chile—CE960, 9.593A, Santiago, noted recently at fair level when tuned 2125 but with light CWQRM. (Hord, Ind.)

China—A Chinese station found as high as 11.712 heard mornings around 0500-0530 and later may be *Radio Peking's* listed 11.690 channel. (Ferguson, N. C., others) Peking has *English* 0400-0430 on 6.100, 9.040, 10.260, 11.690. 15.060. 15.170; 0830-0900. 1730-1800 on 11.690, 15.060. (Radio Sweden) Mukden, 7.677. Manchuria, was heard briefly 0530; female announcer in Chinese to 0533, then music; had strong heterodyne from TTY carrier just below which soon obliterated Mukden. (Kary, Pa.)

Colombia—HJKJ, 6.160, Bogota, noted at strong level 2200-2300. (Tarr,

Many a well-paid man is grateful for this FREE fact-packed booklet, which details

HOW YOU CAN BE SUCCESSFUL IN RADIO-TV-ELECTRONICS

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EVERY success in Electronics has a story behind it. Sometimes you hear it's "luck." Other times, "contacts." What do the successful men themselves say? *They give credit to training.* In addition, many men on the way up thank the day they sent for a booklet titled "Your Future in the New World of Electronics."

This is the eye-opening survey of the fast-growing world of Electronics. Many eager, ambitious men started their technical careers with a study of this booklet.

Expansion is phenomenal in this dynamic industry. There are over 100,000,000 radios in use! Experts predicted that by 1954 there would be 13,000,000 TV sets. That mark was passed a year ago. Today there are 16,184,000. 109 television stations are now in operation, and the lifting of the freeze will send 1500 to 2500 new stations scrambling for trained personnel—so urgently needed in every phase of electronics. That isn't the whole picture. Consider the tremendous defense orders for electronic installations—consider the fire and police departments, the railroads, the cabs, the aircraft—all using radio. Consider radar. Consider the maritime world with its navigational aids, fathometers, ship-to-shore and ship-to-ship communications. Think of electronic heating, fax and ultra-fax, of electronic medicine, and all the other applications of electronic know-how.

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Washington State) HJFW, 5.020, Manizales, noted 2327-2345; all-Spanish. (Patterson, Ga.) HJCT, 6.200, Bogota, heard 2252 with preview in Spanish of next day's program, then signed 2300 with Colombian national anthem. (Casey, Ky.)

Costa Rica—TIHH verified from Radioemisora Athenea, Calle 2a, Avenidas 8 y 10 (or Apartado 2208), San Jose, Costa Rica; frequency (which varies) was listed 11.972. (Kary, Pa.)

Cuba—COJK, 8.665, Camaguey, heard 2003-2055; all-Spanish. (Patterson, Ga.) COCY, 11.725A, Havana, uses both Spanish and *English* for daily sign-off 0030. (Niblack, Ind.)

Curacao—PJC2, 5.017A, noted with commercial in *English* 1925 recently. (Niblack, Ind.)

Cyprus—ZJM6, 6.970, "Asharq al Adna," Limassol, is heard in Sweden 1300 and again 2200. (GDX-aren, Sweden)

Czechoslovakia—"Voice of Peace," Prague. noted on 11.84 in English 0715-0741. Heard signing on 1400 in *English* on 9.504. (Pearce, England) Has *English* for North America 1930-2000 on 9.55; remainder of the evening (1820-0100) takes relay of *Radio Moscow's* beam in *English* to North America. (Saylor, Va.; Gaylord, Washington State; others)

Denmark—Copenhagen, 15.165, noted opening in Danish 0900; *English* 0950; announced was broadcasting Tues., Sat. 0900-1000 to India, Malaya, and the Far East. (Peace, England) OZF, 9.52, has nice signal in the 2030-2130 and 2200-2300 sessions for North America; still asks for reports. (Mast, N. Y.)

Dominican Republic—"La Voz Dominicana" now seems to have an *English* session around 2100-2110 on 9.735, 5.970. (Casey, Ky., others) Also noted over the 11.94 harmonic (of 5.970). (Niblack, Ind.) HI1A, 4.980, *Radio Caribe,* Santiago de Los Caballeros, noted 1939-2000; severe QRM from WWV; all-Spanish. (Patterson, Ga.)

Ecuador—HCJB, Quito. has replaced 12.455 (10 kw.) with 11.915 which has strong level but much QRM and CWQRM. The 9.743A outlet is noted by Pearce, England, in *English* for Australia-New Zealand 0130-0300; strong level.

Radio Manta, HC4EB, *measured* 6.8699, noted 2145-2232 sign-off with Spanish songs to guitar accompaniment and Latin American dance music; good signal but through heavy CWQRM (Rastorfer, N. Y.)

Egypt—Cairo, 7.865A, noted with native music 1715 and signing off 1800 with national anthem. (Pearce, England)

Ethiopia—Radio Addis Ababa, ETAA, 15.047A, still noted from 1130-1303 in Amharic; *no English.* (Pearce, England)

Finland—OIX4, 15.190, Helsinki, still noted opening 2200 to North America; following a preview in Finnish, has short newscast in *English.* (Ferguson, N. C., others) This one noted in Oregon from 2330-2400 close-

down, using Swedish. (Annala) Heard on this channel 0700 with news in Finnish, news in *English* 0715-0729, news in French 0750; also uses 9.55, 17.80. (Pearce, England)

France—According to latest schedules from Paris, *English* is used to Britain 0315-0330 on 7.240, 6.145, and 1500-1600 on 6.200. (Kary, Pa.) Paris, 7.105, noted signing off with "La Marseillaise" 1556. (Pearce, England)

French Equatorial Africa — Radio Brazzaville, 11.970, usually has good signal from before 1700 to 1800 or later; news 1745. (West, Virginia) Has *English* daily 0015, 0515, 1100, 1315, 1650, 1745; principal channels are 9.440, 11.970. (Kelting, N. Y.) Heard on *measured* 15.605 at good level when tuned 0610; identified in French 0615. (Ferguson, N. C.)

French West Africa—Radio Dakar was recently heard on 9.71A at 0250-0300 sign-off in French. (Patterson, Ga.)

Germany—Hamburg, 11.795, signs on Sundays (in German) at 2359 Saturday *EST*; weekdays at 2300; noted in German at 2330 (Bellington, N. Y.)

RIAS, 6.005, Berlin, heard with dance music when tuned 1715; news in German 1800; also noted 0100 with music; daily at 1645 has program "America auf Berlin"; Frankfurt, 6.190, noted 0930 with American program in German, dance music from 1000; also noted 0300 with church service; at 1330 with news in German; Leipzig, 9.730V, noted 1654 with dance music; news in German 1800; heard another day 0100 with news in German, then program details in German, followed by orchestral recordings. Munich, 6.160, tuned 0900 when had a children's ("Kinderfolk") program; Stuttgart, 6.030, heard 0830 with children's program; heard also 0100 with news in German, music at 0115. "Hier ist Deutschlandsender, Berlin (Deutsche Demokratische Republik)", 6.115 and 7.150, noted with call 0100, then music; news in German 0130. (Pearce, England)

Greece—Athens, 9.607, is noted 1430 with *English* news, commentary; French 1445. (Pearce, England) Is currently using 11.718A instead of 9.607 for the North American daily session 2000-2100; *English* news around 2035.

Guatemala—TGWA usually has *English* program now 2230-2300 on 9.760, but some nights has been noted on 15.170 instead. (Ferguson, N. C.; Bellington, N. Y., others) TGWB, 6.180A, heard at good level 2300 with announcement in *English* by woman, announcement in Spanish by man. (Tarr, Washington State) TGNA, 9.668, has strong signal with *English* 2200-2230. (Wright, Texas) Still noted at fine level on parallel 11 85; on Wednesdays has Mailbag session when schedule is extended 2230-2300A. (Hoffman, N. Y.) Has Spanish programs 0730-0900, 1730-2200 over 5.952. (Casey, Ky.) TGTQ, 6.283, *Radio International*, announced an *English* period recently for Mon.-Fri. at 2030. (Stark, Texas)

Haiti—4VEH, Cap-Haitien, operated

by the East and West Indies Bible Mission, has returned to the air; noted by Ferguson, N. C., on *measured* 9.634 at 0650; at 0740 a woman identified and asked for reports. QRA is Box 1, Cap-Haitien, Haiti; formerly used 9.710 at 0600-2030.

Latest *measured* channel of the "wanderer," 4VRW, is 9.988 (moved from 9.9636); when checked 1640 had terrific CWQRM. (Oskay, N. J.) This one noted in Maryland when tuned 1100, 1400, and 2145. (Cleveland) 4VM, 6.005, heard with station announcements in French and *English* at 2131 just before leaving with a march.

Holland—Radio Nederland, 9.59 and 11.73, noted with *English* to North America 2130-2210. (West, Virginia) PCJ, 15.22, noted recently 0550-0610 in Dutch, good level in N. C. (Ferguson) The 9.59 outlet is good level in West Virginia when opens *English* session 1630.

Honduras — HRA, 9.047, *measured* here 1950 when had music; found parallel on 5.920; was inactive for a while and moved here from 9.0295. (Oskay, N. J.) HRQ, 6.124, San Pedro Sula, has been coming in with strong signal around 2200; mentions call frequently.

India—AIR noted to Europe in *English* 1345-1445 on 9.560 (some QRM), announcing 7.24, 6.080 as parallel; news 1350. (Pearce, England)

AIR current schedules from Delhi are to East and Southeast Asia—1930-2000, 15.29, 11.85; 2030-2200, 17.74, 15.16; 0600-0815, 17.74, 15.19; 0830-0945, 15.19, 11.78. To Central Europe and United Kingdom — 0230-0330, 17.705, 15.16; 0345-0415, 17.85, 15.16; 1000-1030, 11.78, 7.125. To East, Southeast Africa and Mauritius—2300-0010, 15.13, 11.87; 1045-1215, 9.55, 7.125. To Burma—1945-1955, 9.72, 7.17; 0615-0700, 17.85, 15.16. To China—0430-0545 (to 0530 on Sat., Sun.), 17.85, 15.16; 0530-0630 (Sat., Sun. *only*), 17.85, 15.16. To Indonesia—1745-1800, 11.79, 9.55; 0700-0730, 17.85, 15.16. To Fiji—0200-0320, 21.70, 15.19. To West Indies—1830-1930, 15.29, 11.85, 9.72, 7.17. To Pakistan—2245-2320, 11.71, 9.63, 7.125, 5.96; 0745-0815, 5.99, 4.94; 0615-0915, 7.17; 0945-1000, 7.17, 4.94. To Afghanistan and Adjacent Areas—2215-2230, 7.125, 5.96; 0845-0930, 4.94. To Afghanistan — 0030-0130 (Fri. *only*), 9.67, 7.17; 1130-1230, 7.17, 5.98, 4.94, 3.945. To Persia, Afghanistan—1230-1330, 7.17, 5.98, 4.94, 4.87. To Saudi-Arabia, Egypt, Lebanon, Syria, North Africa, Trans-Jordan, Sudan—2315-0015, 11.76, 9.72; 1230-1455, 7.125, 5.96. To Europe and United Kingdom —1345-1445. 11.79, 9.565, 7.24, 6.085. News in *English* is scheduled 1400-1410, 11.79, 9.565, 7.24, 6.085; 1930-1940. 11.85, 15.29; 2310-2320. 15.13, 11.87; 0300-0310, 17.705, 15.16; 0830-0840, 15.19, 11.78; 1045-1055, 9.55, 7.125.

Indo-China (Vietnam)—Frost, Denmark, says *Radio France-Asie*, 9.750A, Saigon, opens 1730 with French Anthem and then has *English* news for Europe; fair level and in the clear. Hawthorne, Australia, notes RFA on

(*Continued on page* 141)

Variable Power Supply

(*Continued from page* 67)

180° can be obtained. Actually, in practice, the shift never quite makes the 180°. With the values of 2 μfd. and 25,000 ohms, as shown in Fig. 4, a shift of 0° to approximately 175° can be effected.

Adapting the basic circuit shown in Fig. 3A for use in the power supply, we find it necessary to connect the 5 volt and 6.3 volt windings in series (phase adding) to obtain approximately 11 volts. This insures the fact that the grid voltage will be well below the firing voltage until the proper time. It also stabilizes the output voltage against line voltage fluctuations by making the grid voltage rise rapidly from a highly negative voltage to the firing voltage. The effect of a center-tapped transformer is obtained by two series resistors hooked across the two series windings as shown. Since the plate voltages applied to the 2D21's are 180° apart, it becomes necessary to feed the variable phase voltage into a push-pull audio input transformer to obtain the 180° phase shift required for each grid. Thus the voltages applied to each grid are 180° apart and lagging the applied plate voltage by an angle determined by the setting of the phase potentiometer, R_1. Grid resistors are inserted in series with the control grids to limit the grid current to a safe value after the tube fires.

The filter section of the power supply is quite conventional. No attempt was made at "design" since no load conditions are known and also because the input wave shape to the filter can vary from the usual half sine waves to any jagged part of this waveform. For control reasons we want the power supply filter to act much like a perfect choke input filter in which the input choke inductance is infinite. Under these conditions the tube will conduct whenever the plate is positive. Control can then be effected by manually setting the amount of the cycle during which the tube will conduct with the phase shifter. Thus it is desired to make the input choke as large as possible. A 7 henry, 200 ma. choke was used satisfactorily in this unit. If a condenser input filter is used, no control will be possible.

After the unit is constructed, it may be necessary to reverse the leads to the grids or from the series filaments on the power transformer in order to obtain a lagging phase relationship between the grid and plate voltages. No control will be possible if the grid voltage leads the plate voltage.

An arrangement similar to this could be employed with the larger size thyratrons for use in transmitters and other high power applications. Tubes such as the *RCA* 5557 mercury vapor triode could be used. This tube is similar in current carrying respects to the 866. —30—

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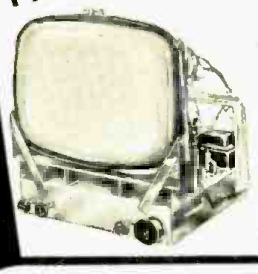

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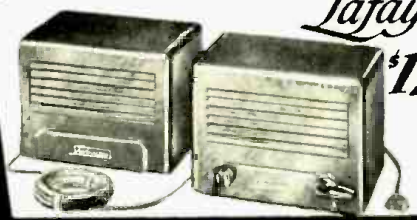

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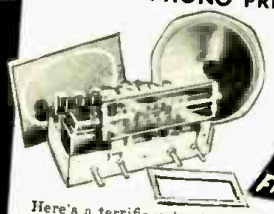

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We're so sure you'll be enthusiastic about this buy that we'll permit you to return it within 30 days of purchase date for a full refund, less transportation charges.
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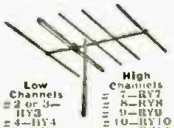

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3	8—RY8	8	9—RY9
4	9—RY9	9	10—RY10
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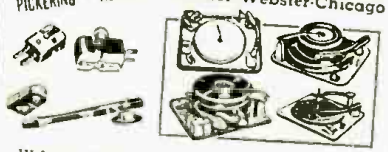

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Increases video and sound output over 20%. Consists of complete IF stage which easily plugs into any receiver inside the cabinet, thus eliminating external switches and connections. Has advantages of broad band boosters but without separate tuning for each channel. Ideal for poor signal areas.
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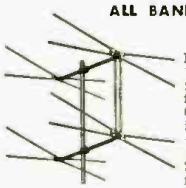

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Model P21861, Shpg. wt. 13 lbs. ..... Net **7.95**
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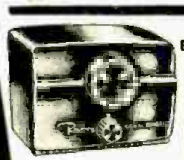

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Spot Radio News

(*Continued from page* 18)

since their requirements constitute such a major factor in over-all production. In one of the frankest discussions of the problem, before the annual meeting of RTMA, Lieut. Colonel William F. Starr, of the Electronics Production Resources Agency, revealed that except for certain special types of receiving tubes, there is sufficient capacity now existent to meet current military procurement. However, he said, the capacity to produce the *reliable*-type miniature tubes is critical and the military will probably seek expansions in this field through private financing, government funding, and the placement of military orders, which was described as pump-priming. It was then pointed out that there are two factors which will undoubtedly influence tube production in case of war: available manpower and the supply of metals such as nickel and tungsten.

Noting that the shortage of receiving tubes that does exist is not due to a lack of facilities, but rather a lack of know-how, the production expert said that this condition exists because so many tubes are of recent design and never have been mass produced. However, he declared, these trouble spots are constantly changing and are usually of short duration.

The power tube field, the Colonel emphasized, does not represent an attractive picture, for here shortages do exist among three classes: hydrogen thyratrons, magnetrons, and klystrons. Reporting that the production of high-powered and tunable magnetrons has not kept pace with military requirements, in spite of the fact that the military services have already expanded the magnetron facilities of ten companies, the government rep added that even more expansions will be necessary.

Describing the critical klystron situation, Colonel Starr said that much of the equipment using the small ruggedized klystrons is now in the development stage. Because of this, it was said, it is extremely difficult to determine realistic requirements. However, the tubes are important and programs are under way to increase klystron facilities. As the projects which are under development approach the procurement stage, the Colonel declared, action will be initiated to expand the industry to meet the new requirements.

To facilitate coordinated tube production, an *assignment-of-responsibility* program has been introduced. According to Washington, this program was developed to eliminate the over-expansion of the same segment of industry by the various services and to provide industry with a contact point for each tube-category where all facility expansion contracts will be negotiated. At present, the Army's re-

sponsibility revolves about flat-press subminiatures and hydrogen thyratrons. The Navy has seven tubes to worry about: button-stem subminiatures, glass and GT tubes, metal tubes, miniatures, phototubes, power (including vacuum and mercury vapor rectifiers), and ultra-high power and transmitting tubes. To the Air Force has been given responsibility for eight categories: acorn, cathode-ray, gas switching klystrons, magnetrons, pool cathode strobotrons, flash tubes, and thyratrons with the exception of hydrogen thyratrons.

Summarizing the present military problems, Colonel Starr said that the military has established a procedure which will determine on a periodic basis the government's tube requirements and industrial capacity. From an evaluation of these factors, he continued, a program will be developed and continuously reviewed to insure that industry will be capable of meeting military tube requirements.

IN RECOGNITION OF FCC Chairman Paul Walker's participation in the recent "Voice of Democracy" contest, a special luncheon was held in Washington to honor him. Among the guests were Judge Bolitha Laws, chief judge, U.S. District Court for the District of Columbia; Judge Justin Miller, NARTB board chairman and general counsel; Rep. William S. Hill of Colorado; Rep. E. L. Forrester of Georgia; Leeman Anderson, secretary to Senator Richard Russell of Georgia; and Allen M. Woodall, president of WDAK, who served as host.

Shortly after his appearance at the luncheon, Walker attended the fifth annual radio and television institute meeting at the Pennsylvania State College and presented some extremely interesting views on the current allocations situation.

Reviewing the importance of TV and schooling, the Commisson's headman said that in due time the TV screen will be as much a standard fixture in the classrooms as the blackboard. "As has been so aptly said, television is the electronic blackboard of the future," he added.

In his opinion, our goal should be a large-screen TV receiving set in every one of our one-million classrooms within range of a TV station. "The question is not, *can* our schools afford television," Walker said, "but can they afford not to employ it."

Commenting on the flood of applications that has reached the Commission's desk, the government's chief air patrolman said that the TV boom is on, and many educational institutions have joined the parade of applicants.

RTMA has expanded its statistical service to the industry to include a nationwide monthly compilation of the movement of radio and television receivers at the retail level, including dealers' sales and inventories. The new survey will provide data by regions, by screen sizes, and by radio receiver types. Results of the first monthly survey will be made available to manufacturers and dealers in September.

THE RADIO AMATEUR CIVIL EMERGENCY service, proposed by the Commission at the beginning of the year and subsequently submitted to radio specialists for discussion, has won the general approval of over twenty state, country, and civil defense organizations, including the Association of Police Communications Officers, the Federal Civil Defense Administration, and the ARRL. As a result, this all-important service has been officially approved and is now ready to serve our country as a robust communications link. The sponsors of this vital CD agent merit a resounding round of applause for their vision and sound planning. . . . . L.W.

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

ONE of our most familiar axioms is the succinct statement that "A chain is no stronger than its weakest link." And as we travel about the country talking to service operators, distributors, manufacturers, and the buyers of service—the general public—we are continually picking up first-hand information about concrete examples of the "weak links" in the independent servicing business. These are the men who are hurting their fellow service technicians because of their ignorance of what their labor and technical skill is worth. We are constantly amazed at how often service technicians practically *give away* their time, talents, and hard-won technical experience even when customers do not expect it from them.

The experience of a friend in dealing with a radio service technician typifies a practice that is common to many men in the radio service business. This service technician drove to the customer's ranch home, located some eight miles from the little town where he lives, to check an inoperative radio set. He checked the tubes and found the trouble to be a dead tube. He charged *one dollar and fifty cents* ($1.50) for the job which included the new tube, his time, transportation, and know-how! In other words, he placed a value of only about fifty cents on ninety minutes of his time, his knowledge, and the cost of his transportation for sixteen miles!

Did he leave a highly satisfied customer through giving this philanthropic service? Listen to what his customer had to say and judge for yourself:

"I was surprised when he only charged a dollar and a half," she said. "At that price I couldn't see how he could pay for his gas and the upkeep on his car to drive out to the ranch and still have anything left in payment for his time.

"I wouldn't let him work on my radio if something really bad was wrong with it, or my wire recorder," she continued. "A man who will work so cheaply can't possibly know much about it."

The unfortunate effect of practices such as these is that the men who ignorantly give away their time and expert knowledge for a mere pittance are apt to set the level of "price expectancy" in the communities where they operate. A customer recites such an experience to friends. When one of these friends calls in a service technician to repair a set and he charges legitimately for what his time, material, know-how, and business operating expenses are worth, the friend would say she was "gypped." These practices, so common in radio servicing, were largely responsible for keeping the business of servicing radios on a mere subsistence level.

The expense involved in setting up a

Industry and political leaders who participated in the service mass meeting attended by 700 southeastern Michigan television sales, service, and management personnel. Pictured here (from left to right): H. W. Gilmore, Harry Gensler, Harold Chase (president of TSA), Governor G. Mennen Williams, Herman Rosen (president of RTTM), G. K. O'Brien, Louis Wolfgang (TSA director), and Al Weiss.

TV SERVICING
is easier than you think

How many times have you asked yourself this question: "What can I do to make my servicing job easier?" Chances are you ask it every time you get a "stickler" in the shop. But have you ever stopped to consider that *all* your servicing . . . from the real headaches to the simplest repair . . . can be easier than you ever thought possible if you GET THE COMPLETE SERVICING INFORMATION ON A RECEIVER BEFORE YOU START TO REPAIR IT. Let's take a closer look to see why. *All* servicing data must originally come from the receiver manufacturer. He made the product, so he knows all about it. His information is not based on a single receiver but on hundreds, which are sampled. If you are using this kind of information, servicing is easy; but if you are using abridged data – information which does not originate with the set manufacturer – you do *not* have all the data required to do easy – permanent – prestige-building servicing.

Here's a typical example: For Stewart-Warner model 9122-A the set manufacturer prepared the equivalent of 35 pages (8½ x 11") of servicing data. The complete data is published in Rider TV Manuals Vol. 8 and in Rider TV Tek-File pack 12. The reason was that the production runs covered seven different codings (from A to G) plus 16 important changes in the receivers. Some of these changes were made to eliminate such actions as component resonance in the I-F system . . . horizontal sync instability . . . and the possibility of arcing in the high voltage system. Other changes were in tubes and parts. But *all* of the changes are vitally important to you when you're faced with a repair on this Stewart-Warner model. This is only one case in thousands of why it is absolutely necessary for you to have the complete, official, manufacturer-prepared servicing information for every set you repair.

There are two ways for you to get complete, official, factory prepared servicing information.One way is to write the set manufacturer directly. However, this takes time when you need it most: While the customer's set is in the shop. So the easy way is to buy this data in complete published form. This means Rider Servicing Data! For 22 years Rider Servicing information has been the only publishing source for factory authorized and prepared servicing information: Exactly as issued by the manufacturer who made the set . . . organized into indexed, easy-to-follow style. 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!

And Rider Servicing Data now has these important new features: manufacturers' trouble cures and guaranteed replacement parts listings. The manufacturers' trouble cures are standard (3 x 5") index cards, called Rider Handies, containing vital manufacturer-issued permanent trouble cures plus production changes. Each Handy is identified with a manufacturer and receiver model. With Rider Handies you save countless hours of diagnosis and repair time . . . because Handies contain the data you *must* have to make permanent repairs on many receivers. The replacement parts listings are included in the latest Rider Servicing Data. All these replacement parts must meet the physical and electrical performance ratings of the original equipment.

To meet your individual requirements, Rider TV Servicing Data comes in two forms. The Manual form; volumes covering the complete data on receivers manufactured during a certain period, and Tek-File form; separate packs containing complete data for specific models.

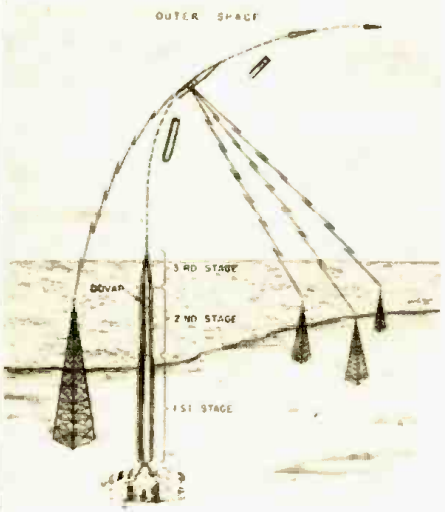
The TV Manual form has nine volumes covering more than 4,200 models of television receivers. Each volume has over 2,000 (8½ x 11") pages of servicing data with an index covering the contents of all volumes. Each volume is attractively bound in a permanent hard cover. The Manual form is ideal for shop use and as a permanent reference.

The Tek-File form now covers more than 2,200 models. Each Tek-File pack contains complete data for several of the most popular models . . . the ones you are called to work on every day. (Contents are clearly marked on the cover of each pack.) These models are bound in handy, standard file folders for easy home and shop use. In each Tek-File pack you get a special coupon. 15 of these coupons plus a small handling charge entitles you to a permanent, hard-cover manual binder for Tek-File shelf use. Or if you prefer, each coupon is worth five cents toward the purchase of any Rider book. Note: Get your free Tek-File indexes covering the contents of all packs at your jobber's. If he doesn't have them, write us.

For the complete servicing facts on *radio*, get Rider Radio Manuals. In 22 volumes Rider Radio Manuals give you the complete, factory-authorized, official AM, FM radio servicing data for receivers manufactured over the past 22 years! Plus complete data on auto radios, record changers, tuners and recorders. Everything is organized and indexed to make radio servicing easy.

DON'T BE SWITCHED

Remember, Rider Manuals and Tek-Files are the *only* source for complete published servicing data. If your jobber doesn't have them, DON'T. BE SWITCHED! If he doesn't have Rider Manuals, write to us . . . we'll tell you where to get them. If he doesn't have Rider Tek-Files, write to us . . . we'll fill your order directly. (Please include your jobber's name.) Why not prove to yourself that Rider Servicing Data really makes servicing easy. Try one Rider TV Tek-File pack *at our risk!* Try a pack for the next receiver you repair . . . if you don't agree that it makes your servicing easier than anything you've ever used RETURN THE PACK TO US WITHIN SEVEN DAYS AND WE'LL SEND YOU A FULL REFUND! So act now . . . you have absolutely nothing to lose! John F. Rider, Publisher, Inc., 480 Canal Street, New York 13, N. Y. West Coast Office: 4216-20 W. Jefferson Blvd., Los Angeles, California.



Ground transmitter (left) feeds questioning signals to DOVAP, which retransmits them to three other ground antennas that are located in triangular pattern.

ROCKET-RIDER RADIO

Miniature radio, known as DOVAP, answers scientists' queries on Vanguard flight.

A RUGGED two-way radio about the size of a loaf of bread will play a part in the launching of the Navy's second Vanguard satellite. The self-contained unit, known as DOVAP (Doppler, Velocity, and Position), is produced by *International Telephone and Telegraph Corp.*

The 10-pound radio will send back continuous information to U. S. scientists on the performance of the first and second stages of the Vanguard missile. Powered by tiny wet cells, DOVAP defines the trajectory and velocity of the two stages during flight and relays vital information on fuel consumption, electrical power, and atmospheric conditions.

Before dropping to earth inside its second-stage carrier, the radio signals that the third-stage rocket and satellite are riding parallel to the earth and ready to orbit. This information is obtained through use of the Doppler principle. Comparison of radio signals transmitted to the missile and retransmitted by DOVAP to three ground stations provide coded data which is translated by high-speed computers to confirm the success or failure of a satellite launching.

The Vanguard DOVAP has been used successfully in high-altitude research studies by IGY scientists at Fort Churchill, Canada, and it will be used later this year at Guam for high-altitude IGY wind experiments. —30—

television service business has forced men who have gone into TV servicing as a business to realistically consider all of their costs of doing business. It is one thing for any individual to be content to worry along ekeing out an existence as a "service technician" in a one-man radio business. It is quite another to put ten thousand dollars or more on the line for equipment and supplies to start a business and then to have to meet a payroll every week. The television servicing activity *must* be operated as a business enterprise or it will fold up.

TSA of Detroit

The Television Service Association of Detroit is one of the several associations of service businessmen that have developed dynamic programs for establishing TV servicing as a respectable, profitable business activity in their local areas. Headed by Hal Chase, president of *Chase Television Service of Detroit,* TSA has been carrying out one of the most effective campaigns ever originated and conducted by a service association. They are assisting responsible service business men in other Michigan cities to create aggressive service associations. They have also been sponsoring a very effective program for the practical training of technicians in how to handle their immediate service problems efficiently.

An important development in the Michigan plan is that they have been able to get the whole-hearted cooperation of set distributors in practically every area where they conduct their two-day clinics. The importance of this phase of their program is in that it conserves the time of technicians in learning the individual characteristics of all new TV models sold by all established manufacturers in a given area.

The plan works this way:

When a two-day clinic is scheduled for a Michigan city, the association arranges for sufficient space to allow each set distributor to have a booth to display his latest TV models. Each distributor contributes a proportionate share of the costs. In addition to this display area, rooms are rented for holding lectures on subjects important to the technicians in the area where the clinic is being held. The set distributors have qualified service personnel in attendance at their chassis exhibits at all times. This enables every technician who attends the clinic to get first-hand instruction on alignment and servicing procedures recommended by the manufacturer on every TV model that he may be called upon to align or adjust in his local area.

The importance of this plan in conserving the time of technicians is immediately evident to everyone engaged in the television servicing business. One of the growing problems of service executives and their technical staffs is in keeping up with set changes and developments from the mass of technical literature that is being produced.

While the lecture programs that are being presented by the individual set manufacturers and test equipment manufacturers are excellent, they demand too many evenings from technicians who are interested in the business only because of the pay they receive for the work they do—and not for "love" of the business.

By presenting the combined programs of all manufacturers in two-day clinics of this kind the industry benefits from the attendance of practically all working service technicians in the area where the clinic is given. As an example, it was estimated that more than 600 technicians attended a one-day, afternoon and evening, clinic presented by the Grand Rapids Service Association and their local set distributors. This is about four times the normal attendance at lectures in this area given by the individual manufacturers.

TSA Mass Meeting

To keep both political and business attention focused on the problems of TV servicing and to build recognition for TV servicing as a legitimate business activity, the Detroit Television Service Association conducted a number of programs during the first half of the year which they backed with extensive publicity.

