HOME-BUILT TV REMOTE CONTROL

MAC

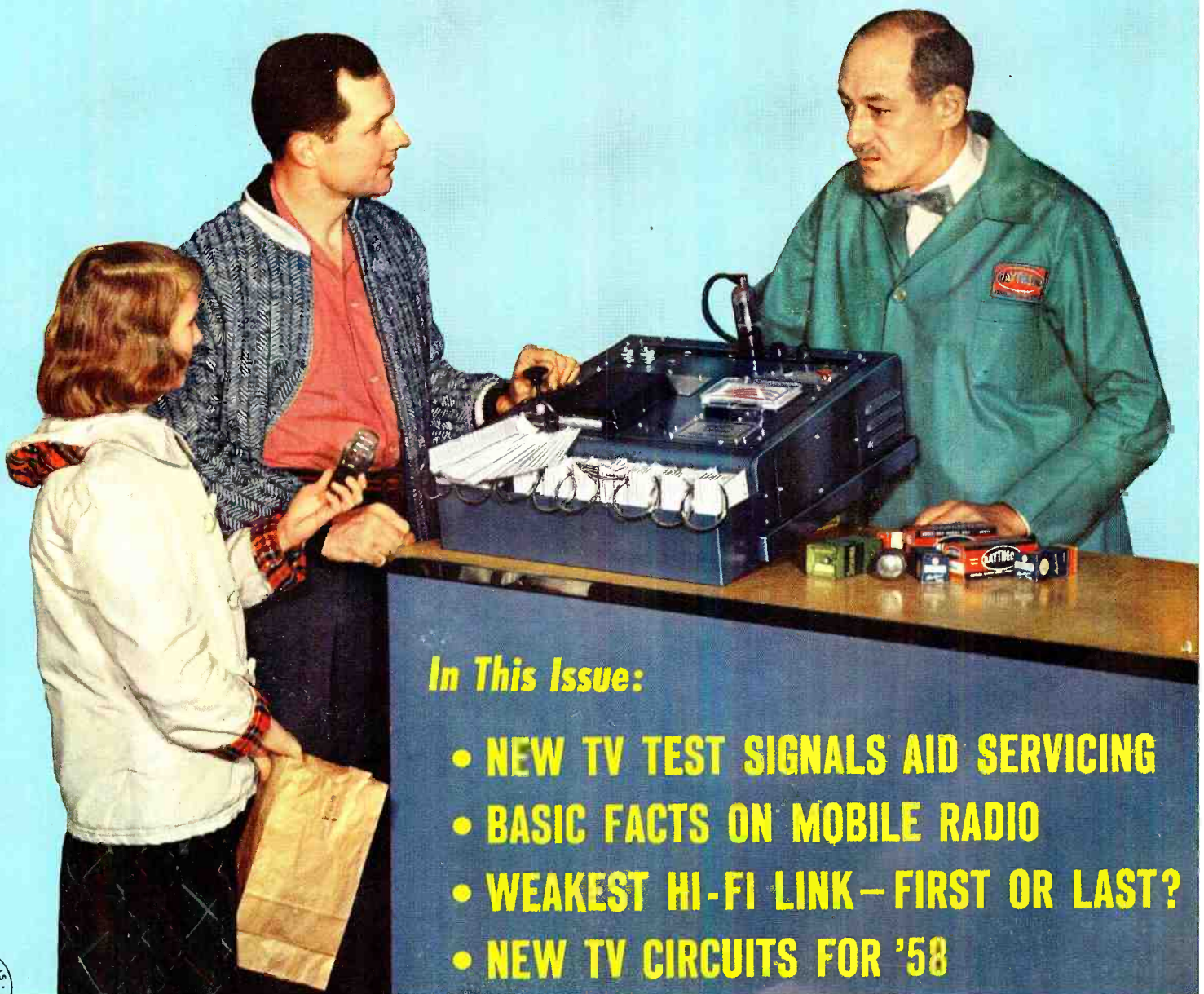
RADIO & TV NEWS

World's Leading Electronics Magazine

APRIL
1958
35 CENTS

Tube Checkers Promote Service

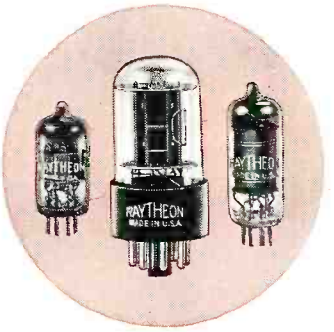
(See Page 45)



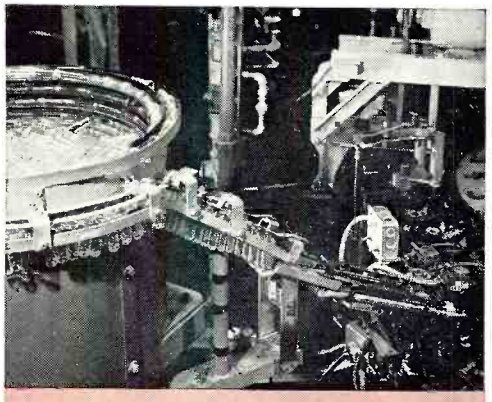
In This Issue:

- NEW TV TEST SIGNALS AID SERVICING
- BASIC FACTS ON MOBILE RADIO
- WEAKEST HI-FI LINK—FIRST OR LAST?
- NEW TV CIRCUITS FOR '58

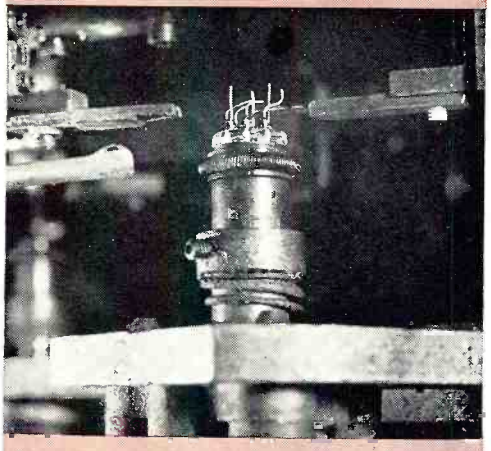
IT'S NOT HUMANLY POSSIBLE



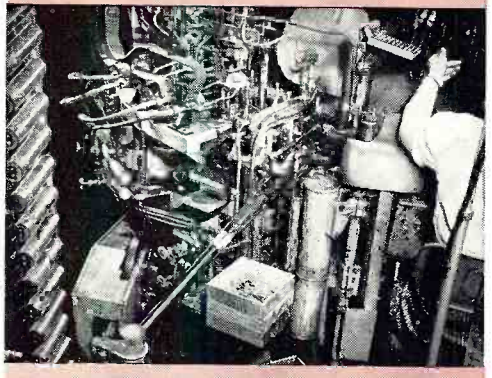
To Make RAYTHEON TUBES AS GOOD AS THEY ARE



Cylindrical machine at left gently vibrates glass tube envelopes, urges them to climb inside track and automatically feed down ramp to tubulating machine. Tubulating machine etches tube type on envelopes, cuts glass to precise tube size, attaches exhaust tube to envelope to allow creation of a perfect vacuum.



Close up of the button on which tube elements are mounted. Fingers, left and right, move in to swiftly make complicated bends which must be kept extremely precise to insure proper positioning of tube's elements.



This exhaust machine seals the glass envelope to the stem of the mounted tube. Pumps then create a perfect vacuum in the tube, the inside parts are "bombed" (heated white hot) and the getter is then flashed to allow this perfect vacuum to be retained during life. Tubes are automatically discharged after they have been tipped, then slide down a ramp to a conveyor and are carried to the next operation.

Here at Raytheon, we think we have the most skillful people in the industry, yet their combined skill alone couldn't make Raytheon TV and Radio Tubes as good as we make them. It takes hundreds of thousands of dollars worth of special instruments and machinery as well.

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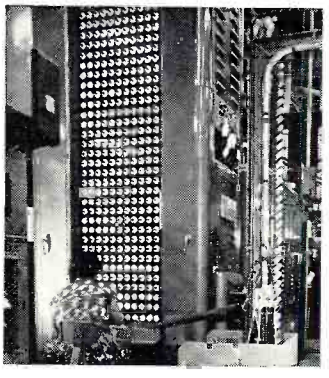
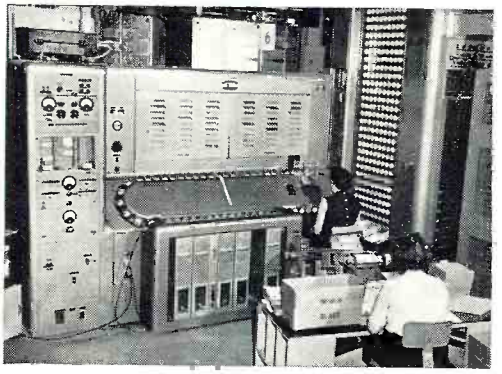
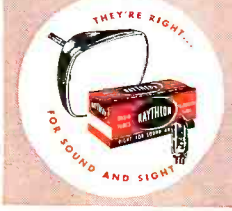




Left: Note the conveyor bringing the finished tubes from the exhaust machine to this rotary aging rack. The aging rack operates the tubes for ½ hour to eliminate early tube failure. Voltages are applied to stabilize the characteristics and season the tubes so that uniform results will be obtained through life. High voltages are applied to eliminate any weak tubes.

Right: This Raytheon designed machine performs many complicated tests — tests formerly dependent on human judgment — and automatically eliminates tubes not up to Raytheon standards of quality and performance.



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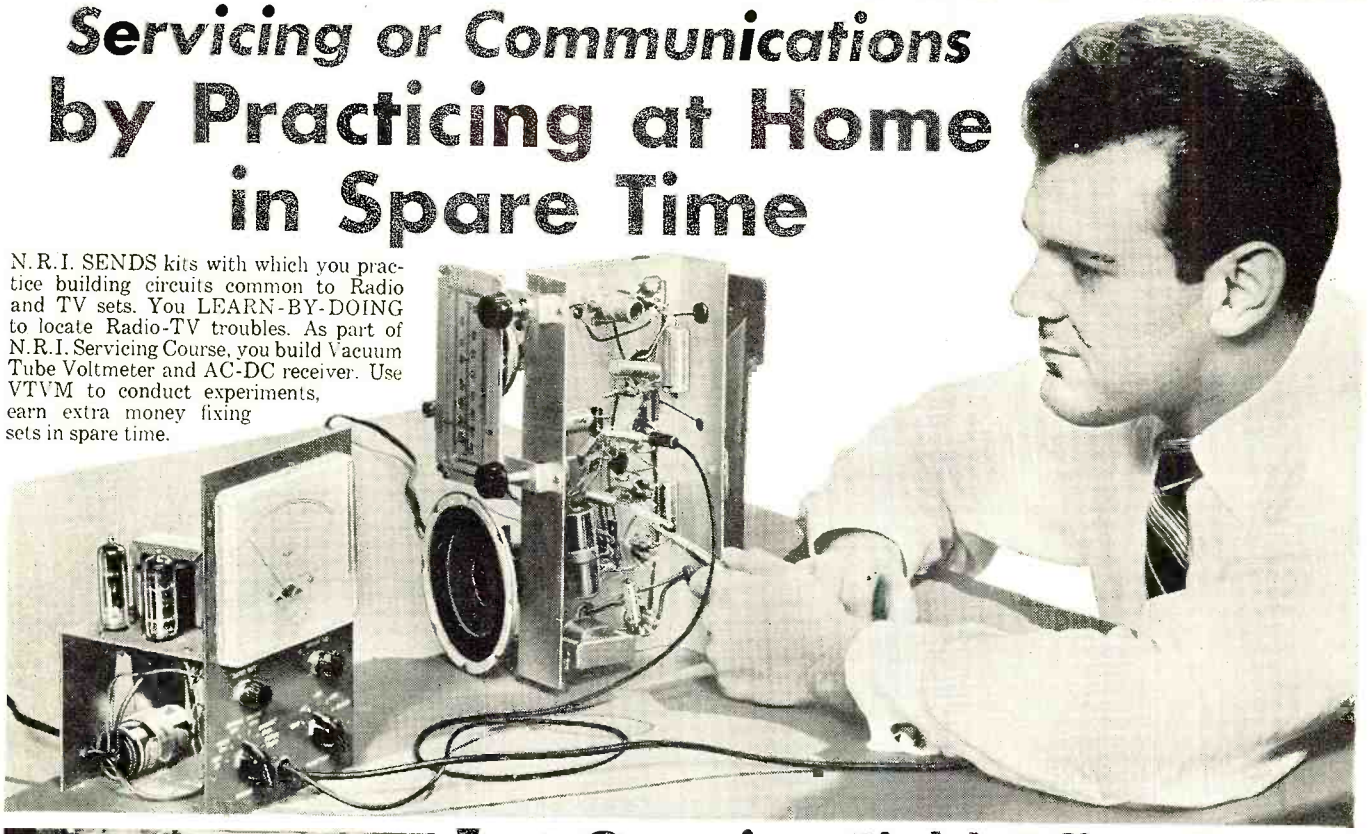