The last of these programs before the summer season "took over," was a mass meeting in Detroit at which talks were given by such outstanding personalities as Governor Williams of Michigan; Nathaniel Goldstick, corporation counsel and city government representative; Horace W. Gilmore, chief enforcement officer for the OPS in Michigan; and Gerald K. O'Brien, prosecuting attorney.

The agenda of the meeting included talks on: television licensing ordinances; joint committee policing activities; public relations and education; TV manufacturers' contributions to TV service personnel; and a "futuristic" program for the TV service occupation.

Groups Lauded for Efforts

Both the TSA of Michigan and the Association of Radio-Television Technicians of Michigan were complimented by the speakers for their untiring efforts to create a healthy business atmosphere in the TV service business in Michigan.

Horace W. Gilmore, OPS district enforcement director, explained the need for controls and also discussed the three types of prosecution for criminal violators. "The cooperation of TSA members and other honest dealers and service men is badly needed," he said.

Gerald K. O'Brien, Wayne County's chief prosecuting attorney, read some case histories of complaints against unethical television sales and service companies. He credited TSA and the press with drastically reducing the number of such complaints. "There's plenty of business for all honest deal-

ers," he said, "but you must educate the public to deal only with such reputable businessmen."

Harry Gensler, representative of the *General Electric Supply Corporation,* told his audience that television was the fastest growing industry in the nation's history. "Customer satisfaction is the most important element for all of us whether we are manufacturers, jobbers, dealers, or servicemen," he said.

Herman Rosen, president of RTTM, detailed the purposes and objectives of his organization. "So far we've been able to keep TV servicing strong enough to eliminate the need for licensing," he said. "But the public must learn that television requires extensive training and high degrees of skill just as do other professions."

Hearty congratulations were expressed by Michigan's governor, G. Mennen Williams, who urged those present to cooperate with one another and to police their own industry. "Raise your level of service, go forward with your present organization (TSA) and prosper," was the advice given by the governor.

Approximately 700 people attended this mass meeting.

RTMA Program

In its report released at the annual RTMA convention, the Association's Service Committee outlined the plan it has submitted to the Executive Set Committee of the RTMA for improving set servicing practices.

The basic principle of the plan is to encourage set distributors to organize the major segments of the industry into local and regional groups for the purpose of carrying out specific programs within these territories. The recommended programs are:

1. Inform the public on facts about TV service.
2. Recommend, sponsor, and support TV service training programs in vocational and trade schools for the purpose of "up-grading" the skills of present service technicians.
3. Sponsor codes of ethics for service technicians.

The report further states that "The RTMA proposes to supply informational material for local and regional use such as: 1. Consumer Education Aids, and 2. Technicians' training programs.

Of these several objectives, the one which would make the best immediate contribution to improving the conditions of the TV service industry is that of enlisting the interest of set distributors in cooperating in the development of programs and clinics for the independent service businessmen and their technical employees in all local areas. The success of the JERCS program in Philadelphia, which has been credited by the Better Business Bureau for reducing consumer complaints on TV service in that area "by better than 85%", and the TSA program in Michigan, indicates what can be accomplished through the con-

USE OF THE AIR-COUPLER

FAS Although it is nearly two years since the first announcement of the Fowler-Allison-Sleeper system of bass reinforcement, the number of reports from people who have made such installations, and the enthusiasm for FAS performance has increased steadily.

Heart of the FAS system, of course, is the now famous Dual Air-Coupler, identical with the original design, but with built-in columns which smooth out the bass response to the satisfaction of the most critical music listeners and audiophiles.

As a result, thousands of hi-fi enthusiasts have reported:

1. That the Dual Air-Coupler reproduces lower frequencies than they thought could be recorded on phonograph records or tape,

2. That balance between treble and bass eliminates unnaturally shrill effects, due to the extended bass reproduction provided by the Air-Coupler, and

3. Full, proportional bass response is obtained at any volume level down to audibility, without the use of treble or bass controls.

Now, in the September-October Issue of HIGH-FIDELITY Magazine, information on a new project completed by the same team will be released. This has to do with crossover networks. The original FAS system called for an 8-ohm woofer, an 8-ohm intermediate speaker, and a 25-ohm tweeter, with crossover frequencies at 350 and 1,100 cycles.

However, many hi-fi enthusiasts wanted to use other crossover frequencies, or other speaker impedances, or to operate the Air-Coupler with a single dual speaker. But when they tackled the mathematics of the networks, they ran into trouble. Different formulas gave different values, or came out with designs that did not deliver the performance of which the FAS system is capable.

To do away with all such uncertainties, a complete set of diagrams and component values has been worked out, from which the correct circuit can be found, as well as the values of standard inductors and capacitors, to use in the network for:

1. Any combination of impedances for a 3-speaker or 2-speaker FAS audio system, and

2. A wide selection of crossover frequencies.

These direct-reading diagrams and tables of values eliminate all mathematics and all guesswork, and make it possible to try different combinations in the FAS system with the assurance that maximum possible performance will be obtained from the selected speakers and crossover frequencies. This information will be found in the September-October Issue of HIGH-FIDELITY Magazine, out September 15.

FAS-2 The suggestion that performance of the FAS system can be improved will come as a surprise to the great number of people who are now using installations of the original design. Nevertheless, further progress has been made which is so basic that the new system is identified as FAS-2.

The same Air-Coupler and the same speakers can be used for the FAS-2, but there are radical changes in the amplifier section of the system, and crossover networks are eliminated entirely. It should be explained that the FAS-2 is more expensive, and to non-critical listeners the extra cost may not seem justified.

However, the super-critical audiophile who wants the very last bit of realism from his system will say: "Here is a system that really does everything!"

And that is literally true of the FAS-2. It is completely versatile not only in its performance on various types of music, but in the freedom of choice it permits as to your particular selection from the various available amplifiers and speakers. There is no uncertainty as to networks, since they are not used. Also, and this point is stressed because it is a basic FAS feature, no tone controls are employed.

Complete information on the FAS-2, together with detailed photographs and diagrams, will appear in the November-December Issue of HIGH-FIDELITY Magazine, out November 1.

Audio Show You are cordially invited to see and hear the FAS system at the HIGH-FIDELITY exhibit at the Audio Show, Hotel NewYorker, NewYork City, October 29 to November 1. If you would like to play your own test records on the FAS installation, you are welcome to do so. That is the best way to judge FAS performance.

High-Fidelity This Magazine, now published every other month, is devoted exclusively to wide-range reproduction from FM, records, and tape. Articles by leading authorities describe in non-technical language the operation and use of new equipment, the latest ideas in custom installations, and all the most interesting activities in the hi-fi field. There is also a 24-page section of record reviews and information on recorded music.

HIGH-FIDELITY is a large-size magazine, profusely illustrated, and printed on fine paper. If you are not already a subscriber, by all means order your subscription without delay. When you receive your first issue, if you are not completely satisfied, the entire amount of your remittance will be refunded.

certed efforts of all industry elements in helping to up-grade the activity of TV servicing as a legitimate business operation.

More Retailers in TV Service?

Close observers of the gradual shifting of the radio sales pattern to accommodate the individual requirements of television are convinced that the maintenance and servicing of TV sets will eventually produce a larger dollar volume of business than the sale of new sets. In the past, appliance and radio dealers have not, as a class, been very much interested in "worrying" with servicing departments as a part of their own retail business. They have been content to "farm out" their customer service to competent independent service operators.

This "farming out" led to some very unhealthy practices in the days when service contracts were sold by the dealer on every possible TV set. Some dealers "chiseled" an extra "profit" for themselves by placing their contracts with the TV technicians who were foolish enough to handle contract service for less money than the established contract service prices. In the end, this practice hurt the dealers who used it for it invariably led to an inferior grade of service and dissatisfied customers.

On the other hand, a number of radio and appliance dealers set up their own complete TV installation and service departments when they started to sell TV sets. Since this type of retailing business is usually capably managed, these dealers conducted their service departments on the basis of sound business principles and they made money out of them.

Heading up the soundly aggressive program that is being carried out by NARDA (National Appliance & Radio-TV Dealers Association) are two retailers whose TV service departments have been very successful business operations. Mort Farr of Upper Darby, Pa. and Harry Price, Jr. of Norfolk, Va. have been able to show their fellow members of NARDA that a complete and efficiently-operated service department is a valuable and profitable adjunct to an appliance and radio-television retail sales business.

Discussions that revolved around the details of managing a service department were very popular and well-attended at the NARDA mid-year meetings in Chicago. This Association has pioneered some of the industry's best "self-help" programs, such as their CTIS plan for helping set owners to recognize legitimate service businesses and the very important (to retailers) "Cost-of-Doing-Business" survey.

Philco's Program

Members of the "*Philco* Factory-Supervised Service" organization were given the opportunity to use a service selling program that follows the successful "maintenance check-up" plan that is used widely in the automobile

repair business. The striking 5½" x 8½" cards had an appealing lead line that read "Get Your TV Set in Top Shape for Convention Viewing!" The card was suitable for use as a mailing piece or for door-to-door distribution.

Under the offer *"Here's Our Money Saving Pre-Convention Offer—A Complete 10 Point Tune-Up for ONLY . . . $7.95,"* the following services were listed:

1. Make physical check of antenna, transmission line, and connections for mechanical condition and electrical efficiency.
2. Make mechanical check of chassis component parts for signs of electrical breakdown.
3. Adjust all rear chassis controls to assure maximum picture linearity.
4. Adjust receiver focus for maximum brilliance and sharpness.
5. Check picture to assure maximum height and width with good linearity.
6. Check range of all front controls.
7. Adjust fine tuning range for maximum picture and sound quality.
8. Adjust horizontal hold system for maximum horizontal steadiness.
9. Clean safety glass and face of picture tube.
10. Furnish written report of inspection and general operative condition of set.

When interviewed by your editor several members of the *Philco* Factory-Supervised Service plan reported that they had gotten excellent results from the distribution of these cards.

Service is a commodity that can be sold and the successful TV service businesses of the future will be those that have "service sales" departments to sell their product—service—just as the retailer must sell his appliances and TV sets. —30—

SOCKET ADAPTER

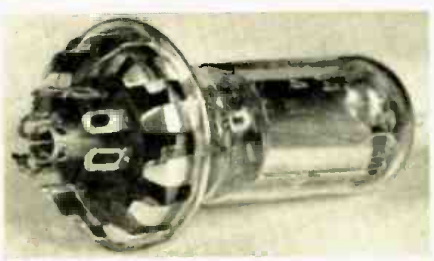
By B. W. WELZ

WHEN replacing large-sized tubes in older receivers with miniature tubes, the problem often arises on how to cover the socket hole so that a miniature tube's socket can be mounted on it.

In some cases this problem can be easily solved by using a snap-hole plug in the socket hole. These plugs can be drilled and miniature sockets mounted on them. Placed in a socket hole, with a few drops of solder on three or four of the prongs to insure a firm hold, they make a neat appearance.

One-inch snap-hole plugs which will fit a number of socket holes are available from Allied Radio Corporation, Chicago. —30—

Snap-hole plug to fill in chassis cutouts when changing over to miniature-type tubes.



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.

TV HARDWARE

A 12-page catalogue which lists television antennas, mounts, hardware, and accessories has just been issued by *iE Manufacturing*, 325 North Hoyne Avenue, Chicago 12, Illinois.

Included in this two-color catalogue are chimney mounting units, wall mounts, antenna hardware, stand-offs, rigging hardware, nuts and bolts, antenna masts, guy wire, antennas, and miscellaneous hardware.

Copies of Catalogue 10 are available for the asking. Address your request direct to the company.

EICO CATALOGUE

Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, New York has just published a new catalogue which covers all the 22 kits and 25 wired instruments which now comprise the *"EICO"* line.

This 1952 catalogue contains large illustrations, complete descriptions, technical specifications, prices, and recommended applications of all v.t.v.m.'s, oscilloscopes, sweep generators, signal generators, tube testers, v-o-m's, battery eliminators, high voltage probes, r.f. probes, and crystals made by the company.

REPLACEMENT PARTS

A revised and up-to-date edition of the company's replacement parts catalogue, C-608, is now available from *Sprague Products Company*, 51 Marshall Street, North Adams, Massachusetts.

This 20-page booklet contains complete listings on all the standard stock condensers and "Koolohm" resistors manufactured by the company, including data on its line of plate and disc ceramics rated up to 6000 volts and its "doorknob" ceramics rated at 20,000 volts.

NEW TV TUBE DATA

A new, enlarged third edition of its "Television Receiver Tube Complement Book" has been released by the Radio Tube Division of *Sylvania Electric Products Inc.*, Emporium, Pa. This newest edition lists receiving and picture tube types required for nearly 4000 different models of television sets now in home use.

Television receivers are listed alphabetically by manufacturers to provide convenient reference for technicians when checking tube types required for a specific model and chassis. The total number of tubes required for each chassis is also given.

The book is cross-indexed to associate trade names with manufacturers' names in the simplest possible way. This cross indexing was included to save technicians time on house calls by permitting them to carry the correct replacement tubes with them.

This 120-page, 5½" x 8½" book is wire-bound and may be carried in the service kit or in the glove compartment of the truck. Copies are available either from the company's tube distributors or direct from the Advertising Department of the company. The price is seventy-five cents a copy.

TV ACCESSORIES

The complete line of television antennas, kits, and accessories manufactured by *Insuline Corporation of America*, 36-02 35th Avenue, Long Island City, New York, is described in a new 12-page catalogue recently released by the firm.

Copies of Catalogue No. T-752 will be forwarded to those making their requests to B. L. Cahn, general sales manager of the company, at the above address.

E-V CONDENSED CATALOGUE

Electro-Voice, Inc. of Buchanan, Michigan has issued a condensed catalogue which illustrates and describes its line of equipment.

Catalogue No. 113 carries information on the company's microphones, phono cartridges, speakers, drivers, horns, crossovers, folded corner horn enclosures, 2-, 3-, and 4-way speaker systems, television boosters, and TV distribution systems.

Copies of this new catalogue are available without charge from the company.

VARIABLE RESISTORS

Complete details on 167 types of military variable resistors available for immediate delivery from stock are listed in the new Stock Sheet No. 162 recently released by *Chicago Telephone Supply Corporation* of Elkhart, Indiana.

Included in the new listing are JAN-R-94 and JAN-R-19 types as well as non-JAN controls. Many of the variable resistors listed are designed for use in military equipment subject to extreme temperature and humidity ranges. Six key controls are illustrated and dimensional drawings of five shaft types are given.

SPEAKER DATA

Oxford Electric Corporation, 3911 South Michigan Avenue, Chicago, Illinois has announced the availability of a new catalogue which contains complete information on its line of speak-

FREE OFFER
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6CD6G ea. $1.49
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807 . . . ea. $1.55

0Z4	49c	5T4	$1.40	6BA7	$ .69	6L5G	$ .95	6W4GT	49c	7Y4	73c	12SR7GT	$ .59	45Z5	$ .59
0Z4G		5U4G	.49	6BC5	.59	6L6G	95c	6X4		7Z4		12Z3	.95	46	89c
1A5GT	.65	5V4G	.87	6BC7	.79	6L6GA		6X5GT		12A7	1.15	14A7	.89	47	
1A7	.59	5W4	49c	6BD5GT	.89	6L7	.69	6Y6G	.69	12A8	.59	14AF7	.93	50A5	.89
1B3GT	.69	5W4GT		6BE6	.49	6N6G	1.40	7A4	.59	12AH7	1.45	14B6	89c	50B5	59c
1B5	29c	5X4G	.65	6BF5	.59	6N7GT	69c	7A5	.89	12AL5	54c	14B8		50C5	
1C7G		5Y3GT	.45	6BF6	.59	6P5GT		7A6	73c	12AT6	.49	14C5	1.07	50C6G	1.04
1E7		5Y4G	.54	6BG6G	1.49	6Q7GT	.49	7A7		12AT7	.89	14C7	.98	50L6	.49
1H5GT	.49	5X4G	81c	6BH6	59c	6R7GT	.69	7A8		12AU6	.59	14F7	.89	50X6	.79
1J5GT	.69	5Z3		6BJ6		6S4	.49	7B4		12AU7	.65	14F8	1.30	50Y6	.59
1L4	.59	6A3	1.15	6BL7	.79	6S7GT	1.15	7B5	.73	12AV6	.49	19BG6G	1.49	70L7	.89
1LA4	1.19	6A7	1.21	6BN6	.89	6S8GT	.69	7B6	.73	12AV7	.89	19T8	.89	71A	.87
1LA6		6A8GT	.59	6BQ6GT	.85	6SA7GT	.59	7B7	73	12AW6	.95	20	1.40	75	59c
1LC5	.69	6AB7	1.15	6BQ7	1.49	6SC7	.59	7B8	.73	12AX7	.69	24A	.59	77	
1LC6	1.19	6AC5GT	89c	6C4	.49	6SD7GT	.99	7C4	1.30	12BA6	.49	25AC5GT	1.04	78	1.10
1LD5	.95	6AC7		6C5GT	59c	6SF5	.49	7C5	73c	12BA7	.69	25BQ6GT	1.15	80	.45
1LE5	1.19	6AG5	.69	6C6		6SF5GT	.49	7C6		12BE6	49c	25L6GT	.49	83	1.45
1LH4	1.19	6AG7	.89	6C8G	1.15	6SH7	.59	7C7		12BF6		25W4GT	.59	85	.79
1LN5	1.19	6AH6	1.40	6CB6	.59	6SH7GT	.59	7E6	.59	12BH7	.69	25X5	1.04	117L7	1.40
1N5GT	.59	6AK5	.89	6CD6G	1.49	6SJ7	49c	7E7	.69	12C8	1.15	25Z6GT	.59	117N7	.89
1P5GT	69c	6AK6	1.08	6D6	.59	6SJ7GT		7F7	.89	12F5GT	65c	32L7GT	1.15	117P7	1.40
1Q5GT		6AL5	59c	6D8G	1.15	6SK7GT		7F8	1.47	12H6		35A5	.99	117Z3	.49
1R5	59c	6AQ5		6E5	.59	6SL7GT	.69	7G7	.69	12J5GT	.54	35B5	59c	117Z6	.69
1S5		6AQ6	.81	6F5GT	49c	6SN7GT	.59	7H7	.59	12K7GT	.59	35C5		807	1.55
1T4		6AR5	.74	6F6GT		6SQ7	49c	7J7	.69	12Q7GT	.49	35L6	.49	813	8.95
1U4		6AT6	.49	6F8G	1.15	6SQ7GT		7K7	1.07	12SA7GT	.59	35W4	.45	1294	29c
1U5	.49	6AS5	.90	6G6G	.95	6SR7GT	.49	7L7	.69	12SC7	.59	35Y4	99c	1299	
1X2A	.69	6AU5GT	.69	6H6GT	.49	6SS7	.72	7N7	59c	12SF5GT	59c	35Z3		1619	.45
2A3	1.15	6AU6	49c	6J5GT	.49	6T7G	1.15	7Q7		12SF7		35Z4	.49	1629	.29
2A5	.79	6AV6		6J6	1.04	6T8	.89	7R7	.89	12SH7GT	.59	35Z5	.45	2050	2.00
3LF4	1.19	6B4G	1.44	6J7G	.59	6U5	.59	7S7	1.07	16SJ7GT	.49	35Z6G	.95	2051	1.15
3Q4	.59	6B5		6J8G	1.15	6U6GT	59c	7V7	.69	12SK7GT	.59	35/51	.79	7193	.87
3Q5GT	1.08	6B6G	.79	6K5GT	.69	6U7G		7W7	1.07	12SL7GT	.69	41	.72	VT51	29c
3S4	59c	6B8GT	1.15	6K6GT	.49	6V6GT	.59	7X6	.89	12SN7GT	.99	42	.59	VT52	
3V4		6BA6	.49	6K7GT	.59			7X7	.69	12SQ7	49c	43	72c		
				6K8GT	.69					12SQ7GT		45			

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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

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Complete with all tubes, including 12½" picture tube **$69.50**

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INCLUDES:

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12" Coaxial PM Speakers **$12.95** ea.

High fidelity with high pass filter attached. 20 watt; 40-17500 cps. response; 8 ohm VC.

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6" P.M. Speaker . . . . . $1.29 ea.

Standard Replacement

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Insulated ½, 1 and 2 watt assortment of most used values, I.R.C. Ohmite, Stackpole, Speer, etc. 100 for **$2.95**

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150V		450V	
20 mfd	24c	8 mfd	24c
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20-20 mfd	39c	8-8 mfd	39c
30-30 mfd	39c	10-10 mfd	39c
40-40 mfd	49c	20-20 mfd	49c
50-30 mfd	49c	30-30 mfd	49c
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ers (electrodynamic and permanent magnet) for auto, p.a., intercom, outdoor, radio, television, and portable applications.

Data on the company's new "HI-Fidelity" speakers is also included along with illustrations of the various speakers covered in the catalogue.

CONNECTOR BULLETIN

A completely revised bulletin covering its line of audio-type connectors has just been issued by *Cannon Electric Company* of Los Angeles.

Designated as Bulletin No. PO-4-1952, this 32-page booklet describes in detail new and improved connector types for microphone, p.a., and low-level sound applications. Included are the company's Type Series P, O, X, XK, XL, BRS, BG, and UA.

Copies of this new publication are available on request from the Advertising Department of the company, P.O. Box 75, Lincoln Heights Station, Los Angeles 31, California.

PHONO NEEDLE DATA

Jensen Industries, Inc., 329 S. Wood Street, Chicago 12, Illinois has published a comprehensive phonograph needle catalogue which gives complete information on every known type of needle replacement.

This 16-page brochure is cross referenced according to the phonograph manufacturer (including 1952 data), cartridge manufacturer, and competitive needle sources. Information is also supplied on the company's magnetic recording tape.

Copies of Catalogue No. 52 are available from parts distributors or from the company direct.

OHMITE LINE

A new catalogue which describes the company's line of resistors, rheostats, tap switches, and chokes has been issued by *Ohmite Manufacturing Company*, 4876 West Flournoy Street, Chicago 44, Illinois.

This new 20-page, two-color catalogue illustrates and provides complete data on the company's products which are stocked by distributors. Included is information on the company's vitreous-enameled rheostats, composition potentiometers and resistors, wire-wound resistors, tap switches, r.f. plate chokes, and power line chokes. Data on *Ohmite's* resistor line is also included.

Copies of the new Stock Catalogue No. 24 are now available from the company on request.

TRIAD CATALOGUES

Triad Transformer Manufacturing Co., P.O. Box 17813, Los Angeles 34, California is currently offering copies of two new catalogues to the trade.

Catalogue TR-52 lists more than 450 items along with specifications and prices. Included in this publication are details on the company's "HS" transformers, audio transformers, 400-cycle power transformers, miniature units, toroids, and general purpose transformers for radio and television

RAPAR CUSTOM ENGINEERED TELEVISION

The finest in custom-made television. The latest in television development. More contrast with greater uniformity! Greater picture fidelity!

NOW PUSH-PULL VIDEO ACTUAL PHOTOGRAPH→ OF TEST PATTERN

Featuring:

Two new ideas in television!

***PUSH-PULL VIDEO:**

1. Picture tube drive of 150 volts without amplitude distortion.
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***AUTOMATIC CONTRAST CONTROL:**

1. Compensates for variations in picture composition, reducing contrast on predominantly white backgrounds and increasing contrast on predominantly dark backgrounds. This action eliminates eye fatigue due to extreme variations in overall brightness of the TV image.
2. Fast acting. Will follow variations resulting from airplane reflections.
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The above ideas make a receiver so sensitive that with a four stage i.f. system the internal noise generated within the first i.f. amplifier will fully modulate a 20-inch pix tube.

Prices of tubes when purchased with Rapar Chassis:

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Patent is pending. May be used with 24″—21″—20″—19″—17″ picture tube.

PRICE . less tube . $179.95 . FOB Chicago

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14″ CONVERSION KITS AT NEW LOW PRICES!

Simple conversions to larger screen television. 14″ Kit, 70° Deflection yoke. Attractive Lucite mask. 14″ RCA Picture tube.

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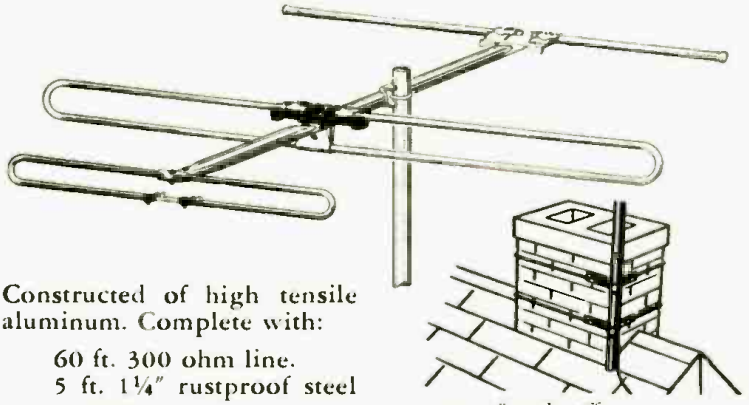

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Double strength chimney mount.
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MINIATURE HIGH SENSITIVITY MULTITESTER

20,000 ohms per volt DC and 10,000 ohms per volt AC instrument. Hand-held, weighs only 10 oz! Clear plastic face cover. Has 23 most used ranges selected by single switch. With batteries and leads. Shpg. wt., 1 lb.

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replacement work. Geophysical transformers and amplifier kits are also described.

The second catalogue, TV-52, features replacement items for 77 different makes of radio and television receivers. The publication contains a complete and separate listing of all replacement transformers together with specifications and prices. Typical cases and types are fully illustrated.

ELECTRONIC COMPONENTS

A new, 16-page catalogue of electronic components has recently been issued by *Switchcraft, Inc.*, 1328 N. Halsted Street, Chicago 22, Illinois.

The new publication includes many additions to the company's line of components as well as items of special interest to the industry, *i.e.*, adapters, shielded jacks, microphone connectors, switches, and cable assemblies.

Please specify Catalogue S-52.

DISTRIBUTORS' CATALOGUE

P. R. Mallory & Co., Inc., Indianapolis 6, Indiana has recently released a 60-page catalogue to distributors and service technicians.

Two versions of this catalogue are available. The catalogue for the service technician has the colored price sheets bound within the catalogue itself. A complete table of contents is also included to permit the rapid determination of the part required.

The distributors' catalogue is punched for easy insertion in standard binders. Special interleaf price pages list both the list prices and recommended dealer net prices on pages adjoining listings and descriptions of products. New price sheets will be issued in case of price changes and can be easily inserted.

CONDENSER CATALOGUE

The Hammarlund Manufacturing Company, Inc., 460 West 34th Street, New York 1, New York has issued a comprehensive catalogue covering its line of standard variable air condensers.

The catalogue gives complete specifications on the company's Types BFC, APC, MAPC, HF, HFD, HFA, HFBD, MC, MCD, RMC, NZ-10, and VU condensers as well as data on Type FC and FNC couplings and information on the company's custom engineered units.

TRANSFORMER CATALOGUE

Crest Laboratories, Inc., Whitehall Building, Far Rockaway, New York now has available for distribution copies of a new eight-page catalogue which describes its line of hermetically-sealed transformers.

Complete technical specifications are given on the line of miniature, subminiature, and micro-miniature transformers.

Copies of this catalogue are available on letterhead request. —30—

COLOR-CODED METER READINGS

By JOSEPH ZELLE
Technical Staff, Station WERE

IN THE average AM-FM transmitting plant, the radio operator has to keep track of some 60 to 70 meters. If there is also a TV installation, the additional video and audio transmitters may easily raise the total number of meters to 150. While generally all these meters are made to read in the middle portion of their scales, it is almost next to impossible for an operator to remember the required readings of each meter, especially if he is in a hurry.

One way to provide a ready reference for each meter to be read at a glance, is to paint a thin line or bar on the glass of the meter, directly over the needle at its normal setting. Then, in the case of certain kinds of trouble which do not necessarily knock the transmitter off the air, the operator can notice any abnormal deviations at once. The troublesome circuit is thus quickly localized.

These markers become automatic indicators of departure from the original or correct meter settings as tubes and parts age. When these departures become quite noticeable, it will be time to check the circuits or retune them. Furthermore, some breakdowns or tube failures can be anticipated. In such instances, the radio operator will be preconditioned to get to the seat of the trouble.

Another advantage applies to meters which operate over a certain range, as is the case of the r.f. output. By drawing two lines, indicating the minimum and maximum values permitted for legal broadcast operation, the operator has a couple of markers which serve as a constant and instant check of his output tolerance.

Let us say, though, that a single meter is used with a selector switch. Here the required readings could be color coded with the position on the switch. For example, in Position 1, a red dot on the selector would correspond to a red line or dot on the meter. In Position 2, a blue dot on the selector would correspond to a blue line or dot on the meter, etc.

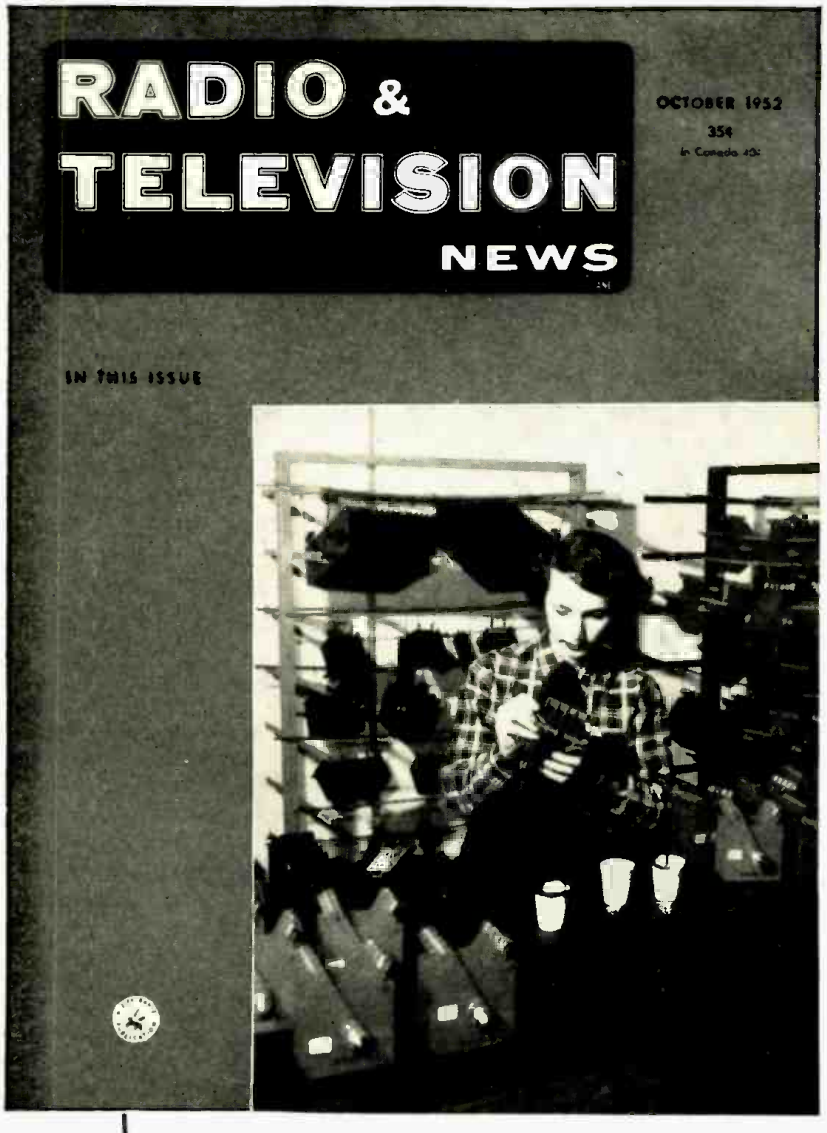
Color coding could be extended to all the meters. Instead of lines and bars, moreover, dots might be dabbed in color at the spearhead of the needle. Too many colors would become confusing and defeat the purpose of the device. By resorting to three basic colors, the operator would readily associate them with critical circuits. Most operators probably would agree that the r.f. plate current and "C" bias indications are the most essential. Therefore, a color code as follows might be employed: red would indicate plate currents, light blue would be "C" bias, yellow the r.f., black the filaments, etc.

When circuits have been retuned or tubes replaced causing the meter readings to change, the new readings or ranges could be painted on the glass after the old marks had been removed.

These markers are an added convenience for the operators. They produce increased efficiency in transmitters as well as transmissions. Besides, it takes so little time to paint the markers and it costs so little, too. —30—

designed for your future

the new dynamic



Just part of the October issue:

Radio-Controlled Midget Auto which starts, stops, reverses! Complete details on how to build. Apply this same principle on other types of models.

•

A 35 - Watt Novice Transmitter! Compact — easy to build — uses but two tubes and few parts!

•

The Yagi! How to construct a fringe area antenna. Designs cover all v.h.f. television channels.

•

A Remote Control AM Tuner ideal for "custom" installation! This compact unit features a unique power supply and cathode-follower output.

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Technical BOOKS

"APPLICATION OF THE ELECTRONIC VALVE IN RADIO RECEIVERS AND AMPLIFIERS" by Dr. B. G. Dammers, et al. Published by *Philips Gloeilampenfabrieken*, Eindhoven, Netherlands. 425 pages. Price $7.75. Available in the United States from *Elsevier Press Inc.*, 402 Lovett Blvd., Houston 6, Texas. Volume 2.

This is the second volume of a projected three-part series on the use of vacuum tubes in audio and radio applications.

Like the first volume of this trilogy, the present text is a meticulous inquiry into the functioning of vacuum tubes when used for audio frequency amplification, in the output stages of receivers and amplifiers, and in several types of power supply circuits.

The broad category dealing with a.f. amplification has been subdivided into sections which cover a.f. amplifying circuits, phase inverters and splitters, frequency response of an a.f. stage, the design of a.f. transformers, and a discussion of non-linear distortion.

The use of tubes in output stages has been broken down by classes of operation (A, B, and AB) and a comparison of the different types of operation using triodes and pentodes. The final section on the power supply provides data on filament supplies, rectifying circuits, design calculation of high-tension rectifiers, and circuits for stabilizing such a supply.

This book is written at the engineering level and includes all of the formulas and circuit data needed by the design engineer. The text material is completely illustrated with circuit diagrams, graphs, and tabular material.

* * *

"RADIOTELEPHONE LICENSE MANUAL" by Woodrow Smith. Published by *Editors and Engineers Limited*, Santa Barbara, California. 197 pages. Price $3.75.

This study-aid covers the first four elements of the FCC examinations for radiotelephone licenses.

This manual is not intended to replace text books on the technical aspects but merely serves as a review and as a guide to the type of material that candidates can expect to encounter in the tests.

The book is divided into separate sections covering the four elements and is concluded with six appendices containing essential data on such subjects as useful formulas, FCC publications, Laws and Regulations, "Q" signals, miscellaneous abbreviations, and standard procedure for applying artificial respiration.

In conformance with standard procedures followed in FCC examinations, the suggested answers given in conjunction with the various questions are brief and to the point. Technical explanations have been eliminated and the student who requires further clarification of the subject matter should consult standard textbooks.

* * *

"ANTENNAS: THEORY AND PRACTICE" by Sergei A. Schelkunoff and Harald T. Friis. Published by *John Wiley & Sons, Inc.*, New York. 608 pages. Price $10.00.

This comprehensive work has been written by two members of *The Bell Telephone Laboratories'* staff and deals with various types of antennas for a wide range of frequencies.

The book contains nineteen chapters and ten appendices and covers such phases of the problem as the physical principles of radiation; Maxwell's equations; plane waves; spherical waves; directive radiation; directivity and effective area; waves over ground; antenna current; impedance, reciprocity, equivalence; small antennas; self-resonant antennas; the general theory of linear antennas; impedance of dipoles; rhombic antennas; linear antenna systems; horns; slot antennas; reflectors; and lenses.

The appendices cover characteristic impedances of transmission lines; patterns of continuous arrays; radiation resistance and gain of cylindrical antennas; space factors of uniform linear arrays; gain of "pine-tree" antennas, horns, lenses; mutual impedance of parallel antennas as seen at the input terminals; constants of a medium; and a summary of Maxwell's equations for the propagation of electromagnetic waves.

The text is written at a college level and presupposes a thorough working knowledge of applied mathematics and physics. A series of problems appears at the end of each chapter to enable the student to check his grasp of the subject matter.

Since all of the material included in this text is fundamental, persons concerned with the design and/or production of all types of antennas should have a copy of this comprehensive work.

* * *

"AN INTRODUCTION TO ACOUSTICS" by Robert H. Randall. Published by *Addison-Wesley Press, Inc.*, Cambridge, Mass. 330 pages. Price $6.50.

This text is designed for the advanced physics student and the audio engineer. A year of college physics and a year of calculus are minimum prerequisites for an understanding of the subject matter.

The book is divided into twelve chapters, four appendices, a listing of symbols, references, and answers to the chapter problems. The author presents an introductory chapter and then discusses such subjects as the fundamental particle vibration theory, plane waves in air, waves in three dimensions, interference patterns, acoustic impedance and the behavior of horns, longitudinal waves in different gases and in liquids and solids, stationary waves and vibrating sources, the reflection and absorption of sound waves,

way out yonder in the fringe areas...

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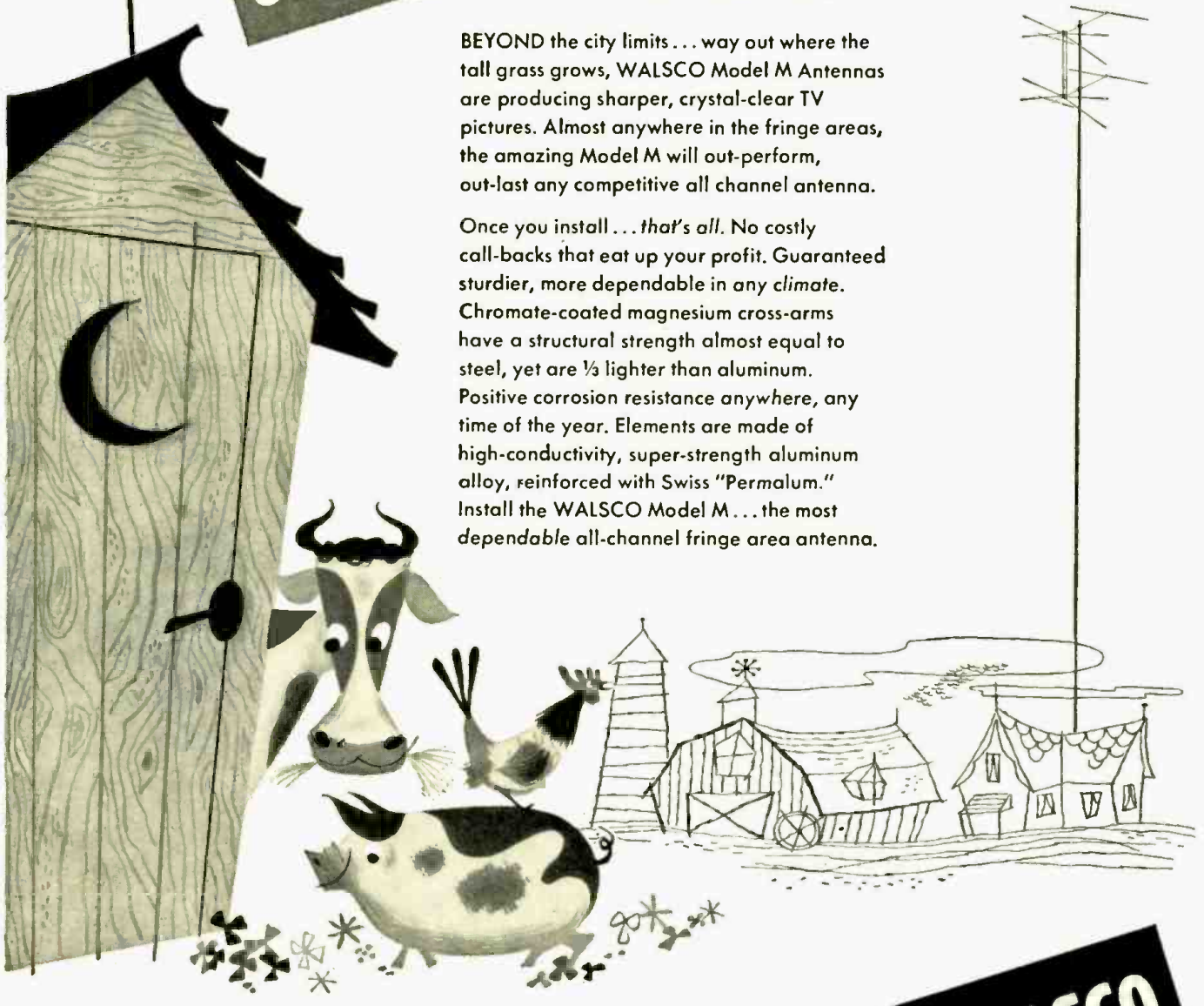
MODEL M ANTENNA OUT-PERFORMS ALL OTHERS

BEYOND the city limits... way out where the tall grass grows, WALSCO Model M Antennas are producing sharper, crystal-clear TV pictures. Almost anywhere in the fringe areas, the amazing Model M will out-perform, out-last any competitive all channel antenna.

Once you install... *that's all.* No costly call-backs that eat up your profit. Guaranteed sturdier, more dependable in any *climate.* Chromate-coated magnesium cross-arms have a structural strength almost equal to steel, yet are ⅓ lighter than aluminum. Positive corrosion resistance *anywhere,* any time of the year. Elements are made of high-conductivity, super-strength aluminum alloy, reinforced with Swiss "Permalum." Install the WALSCO Model M... the most *dependable* all-channel fringe area antenna.



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speech and hearing, sound measurements and experimental acoustics, the reproduction of sound, and miscellaneous applied acoustics. The appendices contain related mathematical formulas for acoustical computations.

As a text book or reference manual this book should provide a worthwhile bridge between the more elementary texts and the highly mathematical engineering treatises currently available.

* * *

"THE SATURDAY REVIEW HOME BOOK OF RECORDED MUSIC AND SOUND REPRODUCTION" by E. T. Canby, C. G. Burke, and I. Kolodin. Published by *Prentice-Hall, Inc.*, New York. 299 pages. Price $4.50.

Here is a non-technical discussion of a technical subject which has captured the fancy of a large segment of the lay public. Acknowledging the fact that "high-fidelity" is no longer the exclusive prerogative of the audio engineer, the authors of this text have prepared a thoroughly readable handbook for those whose interest in sound reproduction is aesthetic rather than technical.

The book itself is divided into three parts, each written by one of the authors. The first section covers the phonograph record itself, a little of its history, how it is manufactured, how the master is recorded, and other interesting and informative details.

The second section deals with the equipment used to reproduce the records. Written by C. G. Burke, this part of the book covers the type of home equipment available in the various price ranges, testing such equipment, how to set up such a system in the home, and a host of other material for the audio enthusiast.

The third part of the book is written by Irving Kolodin, editor of the Recording Section in the *"Saturday Review."* His contribution, entitled "Learning to Listen and Listening to Learn" is a primer of recorded music. He points out the things that the listener should look for in his recordings and then provides a basic list of recordings that should be in any well-rounded classical and semi-classical record library.

The music lover and the high-fidelity fan should find much of interest in this compact and fact-filled handbook.

—30—

TRI-STATE HAMFEST

THE Tri-State Amateur Radio Society of Evansville, Ind., will hold its annual hamfest on Sunday, Sept. 14th. The hamfest, which has grown in popularity and scope, will be held at the Servel Picnic Grounds, southeast of Evansville.

A transmitter on 29.6 mc. will guide mobiles to the area and signs will be posted at highway junctions.

While refreshments will be available, those attending are asked to provide their own lunches. Numerous contests are scheduled with the c.w.-phone ball game being the main event.

Registration fee is $1.00 at the grounds. —30—

International Short-Wave

(*Continued from page* 120)

6.115 to 0610 daily; opens again 0615 on 9.750A. (Radio Australia) The 9.750A channel (sometimes as high as 9.770A) is noted to *after* 0800. (Stark, Texas, others) Pearce, England, notes the 9.750A channel with *English* for Europe 1730, and announcing next news in *English* for 1830 over 7.230; says at times seems as high as 9.755A but *announces* 9.750.

"Voice of Vietnam," 9.62, Saigon, is audible in Pa. some days around 0530-0600; best day to try is Sunday when *Radio New Zealand* leaves this channel 0500. (Kary)

Iran—Radio Teheran, EPB, 15.100, is currently scheduled 0845 Arabic, 0915 Urdu, 1330 Turkish, 1430 German, 1445 French, 1500 *English*, 1515 Russian; has recordings between talks or news sessions. (Pearce, England)

Iraq—HNQ, 11.724, Baghdad, was noted recently in Arabic 0000-0100 sign-off, fair level in Virginia. (Saylor)

Ireland (Eire)—"Short-Wave Listener," London, says *Radio Eireann* has daily news broadcasts 1230-1250 on 15.120 and 1610-1630 on 9.595. (Catch, England) However, ISWC, London, lists the 9.595 transmission for 1710-1730.

Italy—Rome, 11.810, noted 1605-1855 in various European languages; heard beginning *English* period for North America 1900 on 11.905. (West, Virginia) Heard at good level on 17.800 at 1100-1145 in *English* for South Africa. (Pearce, England) Has news 1100-1115 on 15.120; considerable QRM. (Kary, Pa.) Noted with news 1245-1300 on 15.400, then talk to 1320. (Sutton, Ohio)

Italian Somaliland—Radio Mogadishu, near 7.385, noted around 1215 tune-in to 1300 closedown; news in Italian 1225A. In verifying, listed schedule of 0530-0615 Italian; 0915-1015, 1100-1200 Somali, and 1200-1300 Italian; power was given as 300 watts and channel as 7.420 (but is still near 7.385). (Pearce, England)

Jamaica—Radio Jamaica, 4.950, now opens 0600 with "Church in the Wildwood." (Cushen, N. Z.) Recently was noted on 4.950 instead of 3.360 at 2200; *Sunday* sign-on on 4.950 appears to be an hour later than weekdays—0700. (Stark, Texas)

Japan—JKH, 7.257, Yamata, fair to good around 0430-0500. (Saylor, Texas)

Radio Japan, 9.675, noted at nice level in British Columbia around 1000-1030 despite CWQRM. (Brooke) The 11.705 outlet has been heard rather regularly of late in its 0900-1000 beam to Philippines-Indonesia; good level in Washington State. (Gaylord) Noted on 7.180 with *English* 0600-0615 or later. (Waller, Hawaii) AFRS, 4.860, is good level 0600-0800; plays many American recordings. (Tarr, Washington State)

Kashmir—Radio Kashmir, Srinagar, has dropped 3.335; schedule is now

2130-2330, 0630-1200 on 4.860, and 0100-0230 on 6.110. (WRH)

Kenya Colony—Nairobi, 4.855, noted with BBC news relay 1300; usually has "local" news 1315; heard closing 1500 (*Sundays* 1400). (Pearce, England)

Lebanon—Beirut, 8.036A, has extended its schedule to 1630. (Radio Sweden)

Liberia—ELBC, 6.028A, Monrovia, is again being heard with weak signal in Eastern U.S.A., much QRM, during the last 15 minutes or so of its daily transmission which concludes 1845.

Luxembourg—*Radio Luxembourg* is now scheduled on 15.350 at 0600-0800 on Sun., Thur., Sat., other days 0600-0815; uses various European languages. *English* is used over 6.090 daily from 1300 or earlier to 1800 (*Sun.* to 1830). (Radio Sweden)

Madagascar—*Radio Tananarive*, 3.205, is fair level in N. Z. at 1230. (*"The Radio Amateur,"* London)

Malaya—A station opening 0630 on 7.120 is probably BFEBS, Singapore; has French 0700. (Stark, Texas) BFEBS heard opening 0400 on 15.435. (Pearce, England) Heard on 9.690 at fair level 0515-0530. (Kary, Pa.)

Mexico—XEUW, 6.020, Vera Cruz, is good level around 2200; XEKW, 6.030, Morelia, is also good 2200. (Tarr, Washington State) XESC, 15.205, heard well in Spanish 1340. (Mast, N. Y.) XEXE has news in Spanish weekdays 2245-2300 over 6.065 in parallel with 11.900; XEBT, 9.625, is heard signing *on* 0900; XETW, 6.042A, is noted 2030-2130 with *English* programs. (Casey, Ky.)

Monaco—*Radio Monte Carlo*, 6.035, noted 1735-1740 with program details by woman in French to 1738 when had station identification and signed off with dance music and chimes. (Rodger, Scotland) Good on 9.785 at 0200 with musical program in French. (Saylor, Va.) Noted on that channel 1700 with news in French. (Hord, Ind.)

Mozambique—CR7BG, Lourenco Marques, was recently noted as high as 9.860A, fine level with the Portuguese session 0000-0100; still uses "William Tell" opening. (Saylor, Va.) This one usually is lower—around 9.795. (Bellington, N. Y.) CR7BU, 4.825A, noted 1530 tune-in to 1600 sign-off with "Good Night Song" and "A Portuguesa"; uses *English*. (Pearce, England) Heard in *English* over 9.760A daily to 1648 closedown.

Nepal—*"DX-Radio."* Sweden, says Nepal is now on 11.910 at 1000-1127; has news in Nepali and *English*.

New Caledonia—*Radio Noumea*, 6.035, was noted recently in French from 0445 tune-in to 0528 sign-off with fair level; identified as "Ici Noumea, La Voix de La France dans le Pacifique." (Kary, Pa.)

New Zealand—ZL2, 9.540, Wellington, noted recently 0600 with news. (Ferguson, N. C.) ZL10, 15.22, heard leaving air 2357 to resume on ZL8, 9.620; good level on West Coast; ZL2, 9.54, and ZL8, 9.620, heard in parallel at 0622 recently when signed off abruptly. (Harris, Calif.)

Nicaragua—YNBH, 6.549.2, noted 1940 in Spanish; did *not* move to 6.015 as reported recently by European sources. (Oskay, N. J.)

Norway—Oslo, 11.735, is good level 2000-2100; identifies in *English* as "Radio Norway." (West, Virginia) LLN, 17.825, noted Sundays with "Norway This week" (*English* news) 1201; ended 1220; also audible over LLM, 15.175, LLK, 11.850. (Pearce, England)

Outer Mongolia—Ulan-Bator, 6.518, noted 0530, weak level. (Oskay, N. J.)

Pakistan—*Radio Pakistan* is now heard near 17.735 with news 0330-0340, also noted another day with news for East Bengal 0210; heard with slow-speed news 1210-1230 on 7.010; has news 1015-1050 near 11.845; still tests 1430-1515 to Turkey and 1515-1600 to Britain on 9.848 and 11.914, and to Indonesia 0630-0715 on 17.835, 15.270. (Pearce, England)

Paraguay—ZPA1, 6.275, heard signing off 2131 with Paraguay national anthem. (Harris, Calif.)

Peru—OAX4R, 15.146A, Lima, noted at good level recently 2125 and still in Spanish at 2238 tune-out. (Ferguson, N. C.) This one may have some *English* irregularly. Lima has at times used 9.535 instead of 9.562, but more recently was noted back on its listed (9.562) outlet mornings to 0815 or later. (Stark, Texas) Is good some days on 9.562 with all-Spanish programs around 2000. (Gaylord, Washington State)

Philippines—Some days, DZH8, 15.300, Manila, is audible after Paris, 15.295, leaves the air 0645; has religious programs; usually is unreadable by 0730; uses *English*. DZH7, 9.725A, Manila, was noted recently 0500-0530 with religious broadcast. (Kary, Pa.)

Poland—Warsaw has added another period—1800-1830—to its North American "evening" schedule on 11.815. (Kary, Pa.) Heard on 11.74 for Europe opening 1515 in Spanish; French 1530-1600, then Spanish again; *English* 1615. (Bellington, N. Y.) Noted on 11.845 with *English* for Europe 1545-1615 sign-off. (Kary, Pa., Bellington, N. Y.) Heard at 1230-1300 with *English* news, commentaries, request program on 9.525, 7.155; should also be on 11.935 which was not heard; the *English* period 1545-1615 on 11.845 is also carried on 9.555, 7.145 (Pearce, England)

Portugal—Lisbon noted to 1830 on 9.74; heard on 11.962 at 0800 carrying a program different from that on the 15.125 channel. (Pearce, England) CSA38, 6.360, Lisbon, good signal from around 1600-1900 sign-off; has music and talks in Portuguese. (Saylor, Va.) Niblack, Ind., notes the 15.125 channel closing down 1300. Bellington, N. Y., recently heard *Radio Free Europe*, 9.607, at 0158 tune-in with music by chorus; identified in Hungarian at 0200; strong level.

Sao Tome—CR5SB, 17.6775, noted Sundays 0700-0800; closes with "A Portuguesa." CR5SC, 4.8075, heard 1450 with talk in Portuguese; signed-

off 1600 with "A Portuguesa." (Pearce, England)

Saudi-Arabia—Bellington, N. Y., recently noted Djeddah, 11.75, opening 2312, preceded by eight-note interval tune; uses Arabic; has bad QRM from London, same channel. The 11.75 outlet had been inactive for some time.

South Korea—Cushen, N. Z., reports HLKA, Pusan, heard on 4.785, 7.935A around 0700. Noted by Waller, Hawaii, at 0500 on 7.935A at excellent level, when announced simply as "HLKA, Korea."

Spain—Radio Nacional de Espana, 15.635, Madrid, noted signing off 1152. (Ferguson, N. C.) Is usually excellent on 9.363 in *English* for North America 1800-1840, then goes into Spanish for Latin America. (West, Virginia) "La Voz de la Falange," 7.380, Madrid, signs on with the Falangist March; noted with recordings recently 1700. (Pearce, England) EAJ9, 7.021, Malaga, noted 1615 with all-Spanish session. (Saylor, Va.) *Radio Juventud*, Cadiz, sent QSL card which listed frequency as 7.200. (Tonsi, Wisc.)

Sweden—Radio Sweden, 11.88, now seems to have news daily 2130, in addition to other regularly scheduled periods. (Bellington, N. Y.) Heard on 15.155 with *English* for South America 0600; repeats for North America 0700. (Pearce, England) Heard on 11.880, 11.705 with *English* for North America 1900, good level in Virginia. (Saylor) Good Signal 2300 to western North America in *English* on 11.705. (Gaylord, Washington State)

Switzerland—The United Nations Information Centre, Geneva, broadcasts Mon.-Fri. on 6.672 with *English* 1330, French 1345. (ISWC, London) Berne noted signing on in *English* for Southeast Asia 0745 over 11.865, 15.305, 17.784 (best on 11.865).

Syria—Damascus, announcing "Huna Damas," is noted by Pearce, England, with Arabic music and vocalists from tune-in 1630 to 1700 sign-off. The 11.913 channel still has French 1530-1630 and *English* 1630-1730 closedown.

Tahiti—Radio Tahiti, 6.135 and 6.980, Papeete, signs off 0130 with "La Marseillaise." Is best level on 6.980 although the channel has severe CWQRM. (Cushen, N. Z.) The 6.135 outlet is best signal in Calif. around 0000-0100. (Balbi)

Taiwan—Taipeh, 7.133A, noted at good level 0530; news 0600, followed by session in French. (Saylor, Va.) Noted with native program on 11.735 at 0510-0520 recently. (Ferguson, N. C.) *"The Voice of Free China, Radio Station BEC,"* is heard over BED4, 11.920, with news 1320; commentary in *English* 1335; has Russian 1303 (jammed). (Pearce, England)

Tanganyika—The Department of Social Development, Box 1649, Dar es Salaam, is broadcasting on 1250 kc.,

SIMPLIFIED PHASE INVERTER

By WILLIAM CREVISTON

THE split-load phase inverter, such as is used in Williamson-type audio amplifiers, can be simplified by leaving out the cathode bypass condenser and changing one connection to give an increase in gain and no bad effects on its other characteristics.

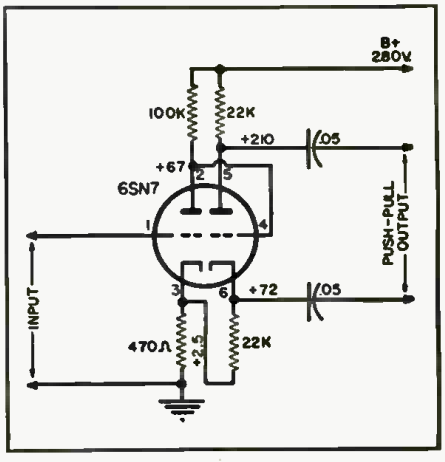
Fig. 1 shows a complete circuit so modified. The first half of a 6SN7 serves as a straight voltage amplifier, direct-coupled to the grid of the second half which performs the inversion. The cathode resistor of the first triode section is omitted, and the low side of the cathode load of the inverter triode is tied to the first cathode. The gain from input to either side of the inverter output is 21. Gain with the 470 ohm resistor bypassed is 14. Unbypassed, as in original circuit, the gain is only 7.

Maximum output per side is about 30 volts. The trick connection has no measurable effect on this factor, nor on balance or bandwidth.

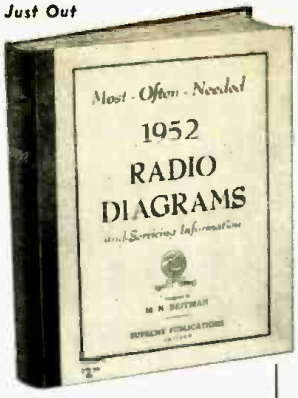
The increase in gain comes from a slight degree of positive feedback which obtains from the coupling of the two cathodes together. This type of circuit scheme is sometimes used in miniaturized equipment to eliminate the bulk of a condenser. The feedback is proportional to the current in the inverter load resistors. Such positive current feedback has the property of reducing the output impedance of an amplifier. The effect in this case is beneficial but slight, tending to improve the impedance balance. The output impedance of a split-load inverter is high on the plate side, and low on the cathode side due to the cathode degeneration in the tube. Without the positive current feedback, the measured output impedances were 22,000 ohms to the plate and 1800 ohms to the cathode. With the positive feedback added, these changed to 20,000 and 2500 respectively.

Frequency response is down 1 db at 50 kc. on the plate side, and 1 db at 150 kc. on the cathode side, measured with a low impedance signal source. Phase shift between the two outputs begins to be noticeable on a scope at 10 kc., but is only about 5 degrees at 20 kc. —30—

Fig. 1. Simplified phase inverter circuit which provides 50% more gain while eliminating bypass condenser. There is no change in balance or bandwidth with circuit.



Just Out



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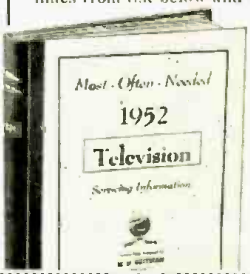

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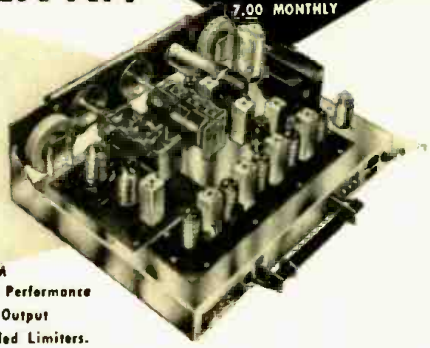

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Tangier—"*Dux Radio, Stockholm,*" noted over *Radio Africa*, 7.126, with Swedish session 1635-1705 on Tue., Thur. *Radio International*, 6.110, noted opening 1500 in French; also uses Spanish. (Pearce, England)

Thailand (Siam)—Reception of Bangkok varies considerably in Australia; at times is good during Overseas Transmission 0500-0627 on 11.910 and 6.240; the transmitter on *measured* 7.105 is good from 0627 when used for the Home Service (in Thai) relay; an interval signal is used 0627-0630 and the Thai national anthem is then heard with a brief announcement in Thai, then in *English* says "This is the National Broadcasting Station of Thailand at Bangkok"; lists frequencies as operating in the 48-, 41-, 25-, and 19-m. bands; when transmitting the Overseas program 0500-0627, announces as "The Overseas Broadcasting Station of Thailand." (Hutchins, Radio Australia)

Trans-Jordan—Ramallah is currently noted on 6.990A from 1200-1430 sign-off; news in Arabic 1400. (GDX-aren, Sweden)

Trinidad—VP4RD, 9.625, Port of Spain, heard 0555 with recordings, commercials, time checks. (Ferguson, N. C.) Has news 0545. (Kary, Pa.)

Turkey—*Radio Ankara* is using *measured* 15.160 instead of 15.165 this year for *English* to British Isles around 1600-1645. (Ferguson, N. C., others) TAP, 9.465, is heard in parallel, but at poor level in Ohio. (Sutton) These continue in Turkish 1645-1700 closedown. (Rodgers, Scotland; Golden, Mass., others) TAV, 17.820, noted to Far East in *English* 0730-0815. (Pearce, England)

Uruguay—Montevideo, 11.835, noted signing off 2200 in Spanish at weak level. (Cleveland, Md.)

USI (Indonesia)—YDJ2, 7.098A, Jogjakarta, is fairly good in parallel with YDJ, 5.060; takes relay from Djakarta 0630, 0730. Bukittinggi, Sumatra, YDM2, 5.030A, also takes news from Djakarta. (Dilg, Calif.)

The station heard early mornings on 11.089A is YDR2, Ambon, in the Moluccas; at times this one relays news in Dutch from Makassar, Celebes, and from Djakarta. (Dilg, Calif.) Probably closes down 0930.

"Voice of Indonesia," Djakarta, noted in *English* around 0945 on announced 11.77, poor level in Washington State. (Gaylord)

USSR—West Virginia, reports Moscow on 11.805A with *English* 1650-1700. Is heard by Ferguson, N. C., in *English* on 15.36, 15.18 when tuned recently 0435, good level.

As a part of its North American "evening" transmission, *Radio Moscow* recently started a period in the Ukrainian language (originating in Kiev) at 2030-2100 over 9.67, 11.830, 15.180 (other frequencies carry *English* throughout the 1820-0100 schedule).

Petropavlovsk, 15.100, is heard with

fair level to 1000 sign-off with programs in a Chinese dialect; suffers some QRM. (Kary, Pa.) *Radio Moscow* is noted with *English* on 7.340 to 1800 sign-off; probably is beamed to Europe.

Venezuela — YVNC, 9.639A, Coro, noted recently 0730 in Spanish. (Stark, Texas)

Yemen—Allocated channels for a 25-kw. transmitter of the Ministry of Posts, Telegraphs, and Telephones in Sanaa are 5.985, 9.705, 11.905. (WRH)

Yugoslavia — Radio Yugoslavia, 9.505A, Belgrade, still has *English* 1645-1700. (Pearce, England) Also 1100-1115, at times with good level in Pa. (Kary)

* * *

Press Time Flashes

VRO6, 6.005, Suva, Fiji, was used recently during yacht races with a relay over VPD83, 17.680; programs were taken from ZJV, medium-wave. (N. Z. DX Times, others)

"The Radio Amateur," London, says *Pan-American Radio,* Tangier, is now on 7.285 to 1805 closedown.

"Voice of Vietnam," Saigon, Indo-China, has been noted on a *new* channel of 7.29A with *English* 0845-0900 sign-off in parallel with 9.62; formerly was on 7.095. (Balbi, Calif.) The *new* 7.29A outlet is heard in native session around 0600 by Eastern U.S.A. DX-ers.