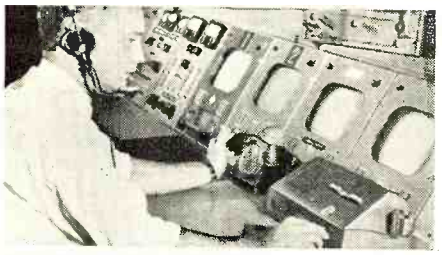

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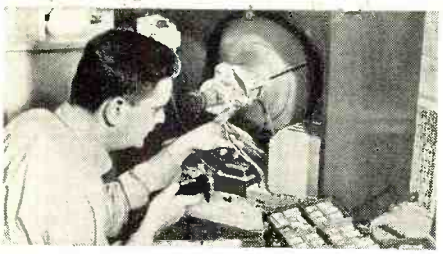

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CONTENTS

APRIL, 1958 **VOL. 59 ■ NO. 4**

INDUSTRY NEWS

HIGH FIDELITY AND AUDIO

SERVICING

Television-Radio

Test Equipment

AMATEUR AND COMMUNICATIONS

ELECTRONIC CONSTRUCTION

DEPARTMENTS

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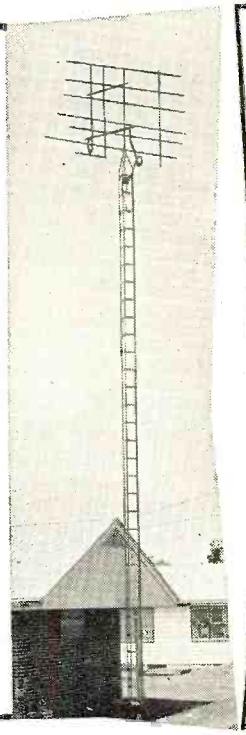

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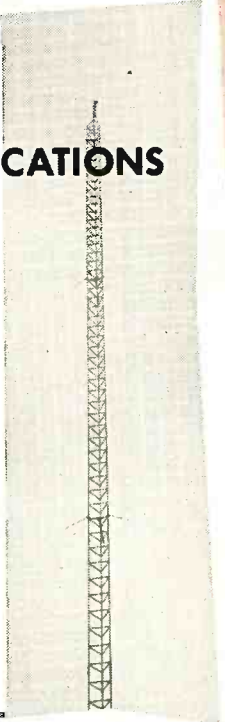
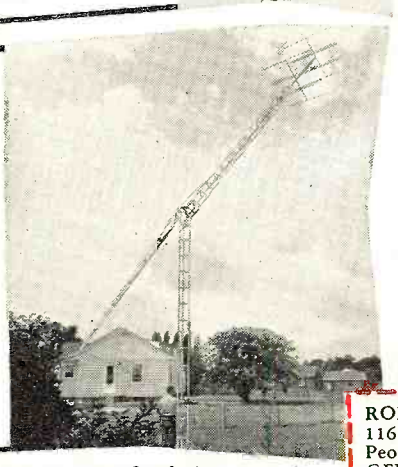


3 AMATEUR USE

Another major field of usage for Rohn Towers is in the field of amateurs and experimenters. The especially designed "fold-over" tower is the *best in the field* for the amateur because it allows working on the antenna *on the ground*. Thousands of amateurs use Rohn Towers with a tremendous demand still to be sold. You can supply this demand in your area and capture BIG PROFITS for yourself.



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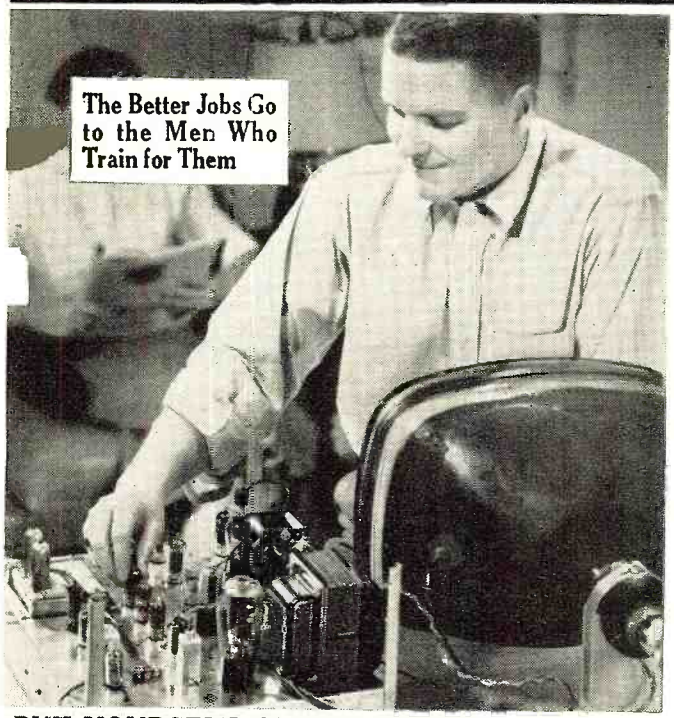

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THE STEREO DISC

CONGRATULATIONS are in order—for once the high-fidelity industry, after extensive laboratory analysis by the best technicians in the field, has come up with an answer in regard to a standard stereo disc system. Although the vote isn't in, it seems obvious that it is almost a unanimous opinion that the *Westrex* system will become the industry-wide standard and, considering that it has only been a number of months since the stereo demonstrations by *Westrex* and *London,* we believe that the high-fidelity industry has done a remarkable job.

The *Westrex* system is known as the 45°-45° method. To best explain the operation of this system, let's look at the record itself. The separate channels are recorded individually on the two sidewalls of the tiny record groove. A single stylus riding in the center is moved in one direction at a 45° angle to pick up the recording from one side of the groove. It is moved perpendicular to the first channel to pick up the second channel.

The stylus movement, instead of being completely lateral as in monaural playback, now combines both hill-and-dale and lateral motion. The two separate channels being picked up individually by separate coils (in a magnetic cartridge) are then passed on through a normal two-channel system.

There is no doubt that the advent of stereo discs will be a terrific boon to the high-fidelity industry, affecting not only one group of manufacturers but practically everyone in the industry, including preamplifier, power amplifier, and speaker manufacturers. Stereo, in itself, adds such depth and realism to recorded music that for those who have not yet had the pleasure of hearing it, it would be beyond imagination.

The new stereo discs will not obsolete present high-fidelity systems. Your present equipment can be used as one of the channels and all that will be required is a stereo cartridge and equipment for the second channel which most likely will include preamplifier, power amplifier, and speaker system.

The new stereo cartridge will require three or four wires instead of the conventional two so the conversion problem would seem to be simply a rewiring operation.

Do not, however, be misled by the many comments that have been made in promotional pieces and other publications as to the apparent simplicity of adapting your present equipment for stereo operation. In the final analysis, only the best equipment, and now we are considering only the cartridge, tone arm, and record player, will provide the ultimate quality that would dignify the term "high-fidelity reproduction."

Since this new system employs, in part, a hill-and-dale recording principle, it is only reasonable to believe that turntable rumble will become a more serious problem. In monaural recording, since only lateral motion is employed, most cartridges are heavily damped, thereby reducing the rumble component. Since this is not true in stereo, only the better turntables will be found applicable.

Another point of importance is that the tone arm and cartridge assembly cannot be tilted in any one direction. The stylus pressure must be equally distributed on both sides of the groove.

As far as compatibility is concerned, there is no problem in using a stereo cartridge to play monaural records. However, the reverse is not true. It will not be possible to play stereo records using a monaural cartridge in most cases. This should be quite obvious in that monaural cartridges, as mentioned previously, are heavily damped vertically and therefore can seriously damage the stereo disc.

Cartridge manufacturers have had a field day—*Electro-Sonic Labs., Electro-Voice, Fairchild,* and *Pickering* have all announced samples for test purposes. *Fairchild* hopes to have its cartridge available to the general public by the time you read this. The announced prices range from $19.50 for *Electro-Voice's* ceramic to $79.50 for a *Fairchild* magnetic.

Record manufacturers are doing a lot of work trying to solve their own problems. *Audio Fidelity Records* has made available sample records to those in the industry but no one company has made any commitments as to when stereo discs will be available to the consumer. Our guess is that the Fall line will include quite a large assortment with the high point coming at the High-Fidelity Show here in New York in October.

The one big concern is the effect that this new disc will have on stereo tape equipment manufacturers. The general belief is that it will not be detrimental. Any stimulation of interest in stereo on the part of the consumer will obviously result in greater sales of both turntables and tape recorders. It is the general belief that when it comes to quality, tape will be on top. Another outlook is that stereo tape can always go to three-channel stereo instead of two, which is not foreseeable with the disc at the present time. . . . . W.S.