More recently, *Radio Peking's* 25-m. outlet has been on approximately 11.725; has news 0830; the 15.06V channel is inaudible at that time while 9.04, 10.20, and 10.26 carry Chinese. (Balbi, Calif.)

Warsaw, Poland, sent QSL card and *new* schedule for *English* to British Isles—1230-1300, 9.525, 7.155, 11.935; 1315-1345, 11.740, 7.145, 9.555; 1350-1420, 9.525, 7.155, 11.935, 5.973; 1545-1615, 9.600, 7.175, 11.845, 6.115; 1615-1645, 11.740, 7.145, 9.555. (Pearce, England)

Radio Free Asia has news 0845; 6.11, Manila, is fair; 11.94A, Manila, is weak; 9.49, Guam, is quite poor. (Balbi, Calif.)

Cairo, 9.715, sent a letter asking for reports on this channel during the daily 1345-1700 schedule; heard 1400 with clock striking 9 p.m., then news; some days continues in *English,* other days takes French. (Pearce, England)

Radio Tirana, ZAA, Albania, sent this schedule for its 7.850A and 6.560A outlets—Italian 1315; French 1345; Italian 1515; *English* 1615; music 1550-1615 (Wed., French-*English*; Thur., Italian). (Pearce, England)

Casey, Ky., and Pearce, England, have received this *new* schedule from Copenhagen, Denmark—test broadcast for Greenland (daily) 1900-2000, 9.520; to North America daily 2030-2130, 2200-2300, 9.520; Tues., Thur., Sat. for Australia-Far East, 0400-0500, 15.180; Tues., Thur., Sat. for India, Malaya, Far East, 0900-1000, 15.165; program for Danish Ships in European waters, Tues., Thur., Sat., 1200-1220, 9.520; Home Service daily 1240-1615, 7.260; for South America, Mon., Wed., Fri., 1730-1830, 9.520; for Faroe Islands on

Sun. 0900-1000, 9.520; for Danish Ships outside European waters, Mon., Wed., Fri., 1830-1850 on 9.520. Tues., Thur., Sat. 2000-2020, 2130-2150, 2300-2320 on 9.520, 0500-0520 on 15.180, 1000-1020 on 15.165.

When this was compiled, *Radio Free Asia* had begun to shift its operations from San Francisco, Calif., to Manila, Philippines. A team of four radio experts had left for Manila to plan and direct programming from that point. By this time, broadcasting hours may have been increased. When this was written, schedule was 0700-0900 over 6.110, 11.940, Manila, and 9.490, Guam. Dilg, Calif., notes the Guam outlet is a *commercial* outlet with a call at 0920 sign-off that sounds like KUJZ (may be prewar call KU4G).

At the time this was written, the International Goodwill Station was in the process of moving from Leopoldville, Belgian Congo, to Brussels, Belgium, where two new high-powered (100 kw.) transmitters may be in use by now. QRA in Brussels is The Belgian National Broadcasting Service (Service Mondial), P.O. Box 26, Brussels, Belgium. OTC, Leopoldville, will continue to be utilized for relay for programs to North and South America.

New QRA for *Radio Quitandinha* is International Division, Radio Quitandinha, Caixa Postal 5292, Rio de Janeiro, Brazil; Flavio Serrano, long a monitor for the *ISW DEPARTMENT*, is now chief of the International Division of this station; says all reports, old or new, will be answered although it will take several months to do so, but that SWL's do not need to repeat an out-dated report in order to get the QSL card now available. (WRH)

The University of Istanbul, Turkey, operates a transmitter on 7.300 at 1000-1045; a station of the Technical University of Istanbul is on 7.100 on Mon., Wed., Fri., 0700-0700 and other days 1330-1500; *Radio Izmir*, Smyrna, broadcasts on 6.383 now at 0800-1430.

Forecasts over WWV, Bureau of Standards, Washington, D. C., are now given twice each hour—19½ and 49½ minutes past the hour on 2.5, 5.0, 10.0, 15.0, 20.0, 25.0. Letters used are still "N," "U," and "W" to signify the radio propagation conditions are "normal," "unsettled," or "disturbed," respectively. A digit is now forecast to show the expected quality of transmitting conditions on the N.B.S.-C.R.P.L. scale of 1 (*impossible*) to 9 (*excellent*). The digit forecast indicates these propagation conditions—1—impossible (W); 2—very poor (W); 3—poor (W); 4—fair to poor (W); 5—fair (U); 6—fair to good (N); 7—good (N); 8—very good (N), and 9—excellent (N). (Oskay, N. J.)

Miers, Germany, says that plans are being made for Western Germany to resume international broadcasts just as soon as the German treaty is ratified; will at first use German, later French and *English*, possibly other languages.

According to a recent verification, *Radio Jornal do Commercio*, Recife, Pernambuco, Brazil, uses 9.565 at 0455-1105 and 1300-2120; 11.825 at 1600-2120, and 15.145 at 0455-1300. "Brazil Calling" (*English*) is radiated Mon.-Sat. on 9.565 at 2005-2030, and on 11.825 at 1935-2000; Sundays on 9.565 at 1625 and on 11.825 at 1605. (Radio Sweden)

CR7IB, Beira, Mozambique, is operating on 7.199 with 0.3 kw. weekdays 0430-0630, 1100-1500; Sun. 0400-0700, 1100-1500; news in Portuguese 0500, 1300. (WRH)

According to WRH, ZNB, Mafeking, Bechuanaland, is now using 7.895 weekdays 0600-0700, 1200-1430; Sun. 1300-1430; is 0.5 kw.; says a 0.2 kw. transmitter will shortly operate on 5.900 (ZNB's old channel of some years ago). WRH says RIAS, Berlin, is operating 24 hours daily now, but that the s.w. outlet on 6.005 is on the air *only* 0400-0245.

Radio Sweden reports the "DUX" transmissions in Swedish over *Radio Africa*, 7.126, Tangier, are now Tuesdays 1500-1530 and Thursdays 1530-1600.

At press time, Kary, Pa., had just received confirmation from "La Voix du Vietnam," Saigon, Indo-China (Vietnam), that the 7.090 channel has been replaced by 7.288. Officials listed *English* sessions for 0800-0830 in 7.288 ("Disc Jockey Time"), and 0830-0900 on 9.500 and 7.288 (music, commentary, and news); sign off is 0900.

Bellington, N. Y., more recently noted *Radio Athens*, 11.718A, opening in Greek 1900.

The director of *Radio Nacional de Espana*, Madrid, has informed Casey, Ky., that the monthly program bulletin has ceased to be published for the time being, but that a list of frequencies and hours on the air will be sent free on request.

A *new* Colombian seems to be *Radio Neiva* on 4.852; signs off 2302; has had QRM. (Stark, Texas)

* * *

Acknowledgement

Monitor certificates for 1952-53 have been mailed to "active" monitors; I will be happy to send a certificate to anyone else, anywhere in the world, free on request to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, U.S.A. Thanks for the fine reports—and good listening!—. . . . . K.R.B.

TV Conversions

(*Continued from page 55*)

3. Core material. Deflection yokes have core pieces which can consist of either powdered iron, iron wire, or ferrite. For Circuits B and C the ferrite core type is the most efficient although some of the better iron wire types can also be used. In practice it will be found that most of the new 70 degree yokes have ferrite cores.

A fourth consideration concerns the method of winding the yoke. There are now available various "anastigmatic" or "cosine" yokes which help to maintain even focus over the entire picture. Even focus is a great advantage, but many of these yokes introduce non-linearities at the sides of the picture which are called "bulging" or "pincushioning." These faults can sometimes be overcome by placing small magnets near the tube. In general, good focus is obtained, even with these special yokes, only when the anode voltage is sufficiently high and the focus coil is set correctly.

Vertical Sweep Section

Many small screen receivers have a vertical sweep section which has sufficient reserve power to deflect the new, large picture tubes. Unless the sweep is barely sufficient for the small tube it is best to try the new picture tube first before modifying the vertical section.

To increase the vertical sweep in receivers using a single 6SN7 as the oscillator and output amplifier tube, simply substitute a new type 6BL7 in the same socket. This tube is designed to replace the 6SN7 for wide angle picture tubes without circuit changes.

If a single 12AU7 is used in the vertical circuit, the height can be increased simply by substituting a 12BH7 in the same socket. (This will work only in receivers with parallel-connected filaments.) Where a 6K6 is used, try substituting a 6V6 or, if the pentode is triode connected, rewire the tube socket and return the screen grid to a well filtered "B plus" point (150-250 volts).

If tube substitution is not possible or does not give enough height, connect the "B plus" side of the vertical height control to the boost voltage. If the height is still insufficient it may be necessary to connect the "B plus" side of the vertical output transformer to the boost voltage. For this connection use a 5000-ohm, 2-watt resistor and a 10 μfd., 600-volt condenser as a decoupling filter. This will reduce the high voltage and width slightly.

Focus, Ion Trap

Most picture tubes larger than 14 inches (rectangular) require more focus flux than the smaller tubes. The simplest change in most receivers will be to substitute a new focus coil in place of the one used for 10- or 12-inch picture tubes. This new coil (RTMA

#109) is larger and has a round steel case. Its d.c. resistance is approximately 470 ohms. If focus cannot be obtained, reverse the connection.

Receivers using a combination EM-PM focus coil may require a new coil of this type or else a full PM focus ring, such as the *Quam* QF2 "Focalizer," can be used. New nonmagnetic brackets will be needed to mount such units.

Practically all new, large screen tubes use either a single or double magnet ion trap. If the old receiver uses an electromagnetic ion trap (two coils) leave it in the circuit, but mount a new PM ion trap on the picture tube neck. Be sure to ascertain which type of ion trap is recommended for the new tube, because on some tubes both double or single magnet traps will work, but only one will give sharp pictures.

Troubleshooting Conversions

Corona or arcing: Because of the higher voltage the old high-voltage section may now have corona or even arcover. To avoid this, leave all high-voltage connections smooth. Clean all insulating surfaces with carbon-tet and, if necessary, paint the entire HV rectifier socket with glyptol, polystyrene coil dope, or similar preparation. Dress all leads carefully to avoid arcing. Coating grounded parts near the high-voltage points with glyptol etc. or cementing insulation material between such points also helps. If no corona ring is used on the high-voltage socket, connect all unused tube pins together with #20 bare wire (or even larger) and leave smooth well-soldered connections.

Insufficient width: In Circuits A and C it is possible to increase the width by shunting a .05 μfd. condenser across the width coil. Increasing the driving voltage on the grid of the output amplifier will increase both the width and high voltage on all three circuits. Reducing the value of the screen resistor will also help in all three cases. The screen voltage on the 6BG6 or 6CD6 can be increased to about 300 volts while on the 6BQ6 no more than 150 volts can be applied to the screen. If other tube types are used the tube manual should be consulted for maximum screen voltage. The total cathode current is indicative of the correct operation of the output amplifier and if, as shown here, a 100-ohm resistor is used, the cathode current can be quickly determined by measuring the voltage across this resistor. For a 6CD6 this voltage should not exceed 12 volts, representing 120 ma. The 6BG6 should not draw more than 100 ma. and the 6BQ6 no more than 85 ma. If current appears excessive, measure the grid bias. This bias, measured from grid to cathode, should range from 20 to 40 volts. Increasing the driving signal will increase the bias.

In many cases with circuits such as B and C it is possible to get better width and linearity by connecting the yoke to a higher tap on the secondary winding. —30—

NEW TV PRODUCTS on the Market

"PICTURE TUBE SAVER"

Television Communications Industries, 222 N. Wells Street, Chicago, Illinois is currently marketing a new "picture tube saver" which is said to improve contrast and restore brilliance of old tubes.

The "Stay-Brite" unit works automatically. Five positions permit increasing filament voltage to prolong the useful life of all tubes for a year or more. The installation of the unit requires no wiring or outside connections and this one unit will fit all sizes of picture tubes.

Full details on this unit are available from the company.

TV "WALL-THRU"

Mosley Electronics, 2125 Lackland Road, Overland, Missouri is offering a new weatherproof TV or FM lead-in wall entrance to the trade.

Known as the "Wall-Thru," the new unit can be quickly installed in any wall up to 13" thick. The unit consists of precision molded polystyrene inside and outside wall plates combined with a sturdy 14" extruded polystyrene tube, ¾" o.d. Both wall plates are designed to accommodate either standard flat 300-ohm line or RG-59/U coaxial cable and are readily adapted for use with tubular type 300-ohm line.

For extra convenience, the new "Wall-Thru" is designed so that a *Mosley* universal TV lead-in socket

may be mounted directly on the inside plate if desired. This provides a neat, solderless, and low-loss plug-in connection of the TV set to the lead-in when mated with the company's transmission line plug.

COAXIAL CABLE

The Plastoid Corporation, 42-61 24th Street, Long Island City, New York has announced the availability of a new radiation-proof coaxial cable which has been especially engineered for community TV installations.

The cable was developed to overcome the loss of signal strength usually encountered in community systems due to the length of the cable run. The new product also provides higher-than-average tensile strength to take care of the mechanical problems of the long runs.

Full details on this new radiation-proof cable are available from the company on request.

"GLOW-RING"

Pioneer Electronics Corp. of Santa Monica, California has recently introduced a new feature in connection with its picture tube line which is said to speed the work of television picture tube adjustment by indicating to the

operator when the correct ion deflection has been obtained.

Called the ion trap "Glow-Ring" indicator and located a few inches from the base of the tube, the device consists of a narrow encircling band of luminous material applied to the neck of the tube during manufacture.

When the ion trap is incorrectly adjusted, the "Glow-Ring" emits a soft green light which dies out when the trap is rotated to the exact setting.

ION TRAP

Heppner Manufacturing Company of Round Lake, Illinois, has announced the availability of a new low-priced slip-on ion trap of simplified construction.

Each Model T-312 trap is stabilized and tested on special equipment designed by the company for that specific purpose. Installation time is 2 or 3 seconds. While the smooth metal-to-glass contact permits easy adjustment the unit stays in position without wobble or shift during shipment of the complete TV set.

The Model T-312 weighs just 3/5 ounce so that the neck of the tube is not damaged. The gauss readings range from 25 to 60.

ALL-CHANNEL ANTENNA

The Gonset Company, 801 South Main Street, Burbank, California is now in production on a new all-channel (v.h.f.) antenna which is based on a new engineering principle.

Tradenamed the *"Gonset Rocket,"*

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Tube Mtg. Brackets $6.50
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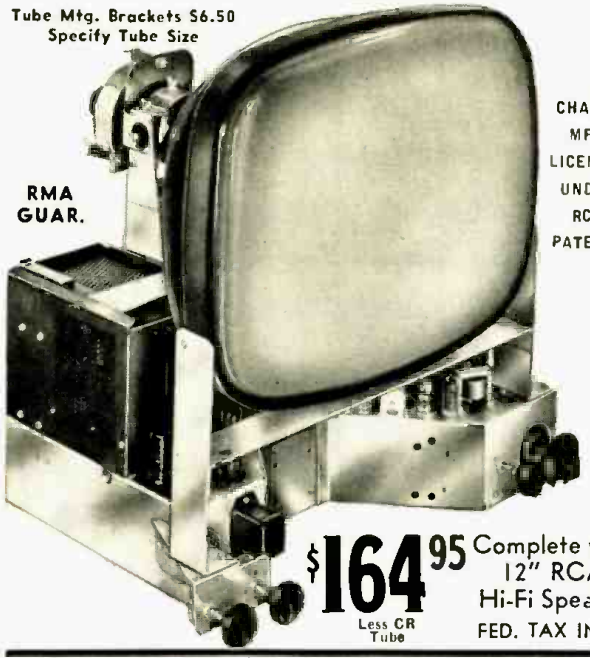

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- ☆ No removal of chassis necessary; special leads connect to tube pins.

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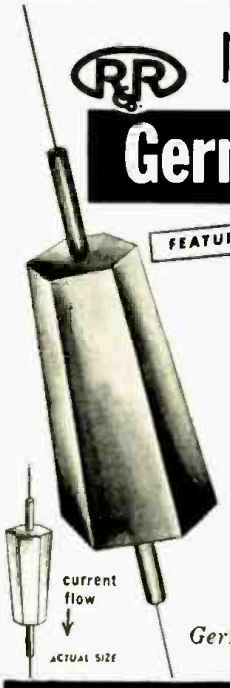

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Normally in diodes such as these, one side of the germanium wafer is plated so that it may be soldered to the base . . . but Radio Receptor's improved production methods make it possible to omit plating, thus eliminating possible flaking and improving quality.

The distinctive tapered shape of the glass-filled phenolic cartridge body indicates the direction of current flow, while the hexagon form assures ease of handling — prevents rolling, especially when the leads are cut off to permit mounting the diode in clips.

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the antenna functions as a resonant unterminated rhombic on the high channels and a folded dipole with reflector on the low channels.

By making the legs an odd number of quarter-waves long on the high channels, a good front-to-back ratio is obtained without a terminating resistor. The impedance match to 300 ohms is said to be better than if a terminating resistor were used.

On the low channels the functioning and performance are comparable to those of a folded dipole of conventional configuration. Gain and front-to-back ratio on the low channels are improved by the use of a parasitic reflector which has been designed for optimum performance on these channels.

"KENMAST"

The Tenna-Trailer Company of 321 N. Plum Street in Pontiac, Illinois has developed a new, easily-transported, easily-installed, low-cost telescoping mast which has been tradenamed "Kenmast."

The new mast can be handled by one man and weighs only 75 pounds. It can be easily installed by mounting it on a standoff bracket with two lag screws on the side of the building. The mast is then raised, the ground spikes are driven into the base plate, the unit cranked up to its full 50-foot height, and the guy wires are tied off. Adjustment of the tension on the guy wires by means of the handcrank completes the installation.

The "Kenmast" is constructed of square tubing which the company claims insures strength and rigidity.

Additional information on this new unit is obtainable from the factory on request.

BALLAST RESISTORS

Clarostat Mfg. Co., Inc. of Dover, New Hampshire has designed a new TV ballast unit which may be plugged in between the TV receiver and the electric receptacle.

The new unit is intended for use in areas where the line voltage tends to increase up to 140 volts. The unit operates on the ballast principle so that as the voltage increases the resistance increases giving an increased drop across the resistance and lowering the voltage to the receiver.

At 110 volts and under, the voltage drop is negligible but with increases up to 140 volts, the voltage applied to the television set will not normally increase much above 115 volts, depending, of course, on the load applied.

The units are so designed that they can be plugged into one another or two or more can be operated in series to obtain a greater voltage drop. Currently, the ballasts are available in two types, the Type TVA for 200 to 300 watt loads and the Type TVB for 300 to 375 watt loads.

TV ACCESSORIES

Radio Merchandise Sales, Inc., 1165 Southern Boulevard, New York 59,

New York has announced the availability of four new accessories for television installation—a thermal switch, a two-set coupler, a local-distance switch, and a four-channel switch.

The *RMS* thermal switch, Model TH-SW, permits the automatic operation of lamps, rotor, booster, and similar devices through operation of the TV receiver. In addition to this convenience, neatness of wiring arrange-

ment and protection against operation of the electrical units overnight are other advantages claimed by the manufacturer. The switch is compact and mounts easily to the wall. A spare outlet is provided for the independent operation of other electrical devices.

Additional details on the thermal switch and complete information on the other three units in the new accessory line are available from the company direct.

"ULTRA Q-TEE"

The LaPointe-Plascomold Corp. of 155 West Main Street, Rockville, Conn. has announced a new antenna development, the "Ultra Q-Tee."

This new *Vee-D-X* unit incorporates a special six-section printed circuit band reject filter. A portion of the v.h.f. antenna (the v.h.f. high channel director) is used as a reflector throughout the range of 470-890 mc. The ultra-high-frequency "V" is the first element of the total antenna, with the critical angle and length chosen so that no interaction exists between the v.h.f. and u.h.f. sections.

The six-section filter is located on the antenna boom between the common u.h.f. and v.h.f. transmission line feed points. At v.h.f. the "Q-Tee" operates as an independent antenna through the short-circuit action (off resonance) of the u.h.f. filters placed in series with each side of the transmission line. At u.h.f. these filters are off resonance, and voltage is allowed to reach the line without attenuation. The v.h.f section is effectively isolated by the high series impedance of the u.h.f. filter sections in the same range so that no interaction can occur between the ranges of 54-88, 174-216, and 470-890 mc.

—30—

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Circuitry is of the Armstrong FM type, with limiter and discriminator; sensitivity is 3 microvolts (on FM) for 20 db quieting, 75 microvolts loop sensitivity on AM; **frequency response** is, for FM, 20-20,000 cps ± 1 db, and for AM 20-5,000 cps ± 2 db; **output voltages** are: FM—2½ volts for 100% modulation, AM—1 volt average. **Output jacks** include AM-FM Monaural, AM Stereo, AM Tape Recording, FM Tape/Multiplex. **Controls** include Stereo-Monaural switch, Selector Switch (AM, FM-AFC, FM, Off), AM Tuning, FM Tuning, Multiplex-Tape switch. **Built-in FM and AM antennas. Tubes** are 6BE6, 2-6BA6, 6U8, 12AT7, 6AU6, 6AL5; diode AM detector, selenium rectifier. For 105-120 volts, 50/60 cps AC. **Size** 8-1/2" d x 13-5/16" x 4-1/4" h. **Shpg. wt.,** 16½ lbs.

LAFAYETTE LT-99 Stereo Tuner ..... Net **72.50**

2-Meter Transmitter

(*Continued from page 41*)

carefully tuned while watching the r.f. meter on the test instrument for evidence of operation at the desired frequency. It is advisable to listen for the 24 megacycle signal on a communications receiver, to make certain that the frequency of this stage is being controlled by the crystal. When the signal is indicated on the r.f. meter and is heard in the receiver, the crystal should be grasped between the thumb and forefinger. If the frequency shifts or shows signs of instability, as evidenced while listening to the receiver, it is reasonably certain that the stage is self-oscillating. The tap on the coil L_1 should be shifted one turn closer to the "cold" end of the coil (closer to the crystal). This simple operation will eliminate this condition.

We may proceed to the next stage of the transmitter, the frequency tripler section of the 6J6. The grid-dip oscillator or wavemeter should be tuned to 72 megacycles and the pickup coil of the test instrument held close to L_2 while tuning C_5 for an indication on the r.f. meter. When this point is found, the 5763 frequency doubler may be resonated by plugging a test meter with a 0-10 milliampere scale in jack J_1 and tuning C_{10} for a maximum reading on the meter. The coupling between L_3 and L_4 should then be adjusted to provide a meter reading of slightly more than 5 milliamperes. After tuning the final amplifier, this current reading should be checked again and the coupling between L_3 and L_4 adjusted until the proper reading is obtained.

The final r.f. amplifier may now be resonated. Apply high voltage to the stage and insert a test meter with a 0-200 milliampere scale into jack J_2 and tune C_{11} for a minimum or dip as indicated on the meter.

After the transmitter has been properly resonated, the antenna may be connected to the antenna output coaxial fitting. L_6 should be adjusted so that the transmitter will load up to 150 milliamperes.

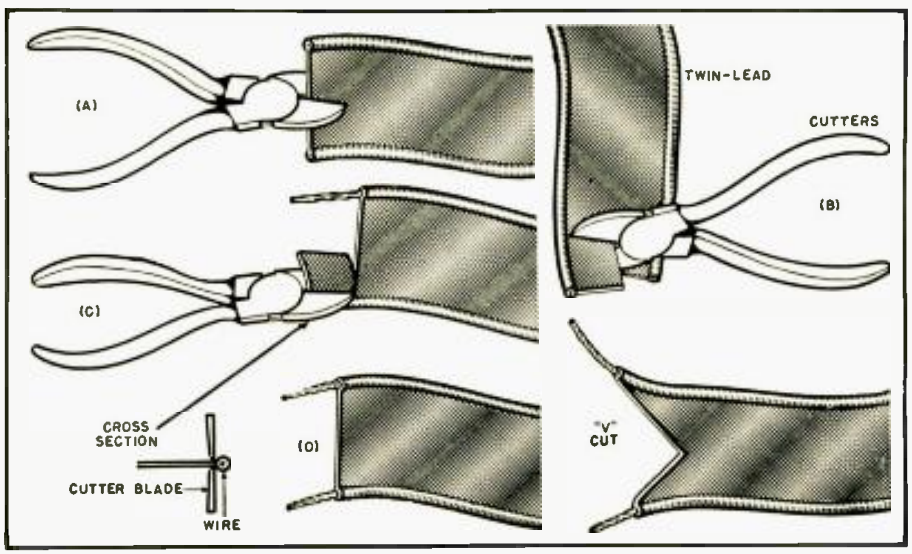
When tuning for the maximum output in an r.f. amplifier stage employing a beam power tetrode such as the type AX 9903, with the meter circuit in the cathode of the tube, it will be found that the minimum or "dip" indicating resonance will be less pronounced as the antenna load is increased. This is due to the fact that the meter indicates the screen grid and the control grid current in addition to the plate current. Therefore, when resonance is approached the screen current increases making the dip less pronounced.

The transmitter just described is designed for operation in conjunction with any standard AM modulator providing 50 watts of audio power; all circuit constants and operating voltages and currents, as set forth in the circuit diagram and in the text, are for AM phone operation.

If the transmitter is to be used for FM operation or is to be used to drive a high power stage, up to 600 volts of plate voltage may be applied to the tube with 200 milliamperes of plate current. Under these conditions only 2 milliamperes of grid current is required for the final amplifier tube. However, it will be necessary to replace the final amplifier grid bias resistor (R_7) with one that will provide 80 volts of grid bias.

—30—

From Hugh Lineback comes a practical suggestion on a quick and neat method of stripping the end of twin-lead transmission line. Diagonal cutting pliers are used, thus avoiding the greatest danger of peeling the wire with a knife—that of nicking the strands which might break later. In step A make a split with the cutters; step B, with the point of cutters against wire, cut crossways at bottom of split (for both wires); step C, cutters grip plastic and tear it from wire (don't squeeze hard enough to cut); and step D is a "V" cut in the plastic which gives flexibility for fitting terminals.



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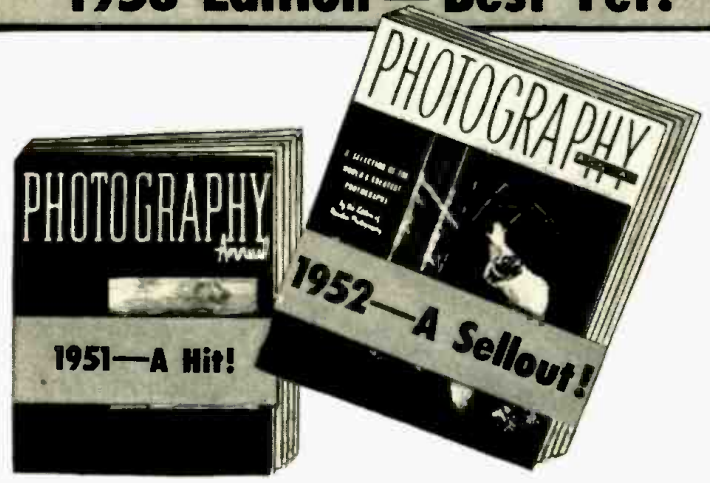

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Mac's Service Shop

(*Continued from page* 70)

only rarely. Experiments carried on by the *Collins Radio Company* and the National Bureau of Standards last May upset previous beliefs that under ordinary conditions no v.h.f. signals were returned from this region, since the experiments showed that weak signals were returned continuously. I expect to know more about these experiments a little later, but the summary report explaining 'A new kind of radio propagation observable over long distances' has not yet been cleared for release. Mr. Rosen of the Technical Reports Section of the U. S. Department of Commerce warns me that many of the writers who have published material on these experiments have drawn erroneous conclusions; so I guess we will just have to wait until the report is released.

"During the months of May, June, and July ionized 'clouds' form in the lowest layer of the ionosphere, called the E Layer; and if one of these clouds drifts into just the right position above the TV station and the receiving position, freak reception often results, especially on the lower channels, over distances of several hundred miles for a few hours at a time. Again, under conditions of intense ionization, such as occur at the peak of the sunspot cycle, the upper layers of the ionosphere occasionally are able to return signals from the lower TV channels and produce some exceptional DX.

"While on the subject of freak reception, two other causes are worth noting. One is the condition of intense ionization of an area 50 to 500 miles above the earth that accompanies a display of the aurora or northern lights. When the aurora is visible, TV signals will often be returned from this ionized area, and reception will be effected over unusually great distances. Unfortunately, aurora-reflected signals undergo such rapid changes in strength that the picture is usually too distorted by the rapid flutter to be enjoyed. The final cause of freak reception is the meteor trail. A meteor passing through the atmosphere ionizes the air in its wake, and TV signals will be returned from this ionized space in a sudden burst of signal strength of only a few seconds' duration.

"All of these cases have nothing to do with the ordinary day-in-and-day-out brand of fringe-area reception in which we are interested; but before we can draw any conclusions about how conditions inside the troposphere affect reception, we must know about some conditions outside this region that also may affect television signals. Otherwise, if we try to explain everything that happens purely in terms of tropospheric conditions, we are bound to become confused."

"I'm already confused," Barney confessed.

"Now let's consider a TV signal mov-

ing out into the troposphere from a transmitter. In the standard moist atmosphere, the velocity of the signal will increase at a uniform rate with altitude. This means that if we consider a wavefront moving out roughly parallel to the earth's surface, the upper portion of this signal will be moving faster than the lower part, and this will put a kind of 'English' on the signal that will curve it downward on an arc that has a curvature roughly 1/6 that of the globe. This fact accounts for the condition in which radio line-of-sight is roughly 15% greater than geometrical line-of-sight. 'Diffraction' extends this radio line-of-sight still farther. It is the tendency of a signal to curve around an opaque object into the shadow area. In this case the earth itself is the opaque object. The diffractive process decreases rapidly as the wavelength becomes shorter; and this explains, in part anyway, why the lower channels reach out into the fringe areas better than the higher ones do."

"But all this has nothing to do with the weather," Barney complained.

"We're coming to that right now," Mac assured him. "The first fact to keep in mind is that when a TV signal ranging up through the troposphere encounters either warmer or drier air, it is bent downward much more sharply than is the case in a standard atmosphere. You remember that under standard conditions the temperature drops about 3.5 degrees for every 1000 feet of altitude; so obviously something must upset this condition if the signal is to encounter warmer air above the earth. Several conditions can produce such an upset: For example during a summer day the earth is warmed by the sun. After the sun sets, this heat is lost rapidly in the form of radiation, and the air nearest the earth is cooled more rapidly than the air above it. The result is a 'temperature inversion' that often makes TV reception good up to distances of 150 miles. Another case is when the sun warms the upper reaches of the atmosphere without falling on the earth. This accounts for the excellent reception often obtained just at sunrise and sunset. Still another case is that of warm dry air from land blowing across a body of water, such as a lake. The warm air rises, while the air near the water is cooled by the water and is more moist.

"Frontal action also produces thermal inversions. The spiral action of winds moving counter-clockwise into low pressure areas and clockwise out of high pressure areas move great masses of cold air down from Canada and bring up warm air from Mexico and the Gulf. For example, when a low-pressure storm approaches us here in the Great Lakes region from out of the west—and the procession of lows and highs across the United States is always in the general direction of west to east—the swirling counter-clockwise winds first sweep up warm air from the south. When this light warm air encounters the cooler, heavier air

about us, it rises up over that cool air as though it were climbing the slope of a mountain. The line on the earth's surface where the advancing warm air first meets the cold air is called a 'warm front,' and when it is advancing toward us from a comparatively short distance, we can be reasonably sure we have a thermal inversion overhead.

"After the low center has passed, the north and northwest winds will be bringing down cold air from Canada; and this advancing cold air will slide under the warm air and lift it up the way you slide a knife under a piece of pie. As soon as a cold front has passed us, the chances are excellent that we have a thermal inversion overhead. Whether or not these frontal passages will bring good TV reception depends upon whether or not the inversion area is at the proper height and in the proper position to bend the signal from a TV transmitter down to our particular location. Another consideration lies in the fact that a frontal-produced thermal inversion usually results in the moisture content of the warm air aloft being greater than that of the colder air below, which means that the moisture factor and the temperature factor are working against each other. When the warm air is from Mexico rather than from the Gulf, the approach of a warm front is much more likely to produce good TV reception, for then the air above is both warm and dry.

"Still another form of inversion is produced by what is known as a 'subsidence of air.' As you know, air moves upward from a low center, and there is a general downward movement of air in a high center to counteract this. When a large parcel of air is rapidly lowered, the temperature of that air rises about 5.5 degrees F. for every 1000 foot loss of elevation. When you place this figure alongside the normal 3.5° drop in temperature for every 1000 foot increase in elevation, you can see subsiding air will acquire a temperature considerably above that of the air below it; furthermore, the relative humidity of this warming air is greatly decreased, and a subsidence of air seldom persists clear to the ground. The end result of all this is a thermal inversion that is excellent for returning TV signals to the earth. I think the frequency of these subsidence inversions, although they do not invariably occur in every high, account for the belief that a high barometer means good TV reception."

"How about fog? I often get excellent reception on a foggy night."

"A fog means the air at ground level is moisture-saturated, doesn't it? Then the air above would be drier. And didn't we say that a change from moist air to dry air would tend to return a rising TV signal back to earth?"

"It was a dumb question," Barney admitted; "but let me see if I have the rest of it straight: the thing to look for on weather maps are conditions that will place a layer of warm dry air on top of a layer of cold, moist air

somewhere between me and the TV station. A close study of the passage of warm and cold fronts should help do this, and I can also be on the alert when in the middle of a pronounced high, for then a subsidence of air is likely to produce good TV signals."

"That's about the essence of it, although it sounds darned meager when you put it that way. However, matching weather maps and TV reception makes a very interesting hobby and one that becomes more fascinating as you go along. After you have got the hang of weather maps from studying those put out by the Weather Bureau, you can usually get all the information you need from daily maps published in newspapers or from those shown on TV weather programs. Don't forget, though, if you encounter some good reception that simply cannot be explained by what you see on the map, it may be the ionosphere or the aurora or a meteor trail trying to mess you up! —30—

U.H.F. Tuner

(*Continued from page 38*)

length of the cavities is varied by a ribbon which is attached to the dial cord and pulley arrangement, as shown in Fig. 1. In effect, tuning is accomplished in much the same way as varying the length of a tuned stub changes the frequency to which it is resonant. The dial cord is of a special material which is not affected by temperature or moisture and is locked to the pulleys which eliminates the possibility of slippage. Tracking screws are provided in the cavities to obtain uniform bandwidth and sensitivity. The tracking screws vary the capacity between the ribbon and the cavity wall and thus lengthen or shorten the electrical length of the ribbon. The oscillator tube used is a 6AF4 which is similar to the 6F4. The oscillator cavity consists of a quarter wave shorted parallel wire transmission line arrangement. It differs from the r.f. cavities in that a shorting bar is used to vary the electrical length of the cavity. This method provides very stable operation.

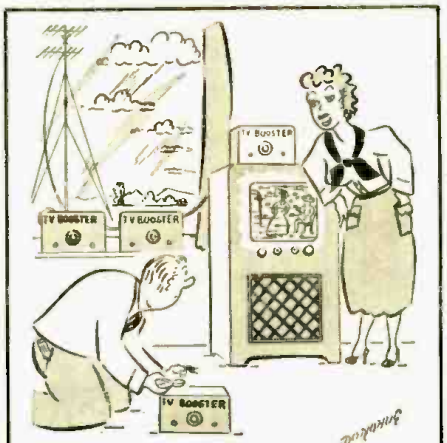
Inductive or link coupling is employed between the antenna, r.f. cavities, and the oscillator to transfer the signal between stages. The arrangement of link coupling gives maximum selectivity and constant bandwidth over the entire u.h.f. band. The signal from the output coupling link is mixed and detected by a *Raytheon* CK-710 crystal detector and then applied to the tuned input of the cascode amplifier. A 6BQ7 tube is used in the cascode pre-i.f. amplifier which is tuned to a center frequency of 25 mc. and has the features of low noise and broad bandwidth. The signal is amplified by the cascode amplifier and then coupled to the i.f. amplifier section in the receiver through 10 inches of RG-62/U coaxial cable.

The u.h.f. tuner maintains a fairly constant antenna input impedance of

300 ohms, has an over-all bandwidth of 6 to 8 megacycles, and has an oscillator injection current ratio of approximately 2 to 1. As can be seen from Fig. 2, the only amplification of the signal takes place in the cascode amplifier. The signal is not amplified in the r.f. cavities, therefore the sensitivity of the receiver on u.h.f. will not quite equal that of the present v.h.f. tuners. A receiver equipped with a u.h.f. tuner will have an over-all sensitivity of approximately 150 μv.

Servicewise this tuner contains a convenient check point for measuring the oscillator grid current to determine whether the oscillator is functioning, as shown in Fig. 2, and provisions for measuring the oscillator injection current with a *Simpson* Model 260 type multimeter (100 microamp scale) to check both the crystal detector and the oscillator. In addition, an opening is provided for coupling to the centertap of the input grid coil for aligning the cascode amplifier.

This continuous u.h.f. tuner has quite a number of advantages over other types of tuners and converters. Since it is a continuous-type tuner it has less mechanical noise, it is self correcting for oscillator drift and, by proper tuning, interference can be minimized. The u.h.f. tuner will mount directly over the v.h.f. tuner and will be a permanent part of the receiver. Because of its design, only one tuning knob is required for both u.h.f. and v.h.f. It is a separate tuner independent of the v.h.f. tuner and does not use v.h.f. tubes or components for u.h.f. It employs the separate type of circuitry which u.h.f. demands. The tuner makes use of single conversion which has an advantage over double conversion in that double conversion is susceptible to three spectra of noise and interference whereas single conversion has only two. Because it is a continuous tuner it is capable of full u.h.f. coverage and will receive any and all of the available u.h.f. channels. It does not depend upon a plug-in strip where a v.h.f. channel is unused and is capable of receiving the high end of the u.h.f. band where a strip-type arrangement may not operate satisfactorily. —30—



"This picture is still snowy—do you think this could be a fringe area?"

REEL REVIEW

THIS month's tapes were played back through a new *Concertone* network recorder and a *Craftsmen* C-500 amplifier. The speaker used was an *RCA* 515S2 in an infinite baffle constructed of ¾" knotty pine and fully treated with a lining of 1" *"Ultralite"* insulation.

The equipment was originally adjusted using test tapes and discs of known dynamic range and fidelity and the reviews, in all instances, are based on a known standard.

Tapes of the Month

A-V #105 (MUSICAL VARIETIES)
Moonglow—Everything I Love—To Each His Own—Sleep—Dream a Little Dream of Me—Sweetheart of All My Dreams—All Through the Day—Soft Lights and Sweet Music—By a Waterfall—Smiles.
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

Stock music of the type so popular with cocktail lounge crowds, for drive-in theater intermissions, and other spots where "incidental" or "fill" music is required. If you've ever read the labels on a 16" transcription from one of the numerous stock-music libraries you've noted the fictitious names of the recording artists imprinted thereon. Actually, those artists are some of the top names in the music business working under pseudonyms to avoid contractual difficulties over part-time work. Some of the names they assume are amusing, tongue-in-the-cheek plays on their real and easily-recognized names. The point is that these recordings are, performance-wise, top-notch. This critic is grateful to *A-V* for sparing us these coy fabrications and has simply omitted any reference to the artists.

The music on this reel is performed by small ensembles—and performed well, too. Such groupings as two clarinets, a softly-exercised accordian, and bowed bass are mighty easy listening. One bad point, however. This reel has at least three different ensembles performing. Some of the segués, such as between the first and second selections which change from predominant reeds to strong strings, are rather disturbing. A more intelligent and tasteful assembly job is called for here.

A-V #301 (MOMENTS IN MUSIC)
In the Blue of the Evening—Do I Love You—Valse Bluette—Just Let Me Look At You—A Pretty Girl Is Like a Melody—Shepherd King Overture (Mozart)—Eine Kleine Nachtmuzik Excerpts—Plaisire D'Amour (Martini).
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

The 100 Series in *A-V's* catalogue is called "Musical Varieties." The 300 Series is called "Moments in Music." What we are wondering is how does the person who assembles these reels

decide whether a particular selection is for Series 100 or Series 300. The same groups are heard, playing the same faultless, stolid tempos and rhythms in both series.

This reel had a particularly unpleasant treble. It seemed to whine with *glissando* violins and a *bawling* piano. It might afford pleasure to the tone-deaf or entertainment for the aged. Its "Moments in Music" are very dull ones.

The listener to this one is in for a "reel" surprise about half-way through when, suddenly, Mozart is spashed at him in a sudden burst of a furiously-rendered "Overture To The Shepherd King." Too much incongruity for us.

A-V #607
Chorale in A Minor (Franck)—Blessed Are Ye Faithful Souls (Brahms)—Chorale in B Minor (Franck).
Robert Owen, Organist
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

Who is Robert Owen? Well you may ask. We'd never heard of him either until we received this reel of tape for review. A telephone call to *A-V Tape Libraries* brought us the following biographical and recording notes.

"Robert Owen, one of the nation's outstanding young organists, is a graduate of the Oberlin Conservatory of Music, and a student of Arthur Poister and Carl Weinrich. He has been organist and choirmaster of the Christ Church in Bronxville, New York, for the past nine years and was, until recently, Dean of the Westchester Chapter of the American Guild of Organists. In 1948 Robert Owen was selected to take charge of the music of the American Cathedral in Paris. On his return to America, he was invited by E. Power Biggs to play one of the major recitals at the national convention of the Guild of Organists held in Boston. His recitals have been highly acclaimed by the public and music critics. He has been devoting his time to the extensive music program of the Christ Church and to private teaching."

This critic admires the talent of this Robert Owen, organist. His performance is moving and as compelling as we have heard. He demands and achieves great swelling chords from the rich, warm, lusty throat of his instrument. The recording quality of this particular reel is one of the best we've heard from the *A-V* catalogue—good clean sound with no over-emphasis at any part of the spectrum. We recommend it highly.

A-V #1006 (CONCERT HALL)
Part 1. Sinfonia Concertante for Oboe, Clarinet, Horn, Bassoon, and Orchestra in E Flat Major (Mozart)
Part 2. Symphony No. 41 ("Jupiter") in C (Mozart)
Austrian State Symphony, Kurt Woss, conductor
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

The Austrian State Symphony again rears its inconsistent head in the *A-V* catalogue. It amazes us how so un-

like itself the Austrian State Symphony can sound as we go from one reel of its music to another. On this reel it runs the entire gamut of good and bad likenesses.

At the very opening of Part 1 the sound is excellent, making one lift one's eyebrows and settle back to what appears to be a reel of good sound, live acoustics, and well-placed microphone pickups. However, after about seven minutes of listening, the eyebrows' lift becomes an arch because the sound has changed from live to almost dead and back and forth again. This might have been caused by a re-recording engineer with a heavy hand for equalization which can change acoustics somewhat by altering the harmonic relationships and timbre of the instruments.

A-V #1008 (CONCERT HALL)
Part 1. Symphony No. 5 in E Minor, Opus 64 (Tschaikovsky)
Austrian Symphony Orchestra, Kurt Woss, conductor
Part 2. Symphony No. 5 (Concluded)
Capriccio Espagnol (Rimsky-Korsakoff)
Austrian Symphony Orchestra, Ernest Melich, conductor
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

This is a bad one—one of the worst. From the very beginning through to the very end it is bad. We listened to it shortly after auditioning the "Robert Owen" reel and this probably made the contrasting qualities all the more pronounced. The performance is horribly full of wince-producing "clinkers," especially during the many soft string passages. Obviously poorly rehearsed and economically-produced. With the wonders of magnetic tape as an original recording medium available, there is no excuse other than economy for allowing "clinker" passages to stay in the final tape.

Technically, this tape is a queer one. It lacks bass, is over-brilliant to the point of being shrill, and has some distortion which sounds much like an overloaded microphone preamplifier. However, suddenly the tape quality cleaned up at the very last portion of the "Capriccio Espagnol." —30—

By BERT WHYTE

I AM writing this about three weeks before I leave for Chicago to attend the convention of the National Association of Music Merchants. As I have noted in these pages before, this is the place where the stereo disc gets more or less "officially" launched. Quite obviously, after that time, stereo discs will be the subject of reviews and given the same attention as their monaural counterparts.

As most readers are aware, there have been a trickle of stereo discs from a number of the small independents and I have managed to get my hands on a few of the stereo discs that will be issued by the major labels. I have not reviewed them, for a number of reasons. First and foremost, I don't feel that what I hear can be classed as representative of the type of stereo disc sound that will be offered after the NAMM convention. This is not necessarily meant in a derogatory sense. In fact, I would go so far as to say that some of these present recordings, being virtually "hand-made," with a lot of time and patience lavished on them, may sound much better than the run-of-the-mill production stuff. It is also true that I have heard some incredibly poor material passed off as stereo discs.

Out of the convention will undoubtedly emerge a median level of the quality we can expect from a stereo disc, as well as outstanding individual quality discs. My own feeling as regards reviews of stereo discs is that, whenever possible, the stereo disc should be compared to its monaural disc and stereo tape counterparts. At least, this type of review should be used until all the "bugs" have been ironed out of stereo discs and they have reached a certain uniform level of acceptable quality. Of course, if the stereo disc never had any previous issue as a monaural record or a stereo tape, this would have to be an exception. Maybe I'm all wet, in this thinking, but I feel there is a need for the comparative review approach in the early stages of the stereo disc. Your comments on this question would be welcome and I'll go along with the majority on how stereo discs should be reviewed.

FALLA

MASTER PETER'S PUPPET SHOW CONCERTO FOR HARPSICHORD

Robert Veyron-Lacroix, harpsichordist. National Orchestra of Spain conducted by Ataulfo Argenta. London LL1739. Price $4.98.

Here are two of Manuel de Falla's lesser-known works that deserve a wider public. "Master Peter's Puppet Show" is unusual in form, in scoring, and in presentation. There are three principal characters calling for a soprano, tenor, and baritone. The singing required of them is very different and off-beat . . . in his score. Falla gives specific instructions about how the roles are to be sung and they are particularly directed not to "be too musical, or lyrical, or theatrical." If this sounds like the result would be awful, I assure you that it isn't. The usage is unique and you have to hear it for yourself, rather than trust to a description.

As with most Falla works, it is very colorfully scored with much use of percussion. This is apparent right from the opening bars with the roll of tympani and the rattle of snares. Throughout the score the sound is very clean with especially notable brass. Transients in all respects are quite free from distortion. Argenta's performance is absolutely masterful and true to the idiom. He realizes much more of the essential feeling of the work than do any of the other conductors in the competing versions.

The "Concerto for Harpsichord" is also most unusual. A prime reason is, of course, that the harpsichord is rarely used in modern works. Falla nods his head towards classical form and structure in this work, but all the rest is quite original and the harpsichord is used in ways that I'm sure the classicists never did! There is plenty of rhythmic drive in the score and the general flavor of the work still smacks of the Iberian school. Fine recording here, too, with the harpsichord miked quite close and with a subsequently "larger-than-life" sound, which is perfectly legitimate here. All-in-all, I found this a most rewarding musical experience.

PROKOFIEV

ROMEO AND JULIET BALLET (EXCERPTS)

New York Philharmonic conducted by Dimitri Mitropoulos. Columbia ML5267. Price $3.98.

If ever a piece of ballet music was recorded in all conceivable formats to satisfy almost any taste, it is Prokofiev's "Romeo and Juliet." Depending on your liking of the work and how much you want to hear of it, it can be found on LP as a complete ballet or in the form of single, double, or triple suites. What's more, there are even multiple recordings of each of the forms. Mitropoulos draws on the first two suites for his material, selecting nine scenes which he has arranged more to the letter of the dramatic action of Shakespeare and less to the musical ideas of Prokofiev. Far from being odd sounding, these juxtapositions blend together quite logically and are certainly enjoyable to hear.

Mitropoulos' reading here brings out the colorful scoring and brilliantly shows off the orchestral palette. His pace is a bit faster than most and although his handling of the slower sections is most evocative, he can't

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publishers of this magazine.

Antenna Testing

(*Continued from page* 58)

As has been mentioned, direct signals from a New York station were employed. This approach was preferred not only because it simulated actual consumer operation, but also because incidental difficulties arise when a special signal is generated for gain and directivity testing purposes. These include distortions of the radiated field because of the radiating equipment's proximity to the transmitter, with attendant reflections, etc.

The directivity patterns of the yagi were also determined by receiving signals from a New York City station. The test antenna was mounted in a selected position on the *Hazeltine* lab roof (simulating free space), and fixed to a mast capable of revolving around a full 360° traverse. It was then connected by balanced, shielded 300-ohm lead-in wire to the monitor receiver.

The need for the 360° traverse was indicated by the fact that it is the only means by which a really full pattern can be obtained. Sometimes, yagi directivity tests are conducted over a 180° area and then charted over the full azimuth by "flopping" the half circle graph. This results in the perfect-looking graph so often seen. Its remarkable symmetry, however, is rarely accurate.

The calibrated monitor receiver was again tuned to the test channel and the antenna rotated. Every 10 degrees, the output was noted. Since the signal was undisturbed and in relatively free space, the recorded figures could be accepted as final. For additional assurance, however, the shielded transmission line passed through a finely-balanced antenna transformer at the receiver in order to eliminate unbalanced pick-up on the antenna's transmission line which might have obscured its true directivity pattern. After the full 360° traverse had been covered, the patterns shown in Figs. 1A and 1B were obtained. Front-to-back ratios for the single bay and stacked arrays are, in order, 3½ to 1 (or 10.8 db) and 4 to 1 (or 12 db).

Since testing the antenna impedance of balanced systems with an unbalanced slotted line (characteristic impedance 50 ohms) caused confusion and generally produced inconsistent answers, it was decided to build new and better apparatus for such studies.

This device consists of a balanced slotted line with a characteristic impedance of 104 ohms. During these tests, two shielded coaxial cables with the same characteristic impedance were used to connect the balanced slotted line to the yagi.

A square-wave modulated r.f. signal was then fed to the end of the balanced slotted line. When the line was shorted at the antenna terminals, a null was detected. Following this, the line was opened, the antenna connected to it, and another null detected. The

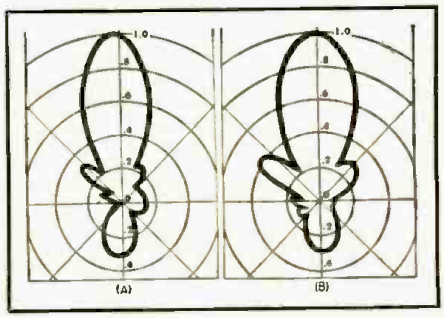
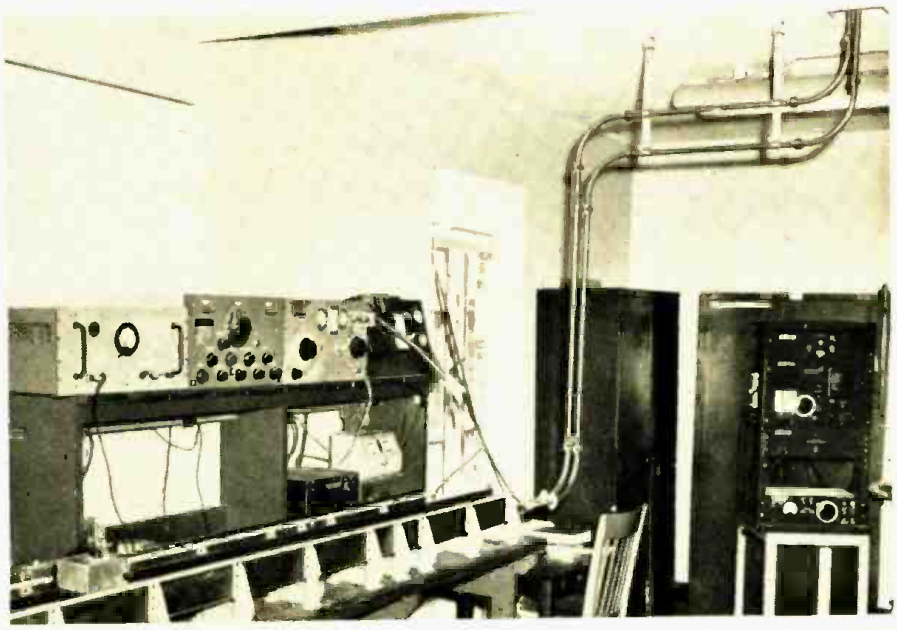


Fig. 1. (A) Directivity pattern of JFD Model 10Y7 single high-band yagi cut for Channel 7. The gain is 9.5 db with respect to the folded dipole with both antennas working into matched loads. (B) Directivity pattern of JFD Model 10Y7S stacked high-band yagi cut for Channel 7. Gain is 12 db under almost the same conditions as (A).

Laboratory set-up at Hazeltine showing calibrated monitor receiver, balanced slotted line, shielded coax running from antenna mounted on the roof, and other test gear.



distance between the two was charted on a special hemisphere chart and, using this, the impedance and standing wave ratio of the yagi could be read.

This hemisphere chart, designed by *Hazeltine* in the form of a nomograph, translated the measured data into actual impedance.

For impedance studies of the two-bay arrays, special balanced-line matching transformers were designed. Of course, they played an important part in gain research too, as has been discussed.

However, for the two-bay impedance inquiry, engineers proceeded from one basic characteristic of transmission lines: the characteristic impedance of transmission lines is dependent on the ratio of the spacing of the lines to the diameter of the wire. It was concluded that a pair of quarter-wave matching transformers made of #6 gauge wire (aluminum) and spaced three inches apart will have a surge impedance of 600 ohms. Placing two of these in parallel at the take-off point gives the desired 300-ohm impedance to match that of the set.

The design and tests of *balanced-line*, impedance-matched 10-element yagis have since been completed for all v.h.f. channels and one for both Channels 4 and 5. In each case, engineers who worked on the project have proved to themselves the effective application of balanced line testing.

-30-

METER CASES

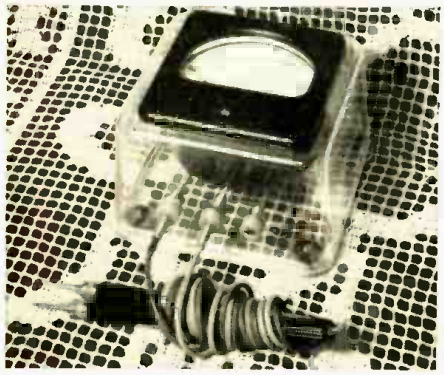
By ARTHUR TRAUFFER

THOSE plastic refrigerator food-storage containers, which come in a variety of shapes and sizes, will make modern, economical, and non-magnetic cases for various panel-type meters. These plastic containers are especially valuable for holding sensitive meters which were calibrated and adjusted for use in non-metallic cases.

The photo shows one of the writer's voltmeters mounted in the bottom of a 4" by 4" by 2½" square styrene container. The extra tip-jack is for the multiplier which doubles the range of the voltmeter. The lid of the container forms the bottom of the box, and it is easily removed for getting at the wiring inside the box. Four rubber feet are cemented to the corners of the lid bottom. Other containers are available which will hold small meters in a vertical position.

-30-

Plastic refrigerator boxes make ideal housings for delicately calibrated test meters.



Instrument Probe

(*Continued from page 65*)

Finally, with C_1 properly adjusted, a "perfect" square wave will be observed on the screen of the CRO, as shown in Fig. 5C.

It is mandatory, of course, that the CRO used for adjustment be capable of reproducing the square-wave signal used without distortion. If in doubt as to the capabilities of your instrument, check the appearance of the square-wave signal on the CRO without the probe in place before attempting adjustment of C_1.

After C_1 has been properly adjusted, using the procedure outlined above, the attenuation obtained may be checked by using a sine-wave signal.

First, connect a sine-wave signal generator (a 400-cycle signal is satisfactory) directly to the input of the CRO. Adjust the output control of the signal generator and the vertical gain control of the CRO until an arbitrary deflection is obtained on the screen of the CRO (using the transparent graph screen as a guide). A deflection of 10 squares is generally used by the author.

Next, *without changing the output of the signal generator or the gain control of the CRO*, remove the direct connections between the signal generator and the CRO, using the probe instead. The deflection obtained will be reduced, with the ratio of deflections being equal to the attenuation obtained with the probe.

As an example, if 10 squares are obtained with the probe out of the circuit, and only two squares deflection with the probe in place, the attenuation is 5:1. If one square is obtained with the probe in place, the attenuation is 10:1.

If reasonable care is taken in construction and adjustment, it is possible to construct a probe which will provide a low capacity input and which will be essentially "flat" in frequency response from d.c. to better than *10 or 15 megacycles*. The probe must be adjusted for the instrument with which it is to be used and can be used with other instruments only if readjusted (unless the input capacity and input resistance of the other instruments are equal to those of the instrument for which the probe is adjusted).

The basic procedure described may be used for designing and building a probe for use with any test instrument, whether a CRO, a v.t.v.m., a signal tracer, a distortion meter, or a frequency measuring device.

Since the number of parts necessary for construction is held to a minimum, and since construction and adjustment time together will seldom exceed an hour or two, the experimenter or technician may find it advisable to build low-capacity test probes for each of his test instruments. The instrument for which the

probe is intended, the attenuation obtained, and the input capacity and resistance may be marked directly on the probe case for ease of identification.

If the input capacity and resistance of a particular instrument are not known, this data can generally be obtained from the manufacturer, by reference to the schematic diagram, or by direct measurement. When measuring the input resistance of an instrument, make sure any d.c. blocking condensers used in series with the input are shorted out. —30—

Antenna Tuning Unit

(*Continued from page* 63)

so that when in the fully meshed position, it shorts the condenser out of the circuit and provides a ground return when the equipment is used in a grounded-tuned circuit arrangement.

The coil is another surplus item which was obtained for the price of a good cigar. It is a *Barker & Williamson* TA type having a diameter of 2¾ inches and comprising 40 turns of wire spaced the wire diameter.

Inductance in the circuit is determined by the setting of the three ceramic switches originally in the surplus unit. Two of these switches must have an open position and since they did not come that way, an additional notch was filed in the detent plate to provide this position.

One other addition is a surplus 0-2 ampere r.f. meter (thermocouple type) also from the surplus market. These are excellent meters and the one used here was made by *Triplett* and bears the identification marking KS 8788.

Link coupling is normally provided for the tuned circuit set-up although capacity coupling may also be used if desired.

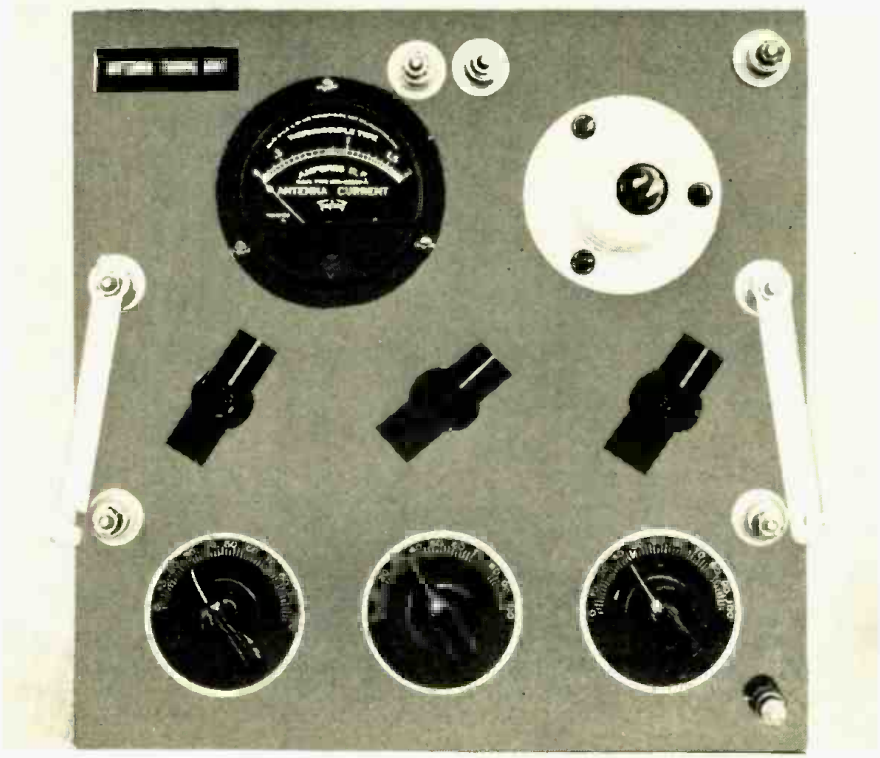
Since the original case was much too long for our purpose, part of it was trimmed off with a hacksaw to make a case 8" x 8", x 8". • All controls were mounted on one face of the box.

Provision was made for strapping between binding posts on the front panel for the various modes of connection and this is shown in Fig. 2. The straps may also be seen in the photograph of Fig. 3.

Fig. 1 is a view of the inside arrangement. The link coupling is shown going to the end of the coil where one turn at a time is selected by the ceramic switch. The other two switches select progressively larger amounts of inductance per step as shown.

In Fig. 3, the two binding posts on the top edge of the panel are for link input when using the gadget as a tuned-circuit device. If condenser input is desired instead it may be brought to the upper of the two binding posts on the left-hand edge of the panel. The large insulator is for the antenna connection. The three ceramic binding posts on the right-hand edge of the panel are for strapping as per the diagram. Next are the knobs for the three ceramic switches. Below them are the condenser controls, the two outside ones for the pi network, when used, and the center one for the tuned circuit, when used. In the extreme lower right-hand corner is the binding post for the ground connection. The stand-off insulator to which the antenna connection is made may be seen just to the right of the r.f. meter. —30—

Fig. 3. Front view of antenna tuning unit. Surplus parts were used in construction.



Transistor Development

(*Continued from page* 45)

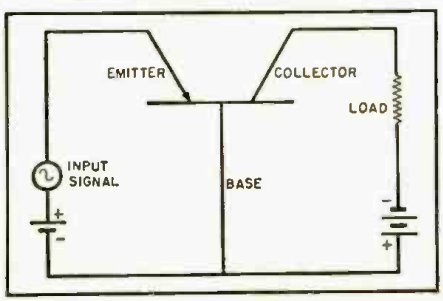
plete assembly is then embedded in a thermosetting plastic to provide ruggedness and freedom from atmospheric contaminants. The final process, and one of the most important, in transistor fabrication is electrical forming. In this process, relatively large surges of current are passed through the collector to the base. The importance of "electrical forming" will be explained shortly.

Point-Contact Rectification

Before the operation of the transistor in specific circuits is covered, it is important to discuss briefly the current rectification obtained when the metal point electrode makes contact with the germanium-crystal surface. When this contact occurs, a nonlinear relationship exists between a voltage applied to and the current flowing through the point of contact. A so-called "barrier" to the flow of current will be present or absent depending upon the polarity of the voltage applied to the metal point. For instance, if a metal point contacts the surface of an "n"-type germanium, the barrier will be absent and a large forward current will flow if the metal point is biased positively with respect to the crystal. If the point is biased negatively with respect to the crystal, the barrier will be present and only a small reverse current will flow. If the germanium is a "p"-type, the forward current will flow when the point is biased negatively with respect to the crystal. One explanation of this barrier is that it is a very thin layer at the surface of the crystal which acts as an insulating layer. If the germanium resistivity is too low, this insulating barrier at the surface does not exist because of the large number of current carriers present both in the interior and on the surface of the germanium, and poor rectification results.