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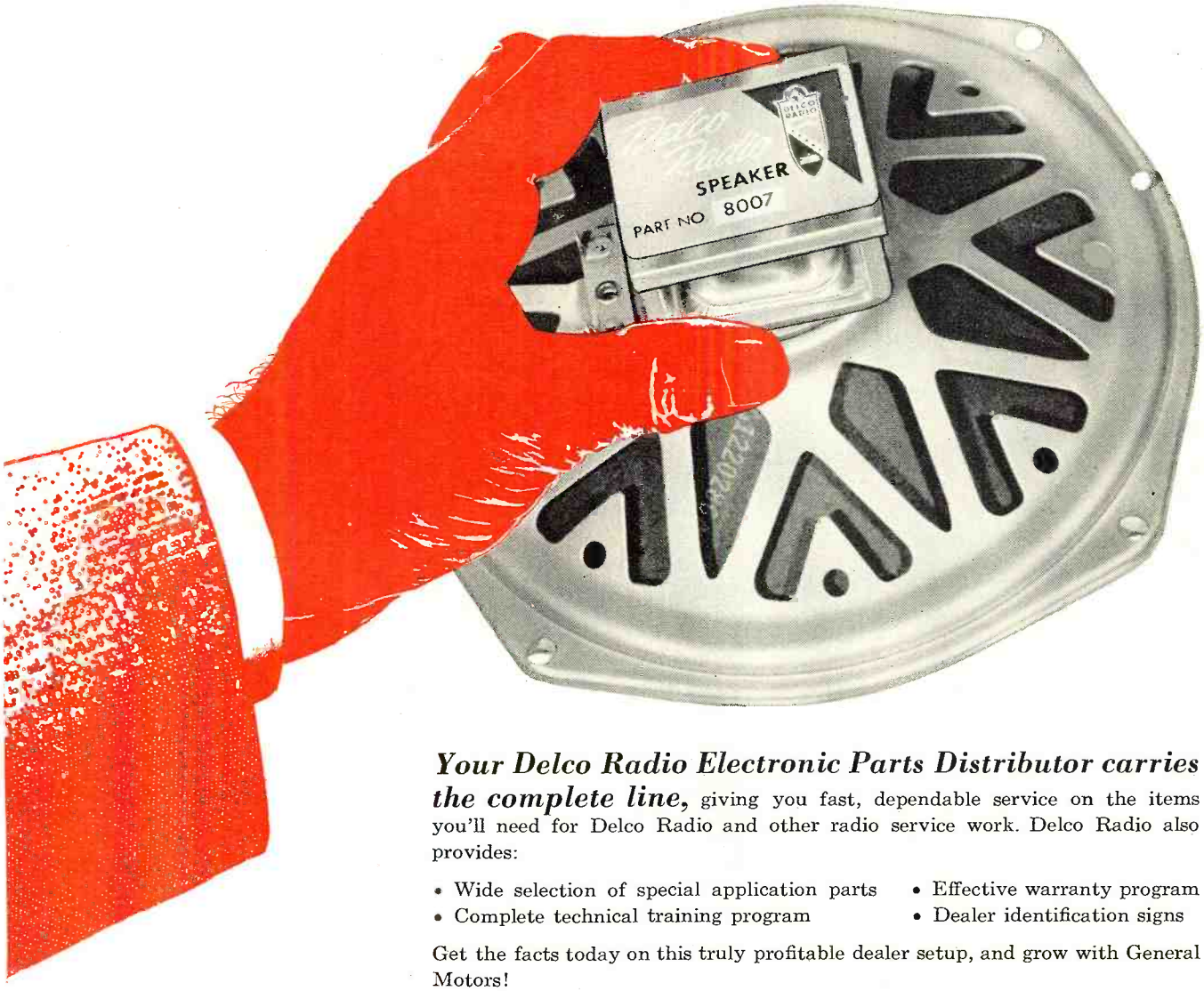

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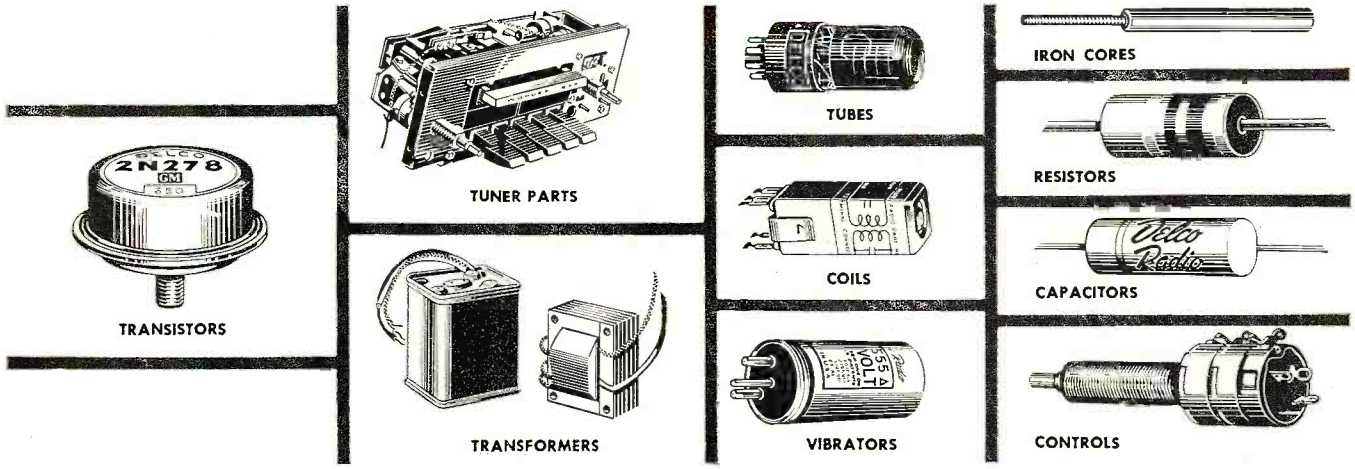

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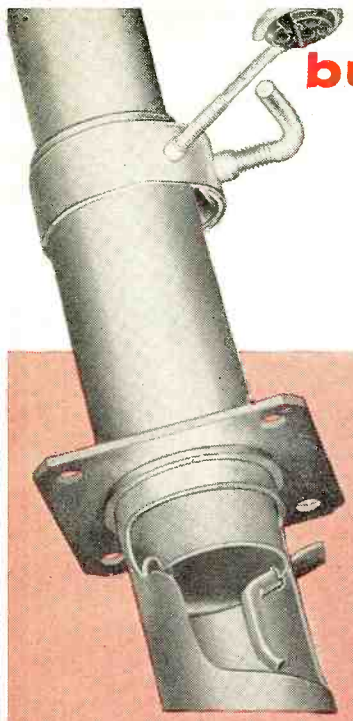

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Cash-In On Channel Master's Consumer Popularity! Feature these top-quality accessories bearing the nationally advertised Channel Master name.

MOUNTS COUPLERS STANDOUT INSULATORS GUY WIRE

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.
WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

Only CHANNEL MASTER offers you this

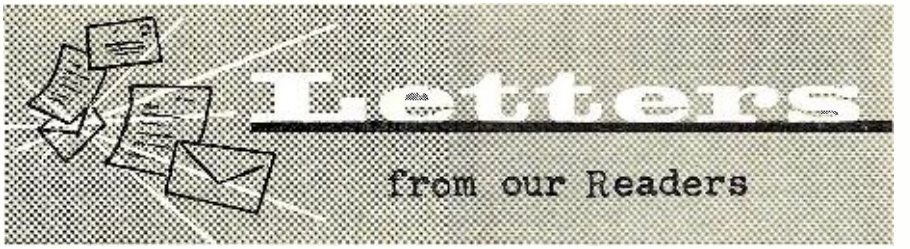
"SUPERMARKET" VARIETY of TV WIRE

Your choice of 37 models...14 different types...of VHF, UHF, and Rotor Wires

- **NEW! JUMBO TRANSMISSION WIRE — extra heavy-duty 170/18 and 155/20 wire.**
- **NEW! "SUPER FOAM" TRANSMISSION WIRE — superb-quality foam poly insulation.**

When you feature Channel Master you have the widest selection of TV wire . . . plus premium quality for longer life and better performance — at no extra cost. That's why . . .

"Live Wire" Dealers use Channel Master Exclusively



ULTRASONIC GENERATOR

To the Editors:

I have recently subscribed to RADIO & TV NEWS. I find it to be an interesting and informative magazine.

As a science student in school, I have been asked to construct a device which generates ultrasonic sound. The device which I would like to construct does not have to be too powerful as it is just intended for demonstration purposes.

STEPHEN BURNS
Romeo, Michigan

Quite a few students, and some teachers, too, have written to us for some type of device that could be used to demonstrate principles involving very-high-frequency sound or ultrasonics. A very simple unit which would be fine for the purpose is the "Transistorized Ultrasonic Generator" described by Louis Garner in our May, 1957 issue. This uses a readily available high efficiency horn tweeter as the transducer. If you don't have this back issue and your local library can't help, you might try our Circulation Dept. at 64 E. Lake Street, Chicago 1, Ill. for a copy. Enclose 40 cents.—Editor.

* * *

TUBE TESTER CHARTS

To the Editors:

This is to enlist your assistance in obtaining a new tube tester data chart for my tester which was purchased a year and a half ago. I have written to the manufacturer more than a dozen times in the last year and a half and have always received a letter saying that a new test chart was being prepared by engineering and would be sent when completed. You and I know that a manufacturer should put out new test charts at frequent intervals as new tubes are developed and put on the market.

Perhaps if you will voice my complaint and others like mine, it will hurry completion of the chart. I have over a hundred dollars in this tester and I must have data that will enable me to have up-to-date information. The manufacturers of the unit certainly must have some obligation in this particular regard.

PAUL D. LADD
Ladd's TV-Radio Service
Albuquerque, New Mex.

Most tester manufacturers are pretty well aware of their obligations on this score. Many record requests for such charts and send out new charts when they are available. Of course, we are also trying to help by publishing such information regularly as it becomes available.—Editor.

* * *

SURPLUS GEAR CONVERSIONS

To the Editors:

I possess an AN/ARR-1 radio receiver which I would like to convert for use by adding a power supply but making no modifications in band coverage. I heard that you wrote up this conversion in the January 1949 issue of RADIO & TV NEWS. I would like to know if you can send me a reprint of this article or information on making the conversion.

STEVEN BEEFERMAN, KN2VWI
Bayside, New York

We are sorry that some of the older issues of RADIO & TV NEWS *with surplus gear conversions are no longer available from us. You might try your local library for the back issues required. Another suggestion is to write to R. E. Goodheart, Box 1220, Beverly Hills, Calif. for their latest list of surplus gear technical information, conversions, and manuals. This company makes a specialty of reprinting the type of material that you are interested in. They also have reprints of quite a few of the early articles that have run in this magzine that are still so frequently requested by our readers.—Editor.*

* * *

MULTIBAND FM RECEIVER

To the Editors:

In your June, 1957 issue you ran an article on a "Multiband FM Receiver" by Ed Bohr. Although you do give the specs on the main tuning capacitor (C_6-C_{31}) in the parts list, I am having difficulty in finding a unit to use. Please give the manufacturer and model number of this capacitor.

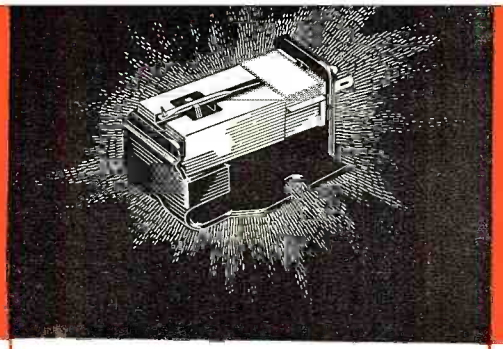
HERBERT JOHNSON
Marshfield Hills, Mass.

To the Editors:

Please refer to the schematic diagram of the multiband FM receiver which appears on page 68 of your June issue. What has happened to the heater supply for V_7?

THOMAS D. INGHAM
Sao Paulo, Brazil

From the large amount of correspondence received on the above circuit, a good many of our readers are building this receiver. The tuning capacitor is a dual 25 μμfd. ganged unit and any of the following should be suitable: Johnson 25LD15, Bud LC-1661, Cardwell PL-6030, and Hammarlund MCD-35MX. Regarding the heater supply for V_7, the squelch tube, this may be obtained directly across the pilot light.—Editor.