Fig. 8 is a diagram of a transistor amplifier circuit utilizing the "n"-type transistor. In this circuit the collector is biased negatively with respect to the base. The emitter, also shown in Fig. 8, is biased positively with respect to the base. If we first assume that no voltage is applied to the emitter, the collector will draw approximately 0.5 milliampere if a negative voltage of 25 volts is applied to the

Fig. 8. Transistor amplifier circuit.



collector contact. Then, if a positive voltage is applied to the emitter contact, electrons will be drawn into the emitter and a flow of holes from the emitter will be attracted to the negative field of the collector, thereby increasing the collector current appreciably. Now, with both the emitter and collector drawing current, a small signal voltage is applied to the transistor as indicated in the circuit diagram. As the applied voltage swings positive, the emitter current will increase, thereby increasing the collector current by supplying additional holes. On the negative swing of the signal voltage, the collector current will decrease. If the assumption is made that every unit of hole current which leaves the emitter reaches the collector, it follows that a small change in emitter current will result in an equivalent change in collector current, producing a current amplification factor of one. The current amplification factor is defined as the ratio of the change in collector current to a change in emitter current when the collector voltage is maintained constant. A very significant characteristic of the transistor, however, is that this current amplification factor may actually be two or greater. Factors greater than unity are made possible by the electrical "forming" process previously described. One explanation of the results of this process is that a space charge of holes is formed around the collector point. It appears that this positive charge increases the electron flow from the metal collector to the germanium and accounts for the increased current amplification.[1]

The transistor amplifies not only input current, but also power. Because the emitter is biased in the forward direction, only a small impedance to the flow of current exists; therefore, the input impedance of the transistor is fairly low, on the order of 500 ohms. The collector, on the other hand, is biased in the reverse direction; it offers a higher impedance, therefore, to the flow of current. The collector resistance comprises the greatest portion of the output impedance of the transistor. The load resistance, to provide a proper impedance match, must be fairly high, on the order of 10,000 to 20,000 ohms. With the input signal applied to the transistor at a low impedance and the output taken from a high impedance, power amplification results.

In the "p"-type transistor, electrons are emitted from a negatively biased emitter and are collected at a positively biased collector. In general, the "p"-type transistor[2] has characteristics similar to the "n"-type unit, except that in operation all battery polarities are reversed. This type need not be discussed in detail here.

(To be continued)

1. *Shockley, W.; "Electrons and Holes in Semiconductors," D. Van Nostrand, 1950*
2. *Pfann, W. G. and Scaff, J. H.: "The P-Germanium Transistor," Proceedings of the I.R.E., Vol. 38, pages 1151-1154, October, 1950*

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power input: 90-130v cy cyc.; pulse rate: 800 cyc.; range: 3, 15, 45 miles; pulse width: 1 microsec.; 300 yds. min. range, all ranges; I.F.F. synch. output available; accuracy ±5°; power output 1 KW; beam width: 8° horiz. 15° vert.; presentation: A, B, P.P.I.

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. checked out.

SCR-269/G Automatic Radio Compass. Freq. range 200-1750KC. Complete with BC-433-G receiver, BC-434, LP-21, 1-81, 1-82, BK22, etc. Very good condition $129.95

TCS Marine Radio Telephone and Telegraph Xmitting and Receiving Equipment. Freq. range 1500 12000KC. Consists of xmitter, receiver, antenna loading coil, remote control box, power unit, cables, etc. Power input is 12 or 32v DC. We can supply an 110v AC power supply for stationary use at additional cost. Excellent condition.

SCR-536 Xmitter-Receiver (handy talkie). Freq. range 3885-5500KC. Complete with coils, tubes, crystals. Very good condition. Pair. $185.00

AN/APA-10 Panoramic Adaptor for use with any receiver with following IF's: 455KC, 5 mcs, 30 mcs. Unit will give panoramic presentation (1 mc wide for 455KC input) (100KC for 5MC input) (2MC for 30 mcs input). Power input 115v 400 cyc. but can be changed with the addition of a proper power transformer. Excellent condition $175.00

10 CM R.F. package, 2700 mcs. Consists of BC-1007 modulator and BC-1091 RF head. Power output approx. 40 KW. Complete with tubes $125.00

AN/CRT-3 Victory Girl. Dual frequency emergency lifeboat xmitter. Complete with xmitter, kite hydrogen generator, etc. New in knapsack. C.A.A. approved.

AN/APR-5 Radar Search Receiver. Freq. range 1000-3100 mcs. Will detect signals up to 10,000 mcs. with reduced sensitivity. Contains oscillator and mixer cavity, IF strip, power supply. Input 60-2600 cyc. 115v. Excellent condition.

T-50 Radiotelegraph Transmitter complete with power supply and all accessories with spares. Portable. New in cases. $275.00

AN/APT-5 300-1500 mcs. xmitter cavity oscillator using 3C22 lighthouse tube. Power output 30 watts. Noise modulated. Excellent condition. Complete with all tubes. $169.50

PE-104 Vibrapack for SCR-284. Overseas packed in original cartons with spare vibrator. Large quantity available. New.

SCR-522 VHF Airborne Command Equipment. Freq. range 100-156 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 in 28v. We can supply PE-98 dynamotor for 12v input at additional cost.

HEADSETS - MICROPHONES

HS-18	HEADSET	8000 ohm	PL-54	PLUG	$2.95
HS-23	"	8000 ohm	PL-54	"	4.95
HS-30	"	200 ohm			2.95
HS-31	"	600 ohm	PL-354	"	4.95
HS-38	"	600 ohm	PL-354	"	2.95
T-30	THROAT MICROPHONE		PL-291	"	.95
T-17	"		PL-68	"	4.75

MISCELLANEOUS

Sound powered chest and headsets MI-2454-B type O, mfg. RCA. Brand new. Pair	$ 29.95
R-57/ARN-5 receiver	29.50
AS-32/APX-1 antenna	2.50
AN-CRC-7 V.H.F. Handi-Talkies 112MC CRYS Controlled	
RA-62 power supply for SCR-522	165.00
RA-34 power supply for BC-375	250.00
BC-1206 beacon rec. 200-400KC 28v in, exce	14.95
MN/26-Y compass receiver. Excellent	24.95
BC-1016 tape recorder. Complete. New	
BC-733D receiver w/tubes	29.95
C-3 Navy shoogescope in carrying case. Uses flashlight batteries	425.00
BC-1284 lighthouse tube preamplifier	69.95
AN/ARC-4 2 meter trans/rec.	22.50
AN/APA-17 radar direction finding antenna, back to back parabola; freq. range 300-1000 mcs. horizontally and vertically polarized	59.00
BC-996 interphone amplifier	9.95
RL-42 motor antenna reel	6.95
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RD-7/APA-23 recorder for APR	135.00
AS-27/ARN-5 antenna. Excellent	4.95
ARA-500-1500 KC receiver	24.95
ID-80/APA-17 indicator. Excellent	129.95
R-28/ARC-5 100-156 mc. receiver	34.95
BC-639 receiver. New	
RM-29 remote control. New	17.95
BC-455 6-9 mc receiver	13.95
BC-454 3-6 mc receiver	14.95
BC-800 xmitter/receiver	39.95
BC-950 100-156 mc xmitter	49.50
RA-300 FM exciter (mfg. Tempeo). New	32.50
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FL-5 filter. Less cables. Fair	2.65
3C-16-D GSAP gun camera computers with all access. In carrying case. Excel.	19.95
AT-2A/APN-2 antenna. Fair	4.95

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quite match the dramatic power and warm expressive beauty of the Stokowski version.

Soundwise this is one of the best *Columbias* in some time. The recording is moderately close-up and favored with fine spacious acoustic balance, making for crisp orchestral detail with a fine sense of "liveness." Strings throughout were very bright but avoided any stridency, winds were smoothly balanced against rather weighty and imperious brass. percussion was sharp and accurate but would have been better with more impact. Dynamics were fairly wide and, all-in-all, little distortion was in evidence. This is probably the best recorded of the "shorter" suite versions of the ballet.

DEBUSSY
THREE NOCTURNES
LA MER
Concertgebouw Orchestra of Amsterdam conducted by Eduard Van Beinum. Epic LC3464. Price $3.98.

What can one say about the umpteenth performance on disc of these well-worn works? Has this version something which makes it more desirable than all the rest? Well, without laboring the point, we can say that this is a good, expressive job of conducting, which flaunts no mannerisms and hews to the line on tempi. It is better than most available versions, not as good as the Paray and Toscanini readings.

One big point that may weigh heavily with some is that the orchestra is absolutely superb, a really virtuoso group that certainly is as good or better than any in Europe. The strings and woodwinds here are really luscious. Soundwise this is well and cleanly recorded, with fairly wide dynamics and reasonably spacious acoustics. In sum, a pleasant disc, representative of the works involved, but not of such overpowering excellence as to usurp one's affection for several other versions.

JOHN SEBASTIAN PLAYS BACH
John Sebastian, harmonica; Paul Ulanowsky, pianist. Columbia ML5264. Price $3.98.

Musical purists can stop right here, the very thought of a Bach sonata for piano and flute being transcribed for harmonica is enough to make them turn green. For others of a more inquiring nature, they will find that Mr. Sebastian is indeed a virtuoso of the harmonica and his transcriptions are all done in the very best of taste. I can't say that I personally care for the odd sound of the harmonica in what is ordinarily the flute part, but I must admit that Sebastian plays with real musicianship and after a while the sound sort of grows on you.

Ulanowsky furnishes particularly perceptive accompaniment to Sebastian and the whole has been very cleanly recorded, quite close-up, affording a proper and intimate sound with plenty of presence. Offbeat to be sure, but for anyone afflicted by musical ennui, perhaps it's just the ticket.

COPLAND
RODEO (FOUR DANCE EPISODES)
EL SALON MEXICO
DANZON CUBANO
Minneapolis Symphony Orchestra conducted by Antal Dorati. Mercury MG50172. Price $4.98.

Take the music of Copland (who must have been born for the express purpose of writing music suitable for hi-fi recording), record it with stunning brilliance and staggering impact, and have a Dorati lavish on it a performance of outstanding merit and the result is something elevating beyond mere musical experience.

The music itself is some of the most spritely and accessible ever written by Copland and it

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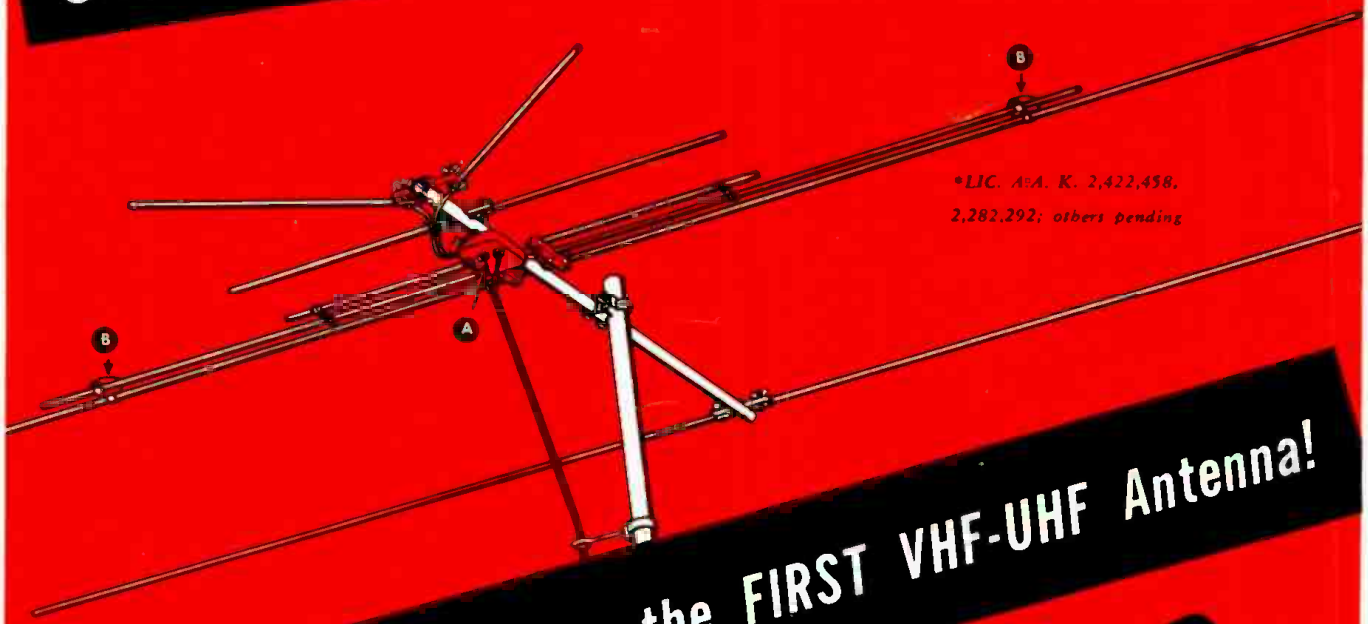

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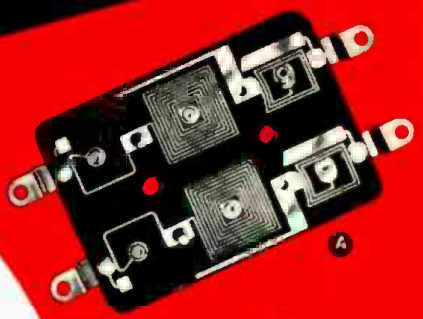

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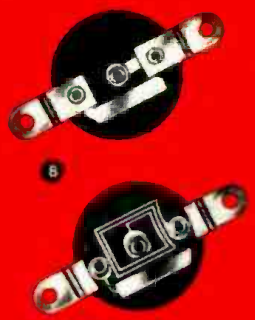

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The ULTRA Q-TEE Employs Eight Printed Circuit Channel Separators

Secret of the Ultra Q-Tee's sensational operation is the unique and patented printed circuit band reject filters (channel separators). The two round filters (B) separate the VHF channels. The large rectangular cross-section printed circuit filter (A) was developed especially for separation of the UHF channels and makes possible the use of a single transmission line. Write for literature!*

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YOU CAN BEAT that kind of sales-killing thinking RIGHT NOW with the help of the Mallory UHF Converter.

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START TODAY to boost VHF set sales by using the Mallory UHF Converter as a sales-tool. Display it in your store . . . talk about it . . . use it in your advertising and sales promotion.

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You can count on the Mallory UHF Converter for extra sales and profits when UHF transmission starts in your area. It's bound to please your customers . . . make more sales for you.

The Mallory UHF Converter works with *any* set and offers reception of all UHF channels . . . no sacrifice of VHF channels . . . built-in UHF antenna . . . high quality picture definition . . . fast, easy installation.

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APPROVED PRECISION PRODUCTS
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

is a rare individual who can resist its blandishments. The recording is of course that well-known and seemingly impossible blend of spotlighted ultra-sharp orchestral detail with rounded spacious acoustics which justly earns *Mercury's* soubriquet, "Living Presence." In every aspect of orchestral writing and color, this is recorded to bright-faceted perfection. The strings are smooth and edgeless and yet can zing and zip incisively when the score demands. The brass is awesome in its huge brazen liveness and weight, the woodwind so beloved by Copland are a pristine pure-toned delight. The percussion is simply staggering. The tympani and especially the bass drum in "El Salon Mexico," are among the biggest and loudest ever recorded. I guarantee you that through a big speaker driven by plenty of watts at a good room-filling level, the impact of that drum is almost frightening! And it's all nice and clean too, not lost in a sea of mud. I don't know whether it's the combination of music and hall and recording technique, but this is the best *Mercury* recording in a long time and I urge any who are interested in exciting sound and music not to miss hearing this outstanding disc.

THE WEAVERS AT HOME
Vanguard VRS9024. Price $4.98.

The ubiquitous Weavers are here again, as ingratiating as ever in a program of folk tunes of very wide origin and musical content. This is a group that most people either like with a vehement passion or detest with equal gusto. I freely admit I have never been much "taken" with the folk idiom, but this is one bunch that gets my vote for their sincerity and charm and downright solid musicianship. *Vanguard*, as usual, furnishes the group with bright, clean, well-balanced recording.

GEMINIANI
CONCERTI GROSSI (OPUS 7)
I Musici. Epic LC3467. Price $3.98.

This is another in *Epic's* series of "Monumenta Italicae Musicae" and is, in every respect, equal to the fine quality of its predecessors. Admittedly, this is not music with a universal appeal, but to those who appreciate the similar writings of Corelli and Vivaldi, this will furnish much enjoyment. The I Musica is, as always, a splendid ensemble which plays with such dedicated musicianship as is rarely found these days. Under their expert urgings, these five concerti grossi are vibrantly fresh in melodic invention and revealing of rich harmonic structure.

This recording is quite high level and the over-all musical effect rather on the "big" side . . . perhaps a shade too much for a chamber-type work. The recording is close-up with just enough acoustic liveness to give depth and roundness to the sound. String sound is for the most part quite smooth and really quite opulent. For my taste I thought there was a trifle too much resonance in the bass line and sharper definition here would have been quite beneficial.

HAYDN
CONCERTO FOR TRUMPET AND ORCHESTRA
MOZART
CONCERTO FOR FLUTE AND ORCHESTRA
SCHUMANN
ADAGIO AND ALLEGRO FOR HORN
Paolo Longinotti, trumpet; Andre Pepin, flute; Edmond Leloir, horn; with L'Orchestre de la Suisse Romande conducted by Ernest Ansermet. London LL3020. Price $4.98.

It is not often that Ansermet turns his attention to the classic repertoire, nor have the results always been particularly happy.

Here, however, he is in good form furnishing bright sympathetic accompaniments, somewhat briskly paced for the soloists. The Haydn piece has always been one of the supreme tests of trumpet virtuosity which Longinotti impresses upon us.

The flutist does very well in his piece and as a whole the Mozart is the best conducted of the three works on this disc. The horn player is proficient and fluent, but I fail to detect much warmth or expression in his effort. Soundwise this is exceptional for the brilliant exposition of the trumpet and the smooth clarity of the flute, all neatly balanced with the orchestra. Wide dynamics and very quiet surfaces are plus virtues of an enjoyable disc.

DEBUSSY
RAVEL
PIANO MUSIC
Friedrich Gulda, pianist. London LL-1785. Price $4.98.

Friedrich Gulda continues to buck the almighty competition of Gieseking and Casadesus in his review of the Debussy and Ravel piano literature. More often than not he is quite successful and in this instance more so. With Debussy he tackles "Reflections on the Water" and "Pour le Piano" among others and outside of a slight percussive hardness to his tone, he leaves little to be desired in terms of expressive dynamics and phrasing.

With Ravel he essays the "Sonatine" and "Valses Nobles et Sentimentales." In the "Valses" he reveals an exquisite fluency and grace coupled with considerable warmth and, with his slightly elevated tempi, the work is a complete delight. The artist is greatly aided by the sharp, pristine cleanness of the piano, recorded fairly close-up for a fine sense of intimacy with just a hair of reverb to lend presence. —30—

25-Watt Amplifier

(*Continued from page* 65)

to a standard procedure. The results obtained from this power amplifier were extremely gratifying in that it was proved without a doubt that the quality is of the best and certainly worthy of being called a hi-fi component. The results obtained were as follows:

Sensitivity: .4 volt r.m.s. input for maximum 25-watt power output.

Hum and Noise (down from 2 watts): −78 db with open input circuit and −82.5 db with input circuit shorted.

Frequency Response: 8 to 45,000 cps, ± 1 db at the 2-watt output level. For maximum rated power output, frequency performance is 13 to 32,000 cps, ± 1 db.

IM Distortion (60 and 6000 cps: 4 to 1 ratio): with equivalent sine-wave output of 2 watts, the IM distortion is .085%. At the maximum rated output of 25 watts, the IM distortion is .285%. Since our standard calls for a maximum of 1% IM distortion as permissible, it is obvious that the .285% figure turned out extremely well. Actually the power amplifier will put out as much as 35.3 watts before it reaches the 1% figure.

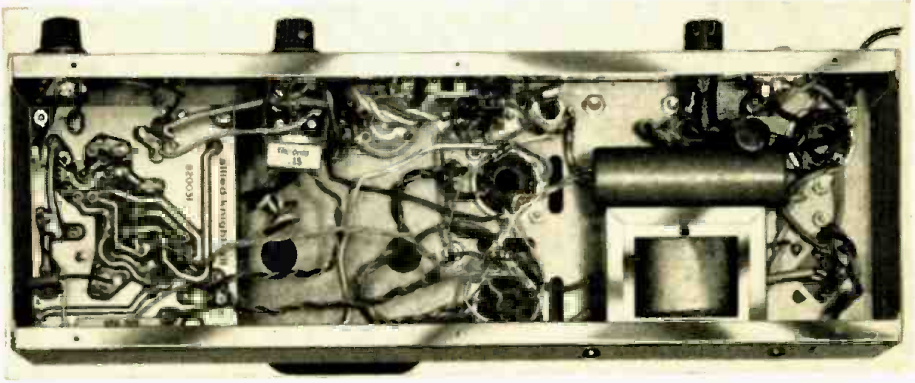
Harmonic Distortion: at 1000 cps, 2-watt output, the harmonic distortion is .07%. At the 25-watt level, the harmonic distortion is .04%. At 20 cps the harmonic distortion is .1% at 2 watts and at 25.5 watts we obtained our acceptable distortion figure of 2%. At the high-frequency end (20,000 cps) the harmonic distortion figure is .14% at 2 watts output and 2% at 20 watts. The latter figure is somewhat low but the standard we have set is an extremely difficult one to meet. We have not as yet found any amplifier which would meet the 2% distortion figure at full rated output. We probably could lower our requirements and check all power amplifiers at 15,000 cps instead of 20 kc, but since all units are tested under similar conditions we would prefer to leave our standards as they are.

We found that the power amplifier is extremely stable irrespective of loudspeaker load or with any reasonable length of leads for remote speaker operation. Actually, we found no signs of instability when speaker terminals were left unloaded or even when a .1 μfd. capacitor was used in lieu of a speaker.

The damping factor was checked for an 8-ohm speaker load and we found that it followed closely the calibration on the dial. Our actual figures from minimum to maximum were .705 to 20.

There is one specific characteristic that warrants special mention and that is the sensitivity of .4 volt for maximum power output. This is a moderately low input in that most power amplifiers run between .5 volt and 1.5 volts. This is certainly not detrimental and, in some cases, the added sensitivity could be used to advantage. The manufacturer actually rates this sensitivity figure at .47 volt so that we can see that this figure is somewhat conservative. —30—

Under-chassis view shows position of various components and printed circuit board.



THE INFLUENCE of service-association house organs in shaping and crystallizing the opinions of dealers on basic issues has been growing steadily. Through the interchange of their publications and editorial copy, house-organ editors are bringing to the attention of their readers the thoughts and opinions of dealers in many sections of the country. The result is a steady firming up of programs designed to put the activity on a more solid foundation.

The latest formal house organ to make its bow was launched recently by the newly formed Television Service Association of Delaware Valley. A monthly publication titled "TSA News," it is edited by Ray Fink with Charles Knoell, TSADV publicity chairman, as its associate editor. The official address of the new magazine is % Ray Fink, Editor "TSA News," 7819 Rugby Street, Philadelphia 50, Pa. Ray H. Cherrill, 6321 Frankford Ave., Philadelphia, Pa., is president of TSADV.

Another recent addition to the growing ranks of association publications is the "Service Dealers Bulletin" published by the members of the Radio & Television Service Dealers Association of Durham, N. C. The "Bulletin," which will be issued on a monthly basis, is edited by Garland E. Hoke with Norman Schultz as assistant editor.

The Durham association is noted for its sponsorship of an electronic technician training program under the plan available through state educational institutions with the cooperation of the apprenticeship training section of the U. S. Department of Labor. Subsequently an advanced black-and-white TV service school was added to the original apprenticeship program. Diplomas were recently issued to ten Durham dealers and technicians who completed the advanced course in black-and-white TV servicing.

Charles S. McBroom of *Mac's TV Service*, is president of the Durham association. The business address of the organization is P. O. Box 222, East Durham, N. C.

An outstanding "veteran" in the way of association house organs is the "ARTSD News," the official publication of the Associated Radio-Television Service Dealers of Columbus, Ohio. Now in its fifteenth year of consecutive monthly publication, the "News" carries local and national service items in a breezy, concise, informative style. It is edited and published by John P. Graham who is proud of his membership in the Radio's Old Timers Club, which signifies a minimum of twenty years active participation in the radio industry. The business address of the "ARTSD News" is 2552 North High Street, Columbus, Ohio.

The Columbus association also claims to be the first business organization of service dealers. It was formed back in the radio days when service associations were primarily technical groups. ARTSD sponsors several types of social and business events that are held annually and which serve to maintain a high level of interest among members. Their regular, quarterly meetings with parts distributors, which have been carried out since the inception of the association, have created a spirit of distributor-dealer cooperation in the Columbus area that has been very beneficial to both groups.

"Veteran" Elected

In Philadelphia, another "old timer" in the ranks of service associations recently elected a 50-year service-industry veteran to serve as its president for the coming year. Richard Devaney, owner of the *Radio Electric Service Co.*, was the unanimous choice of the members of the Philadelphia Radio Servicemen's Association to head their organization. Devaney, who is observing his fiftieth year in the electronics industry, has been active in PRSMA affairs for a number of years. He served previously as a member of the Board of Directors and as a vice-president of the organization.

Other officers elected by the PRSMA membership include William Poole, vice-president; Al Gribben, recording secretary; C. P. Elliott, corresponding secretary; and William Humes, treasurer.

In Savannah, Georgia, a group of service dealers recently formed the Savannah TV and Radio Dealers Association in a move to stabilize the service activity in that area. Information about this new association may be obtained from W. L. Parktee, president of the association, % *Downey's Inc.*, 2503 Waters Ave., Savannah, Georgia.

NATESA Award

The National Alliance of Television and Electronic Service Associations has presented an award to *CBS-Hytron* for "outstanding service in creating better customer relations." The award was presented by Frank Moch, executive director of NATESA, to A. L. Chapman, *CBS-Hytron* president.

Starting an Association?

Dealers who are interested in forming either a service dealer or technicians' association may obtain a complete package of organizational material from the National Alliance of

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And, of course, the famous Standard Line guarantee remains in effect: All tubes guaranteed to be replaced free if they fail to function efficiently within one year's time. (defective tubes must be returned intact, postage paid. Refunds will be cheerfully made within five (5) days if not completely satisfied.)

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0Z4	3AU6	5W4GT	6BF5	6S8GT	7F8	12SA7	35/51
1A5GT	3AV6	5X4G	6BG6G	6SA7	7G7	12SG7	35A5
1A7GT	3BA6	5X8	6BH6	6SB7Y	7H7	12SJ7	35B5
1B3GT	3BC5	5Y3GT	6BH8	6SC7	7J7	12SK7	35C5
1C5GT	3BE6	5Y4G	6BJ6	6SF5	7K7	12SN7GT	35L6GT
1C6	3BN6	5Z3	6BK5	6SF76SG7	7L7	12SQ7	35W4
1C7	3BU8	5Z4	6BK7	6SH7	7N7	12SR7	35Y4
1H4G	3BY6	6A8	6BL7GT	6SJ7	7Q7	12V6GT	35Z4GT
1H5GT	3BZ6	6AB4	6BN6	6SK7	7R7	12W6GT	35Z5GT
1L6	3C2	6AC7	6BQ6GT	6SL7GT	7S7	12X4	#37
1LA4	3CB6	6AF4	6BQ7	6SN7GT	7V7	12Z3	#39/44
1LA6	3CF6	6AG5	6BR8	6SQ7	7W7	14A7	#41
1LB4	3CS6	6AG7	6BS8	6SR7	7X6	14AF7	#42
1LC5	3DT6	6AH4GT	6BY5G	6T4	7X7	14B6	#43
1LC6	3Q4	6AH6	6BZ6	6T8	7Y4	14F7	#45
1LH4	3Q5GT	6AK5	6BZ7	6U4GT	7Z4	14F8	#47
1LN5	3S4	6AK6	6C4	6U5	8AW8	14H7	50A5
1N5GT	3V4	6AL5	6C5	6U8	12A8	14N7	50B5
1P5GT	4BC8	6AL7GT	6CB5	6V3	12AB5	14Q7	50C5
1Q5GT	4BQ7A	6AM8	6CB6	6V6GT	12AQ5	14S7	50C6G
1R5	4B58	6AN8	6CD6G	6W4GT	12AT6	17AX4GT	50L6GT
1S5	4BU8	6AQ5	6CF6	6W6GT	12AT7	17DQ6	50Y6
1T4	4BZ7	6AQ6	6CG7	6X4	12AU6	19AU4	50Y7
1T5GT	4CB6	6AQ7GT	6CG8	6X5GT	12AU7	19BG6G	#57
1U4	5AM8	6AR5	6CH8	6X8	12AV6	19C8	#58
1U5	5AN8	6AS5	6CL6	6Y6G	12AV7	19J6	#80
1V	5AQ5	6AS8	6CM6	7A4	12AX4GT	19T8	#81
1V2	5AS8	6AT6	6CM7	7A5	12AX7	19X8	117L7GT
1X2	5AT8	6AU4GT	6CN7	7A6	12AZ7	25AC5	117N7GT
2A3	5AV8	6AU5GT	6CU6	7A7	1284	25AV5GT	117P7GT
2A5	5AW4	6AU6	6DG6	7A8	12BA6	25AX4GT	117Z3
2A7	5AZ4	6AU8	6DQ6	7B4	12BE6	25BK5	117Z4GT
2AF4A	5BK7	6AV5GT	6DT6	7B5	12BF6	25BQ6	117Z6GT
2B7	5BR8	6AV6	6E5	7B6	12BH7	25CD6G	807
2BN4	5BQ7	6AW8	6H6	7B7	12BK5	25CU6	9002
2D21	5BZ7	6AX4GT	6J4	7B8	12BQ6	25L6GT	9003
2E5	5CG8	6AX5GT	6J5	7C4	12BR7	25W4GT	9006
2X2A	5J6	6AZ8	6J6	7C5	12CA5	25Z5	
3A2	5T8	6BA6	6K6GT	7C6	12CU6	25Z6	
3A3	5U8	6BC5	6K7	7C7	12DQ6	#27	
3A4	5U4G	6BC8	6L6	7E6	12J5	#30	
3A5	5V4G	6BD6	6L7	7E7	12L6GT	#31	

ALL RECEIVING TUBES SENT POSTAGE PAID.

Please send 25c handling for orders under $5.00 Send 25% deposit on C.O.D. orders and please send approximate postage on Canadian and foreign orders.

Above is only a partial list — order any type at the same price or send for free tube list and order blank. We have over 5,000 tube types on hand or at easy access, including special purpose, industrial and transmitting tubes which are slightly higher.

ALL TUBES GUARANTEED ONE FULL YEAR...

NOTE: When ordering receiving tubes be sure to enclose 48c for each tube or $45.00 per hundred.

Thousands of TRADE-IN TVs

Please Specify Console or Table Model When Ordering

Reconditioned By Factory Trained Technicians! Guaranteed To Be in Working Condition When You Receive Them!

10"	$25.00	19"	$56.00
12"	$30.00	20"	$63.00
14"	$35.00	21"	$70.00
16"	$42.00	24" (when available)	$95.00
17"	$49.00	27"	$129.00

Get yourself a second set or buy some for re-sale!

All TVs sent motor freight or Railway Express F.O.B. our warehouse. Sorry, no A.P.O. shipments.

FREE INDOOR ANTENNA with each TV Purchase

below is our new price schedule of pix tubes. These famous make tubes contain all new parts with the exception of the glass bulb which does not wear out.

Any 10" Tube	$ 9.95	Any 16" Tube	15.95
Any 12" Tube	10.95	Any 17" Tube	18.29
Any 14" Tube	13.95	Any 19" Tube	20.29
		Any 21" Tube	24.29

Prices On Larger Tubes On Request

Remember

Only 48¢ ea.

$45 Per Hundred

ANY TYPE

ANY QUANTITY

Remember — NO Dud Required.

All tubes guaranteed one year.

Picture Tubes shipped F.O.B. Harrison, N. J.

STANDARD LINE ELECTRIC COMPANY

232 HARRISON AVENUE, HARRISON, N. J. · Phone: HUmboldt 4-4997

Television and Electronic Service Associations. Included in this package is information about how to organize a formal association, suggested articles of incorporation, bylaws, formation of committees, etc. This may be obtained by writing to NATESA headquarters, 5908 South Troy Street, Chicago 29, Ill.

Service Story Folder

A new pocket-size folder, "TV Service Safety Hints." is being made available by *P. R. Mallory & Co.* to be used by service technicians and dealers in promoting a better understanding of their role with customers. A series of cartoons dramatize the dangers of amateur "doctoring" of TV ailments in a light style. The set owner is told, "Don't do it yourself—call on us!" There is space for imprinting the dealer's name. The folders are available in quantity to individual dealers and associations from *Mallory* distributors at $1.00 per 100, or by writing to Distributor Division, *P. R. Mallory & Co., Inc.*, Indianapolis 6, Indiana.

Two-Way Mobile News

Service dealers looking for diversification and alert to the sturdy growth of two-way mobile radio equipment can get started in this field by making contact with those manufacturers of such equipment who are interested in working through independents rather than their own organizations. Putting in a bid for dealer interest, *Kaar Engineering Corp.* is marketing a line of "packaged" merchandise in this field to minimize the problems of system engineering. Interested dealers should address inquiries to Frank A. Genochio. *Kaar Engineering Corp.*, 2995 Middlefield Road, Palo Alto, Calif.

Licensing News

In Waterloo, Iowa, the City Council was recently urged by local service dealers to take the lead in establishing regulations and a licensing code for television technicians.

Ulwin W. Davis, president of the Waterloo Radio-Television Service Dealers Association, presented the association's petition for a licensing code to the City Council. Mr. Davis said that, while Waterloo residents have been fortunate in not being preyed upon by unscrupulous technicians, he felt there is a need now for a protective measure to guard against an incursion of incompetents.

In Des Moines, a proposed licensing measure was indefinitely tabled by a majority vote of the City Council of that city. In reporting on this development, which was aggressively opposed by the Association of Independent Servicemen of Iowa, Frank Arnold, editor of the "AITS Scope," said:

"The burden of government regulation of our business is already heavy enough. That there remains much to be accomplished by the service industry is evident, but licensing is not the cure-all that it has been reported to be.

"The only way the serviceman of this city can increase his stature in the pub-

lic eye is by the service he performs. It is the responsibility of the serviceman to maintain a high standard in the service he renders. That the standards have been and are being maintained is an established fact. Not one complaint has been received by our grievance committee since our members' names were filed with the Better Business Bureau. I can say 'well done' and I am proud of that record."

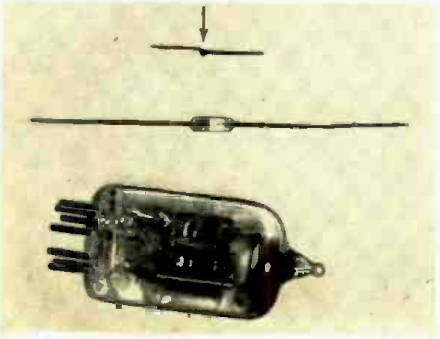
In Toledo, Ohio, a committee appointed by the city administration to look for new sources of revenue came up with the bright idea of taxing TV services. Their recommendation was to levy an annual tax of $30.00 on Repairmasters (service dealers) and $3.00 per year for servicemen.

On the heels of its successful convention, the Radio & Television Technicians Guild of Florida, Inc., inaugurated an expanded program to enlarge its membership and to intensify its efforts to develop better customer relations. As its first step, the association engaged George S. Miller, a professional trade association executive and public relations counsel, to serve as its executive director. In this post, he succeeds Shan Desjardins, who handled this activity for two years and requested help in administering the affairs of the Guild. The mailing address of the RTTG of Florida will continue to be 119 N.W. 12th Ave., Miami 36, Fla.

Advanced Training

Evening instruction for upgrading the practicing TV technician will be given for the sixth straight year at the endowed, non-profit New York Trade School, 310 E. 67th St., New York City. Paul B. Zbar, head of the Electronics Dept., urges early registration for this industry-sponsored course, as class size will be limited. The course begins on the evening of September 18, 1958, and will run for 16 weeks. Entrants must have had at least 3 years full-time experience as TV technicians or 1 year experience in addition to a basic, approved TV course. —30—

Successful development of the world's smallest hermetically sealed diode, tinier than a pinhead was announced by Pacific Semiconductors, Inc. A new glassification process makes the new electronic "tiny tim" possible by eliminating the conventional diode package. Photo shows the new diode (top) contrasted with conventionally packaged glass diode (center) and subminiature 6AL5 duo-diode tube.



Electronic Crossword

By **JOHN J. GILL**

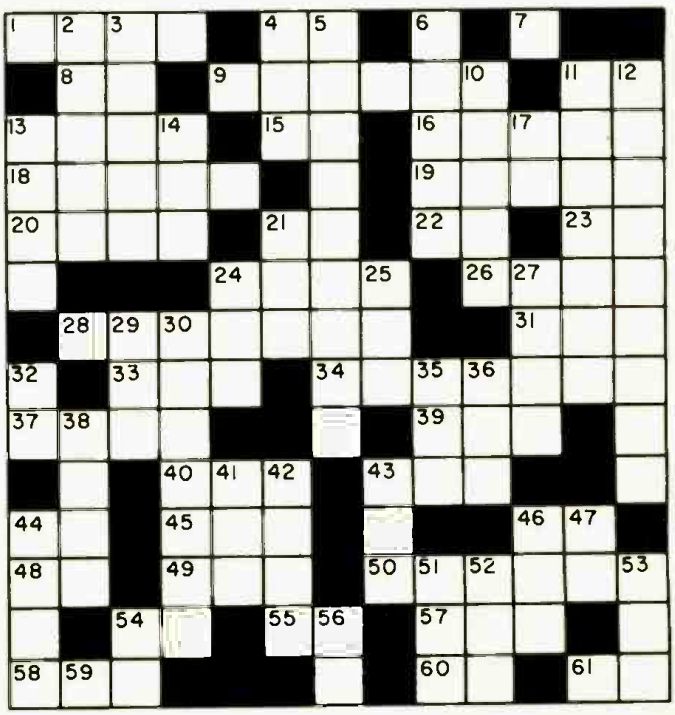
THIS puzzle may prove to be a "fooler" as there are several unusual definitions and a number of obscure words which you will have to work around if your vocabulary of "exotic words" is rusty. Don't feel too discouraged if you don't get it the first time—the answer appears on page 166 if you want to peek!

ACROSS

1. 1/746th of 1 hp.
4. Lower than r.f. (abbr.).
7. 1000 (abbr.).
8. French article.
9. Voltage on an electrolytic causes it to be ———.
11. TV frequency band (abbr.).
13. Used in drills.
15. Pilot light (abbr.).
16. Maurice isn't here (slang).
18. Si, Jah, Oui.
19. Borer.
20. Chew.
21. Tube characteristic.
22. Spanish agreement.
23. Telemetering (abbr.).
24. Demeanor.
26. Oriental nurse.
28. Insects and radio sets have one.
30. Time gone by.
33. Unit of work.
34. TV band assignment.
37. Against.
39. Regret.
40. German electrician.
43. Deed.
44. 2π FL.
45. Two (comb. form).
46. Electronic test set.
48. 1050 (Roman style).
49. Electric driving force.
50. Tube book.
54. Estados Unidos (Eng. abbr.).
55. Gallic (abbr.).
57. As opposed to "min."
58. Voltage dropper (abbr.).
60. Amplifier output stage (abbr.).
61. 1/6.28fC.

DOWN

2. Twiddle the trimmers.
3. Four (comb. form).
4. Charged particle.
5. Cycles per unit of time.
6. Affords.
10. Andrea ———.
11. E.M.F.
12. Resonator.
13. "Pokes" (coll.).
14. Mend.
17. Third note of scale.
21. Opposite of "max."
24. Million (comb. form).
25. Sloppy "no."
27. On a horse's neck.
29. Type of "work" in radio.
30. Three-element tubes.
32. Current measure (abbr.).
35. Leaping current.
36. Fastener.
38. Point of balanced frequencies.
41. Could be a bad capacitor.
42. A thin silk made in Caucasia.
43. Motor winding (abbr.).
44. Transmitter (abbr.).
46. Light.
47. B flat in Tartini's system of solmization.
51. Unit of electric current.
52. Sleep.
53. Used in making varnish.
54. We.
56. It travels at the speed of light (abbr.).



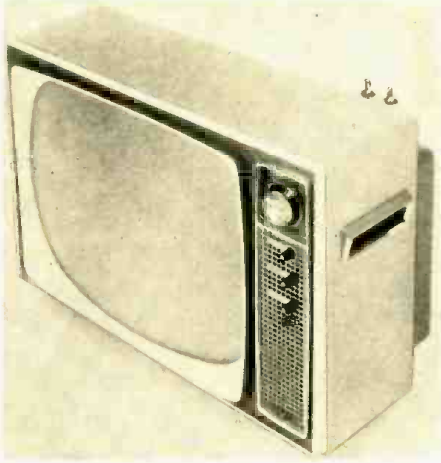
What's New in Radio

SHALLOW TV SETS

The Television Receiver Department of *General Electric Company*, Syracuse, N. Y. has unveiled its new "Designer Series," a line of TV receivers whose unique cabinet design gives the appearance of extreme slimness.

The "Gramercy 17's" and the "Barclay 21's" comprise the two sizes in the series. The former uses the 110 degree aluminized picture tube with 155 square inches of picture area while the latter provides 262 square inches of viewing space.

The cabinets are formed of vinyl-covered aluminum in the 21-inch models and high-impact, color impregnated polystyrene in the 17-inch models. The cabinets follow as closely as possible the contours of the picture tube. In place of the conventional hard-board back and tube cap, the set



has a contoured steel panel back. This panel extends out from the cabinet to accommodate the picture tube but is not as wide nor as high as the cabinet itself.

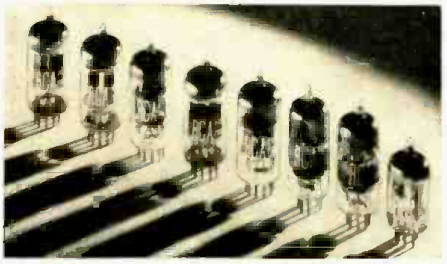
The polystyrene cabinets are available in aqua, beige, or mahogany with oyster white tube masks. The cabinets for the 21-inch sets are aluminum covered in scuff and stain resistant vinyl in russet with leather finish or a linen finish, both with dove grey tube masks.

NEW TUBES FOR MOBILE

The Electron Tube Division of *Radio Corporation of America*, Harrison, N. J. has announced the availability of eight new industrial tubes for two-way mobile radio systems operating from 12-volt storage batteries.

The new tubes are especially designed for transceiver applications. To insure dependable performance when storage batteries are charging and discharging, the heaters of these tubes

are designed to withstand an intermittent heater-cycling test of 2000 cycles minimum at high heater voltage. Designed to operate over a heater voltage range of 12 to 15 volts, the tubes are subjected to rigid controls and tests for heater-cathode leakage,



interelectrode leakage, elevated heater-voltage life performance, as well as intermittent short circuits.

Included in the new series are the 7054 and 7056 sharp cut-off pentodes, 7055 twin diode, 7057 medium-mu twin-triode, 7058 high-mu twin-triode, 7059 and 7060 medium-mu triode-sharp cut-off pentodes, and 7061 beam power tube.

ALPHA TEST-LEAD LINE

Alpha Wire Corporation, 200 Varick St., New York 14, N. Y. has a new test-lead line on the market, designed especially for the service industry.

The line consists of the 12 most useful combinations of test prod and meter tip types. The lead wires are a full 50 inches long and are made of #18 gauge wire encased in heavy-duty, high-dielectric rubber. Voltage breakdown is better than 12,000 volts at 60 cycles.

A special display rack, measuring 38" x 27¾" x 12", holds ten each of the 12 different test-lead items and features each pair of test leads individually packed in an attractive, dirt-free, clear plastic tube.

The manufacturer will be happy to supply complete details on this new line upon written request.

SELF-SERVICE TUBE CHECKER

Century Electronics, 111 Roosevelt Ave., Mineola, N. Y. is now offering a self-service tube checker which is suitable for the "do-it-yourself" departments of service shops or for bench mounting in the service lab.

The Model SS-1 "Fast-Check" will handle over 600 tube types with only two settings. It will check quality, shorts, and leakage, as well as gas content. The circuit is so designed that it will accept new tube types as they appear on the market.

A colorful display tops the cabinet with a tube chart installed directly below the ad panel. The 7½-inch meter is designed to withstand rough handling and is fully protected against accidental burn-out. The tester operates on 117-volt power lines and has a three-wire *UL*-approved line cord.

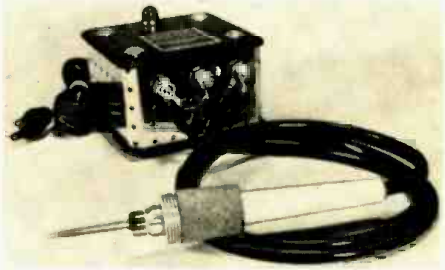
The company is offering this tester in both console and counter models. Write the manufacturer direct for free literature and further details.

MINIATURE SOLDERING TOOL

Wassco Electric Products Corp., 204 S. Larkin Ave., Joliet, Ill. is currently marketing a new low-cost dual-metal-tip soldering tool designed for continuous industrial production soldering.

Especially suited to soldering of miniature connectors and other precision operations, the handpiece provides two very slim metal alloy electrodes arranged at a 3-degree included angle. By adjusting electrodes in or out, the working gap at the tip is easily set from 1/32" up to 3/16" for best accommodation to the work at hand.

The tapered tips of the electrodes provide a pre-loaded spring tweezer function without finger fatigue. The handpiece is designed to be used with



the firm's new 105-A1 100-watt power unit but may also be used with the 105-B2 500-watt unit. The 105-A1 has three heat outputs; 15, 50, and 100 watts. The handpiece and power unit together are catalogued as Bench Set No. 10579.

WIRE DISPENSER KIT

Belden Manufacturing Company of Chicago has recently introduced a new hook-up wire dispenser kit which is designed to eliminate the problems of waste and inconvenience for the technician, hobbyist, and experimenter.

The kits are being offered in the 14 most popular assortments of vinyl, vinyl-nylon, textile, and Teflon insulated wires. The rack, which holds five square spools of wire, is given free of charge. The rack is so designed that it can be hung on the wall or stood on the bench.

Since the dispenser kits are individually packaged in colorful illustrated cartons, they can double as counter or rack displays.

BATTERY ELIMINATOR

Seco Manufacturing Company, 5015 Penn Avenue South, Minneapolis, Minn. has recently introduced its Model PS-2 battery eliminator which is specially designed for operating and servicing portable radios and low-power transistorized equipment.

The PS-2 supplies filtered d.c. in voltages from 0 to 15. The output supply is sufficient for checking transistor receivers of up to 22.5 volts. The unit can also be used to check batteries by substitution. The eliminator uses a

line bypass system to eliminate hum modulation. Internal impedance is less than 2 ohms. The voltage scale is

calibrated at 15 ma. while maximum output is 100 ma.

The instrument comes complete with plug-in jacks for an external voltmeter, 40-inch leads, and insulated clips. The case measures 4½" x 5" x 1½". For complete information and a descriptive data sheet, write the manufacturer direct.

WRL "SIDEBANDER"

WRL Electronics, 34th & Broadway, Council Bluffs, Iowa is now offering a complete bandswitching suppressed-carrier sideband rig, in kit or assembled form, as the DSB100.

The "Sidebander" offers continuous band coverage from 3 to 9 mc. and 12 to 30 mc. which includes all the popular MARS, CAP, and special emergency service frequencies. Designed for double-sideband, AM, or c.w., the unit may be used to convert present AM equipment to sideband

and can be used with standard crystals and regular v.f.o. There is a minimum of 35 db carrier suppression.

A three-stage r.f. section allows straight-through operation for maximum efficiency on all bands. An internal tone generator facilitates tuning. The pi-net output is 52 to 1000 ohms. Speech clipping and filtering assures good communication and maximum bandwidth. The 600-volt power supply has ample reserve to drive external accessories, if desired.

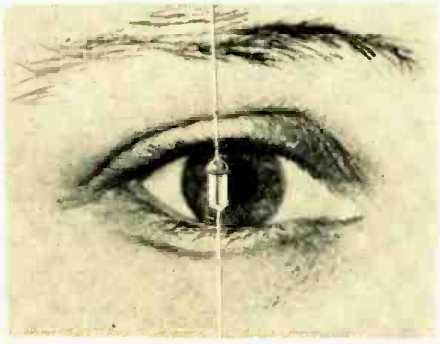
The unit measures 8" x 14" x 9". The company will supply further details and prices on either the kit or wired unit upon request.

SUBMINIATURE TANTALUMS

The Distributor Sales Division of *Aerovox Corporation*, New Bedford, Mass. is now offering a line of wire tantalum capacitors in subminiature

sizes for applications in low-voltage devices such as personal portables, hearing aids, and transistorized circuits.

Type WT units are lead-mounted, wire tantalum units in polarized types only. These are designed for use where



a.c. voltage is small with respect to d.c. polarizing voltage. The capacitor consists of a high-purity tantalum anode and fine silver cathode with special electrolyte and spacer material. The case and attached lead form the cathode and are uninsulated. The anode tantalum wire extends through a bushing and is attached to a solderable lead with a welded connection. A thermosetting resin embedment encases the welded joint to provide maximum protection.

The new capacitors are available from local distributors in standard voltage ratings of 1, 2, 4, 6, 8, 10, 20, 40, and 80 volts d.c.

NEW HAM RECEIVER

Hammarlund Manufacturing Company, Inc., 460 W. 34th Street, New York 1, N. Y. has recently added a triple-conversion, 17-tube superhet to its line of receivers for the radio amateur.

The Model HQ-170 offers full dial coverage of the 6, 10, 15, 20, 40, 80, and 160 meter amateur bands, separate vernier tuning (± 3 kc. for SSB operation), a separate linear detector for c.w. and SSB reception plus normal diode AM detection, seven selectivity positions for mechanical - filter - type skirt selectivity, selectable sideband, b.f.o. control (± 2 kc.), fast-attack a.v.c., and a built-in crystal calibrator.

In addition, the circuit includes a slot filter which is adjustable ± 5 kc. over the passband for better than 40 db attenuation. Additional attenuation of 20 db at any point is available with the slot-depth control. A dial-scale reset feature and automatic noise limiter are also included. The receiver is housed in a ventilated metal cabinet of modern design.

For a data sheet on this receiver and other details as required, write the manufacturer direct.

"15-IN-1" TRANSISTOR KIT

Students, experimenters, and hobbyists who are interested in learning how transistors can be used are being offered a "15-in-1" experimenters' kit by *Lafayette Radio*, 165-08 Liberty Ave., Jamaica 33, N. Y.

The new kit is designed to provide the maximum of instruction, entertainment, and usefulness at minimum price. All components needed to build 15 different devices are included in the kit. A detailed instruction manual explains the operation of each circuit, shows how to mount the components, and how to make the necessary connections for building such devices as an electronic timer, a burglar alarm, two-stage audio amplifier, two-stage broadcast receiver, and many others. The kit is battery powered, shockproof, and entirely safe. It is catalogued as the KT-134.

"APACHE" TRANSMITTER KIT

Heath Company of Benton Harbor, Mich. is currently marketing a 180-watt amateur radio transmitter in kit form as the "Apache."

The transmitter operates with 150-watt phone input and 180-watt c.w. input. In addition to c.w. and phone operation, built-in switch-selected circuitry provides for SSB transmission through the use of a plug-in external adapter.

The circuit incorporates a compact and stable v.f.o. providing the low-drift frequency control necessary for SSB

transmissions. A slide-rule type illuminated dial with vernier tuning provides ample bandspread and precise frequency settings.

The bandswitch allows quick selection of 80, 40, 20, 15, and 10-11 meter bands. This unit also has adjustable low-level speech clipping and a low-distortion modulator stage employing two EL34's in push-pull class AB operation. Time sequence keying is provided for chirpless break-in c.w. operation.

The final amplifier is completely shielded for greater TVI protection and transmitter stability.

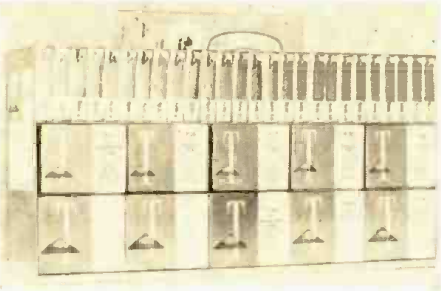
A companion receiver, the "Mohawk," is available for use with this transmitter.

YOKE REPLACEMENT KIT

Triad Transformer Corporation, 4055 Redwood Ave., Venice, Calif. has introduced a new yoke replacement kit which makes it possible for the TV technician to service literally thousands of different TV chassis while maintaining a very small yoke inventory.

The "Yoke Pack" contains eight yokes and 25 network kits, offering almost unlimited network combinations. Housed in a display case, the kit offers both 70- and 90-degree type yokes, with inductance ranging from 8 to 30 mhy. for horizontal matching, plus a special unit for 70-degree drive applications.

Mounting and centering problems are solved with such accessories as the yoke clamp (CL-1) and the centering cover



(YC-1), both of which are included in the kit.

Additional information on this service item will be supplied by the company upon request. —30—

IRE WRITING SYMPOSIUM

THE second annual Symposium of the IRE Professional Group on Engineering Writing and Speech is scheduled for October 1-2 at the Hotel Biltmore in New York City. Keynote speaker will be Dr. George H. Brown of RCA. Other speakers include Dr. Samuel J. Mason of MIT ("How to Murder an Audience") and Dr. James Angell of Philco ("Use of the Vu-Graph"). The two-day meeting will deal with common problems in oral and written communication, and will include sessions on speaking techniques, visual aids, and various aspects of writing. For information on program details, registration fees, etc. write to H. B. Michaelson, IBM Research Center, Box 218, Yorktown Heights, New York. —30—

The "Electro-Melodeon"

(*Continued from page 63*)

you can't get something for nothing. Although it has the advantage of cheapness, resistive tuning cannot be used over a very wide tuning range. This is because too much resistance in series with C_x will affect the generation of overtones and will impart an unpleasant quality to the note. For this reason, C_x must have only a little more capacity than is required to produce the desired pitch. Then, just a few hundred ohms will be needed to accomplish the final precise tuning.

Work on the keyboard should not be started until the rest of the instrument has been completed. Then, connect together all of the *A* terminals of the 25 switches. A lead from one of the *A* terminals is then run to R_{16}. Next, wire up the *B* terminals. A connection is then made from the common *B* line to the junction of C_{16} and R_{20}. Finally, wire all of the *C* terminals together. A wire goes from this common line to the junction of CH_2 and C_7.

You can now begin to install the C_x and C_y capacitors. Start with the highest note, "A" (880 cps), and work down the scale. Either an audio oscillator or an accurately tuned musical instrument must be available for checking the frequency of each note as the capacitors are wired in place. The approximate value of C_x required for each of the 25 notes is given in Table 1. Since the resonant frequency of the oscillator is dependent upon CH_2 and C_6, as well as C_x, manufacturing tolerances in these components may make it necessary to modify the values shown for C_x to some extent. I suggest that you obtain a few extra .001 and .002 μfd. capacitors. These can be used to parallel the C_x capacitors, when necessary, so that resonance will be achieved when C_y is set at mid-range.

As can be seen in Fig. 2, I used a number of ceramic capacitors in the keyboard circuit. This was only because I happened to have a large number of them in my junk box. If you go out and buy the keyboard capacitors new, I recommend that you get either mica or paper ones because of their accuracy and temperature stability. Unless designed specifically for frequency determining circuits, disc ceramic capacitors are apt to be lacking in both of these important characteristics.

Although any person who knows how to read music will experience little difficulty in learning to play the "Electro-Melodeon," the following hints may prove helpful. The melody is played with the right hand. This leaves the left hand free to operate the controls. Volume should be adjusted with the "Expression" knob, not the "Fundamental" or "Voice" knobs. These latter controls are used only for blending the sine- and overtone-outputs from the oscillator. The different tonal qualities resulting from changes in the position

of the "Stop" switch will be most noticeable when the "Voice" control is fairly well advanced and the "Fundamental" control is near minimum. The "Vibrato" switch, normally left on, is turned off only for special effects. Do not depress more than one key at a time. If you do, you'll merely be throwing an extra capacitor across the oscillator tuning circuit. The result will be a note which is lower in pitch than that produced by either key alone.

If you, too, are fascinated by electronic musical instruments, but feel that a full-sized organ is beyond your capabilities, why not try your hand at constructing an "Electro-Melodeon"? I'm sure that you'll be both surprised and pleased when you discover how much pleasant music can come from this relatively simple, inexpensive instrument. —30—

MICROPHONE TESTS AS THEY USED TO BE

By FRED LINGEL

"JOE took father's shoe bench out," sounds like a misplaced phrase but in the days not too long ago, it was part of a daily recital at some of our development laboratories.

Electronic equipment to mix audio frequencies properly and then inject them into a microphone was not readily available back in 1928. It was therefore common practice for a trained operator to repeat the two sentences "Joe took father's shoe bench out. She was waiting at my lawn" into a microphone under test. First he called them into a standard microphone or transmitter and then into the microphone under test. A technician or technical assistant, as he was often called, would listen in another room. He would note the sound intensity from first one transmitter and then the other. Then he would call back to the operator to add or subtract attenuation from the circuit of the test transmitter. When he thought the two units sounded at about the same intensity, he would let the operator know and the amount of attenuation would be recorded for that particular transmitter.

The two sentences were chosen as those most suitable for duplicating the general range of frequencies used in voice telephone communication. In addition, the sentences contained frequency combinations such as those to give "s-es" which were found most important in understandable voice transmission. Trained technical assistants and good operators were often able to repeat test data to within ½ db.

Of course, back in the days of Joe and his father's shoe bench there were no decibels, as such. Instead it was a "T.U." or transmission unit. This was short for "the attenuation which would result from one mile of standard telephone cable." The present day decibel is 10 times the logarithm to the base 10 of the power ratio of the two transmitters. One T.U. produced roughly the same attenuation.

So for the record of how it was done not-too-long ago, we have for the hi-fi do-er of today the story of Joe and his waiting miss. And, too, there is a number D90753, the part number of one of the test transmitters. It means nothing today but it's strange the things one remembers as time rolls by. —30—

Removing Resonances

(*Continued from page 45*)

12-position switch and a series of capacitors. The device covers a range of 300 to 3000 cps with the values shown. For frequencies above this range a standard, two-gang variable capacitor of the type used in broadcast receivers may be employed (with the sections paralleled) to tune continuously to the top of the audio range.

An inductance with good "*Q*" is important in achieving the narrow rejection slot needed to compensate for some resonances. A low-"*Q*" *LC* combination can be used to some advantage but will usually mean unnecessary attenuation of frequencies above and below the point of resonance. The 2.4-henry choke used in the circuit is rated at a minimum "*Q*" of 20 and, in order to obtain minimum insertion loss, a variable resistor is placed between the audio signal source and the *LC* elements to control the depth and width of the rejection slot. To some degree the effectiveness of this expedient is contingent upon the signal source being of relatively low impedance, such as the cathode-follower output found in most current preamplifier-control units. A high-impedance signal source will make it impossible to minimize the amount of rejection past a certain point. It should be noted, too, that apparently a number of preamplifier control units with cathode followers use a relatively small coupling capacitor to feed the outgoing line with the result that impedance at low frequencies may be on the order of 20,000 to 100,000 ohms. If the capacitor in the *LC* circuit is of nearly the same value or larger than the coupling capacitor, then serious low-frequency attenuation may result. In this case it may be desirable to parallel the control unit's output coupling capacitor with a 20-μfd. electrolytic.

Once the series-resonant circuit has been "tuned" to the frequency where the greatest improvement in listening quality is noticed, it may be tucked out of sight where the settings of the two controls are not likely to be disturbed. It should be noted, however, that both the frequency and intensity of resonances in the system may vary over a period of time, depending upon temperature, humidity, and other factors. This is one of the reasons why some outfits appear to change character over the months and years, hence retuning of the series-resonant circuit may be desirable after a period of time has elapsed.

Several precautions are in order when locating the series-resonant unit. The most important of these is to keep it away from power transformers, motors, and other magnetic devices whose fields may cause inductive hum pickup. A second, and somewhat contrary, recommendation is to keep the length of shielded cable between the unit and power amplifier relatively short in order to minimize the effects of cable capacitance on high-frequency response. Usually the choke in the series-resonant circuit can be oriented for minimum pickup from a particular hum source and, as the audio level will probably be a fraction of a volt, there should be no problem in most installations.

When dealing with resonant frequencies below 300 cps, it is desirable to use a larger value of inductance in order to insure a favorable *LC* ratio. Power supply chokes are readily available in values from 8 to 30 henrys and are relatively inexpensive. Care should be taken in selection, however, as reasonably good "*Q*" and freedom from distributed capacity that might cause an unwanted peak in the mid-frequency range are requisite. Fig. 3 gives the component values for a circuit employing a 15-henry choke and tuning from 30 to 300 cps. With this circuit, it is possible to compensate for the primary resonances of speakers and phonograph pickup arms as well as possible enclosure or room resonances falling within this range.

Fig. 5 shows some of the circuits that may be used to achieve rejection of a particular frequency range. Fig. 5A is identical to those already described and requires a relatively low-impedance audio source for the widest range of operation. The circuit of Fig. 5B may be used with a medium-to-high-impedance signal source, as can the circuit of Fig. 5C which is similar. However, for moderate amounts of attenuation, these two circuits act like band-rejection filters, due to their phase characteristics, and are less use-

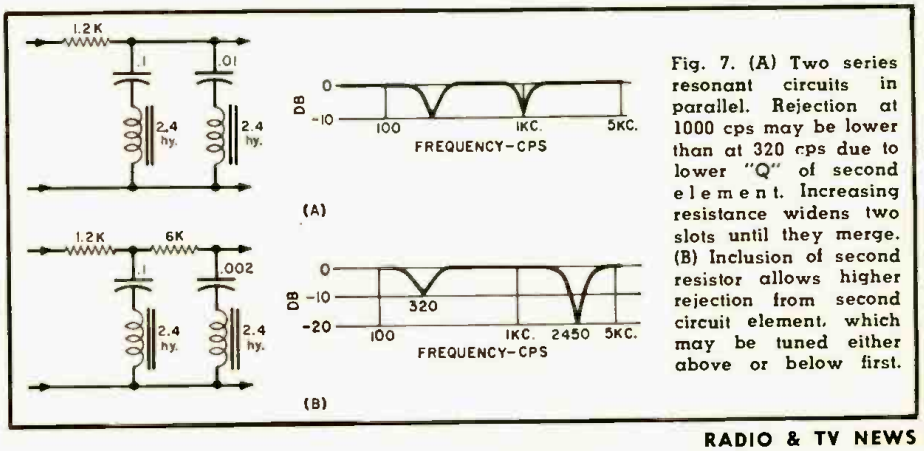


Fig. 7. (A) Two series resonant circuits in parallel. Rejection at 1000 cps may be lower than at 320 cps due to lower "Q" of second element. Increasing resistance widens two slots until they merge. (B) Inclusion of second resistor allows higher rejection from second circuit element, which may be tuned either above or below first.

ful in suppressing a single resonance in the system. The circuit of Fig. 5D although again looking much like the preceding configurations, provides a slot of constant width and varying depth and should be driven by a low-to-medium-impedance signal source. Fig. 5E is a circuit in which the tube plate resistance is used as the element determining the amount of rejection obtained. Fig. 5F is a parallel-resonant circuit which can be placed in the cathode circuit to obtain rejection by means of degenerative feedback.