NOTICE!

DO N'T BUY A NEW

high fidelity phonograph cartridge until you've read this vital stereo report . . .

SPECIFICATIONS

RESPONSE: 20-16000 cps. ±2.5 db to RIAA
ELEMENTS: Ceramic
OUTPUT: (Westrex 1A) .5 volt rms.
COMPLIANCE: 2. x 10^{-6} CM/dyne
TRACKING FORCE: 6 grams
WEIGHT 2.4 grams
STYLUS: .7 mil
MOUNT: EIA (RETMA). Standard ½" and 7/16" centers
CHANNEL ISOLATION: 20 db

THE MISSING LINK to popular-priced stereophonic sound reproduction has been found: It's the new Electro-Voice TOTALLY COMPATIBLE Stereo Cartridge . . . plays the new stereo discs superbly . . . LP's too . . . even better than existing cartridges.

By breaking the stereo cartridge cost bottleneck, Electro-Voice has made popular-priced quality stereo a reality. E-V's ceramic stereo cartridge (Model 21D with .7 mil diamond stylus) sells for only $19.50 (Audiophile net) and is available now at your audio dealer or from your serviceman.

Here are some of the answers to your questions concerning stereo:

Q How does the COMPATIBLE E-V Stereo Cartridge differ from CONVENTIONAL cartridges?

A It has the ability to play both the new type stereophonic discs and conventional records. Inherent in its design is an improved monaural performance. *Exclusive* design for rumble suppression of 15 db or better will permit the use of Electro-Voice's Stereo Cartridge *with any type of changer or transcription player!*

Q Are stereo discs compatible with conventional cartridges?

A Most cartridges damage the stereo record. DO NOT BUY STEREO DISCS UNTIL YOU HAVE AN E-V STEREO CARTRIDGE. You may then play monaural or stereo discs monaurally. Add a second speaker and amplifier, and you have stereophonic sound.

Q What about modification problems?

A Using an Electro-Voice Stereo Cartridge, which is constructed so that its output is already corrected to the RIAA curve, you will not require the equalization of the *second* amplifier. Inserting the cartridge is simple. It will fit virtually any standard tone or transcription arm. The addition of a second amplifier and speaker is not complicated.

Q What about record availability?

A Recordings by major record manufacturers will b available in mid-1958.

Q What effect will stereo cartridges and records hav on your present equipment?

A Only your cartridge will be obsolete. All other com ponents are compatible with stereo.

Q What if you don't have a HI-FI system now . . . shoul you wait?

A *No.* Proceed as before—with one exception: you shoul insist on a stereo cartridge initially. When you are read for stereo, merely add a *second* speaker and amplifier.

Q How do you go about getting your Electro-Voic Stereo Cartridge?

A Visit your dealer. If you don't know the name o your nearest dealer, please write Electro-Voice. Ask fo E-V Stereo Model 21 D with .7 mil diamond stylus o E-V Stereo Model 26 DST Turnover with .7 mil dia mond Stereo tip and 3 mil sapphire tip for monaura 78 rpm records ($22.50).

STEREO IS HERE

NOW STEREO

don't buy an obsolete cartridge . . . replace with the totally compatible Electro-Voice stereo cartridge

Electro-Voice®

ELECTRO-VOICE, INC.
BUCHANAN, MICHIGAN

CANADA: E-V of Canada Ltd., 1908 Avenue Road, Toronto, Ontario
EXPORT: 13 East 40th Street, New York 16, U.S.A., Cables: ARLAB

World's leading manufacturer of Microphones, Cartridges, High Fidelity Speakers and Enclosures, Professional Electronic Instruments and Public Address Speakers.

KNIGHT STEREO PREAMP

To the Editors:

In the January 1958 issue of RADIO & TV NEWS there was a report on page 92 on the "Knight Stereo-Monaural Preamp" which we certainly appreciate.

However, your writer made an error in indicating that this was in the Knight-Kit line. Actually, the stereo preamp is from our line of wired components and should have been so indicated.

J. W. RUBIN
Allied Radio Corp.
Chicago, Illinois

Sorry about our error in this regard. All other details concerning the unit are correct as shown.—Editor.

* * *

"REPAIRMAN'S PARADISE?"

Articles have appeared recently in two nationally circulated magazines containing serious charges of unethical practices by the nation's radio and television technicians. These articles placed emphasis on the comparatively rare but more sensational examples of unethical practice, instead of praising the less newsworthy but vast majority of competent, honest service technicians. The Electronic Industries Association (EIA) Service Committee has written to the editors of the two publications taking exception to the views expressed and indicating that the vast majority of technicians are sound, ethical businessmen and are technically competent. The EIA Letter to the Editors goes on to enumerate the specific things that the various service associations and radio and TV manufacturers are doing to prevent the kind of incompetency and dishonesty cited in the articles. Following is the final paragraph of the letter, which summarizes the view of the electronics industry and our own view on the subject as well.

We, of the electronics industry, believe that the TV servicing industry is basically sound and that the majority of TV servicemen are technically competent and are ethical and honest businessmen, sincerely interested in improving themselves and their service to their customers. We also know, from actual impartial survey data, that over 90% of the American public is satisfied with its TV and radio service. Therefore, your article appealed directly to about 10% of the TV-radio owners and served only to create unfounded doubts in the minds of the majority. The press should recognize these facts and publish them to help build the tremendous and vitally necessary servicing industry instead of undermining the constructive work that has been and is currently being done.

K. H. BROWN, Chairman
Service Committee, EIA

J. A. MILLING, Chairman
Jobber Relations Committee, EIA

-30-

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these valuable all-steel file cabinets with your purchase of

PHOTOFACT *the world's finest TV-Radio Service Data*

NOW—FOR PHOTOFACT SUBSCRIBERS! You can get these File Cabinets ABSOLUTELY FREE from Howard W. Sams if you are a regular subscriber to PHOTOFACT and buy each Set as issued monthly...

NOW—FOR PHOTOFACT LIBRARY PURCHASERS! You can get FREE File Cabinets as you complete your PHOTOFACT Library. What's more, you can own the PHOTOFACT Library the **NEW EASY-BUY WAY:** There's no interest. There's no carrying charge. And Howard W. Sams will give you **ABSOLUTELY FREE** all the steel file cabinets you'll need for your Library.

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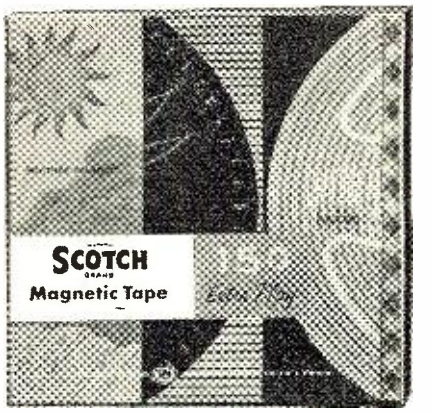
LOWER



NEW

MINNESOTA MINING AND

...WHERE

The term "Scotch" is a registered trademark of 3M Company, St. Paul 6, Minn. Export: 99 Park Avenue,

PRICES!

Now SAVE UP TO 28% on these three super-strong SCOTCH BRAND Magnetic Tapes with Polyester backings!

Good news for tape fans! "SCOTCH" Brand boosts production of its new Polyester-backed tapes. So, down go prices on three of your favorites! Now's the time to take advantage of the big reductions. Save as much as 28% on "SCOTCH" Magnetic Tape 150, weather-balanced for perfect response in any climate, any temperature . . . "SCOTCH" Magnetic Tape 102, popular best seller . . . and brilliant "SCOTCH" "High Output" Magnetic Tape 122. All three tapes feature super-strong Polyester backings plus "SCOTCH" Brand's own precision oxide dispersion for flawless fidelity and exclusive silicone lubrication, genuine built-in protection for your recorder head. Buy today and enjoy these big, big tape savings!

TAPE!

It's SCOTCH BRAND 200 Tensilized Double-Length Tape . . . first to give you DOUBLE-STRENGTH with double length!

This is it—the magnetic tape that makes all the others seem old-fashioned. "SCOTCH" Brand waited until it had perfected an extended play tape of unmatched quality. Now, here it is—the original no-break, no-stretch tape. It's twice as strong, plays twice as long. "SCOTCH" 200 Tensilized Double-Length Tape was first with a Polyester backing twice as strong as other tapes, first with an ultimate tensile strength of 6.8 pounds! Others try to imitate "SCOTCH" 200 Tensilized Double-Length Tape, but no other tape equals the outstanding original. So, why settle for imitations when you can buy the original at no extra cost? Find out what's really new in tape recording. Today ask your dealer for "SCOTCH" 200 Tensilized Double-Length Tape.

MANUFACTURING COMPANY

RESEARCH IS THE KEY TO TOMORROW

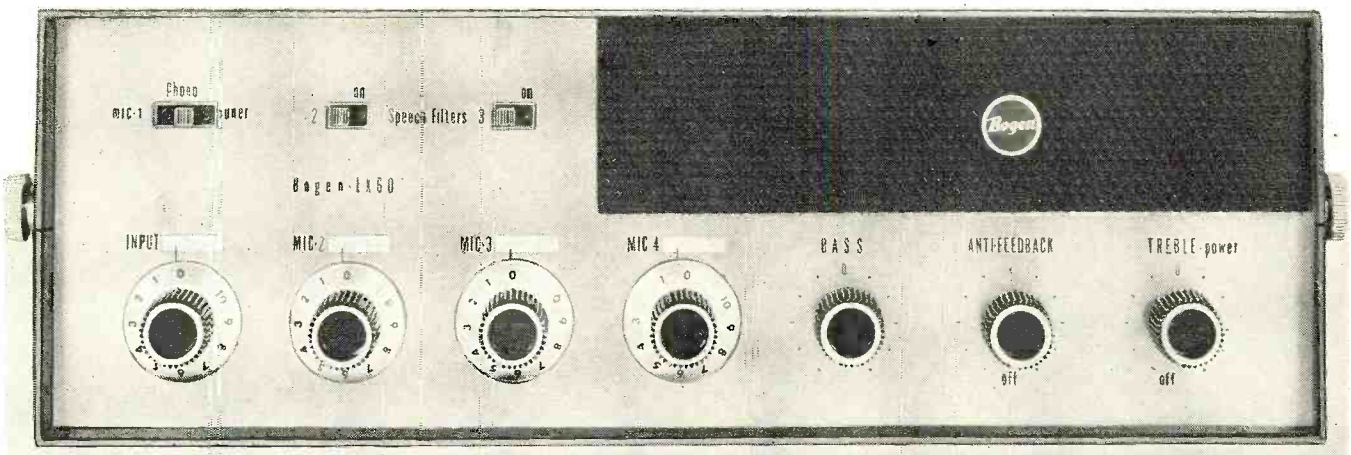
3M COMPANY

New York. Canada: London, Ontario. ©3M Co., 1958

portable  *. . . or permanent*

BOGEN FLEX-PAK®

MAKES EVERY PA JOB AN EASY ONE



pre-engineered to serve 90% of your sound installations

Deluxe LX30 30-Watt Amplifier

4 Microphone Inputs (panel switch converts one microphone channel for phono or tuner); Built-In Remote Gain-Control Circuit; Exclusive Anti-Feedback Control; Speech Filters; Separate Bass and Treble Tone Controls.