Thus far we have proceeded on the assumption that there will be only one major undesirable resonance in the system, although of course this may be far from the actual case. Fig. 4 indicates five of the most common resonant peaks that may be encountered in a system. It may be desirable to compensate for two or more of these. Fortunately, this is quite easy to do by cascading or parallelling series-resonant elements, as shown in Fig. 7. Preferably the operating frequencies of the two circuits should be fairly well separated and the one which requires the higher amount of rejection should be inserted the farthest from the signal source.

The use of series-resonant compensation provides a convenient and versatile method of reducing the unwanted effects of resonance in a hi-fi system and, in the author's experience, can produce an astonishing improvement in clarity and naturalness, particularly in the case of mid-range defects. In addition, these circuits may be used to some advantage in recording work to improve instrumental balance or to reduce the harshness or nasal quality of a voice. They can also be used to achieve a wide variety of tonal coloration in such recording applications.

No doubt a great many other uses for the resonant circuits described in this article will suggest themselves to the audio experimenter who wants to try some novel effects. —30—

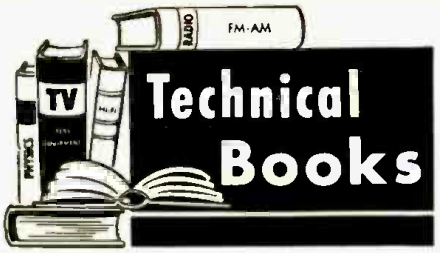
NOVEL SOLDER DISPENSER

By PETER BARNA

YOU can make a novel and practical solder dispenser from an old ball-point pen—at no expenditure except a few minutes of your time. Besides being handy, it can't get lost or be misplaced since it clips onto the breast pocket of your shirt or shop coat.

Using either No. 16 or No. 18 gauge core solder for best results, wind the solder in a close coil around the entire length of the pen filler. Insert the coil into the pen in place of the pen core and the job is complete. —30—

An old ballpoint makes handy dispenser.



"TV DISTRIBUTION SYSTEMS AND ANTENNA TECHNIQUES" by Jack Beever. Published by *Howard W. Sams & Co., Inc.*, Indianapolis. 163 pages. Price $2.95. Soft cover.

The boom in two-set TV homes, the increase in the number of hotels and motels providing television to their patrons, and the mushroom growth of "community antenna systems" have left many technicians ill prepared to cope with the problems of multiple-set installations.

In order to remedy this serious lack, the author offers a thoroughly practical approach to the problem. He provides complete information on every type of TV signal distribution system, explains the requirements of long-line or community antenna systems, and discusses such vital matters as the original installation, troubleshooting, and continued maintenance. Nor has he overlooked the business aspects of such work—he covers the various points involved in bidding, cost estimating, and selling multiple-set installations.

The text material is written in easy-to-understand form and the lavish use of illustrations further simplifies the technician's task. Since both local and fringe area v.h.f. as well as u.h.f. installations are covered, a thorough understanding of the subject matter in this text should equip the technician to handle any antenna job that he is asked to tackle. Since the author is a field engineer with *Jerrold Electronics Corporation*, the material has been tested in the course of making hundreds of multi-set installations throughout the country.

* * *

"OFFICIAL REGISTRY OF RADIO SYSTEMS IN THE TRANSPORTATION SERVICES" compiled and published by *Communication Engineering Book Company*, Monterey, Mass. 84 pages. Price $4.00. Soft cover.

This is the 1958 edition of a publication which gives the details of every mobile radio system in the U. S. operated by railroads, taxicab companies, auto services, bus lines, and truckers (excluding ham stations).

This edition, revised from FCC records, lists the name and address of each company, the number and location of its fixed transmitters, the number of mobile transmitters authorized, operating frequencies, call letters, and the make of equipment used.

* * *

"AUDIO DESIGN HANDBOOK" by H. A. Hartley. Published by *Gernsback Library, Inc.*, New York. 218 pages. Price $2.90. Soft cover.

Regular readers of this magazine are

thoroughly familiar with Author Hartley's style and his unique faculty for "stirring up the Indians." An individualist of the first water and a respected British audio engineer, Mr. Hartley has covered audio techniques—from amplifiers to transformers, feedback, tone controls, speakers, and enclosures—in his own inimitable fashion.

Written at a not-too-technical level, with a minimum of mathematics and engineering concepts — this volume would be entirely suited for both the professional sound man and the enlightened audiophile.

The text itself is divided into twelve chapters covering the perception of sound, the audio output stage, inverters and drivers in audio amplifiers, voltage amplification, amplifier design, audio transformers, negative feedback, filters and tone controls, amplifier power supplies, speakers and enclosures, measurements and testing—winding up with a humdinger concluding chapter, written in first person singular, entitled "High Fidelity—hail and farewell."

The same spritely approach which characterized the author's series of articles in this magazine, "Realistic High Fidelity," is carried over into this book.

We believe that most persons interested in the electronic reproduction of sound will find this volume both challenging and instructive. —30—

The lucky winners of Thorens' unique "10 Year" hi-fi contest receive their awards from Paul W. Kind (center), head of the firm. Hi-fi salesman James Carroll (left) of Harvey Radio Co., New York receives a check for being the "favorite audio salesman" of the winner, Hannes Beckmann (right) of New York. As the author of the best 50-word description of his "favorite hi-fi dealer's salesman," Mr. Beckmann will receive his choice of any one Thorens hi-fi product each year for ten years. For his first choice, he selected the firm's new TD-124 turntable. The winners were selected by the editors of six leading publications in the hi-fi field: W. A. Stocklin, Editor, RADIO & TV NEWS; Warren DeMotte, Associate Editor, HI-FI & MUSIC REVIEW; John M. Conly, Editor, High Fidelity; Milton B. Sleeper, Publisher, Hi-Fi Music at Home; M. Harvey Gernsback, Editorial Director, Radio-Electronics; and Anthony Lord, Managing Editor, High Fidelity Trade News.

TEST REPORT
Hi-Fi Components

NEW SHURE "DYNETIC" CARTRIDGE

THERE are always surprises from *Shure Brothers*. It wasn't too long ago that they announced the development of their "Studio Dynetic" cartridge and tone arm assembly. It was a big surprise then in that this cartridge was an electromagnetic transducer where formerly *Shure Brothers* were primarily known in the field of crystal and ceramic cartridges. They now have a relatively new addition to their line—the "Professional Dynetic" series which like its predecessor is an electromagnetic transducer using a moving magnet. It differs in that this unit needs no special tone arm. It can be used with almost any arm found on record changers and with transcription turntables. Its recommended load impedance is 27,000 ohms and it has an output voltage of .021 volt which is suitable for driving almost any high-fidelity system having a magnetic input without the use of a special transformer. Tests made in our own laboratory showed an extremely smooth response from 30 to 17,000 cps and then dropping off rather rapidly. For those who are interested in an extended high-frequency response, the load resistance may be increased.

The stylus assembly is held in place by a plastic composition which provides extremely high needle compliance, resulting in practically no "needle-talk."

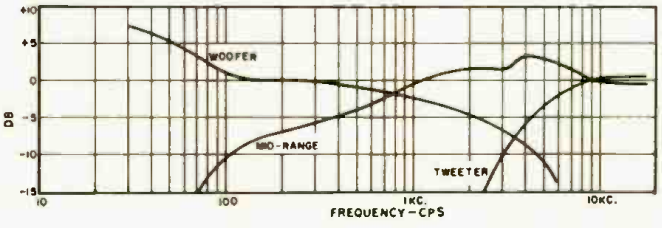
Listening tests made in comparison with other cartridges showed that this new *Shure* unit is a top contender in the present cartridge field. It is extremely smooth yet brilliant and the over-all effect is one of ease. The published tracking force requirement of three to six grams certainly was confirmed in that we had no tracking problems, even on some of the loudest passages. This led us to believe that even lower tracking pressures could have been used.

Another important feature is that stylus replacement is especially simple and fast and no tools are required. It is not a turnover cartridge as many are today. It is available in only two models—the M5D for microgroove records with a 1 mil diamond stylus and the M6S for standard 78 rpm records with a 2.7 mil sapphire stylus. —30—

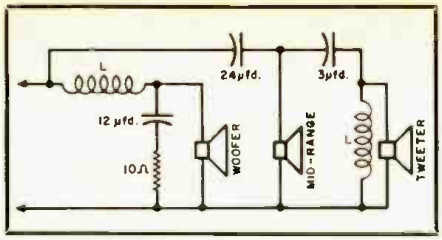
"SHIELDCREST" SPEAKER SYSTEM

WE have seen and tested many speakers from such countries as England, Japan, and Germany but only recently have we run across such units imported from Denmark. The one we have just tried is a three-way system consisting of a 12-inch woofer, 5-inch mid-range, 2-inch tweeter, and an *LC* crossover network. All of the speakers are cone-type units and are being marketed under the tradename of "Shieldcrest" for $24.88 (including crossover network) by *Olson Radio Warehouse* of Akron, Ohio.

These units are certainly worthy of comment, not only because they are extremely low priced but also because we encountered some unusual results. Our first approach was to analyze the dividing network and the results are shown in the diagram below. It was interesting to note that there are actually three crossover points; one at about 750 cps, one at 3500 cps, and one at 9000 cps. The woofer and mid-range curves roll off at only about 3 db per octave. This may be compared with the usual 6 db per octave, or even 12 db per octave, that is more widely used. Further analysis showed that the entire network is basically a two-way system with the mid-range speaker operating throughout the entire mid- and high-frequency range.



Response characteristics of the dividing network showing the crossover points.



Wiring diagram of the crossover network.

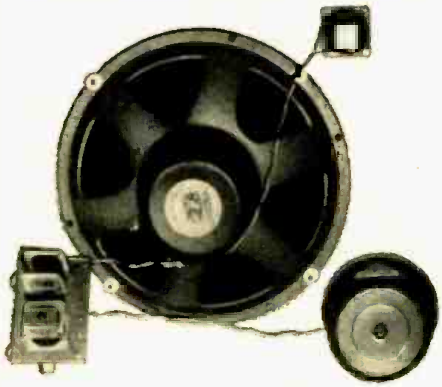
This is rather unusual but not necessarily detrimental to the over-all performance of the system. We know of another system which sells in the $500.00 range that was designed in similar fashion.

Normal practice is to cut off the speakers very sharply at the crossover points to confine each speaker to its particular portion in the audio spectrum. The greatest advantage of this principle is to reduce intermodulation distortion.

The individual speakers, particularly the woofer, were extremely good performers. Cone resonance of the woofer was found to be quite low—on the order of 34 cps. We ran across one point at which the woofer did break up audibly but with further re-checking we were unable to repeat the break-up condition.

Listening tests showed up quite well.

The three speakers with the LC network.



Under normal room listening conditions, with an infinite baffle, the speaker system had a pleasant quality. It was somewhat heavy at the bass end but some high-fidelity enthusiasts may prefer this.

We do not wish to imply that this system can compare with any of the much higher priced, top-quality systems on the market today in "cleanness" of response and freedom from intermodulation distortion, but in view of its modest price, we cannot deny that it is a good system. —30—

GARRARD AUTOMATIC RECORD CHANGER

THE *Garrard* RC121/II record changer is one of the most recent additions to *British Industries Corporation's* line of hi-fi components. This unit warrants special mention in that it incorporates

The Garrard RC121/II Record Changer

all of the desired quality and ease of operation that one would look for in a moderately priced record changer.

It will handle all four speeds: 16⅔, 33⅓, 45, and 78 rpm. It will automatically play any number of records up to ten, in 7", 8", 9", 10", or 12" diameters. All 10- and 12-inch records of the same speed can be intermixed in any desired order without affecting the automatic operation of the changer. All other size records may be played automatically at the same time provided the smaller diameter records are placed above the larger ones.

In addition to the automatic mixing facilities, records may also be played manually and the changer stopped and started as desired without rejecting the record being played.

The manual operation is a "must" feature, in our opinion, for any record changer. Although the basic idea on the part of an owner is to use a record changer to play a stack of records automatically, there are many times when one would like to to play individual records.

The manual control is not unusual since most record changers provide the same facility, but in this particular unit the ease with which one can switch from automatic to manual operation is quite gratifying.

The use of the center post for stacking records is the simplest arrangement for automatic record changers and this unit is no different from others using a similar mechanical system in that there is bound to be eventual wear on the center hole of the record.

Extensive listening tests were made using several different test records and we were pleasantly surprised to find very little wow, flutter, or rumble even under exaggerated conditions. It was unusually free from such unwanted effects considering that this changer is in the medium-priced field and therefore should not be expected to match the quality of any of the really top-notch professional units that are available on the hi-fi market today.

—30—

DON'T MISS NEXT MONTH'S

SPECIAL FEATURE ISSUE ON STEREO

October

RADIO & TV NEWS

Manufacturers' Literature

INDUSTRY "FACT BOOK"

Electronic Industries Association, 1721 DeSales Street, N.W., Washington 6, D. C. has announced publication of its 4th annual "Fact Book" for 1958.

The value of consumer products, tubes, semiconductors, components, and military and industrial equipment is included in this new reference book along with details on the production and sales of various industry items.

Non-members and the general public can obtain copies of the book by writing the Washington headquarters and enclosing 50 cents per copy.

TRANSISTOR CATALOGUE

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. has just issued a four-page, two-color catalogue sheet listing the complete line of *Texas Instruments* semiconductor devices which it is prepared to supply from stock.

Among the units listed are silicon transistors, silicon diodes and rectifiers, as well as germanium transistors. Complete electrical specifications are given on each type handled.

Copies of this brochure are available without charge from the distributor.

DYNAMOTOR CATALOGUE

Carter Motor Company, 2793A W. George St., Chicago 18, Ill. is now offering copies of its new 28-page dynamotor catalogue to interested persons.

The catalogue lists the company's new fan-cooled "Genemotor" as well as several new models comprising the "Genemotor" line which has been materially improved in appearance, performance, and service accessibility. In addition, eleven new listings appear in the 1½" and 2" frame "Genemotors," increasing their range of application.

Catalogue No. 158 is available from the manufacturer without charge.

EICO'S NEW CATALOGUE

Electronic Instrument Co., Inc. 33-00 Northern Blvd., Long Island City 1, N. Y. is now offering copies of its 16-page, 2-color catalogue describing the complete *EICO* line of electronic test instruments and high-fidelity equipment available in both kit and wired form.

The test instruments covered include v.t.v.m.'s, v.o.m.'s, oscilloscopes, tube and transistor testers, signal and sweep generators, battery eliminators, substitution boxes, flyback testers, battery testers, *RCL* bridges, electronic switches, voltage calibrators, Geiger counters, and accessory probes. The audio line includes an FM tuner,

preamplifier, integrated and basic amplifiers, and bookshelf and floor speaker systems.

Free copies of this catalogue are available on request.

DATA ON "FRAMELOK GRID"

A new booklet which describes the design and performance advantages of its "Framelok Grid" construction for electron tubes has been issued by *Sylvania Electric Products Inc.*, 1100 Main St., Buffalo, N. Y.

This 12-page brochure lists structural features of the new grid design and points up their effect on other tube elements. Ratings and performance characteristics of the firm's first "Framelok" tube, a 6FH6 horizontal deflection type, are included in the brochure.

MAINTENANCE HINTS

National Electronics, Incorporated, Geneva, Ill. has issued a pocket-sized, 20-page booklet entitled "Maintenance Hints."

Designed to be of help to equipment engineers and users who work with equipment incorporating electronic tubes, the publication gives maintenance hints for equipment using ignitrons, thyratrons, and gas-filled rectifiers. In each instance both causes of troubles and symptoms are discussed in non-technical terminology with a final section of the booklet devoted to approved practices for handling electron tubes.

The company will supply copies of this handbook without charge as an industry service.

"BUSINESS BUILDERS"

CBS-Hytron's Advertising Service, Parker Street, Newburyport, Mass. has just issued a completely revised fourth edition of its "Business Builders Catalogue" of sales promotion materials, technical literature, and service tools for independent service technicians.

The 16-page catalogue describes and illustrates over 90 useful items ranging from printed-circuit soldering aids to illuminated outdoor signs. A new easy-to-read format makes it possible to find needed items quickly.

When writing for a copy of this publication, please specify form PA-37. It will be supplied complete with order blank and price list.

EIA STANDARDS LIST

Electronic Industries Association, Room 650, 11 West 42nd St., New York 36, N. Y. has issued a 12-page booklet which lists recommended standards, specifications, and engineering publications which are currently available.

The list includes bulletins and publications of general interest, television and facsimile test charts, specifications for military components, standards, plus an alphabetical listing of the standards.

For a free copy of this index plus details on how individual standards can be ordered, write to the Engineer-

ing Office of the Association at the New York address rather than EIA headquarters in Washington.

UTC TRANSFORMERS

United Transformer Corporation, 150 Varick St., New York 13, N. Y. has just issued its 25th anniversary catalogue covering electric wave filters, high "*Q*" coils, transformers, reactors, and magnetic amplifiers.

This 34-page publication provides complete specifications on a wide variety of components and, in addition, carries schematics for five amplifiers ranging in power from 20 watts to 60 watts. A reactance-frequency chart has been included for the convenience of amplifier designer-builders. The company's line includes a number of transformers designed especially for transistor circuits.

B&K TEST INSTRUMENTS

B&K Manufacturing Co., 3726 N. Southport Ave., Chicago 13, Ill. has just issued a colorful 4-page booklet which covers the firm's tube checkers, "Television Analyst," and test instruments for in-the-home servicing and shop use.

Performance and other pertinent data is provided on each instrument, along with a photograph and price information. Copies of Bulletin No. AP12 are available without charge.

AUTO RADIO CAPACITORS

Sprague Products Company, North Adams, Mass. is currently offering a new manual which gives a complete list of "Atom" and "Twist-lok" electrolytic replacement capacitors for use in auto radios manufactured from 1946 through 1957. Some forty makes of radios are listed alphabetically with the company's replacements cross-referenced to the original part numbers.

Copies of the manual are available from the firm's distributors without charge or from the company at 51 Marshall St. for 10 cents.

NEW MILLER CATALOGUES

J. W. Miller Company, 5917 S. Main Street, Los Angeles 3, Calif., has announced publication of two new catalogues of interest to the electronic industry.

No. 159 is a new edition of the "TV Technician's Coil Replacement Guide" which lists the company's replacements for parts which appeared in the color and black-and-white sets of some 67 manufacturers. Both original part numbers and *Miller* replacements are listed in tabular form.

The second publication, No. 59, is a general catalogue covering the firm's complete line of industrial electronic, radio, and TV r.f. coils; chokes, line filters, coil kits, i.f. transformers, and special i.f. windings.

Copies of either or both of these catalogues are available without charge upon written request direct to the manufacturer. Please order by catalogue number. —30—

Within the Industry

(*Continued from page* 28)

Institute of Radio Engineers and the Acoustical Society of America. He has been a director of EIA since 1956.

* * *

A. W. ORLACCHIO has been appointed chief engineer of the *Glennite Instrumentation Division, Gulton Industries, Inc.*

Mr. Orlacchio joined the firm in 1952 and was placed in charge of the development of electromechanical instruments. His new duties as chief engineer include all design, development, and production engineering for products of the Division.

Previously employed at the National Bureau of Standards in Washington, D. C., he worked in the field of propagation of sound through solid media.

Mr. Orlacchio is a member of the Acoustical Society of America, the Institute of Environmental Engineers, and the Instrument Society of America.

* * *

JERROLD ELECTRONICS CORPORATION has moved to new and larger quarters at Jerrold Building, 15th Street & Lehigh Avenue, Philadelphia 32, Pennsylvania . . . **SUPERSCOPE INC.** has moved its executive offices to 8520 Tujunga Avenue, Sun Valley, California . . . **AMPHENOL ELECTRONICS CORPORATION** has announced the formation of a new western division to be located in Chatsworth, California. A 20,000 square foot plant has been erected to house the division, which will have its own complement of sales, engineering, manufacturing, and financial personnel. General manager will be James H. Schaefer . . . **PACKARD BELL COMPUTER CORPORATION** has announced the relocation of its offices to 1905 Armacost Avenue, Los Angeles 25, Calif. . . . **JENSEN INDUSTRIES**, Forest Park, Illinois, announces plans for a plant expansion to increase its floor space by 50 per-cent. The firm will thus increase its factory to 60,000 square feet . . . **TELONIC INDUSTRIES, INC.** plans to move its engineering division, **TELONIC ENGINEERING CORP.**, to Laguna Beach, California where it will expand its development and engineering facilities . . . **H. H. SCOTT, INC.** is now settled in its new building at 111 Powder Mill Road, Maynard, Mass.

* * *

ELECTRONIC INDUSTRIES ASSOCIATION has appointed the following as members of a newly established engineering department policy committee: Ben Adler, president of *Adler Communications* and chairman of the EIA technical products division; Robert S. Bell, president of *Packard Bell Electronics Corp.* and chairman of consumer products division; Sidney R. Curtis, senior vice-president, of *Stromberg-Carlson Co.* and chairman of military products

division; D. W. Gunn, vice-president, sales, of *Sylvania Electric Products Inc.* and chairman of the EIA tube and semiconductor division; and W. S. Parsons, president of *Centralab*, division of *Globe Union, Inc.* and chairman of the EIA parts division.

The principal function of the committee will be to provide closer liaison between the Association's engineering department's various committees and management.

* * *

ELECTRONIC INSTRUMENT CO., INC. (EICO) has expanded its design laboratories and production lines to a newly modernized, one-level 45,000 square foot area at 33-00 Northern Blvd., Long Island City 1, N. Y. . . . Construction is now under way on an ultra-modern, one-story plant for the manufacture of special-purpose vacuum tubes by the components division of **INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION.** The 58,000 square-foot building, rising on an 18-acre site, is located in Roanoke, Virginia . . . The computer division of **BENDIX AVIATION CORP.** has established a computing center at 205 East 42nd Street, New York, N. Y. . . . **ANDERSON CONTROLS, INC.** has relocated its general offices at 9959 Pacific Avenue, Franklin Park, Illinois . . . **THE NARDA ULTRASONICS CORPORATION** has acquired a one-story building at 625 Main Street, Westbury, Long Island, N. Y. The new facility will provide the company with 16,500 square feet of additional production space . . . **PIONEER ELECTRONICS CORPORATION** has taken over an additional building adjoining its plant at 2235 South Carmelina Avenue, West Los Angeles, California. The modern, one-story brick building will provide an additional 10,000 sq. ft. for warehouse, administration, and testing facilities . . . **INSTRUMENTS FOR INDUSTRY, INC.** has completed plans for a new building to be located on New South Road, Hicksville, New York . . . **MERIT COIL & TRANSFORMER CORPORATION** is establishing a Canadian warehouse at 700 Weston Road, Toronto . . . Negotiations will be completed shortly for the construction of a new 150,000 square foot electronics laboratory building on Route 128 in Burlington, Mass. for the microwave and power tube division of **RAYTHEON MANUFACTURING COMPANY.** Estimated completion date is early 1959 . . . **U. S. ELECTRONICS DEVELOPMENT CORP.** has announced the moving of its entire administrative and manufacturing facility from Glendale, Calif. to Phoenix, Arizona.

* * *

ROBERT R. SHERWOOD has been appointed executive vice-president of *Rek-O-Kut Company, Inc. . . . Sylvania Home Electronics,* a division of *Sylvania Electric Products Inc.,* has announced the following promotions: **RICHARD J. STAFFORD,** marketing administrator; **CHARLES L. HUBBARD,** product planning manager; and **JOHN E. LAU,** sales manager, radio and high-fidelity . . . **E. C. RAYMUND** has been promoted to the post of executive vice-

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			2	3	4	5
						12
						19
						26

CALENDAR of EVENTS

SEPTEMBER 12-14

Seventh Annual Chicago High Fidelity Show. Palmer House, Chicago. Complete information from International Sight and Sound Exposition, Inc., 1 N. La Salle, Chicago 2, Ill.

SEPTEMBER 15-19

13th Annual Instrument Automation Conference and Exhibit. Sponsored by Instrument Society of America. Philadelphia Convention Hall, Philadelphia. Fred J. Tabery, exhibit manager, 3443 S. Hill St., Los Angeles, 7, Calif.

SEPTEMBER 22-24

National Symposium on Telemetering. Sponsored by IRE and PGTRC. Americana Hotel, Miami Beach, Fla. Contact Ken West, 1345 Indian River Dr., Eau Gallie, Fla. for program details.

SEPTEMBER 24-25

Industrial Electronic Conference. Sponsored by IRE, AIEE, PGIE. Rackham Memorial Bldg., Detroit, Mich. H. W. Patton, Acromag Co., 22519 Telegraph Rd., Detroit, Mich. for details

OCTOBER 1-2

Engineering Writing & Speech Symposium. Sponsored by IRE and PGEWS. For details, see page 149.

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Answer to Puzzle appearing on page 144.

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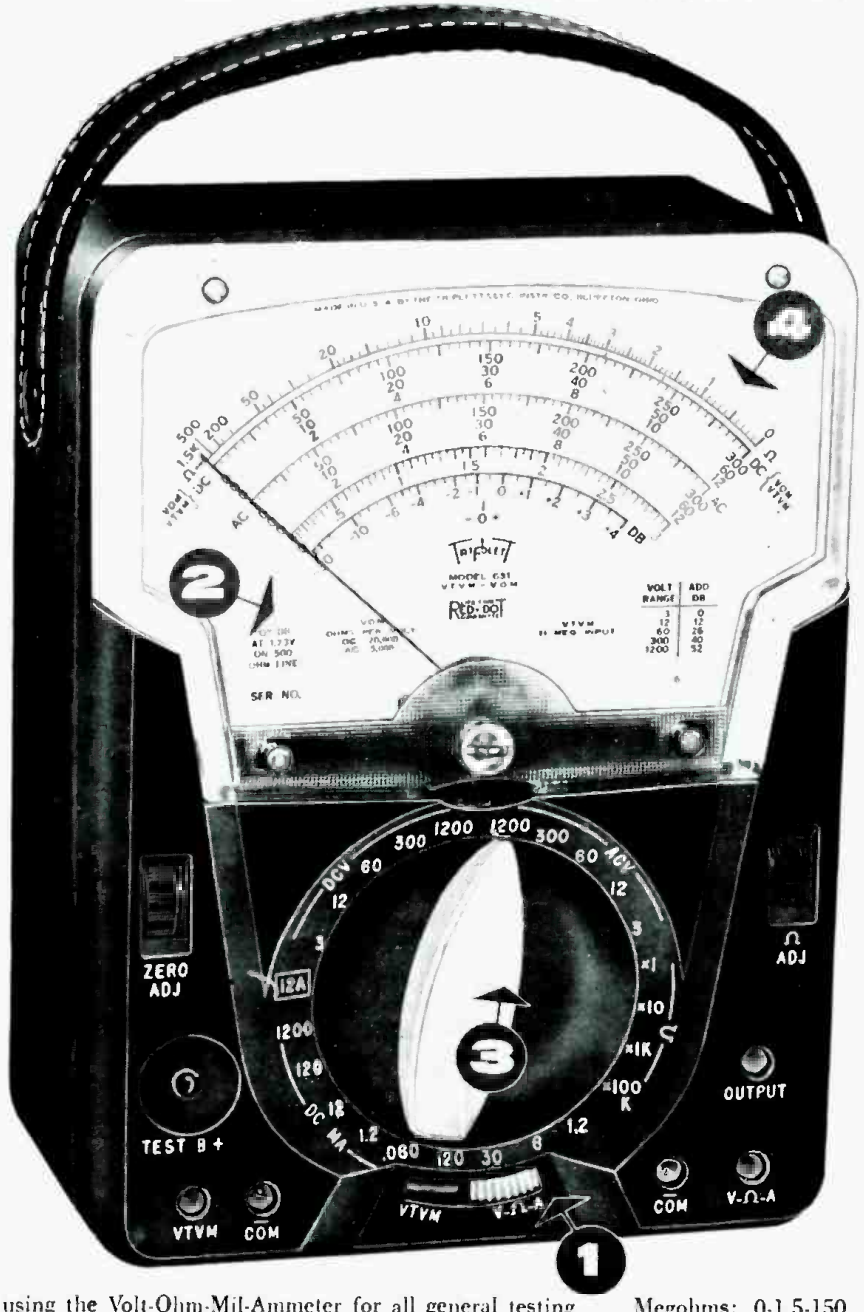

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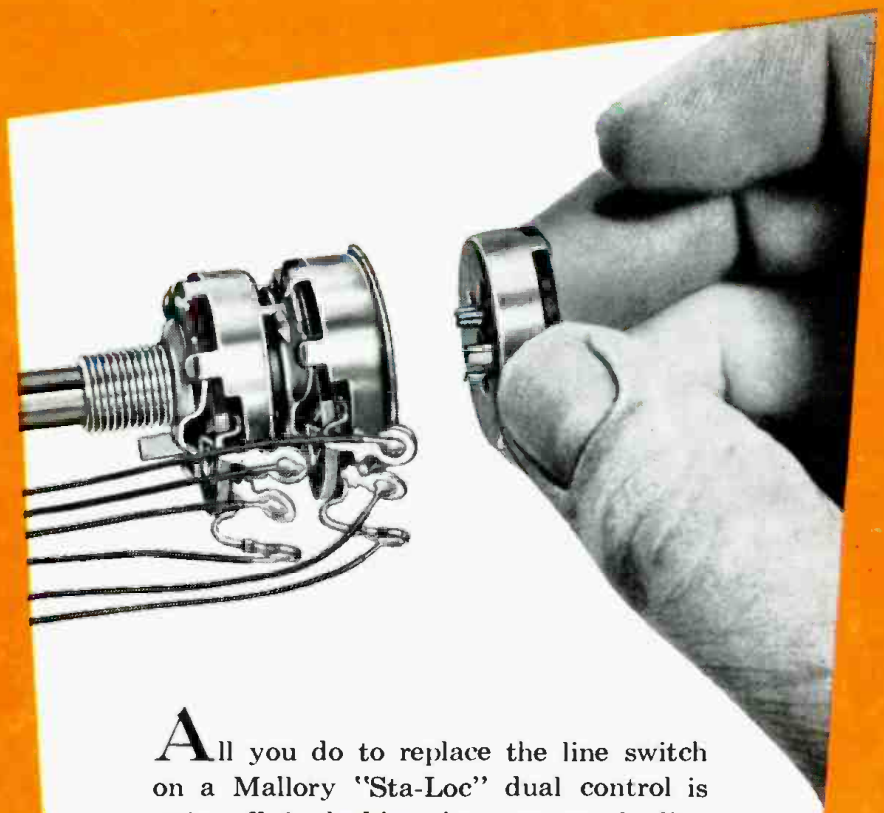

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