H. 5⅜", W. 16¼", D. 13". Wgt.: 25 lbs.

Superb L330 30-Watt Amplifier

3 Microphone Inputs (panel switch converts one microphone channel for phono or tuner); Speech Filters; Separate Bass and Treble Tone Controls.

H. 5⅜", W. 14¼", D. 13". Wgt.: 24 lbs.

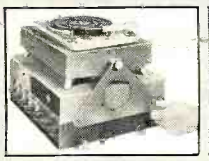
BOGEN'S FLEX-PAK LINE has the flexibility you need to meet virtually every PA installation problem. Flex-Pak units are light, compact, portable, and can be used separately or grouped together. The amplifiers are available in every popular price range and power output . . . 13 models in all. That's why, with Flex-Pak, you can tailor the sound system to fit the job, with none of the fuss and bother of custom installations.

And remember—you can look to Bogen for *all* your sound equipment needs . . . speakers, microphones, turntables, tuners, and accessories. See your Bogen distributor today.

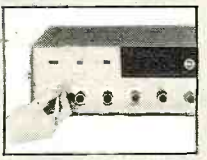
EASY SERVICE . . . EASY INSTALLATION

Loosen 4 thumbscrews and the lid's off for fast, easy servicing.

Folds back when not in use in easy-sliding wall-mount bracket.



4 thumbscrews attach accessory record player mount.



Easily erased write-in's on gain controls mark level settings.

Bogen *A Division of The Siegler Corporation*

EVERYTHING IN SOUND

MAIL COUPON TODAY

David Bogen Company, Paramus, N. J., Dept. S-4

Gentlemen: Please send me descriptive catalog on your BOGEN FLEX-PAK *Public Address Equipment and 24-page, illustrated brochure, "What You Should Know About Sound Systems."*

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Check one ☐ *dealer* ☐ *distributor* ☐ *sound specialist*

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MANUFACTURERS OF HIGH-FIDELITY COMPONENTS, PUBLIC ADDRESS EQUIPMENT AND INTERCOMMUNICATION SYSTEMS

WE'RE MAKING IT EASIER THAN EVER TO BECOME A WELL PAID RADIO-TELEVISION SERVICE TECHNICIAN

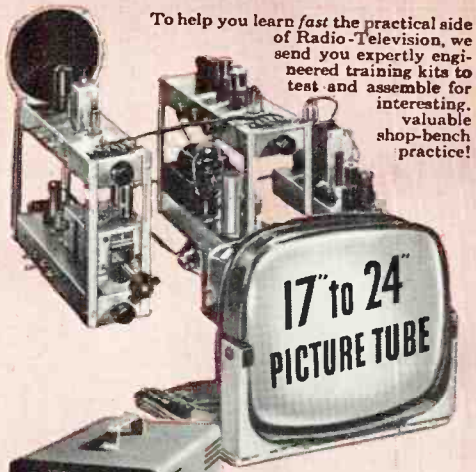
NOW – Just $6 Starts You Training in

RADIO-TELEVISION

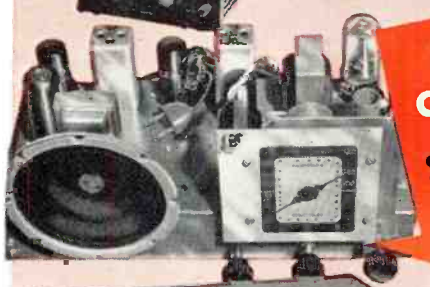
the SPRAYBERRY "Learn-by-Doing" Way . . .

25 BIG, COMPLETE KITS of PARTS & EQUIPMENT

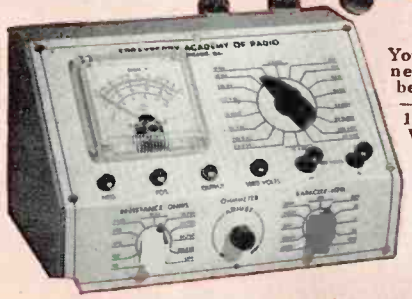
To help you learn *fast* the practical side of Radio-Television, we send you expertly engineered training kits to test and assemble for interesting, valuable shop-bench practice!



- The new Sprayberry Training Television Receiver, built and tested in 5 sections.
- Now offered . . . this fine modern oscilloscope.
- You build this powerful two-band superheterodyne radio receiver.



Big New CATALOG AND Sample Lesson FREE!



You build the new Sprayberry tester—a complete 18-range Volt-Ohm-Milliammeter test meter.

★ ★ ★ ★ This great industry is begging for trained men . . . to step into good paying jobs or a profitable business of their own! Our new plan opens the doors of Radio-Television wide to every ambitious man who is ready to act at once!

Men by the thousands . . . trained Radio-Television Service Technicians . . . are needed at once! Perhaps you've thought about entering this interesting, top paying field, but lack of ready money held you back. Now—*just $6 enrolls you* for America's finest, most up to date home study training in Radio-Television! Unbelievable? No, the explanation is simple! We believe Radio-Television *must* have the additional men it needs as quickly as possible. We are willing to do our part by making Sprayberry Training available for less money down and on easier terms than ever before. This is your big opportunity to get the training you need . . . to step into a fine job or your own Radio-Television Service Business.

Complete Facts Free—Act Now; Offer Limited

Only a limited number of students may be accepted on this liberal and unusual basis. We urge you to act at once . . . mail the coupon below and get complete details plus our big new catalog and an actual sample lesson—*all free.* No obligation . . . no salesman will bother you.

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Under world-famous 27-year old Sprayberry Plan, you learn entirely at home in spare time. You keep on with your present job and income. You train as fast or as slowly as you wish. You get valuable kits of parts and equipment for priceless shop-bench practice. And everything you receive, lessons and equipment alike, is all yours to keep.

LET US PROVE HOW EASILY YOU CAN LEARN!

Radio-Television needs YOU! And Sprayberry is ready to train you on better, easier terms, that any ambitious man can afford. *Just $6 starts you!* Mail coupon today . . . let the facts speak for themselves. You have everything to gain. Let us prove the kind of opportunity that's in store for you!

SPRAYBERRY Academy of Radio-Television
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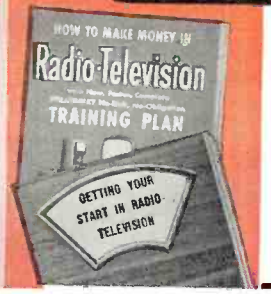
Mail This Coupon Now—No Salesman Will Call



Sprayberry Academy of Radio-Television
Dept 25-F, 1512 W. Jarvis Ave., Chicago 26, Ill.

Please rush all information on your ALL-NEW Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Include New Catalog and Sample Lesson FREE.

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NOW! Mr. Service Dealer

PHILCO announces the 1958 Philco power-packed "PLUS 10" BATTERY PROGRAM for Plus Profits for you!

NOW, MR. DEALER GET UP TO 10% OFF ON EVERY PHILCO PORTABLE BATTERY YOU BUY!

Plus

A BEAUTIFUL PHILCO BATTERY COUNTER DISPLAY!

Yours free with your battery order. Make up your own package with batteries you use every day.

This attractive battery counter display is designed to take up minimum counter space. Shows off a wide variety of batteries. Acts as a silent salesman in your store.

FREE

with your order of $75.00 (or more) in Philco Batteries

Plus 11 Sensational Free Offers!

Select the items you want from the sensational free offers illustrated on the opposite page. Yours free with your Philco Battery Order!

OOK AT THESE FREE OFFERS

(These in addition to the special portable battery discount.)

Select any combination of premiums you want!

FREE OFFER NO. 1

$3.50 VALUE

50 foot heavy duty extension cord and protected utility light. Yours with every $35.00 battery purchase.

FREE OFFER NO. 2

$3.50 VALUE

Flashing lantern and big powerful searchlight, complete with battery. When you buy $35.00 worth of batteries.

FREE OFFER NO. 3

$3.50 VALUE

Six 2-cell prefocused flashlights finished in gleaming chrome. With $35.00 worth of power packed batteries.

FREE OFFER NO. 4

$7.50 VALUE

"Pace" deluxe bathroom scale with magnified dial. When you order $75.00 worth of Philco batteries.

FREE OFFER NO. 5

$7.50 VALUE

Heavy duty hand truck . . . A must in every service shop. Holds up to 500 lbs. With $75.00 worth of batteries.

FREE OFFER NO. 6

$7.50 VALUE

Six tri-color beam flashlights for normal use and for safety signalling. Takes only $75.00 worth of Philco batteries.

FREE OFFER NO. 7

$7.50 VALUE

Rugged "Buckeye" all-steel utility steps. Rubber treads and seat. With your order for $75.00 in batteries.

FREE OFFER NO. 8

$7.50 VALUE

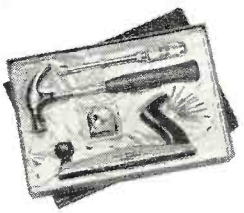
Six 5-cell powerful flashlights with prefocused spotlight for distances up to 1500'. Yours with $75.00 worth of batteries.

FREE OFFER NO. 9

$19.95 VALUE

Philco deluxe tube caddy that carries up to 250 tubes. When you buy only $200.00 worth of batteries.

FREE OFFER NO. 10



$19.95 VALUE

Stanley executive tool set with selected Stanley highest quality tools. When you buy $200.00 in batteries.

FREE OFFER NO. 11

$19.95 VALUE

"Luxo" lamp. Perfect glare-free illumination. Fully adjustable. Only $200.00 worth of batteries and it's yours.

See your Philco Distributor or mail this Coupon now!

PHILCO® Accessory Division

WORLD WIDE DISTRIBUTORS OF

Service Parts • Power Packed Batteries • Universal Components • Long Life Tubes • Heavy Duty Rotors • Star Bright 20/20 Picture Tubes • Long Distance Antennas • Universal Parts and Accessories.

Philco Corporation
Accessory Division
Attn: Carl Areschoug
Philadelphia 34, Penna.

I would like more information on Philco's Power Packed "Plus 10" Battery Program.

NAME.....

ADDRESS.....

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

RN-358

Within the Industry

W. D. RENNER has been appointed vice-president in charge of special services of *Howard W. Sams & Co., Inc.*, Indianapolis electronics engineering and publishing firm.

One of the twelve persons who formed the nucleus of the company in 1946, Mr. Renner has served in executive assignments in the sales and engineering divisions and in a liaison capacity with receiver manufacturers, electronic parts distributors, sales reps, and service technicians. He will further expand these activities in his new position.

He is vice-chairman of the EIA service committee, an engineering graduate of Purdue, a director of the Electric League of Indianapolis, and is active on several industry committees.

* * *

HARMAN-KARDON has announced the acquisition of a building at 110 Hopper St. in Westbury, N. Y. The new plant will supplement production facilities at 520 Main St. . . . **AEROVOX CORPORATION** has moved its West Coast Division facilities to Burbank, Calif. and is combining it with its **CINEMA ENGINEERING DIVISION** at 1100 Chestnut St. Separate factory rep organizations will be maintained for the two lines . . . **GENERAL PRODUCTS CORP.** of Union Springs, N. J., has just completed an extensive plant expansion program which increases floor space over two and one-half times the original area . . . **ROHN MANUFACTURING COMPANY,** Peoria manufacturer of a complete line of TV and communication towers, has acquired an additional 13,750 square feet of floor space by utilizing two buildings near the firm's present main plant-office building. Construction has also begun on a new and greatly enlarged galvanizing plant which will contain approximately 7000 square feet of space . . . **UNITED STATES ARMY COMBAT SURVEILLANCE AGENCY** has moved from the Pentagon to new quarters at 1124 N. Highland St., Arlington, Va. . . . **ZENITH RADIO CORPORATION** has opened a unique "showcase" on the ground floor of the new Tishman Building at the corner of 53rd St. and Fifth Ave. in New York. The company's radio, TV, and high-fidelity models will be displayed but no sales will be made at the "showcase" location . . . **CHESTER CABLE CORPORATION** of Chester, N. Y., has increased its total plant area to 200,000 square feet to provide additional production, storage, and laboratory facilities . . . **SYLVANIA ELECTRIC PRODUCTS INC.** has announced plans for a new 50,000 square foot laboratory and administrative headquarters building for its Mountain View Laboratories in California. Completion is scheduled for later this year . . . The Micronics Division of **ELGIN NATIONAL WATCH COMPANY** will occupy a new 60,000 square foot headquarters and combination development-production plant about September 1st of this year. The new plant is on the southern outskirts of Palatine, Ill., a suburban area 28 miles northwest of Chicago . . . **VIDEO INSTRUMENT COMPANY, INC.** has moved its engineering, manufacturing, and general office facilities to 3002 Pennsylvania in Santa Monica, Calif. The firm was formerly located at 2340 Sawtelle Blvd. in Los Angeles.

* * *

A. A. WARD, executive vice-president and director of *Altec Companies, Inc.*, has been elected president of the firm.

After graduating from Texas A. & M. with an electrical engineering degree, Mr. Ward worked four years for *Southwestern Bell Telephone Company* in Houston and in 1929 joined *Electrical Research Products Incorporated* to install and service theater sound equipment.

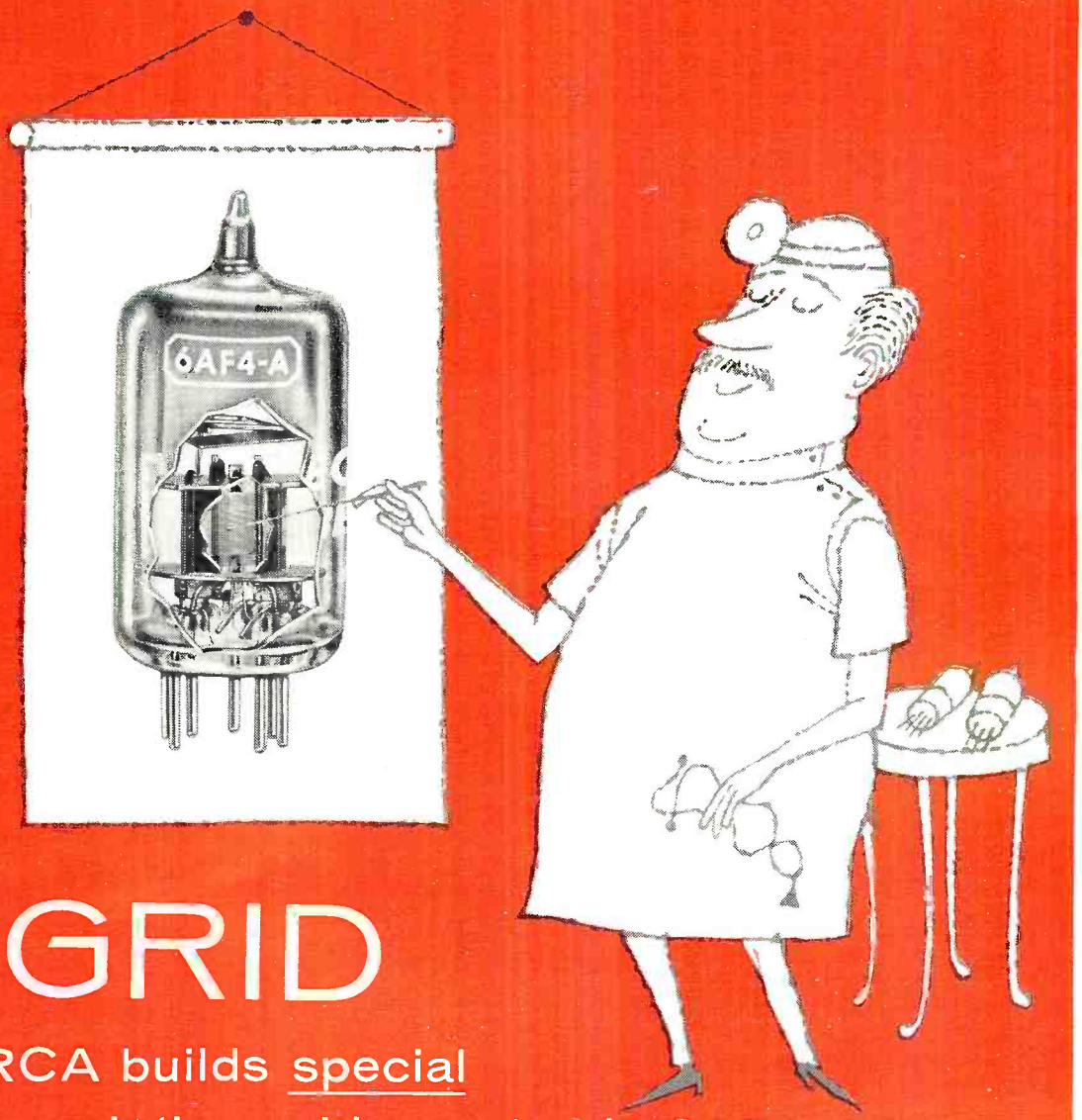
In 1937, he became head of specialty engineering with the newly formed *Altec Service Company* and has been associated with the firm ever since in various executive capacities.

He will maintain offices in the new *Altec Lansing Corporation* headquarters in Anaheim, California. The company also has offices in New York and in Los Angeles.

* * *

ORRADIO INDUSTRIES, INC. has established two new divisions to handle the growth of its tape line. The Instrumentation Tape Division will be headed by James D. Grady, Jr. while the Audio Products Division will have Robert D. Browning as manager . . . **STRETCH WIRE CORP.** has been organized to provide extensible cable for the electronics industry. The firm has set up sales offices at P. O. Box 893, New Rochelle, N. Y. and is headed by Michael L. Kaplan . . . **LITTON INDUSTRIES** has acquired all of the common stock of **MONROE CALCULATING MACHINE COMPANY** and will continue to operate the firm with its present management . . . The Board of Directors of **VAN NORMAN INDUSTRIES, INC.** has voted to integrate **INSULINE COR-**

anatomy of the tube... LESSON #1



GRID

How RCA builds special prescription grids...extends 6AF4-A life!

RCA's redesign of the 6AF4-A has resulted in minimized slump, product uniformity, and projected average life *of 4,000 hours or more!*

Here are some of the materials RCA "prescribes" in manufacturing the new 6AF4-A. The grid is plated with Palladium, a rare metal capable of withstanding high temperatures. The use of this grid structure minimizes interelectrode leakage, prevents grid loading, and as a result, provides stable tube performance. The cathode, a nickel alloy, is specially selected to reduce interface resistance and thus minimizes slump. The use of pins which are silver-plated reduces skin effect at ultra high frequencies and improves tuner performance.

All these features, in addition to dynamic life tests, help to assure long and dependable performance. No wonder RCA's 6AF4-A is tops!

So, here's the #1 lesson in radio, phonograph, and TV service— when ordering tubes for replacement, specify *"RCA Tubes only."*

RADIO CORPORATION OF AMERICA
Electron Tube Division **Harrison, N. J.**

PORATION OF AMERICA and **TRANSITRON, INC.** into a single unit to be known as the Electronics Division of **VAN NORMAN INDUSTRIES, INC.** The address will be 186 Granite St., Manchester, N. H. . . . **CARMINE-PADEN ASSOCIATES,** manufacturers' rep firm has changed its name to **CARMINE A. VIGNOLA ASSOCIATES.** The address, P. O. Box 569, Jefferson City, Mo., remains unchanged . . . **PYRAMID INSTRUMENT CORPORATION** of Lynbrook, N. Y. has announced the formation of a new division to be known as **SARGENT ELECTRIC CORPORATION.** Factory facilities are located at 630 Merrick Road, Lynbrook, N. Y.

* * *

GUSTAF A. WALLENSTROM has been named to the newly created position of consulting engineer on antenna system structures for the *General Electric Company's* Technical Products Department in Syracuse.

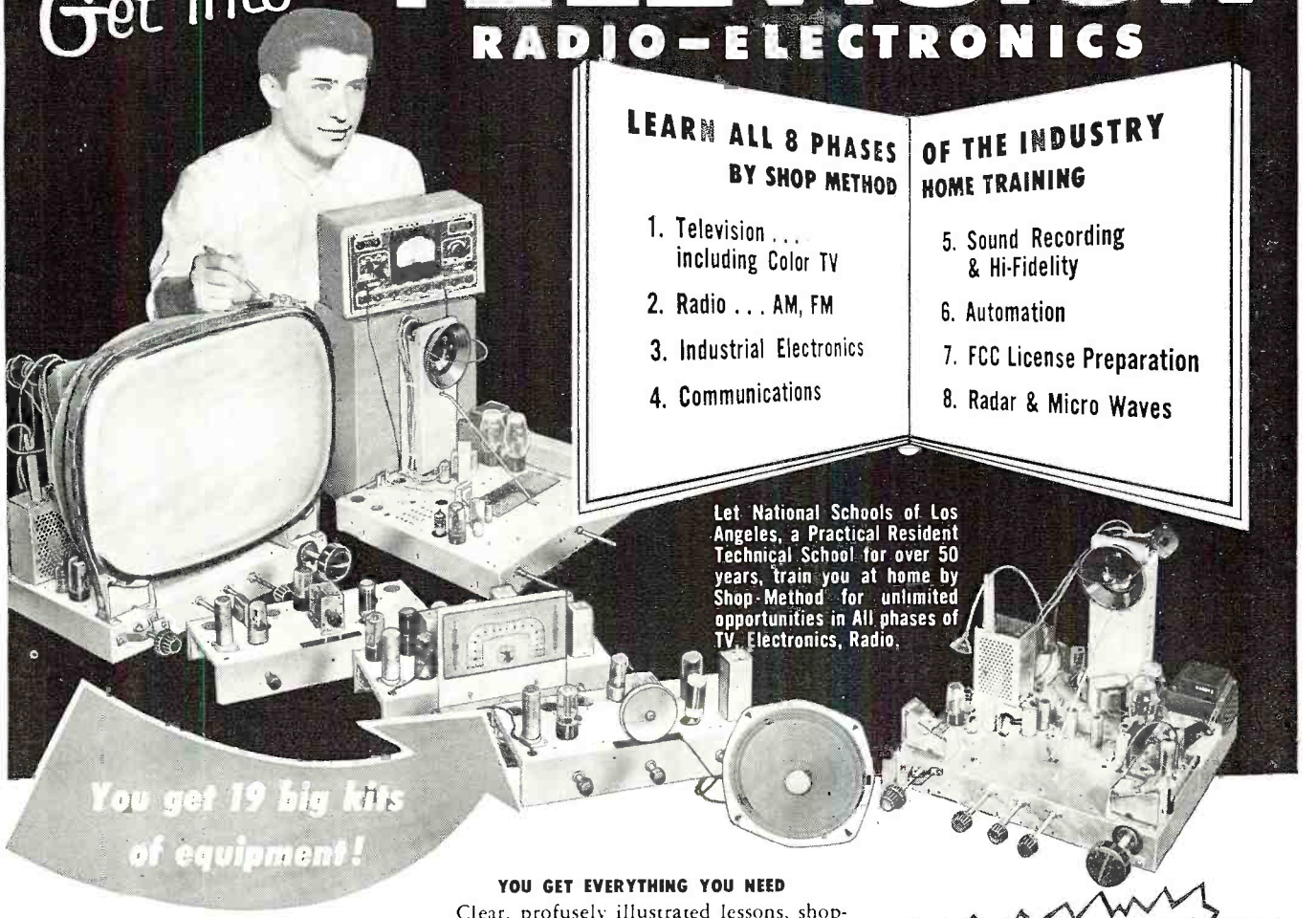
In his new post, Mr. Wallenstrom will be responsible for liaison and consulting work with department marketing, field-service, purchasing, and legal units and with outside customers and vendors. In addition, his wide experience gained in more than 28 years as a design and structural engineer for radio and TV antennas, towers, and foundations will be utilized for improving present products and developing new ones.

He has been with the company since 1924.

* * *

THOMAS ALLINSON has been named president and chief operating executive of the *Weston Instruments Division* of *Daystrom, Inc.* as well as *Daystrom Systems Division* of La Jolla, Calif., and *Daystrom-Weston Industrial Division* of Poughkeepsie, N. Y. . . . *Filtors, Inc.* of Port Washington, N. Y., has named **LOUIS DE LALIO** to the post of chief research and development engineer and added **MICHAEL GIORDANO** to its engineering staff . . . The Special Products Division of *Stromberg-Carlson* has named **MARTIN T. ZEGEL** to the post of product planning manager and upped **WILLIAM E. CUTLER** to sales manager of commercial products . . . **RICHARD N. GOLBACH** has been named to the newly created position of vice-president in charge of marketing for the Semiconductor Division of *Hoffman Electronics Corporation,* Evanston, Ill. . . . The post of sales manager of the manufacturers' division has been filled by *United Catalog Publishers, Inc.* with the appointment of **GEORGE M. KERNER** . . . **CURTIS KELLEY** is the new sales manager for consumer products of *National Company Inc.* He will be responsible for the sale of the firm's amateur and short-wave receiver line and marine products . . . *Rockbar Corporation* has appointed **THOMAS B. ALDRICH** industrial sales manager. He was formerly associated with *Presto* . . . **ED**

Get into TELEVISION RADIO-ELECTRONICS



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We prepare you for a long list of job opportunities. Thousands of TV and Radio receivers are being sold every day—more than ever before. And, now, Color TV is here. Applications of Electronics in industry—AUTOMATION—are growing in tremendous strides. The whole field is alive—opening up new, important jobs rapidly. National Schools complete training program qualifies you in all phases of the industry.

YOU EARN WHILE YOU LEARN

Many students pay for their entire training—and more—with spare time earning. We'll show you how you can, too! Early in your course you receive material that shows you how to earn extra money servicing TV and Radio receivers, appliances, etc., for friends and acquaintances.

YOU GET EVERYTHING YOU NEED

Clear, profusely illustrated lessons, shop-tested manuals, modern circuit diagrams, practical job projects—all the valuable equipment shown above—many other materials and services—consultation privilege with our qualified staff, and Graduate Employment Service. EVERYTHING YOU NEED for outstanding success in Electronics.

INDUSTRY NEEDS YOU. NATIONAL SCHOOLS WILL TRAIN YOU. SEND FOR FACTS TODAY NO OBLIGATION.

YOU LEARN BY SHOP METHOD . . . you do servicing, circuit analysis, and do over 100 down-to-earth experiments. You build a Superhet Receiver and a modern TV Receiver, from the ground up, including a new, big screen picture tube. You also receive a professional, factory-made MULTITESTER. All of this standard equipment is yours to keep . . . at just one low tuition.

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SHAFER is now heading a new market research unit in the Newark, N. J., sales office of *Blonder-Tongue Laboratories* . . . *Shure Brothers, Inc.* of Evanston has named **VINCENT E. EITZEN** to the post of technical assistant to the president of the firm. He has been associated with the company for 17 years . . . **JOSEPH B. CEJKA** is the new general sales manager for electronics at *The Gabriel Company* of Cleveland . . . The Distributor Division of *P. R. Mallory & Co., Inc.* has named **FRANK P. VENDELY** to fill the newly created post of merchandise manager . . . **C. ROBERT LANE** has been named eastern regional manager of *Andrew Corporation* of Chicago. He will maintain offices in Westwood, Mass. . . . *Midwest Research Institute* of Kansas City, Mo. has announced the promotion of **HAROLD L. STOUT** to the post of assistant manager of the engineering division.

* * *

HAROLD A. DeMOOY has been appointed manager of receiving tube operations for the Electron Tube Division of *Radio Corporation of America.*

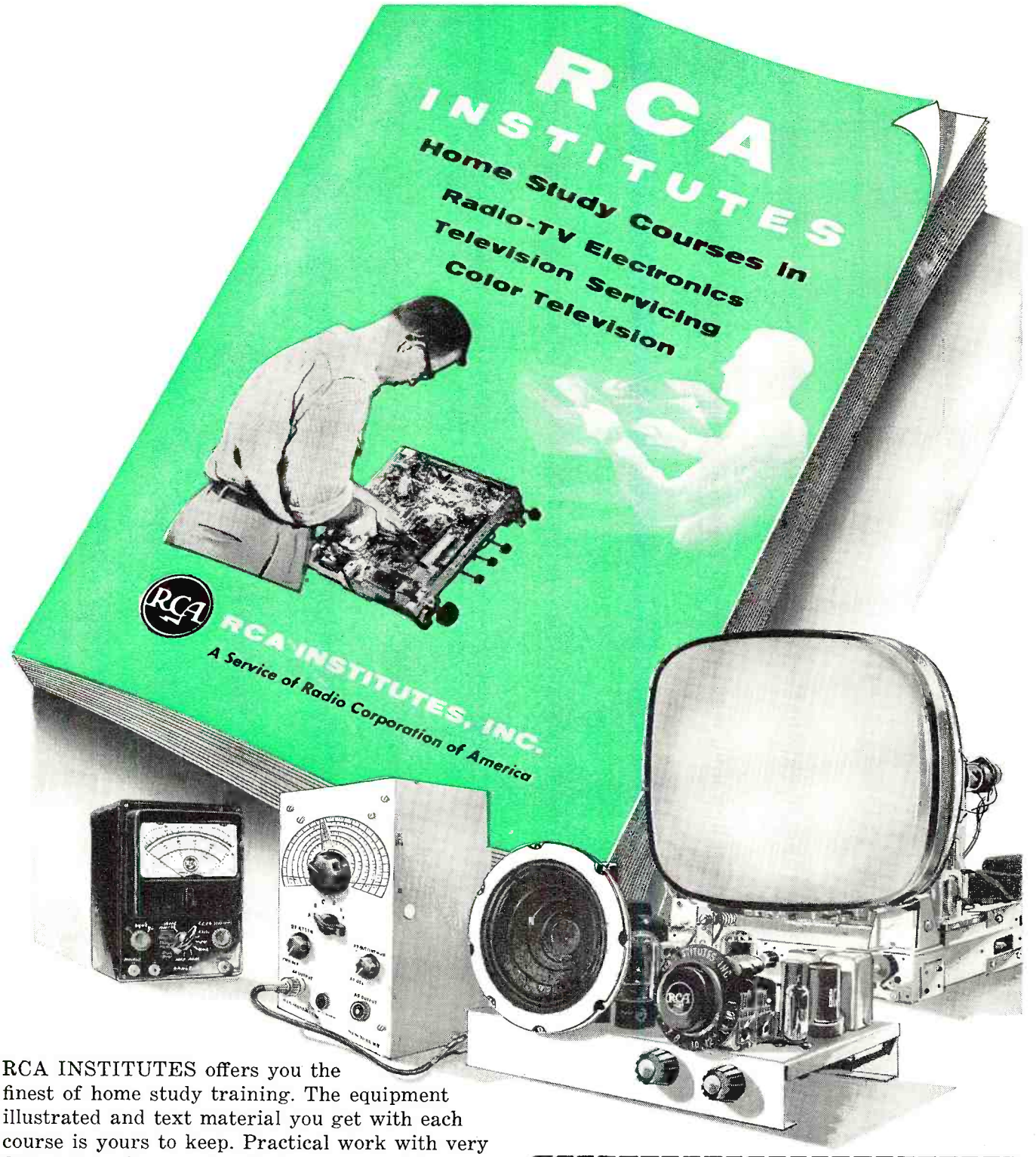
Prior to his new appointment, Mr. DeMooy was manager of manufacturing for the company's receiving tube activities in Harrison and Woodbridge, N. J., Indianapolis, Ind., and Cincinnati, Ohio.

A native of Cleveland, he attended Purdue University where he majored in electrical engineering. He joined *RCA* in 1926 as an engineer and has served the firm in various executive and engineering positions ever since.

* * *

R. K. SODERQUIST has been named vice-president and general manager of *Industrial Tubes, Inc.,* Geneva, Illinois manufacturer of industrial control tubes. He will also continue his post as a director of the firm. The company also announced that **WILLIAM D. BALL** has been appointed design engineer and will head up all of the design and development activities for the tube maker . . . **HEYWARD A. FRENCH** has been named an executive engineer at *Federal Telecommunication Laboratories,* Nutley, N. J. He has been with the company since 1943 . . . The *Helipot Division* of *Beckman Instruments, Inc.* has named **KARL E. HELLER** sales manager. He joined the parent firm in 1955 . . . **S. A. STANDING** has been appointed an assistant to the vice-president and general manager of *Raytheon's* Receiving Tube and Semiconductor operations. Prior to joining the firm 13 years ago, he was associated with *North American Philips Co.* . . . The appointment of **WILLIAM KORNHAUSER** as vice-president has been announced by *Federated Purchaser, Inc.* He has been with the distributing firm for 18 years . . . **PERCY L. SPENCER** has been elected senior vice-president of *Raytheon* . . . *Rockbar Corporation* has

(*Continued on page* 121)



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Sylvania TV Tuner Tubes

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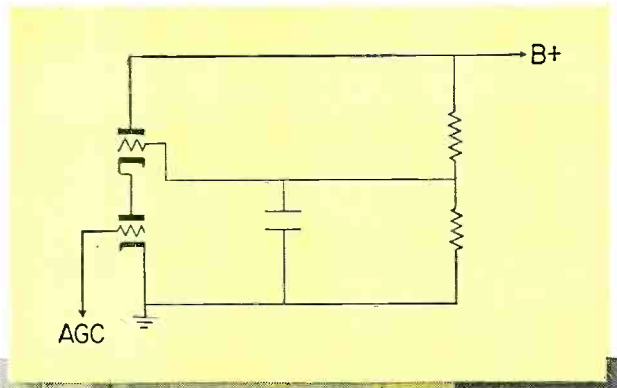
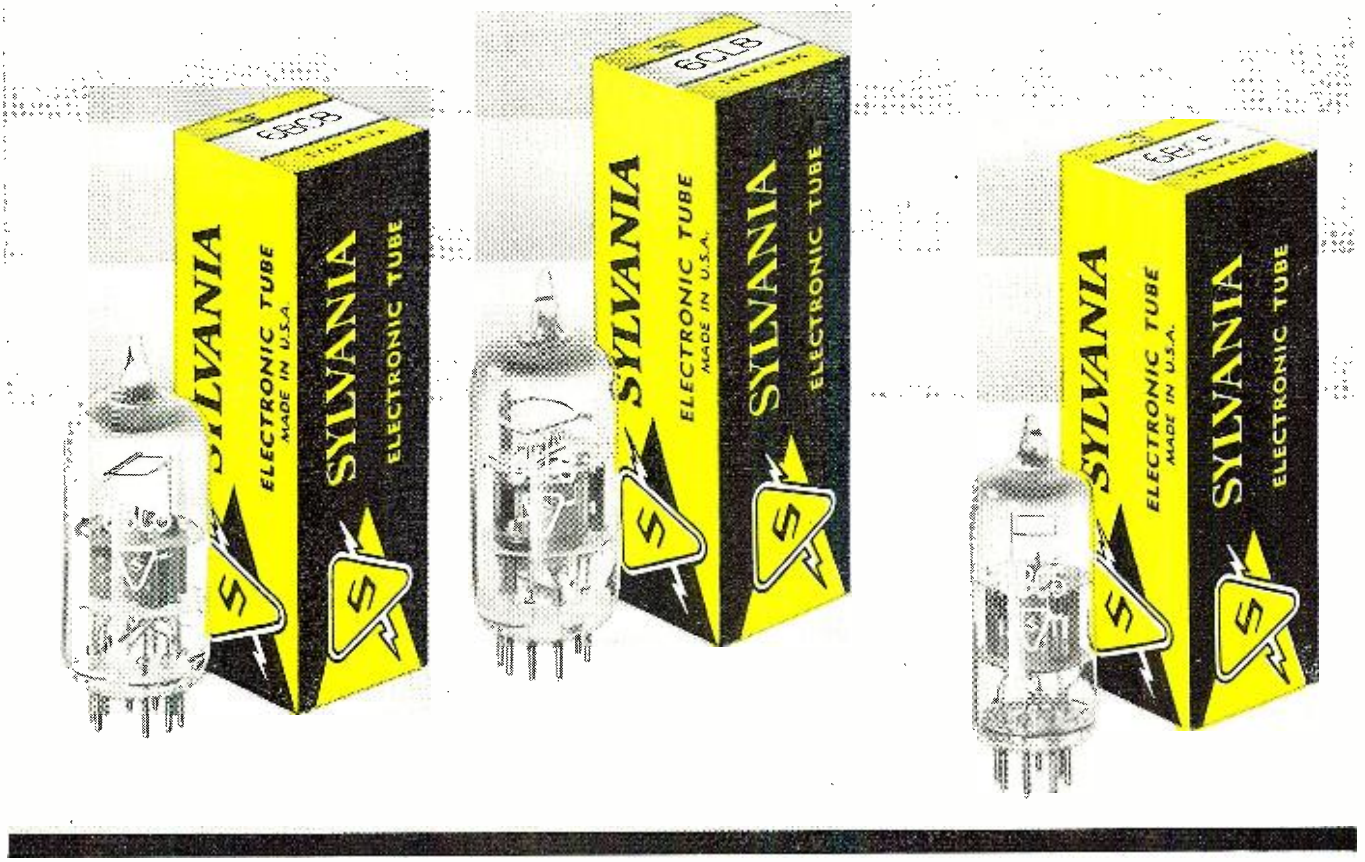


Simplified schematic is a typical cascode circuit in which double-triode amplifiers are tested for transconductance and plate current under actual operating conditions. In this way, Sylvania offers you maximum assurance of proper circuit performance when you repair TV tuners. Regardless of make or model TV, Sylvania tuner tubes mean dependability backed by industry's most exhaustive dynamic testing program.

Type by type, Sylvania's own JEMC (Joint Engineering and Manufacturing Committee) establishes test conditions which represent the most realistic measure of a tube's ability to stand up in the sets you service. Their working knowledge of the needs of TV tuner manufacturers eventually means greater service profits through less callbacks for you.



200 mc for controlled, dependable performance

Measuring input resistance and capacitance of all TV tuner tubes at 200 mc, places important controls over gain and tuning characteristics. This and many other tuner tube tests have been developed by Sylvania to provide you with maximum assurance of dependable performance regardless of make, model, or age of the TV sets you service.

All tuner tubes are fixed-bias tested under conditions which simulate actual applications in TV sets. Cascode types are subjected to series Gm and series Ib tests in typical circuits. In addition, all types are checked both before and during life tests for serviceability at high and low line voltages.

Protect yourself against costly and unnecessary callbacks. Specify Sylvania TV Tuner Tubes in the new yellow and black carton.

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., Montreal

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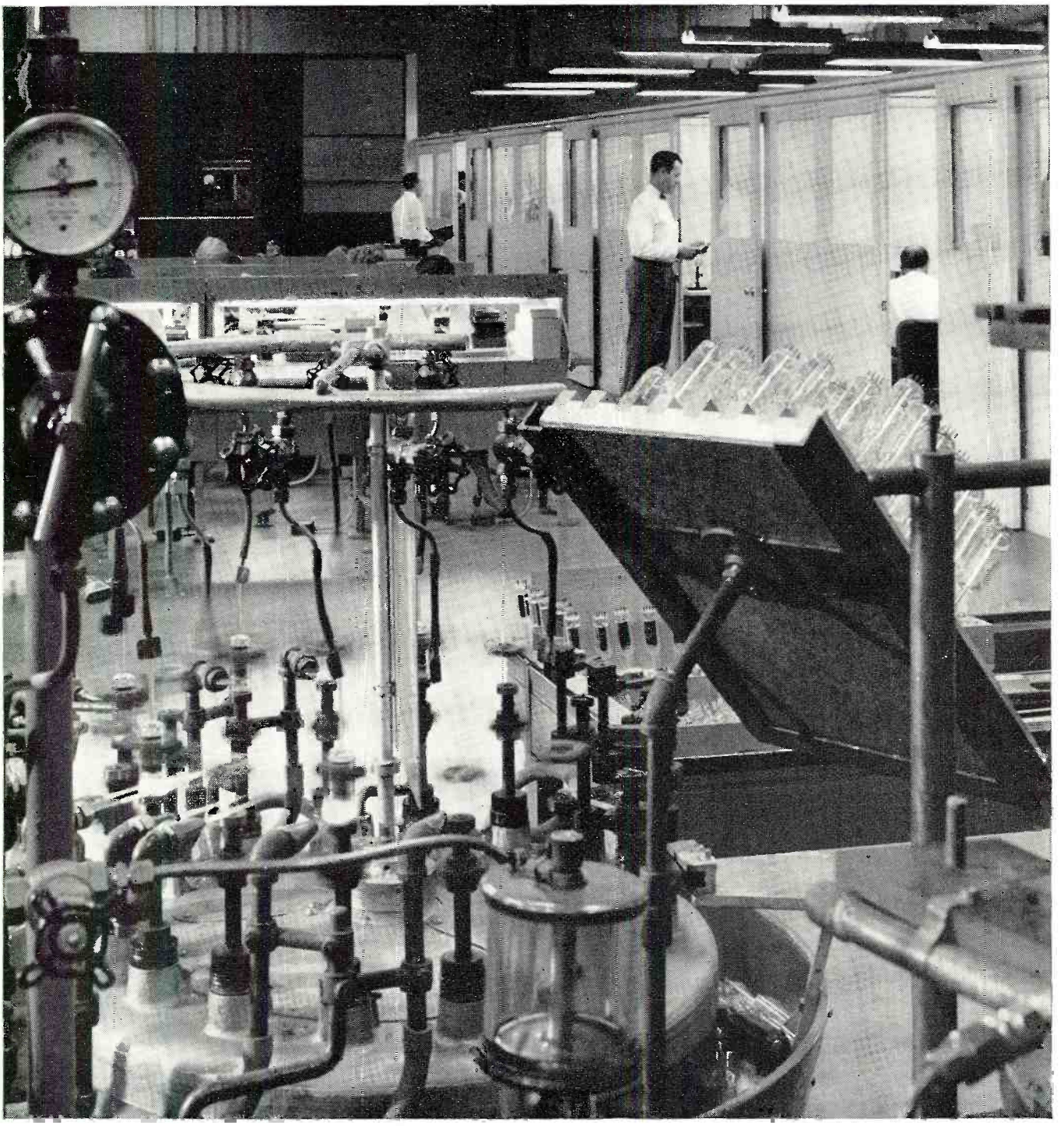


CBS cuts call-backs through approved-for-production design

Here a tube from the laboratories of CBS development engineers is being readied in pilot production for mass production. It may be a CBS original, standard type, or improved tube. The aim is the same: To insure dependable, trouble-free performance through approved-for-production design. Teams like this test in pre-production all CBS tubes . . . receiving, special-purpose, cathode-ray ...and semiconductors. Their approved designs give you reliable products like the 6DQ6, 6626, CBS-Colortron and 2N155. It's easy for you to take advantage of this approved-for-production design. Insure yourself of minimum call-backs always by asking for CBS always.

Reliable products
through Advanced-Engineering

CBS-HYTRON, Danvers, Massachusetts
A Division of Columbia Broadcasting System, Inc.
For the best in entertainment tune to CBS.

Spot News

Latest Information on the Electronic Industry

By RADIO & TV NEWS' WASHINGTON EDITOR

PAY-TV TEST PLAN SPANKED BY HOUSE COMMITTEE--By a 17-7 vote, the House Committee on Interstate and Foreign Commerce told the FCC recently that the toll-TV issue should be settled by Congress . . . In a resolution, the Representatives told the Commission that it was the consensus of the committee members that the public interest will not be served by granting authorizations for subscription-television because . . . "it has not been established to the complete satisfaction of the committee that authority to license such an operation comes within the power of the Commission." . . . The resolution also pointed out that pay-TV . . . "operations might lead to a partial blackout of the present system of TV authorizations with possible injury to the present system in particular communities, if not throughout the nation . . ." . . . Committee members said that the action was based in part on the tremendous anti-pay-TV mail flooding the offices of Congressmen. Representative William L. Springer reported that he had received over 8000 letters and over 400 telegrams; Congressman Peter F. Mack said that he had over 10,000 letters and over 2000 wires strongly voicing "no" to fee-television.

FCC STRIVING TO END CHANNEL SHORTAGE, CONGRESS TOLD--The FCC is . . . "striving desperately to find some way of easing the television-channel shortage . . . " Chairman John C. Doerfer told the House Interstate and Foreign Commerce Subcommittee on Legislative Oversight, during a recent hearing in Washington. . . . "We can't seem to get it off the ground," he added, but the Commission is trying . . "to get a competitive TV system operating through the country."

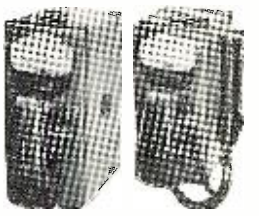
STEREO TAPE-DISC BOOM PREDICTED--A boom in stereophonic tape and phono players is ahead, leading specialists have reported at meetings in the east, midwest, and on the coast. According to one such expert, a 20 per-cent increase can be expected in the sale of stereophonic recorders and at least a 50 per-cent boost should obtain in stereo tape sales . . . RCA is so sold on stereo that it has developed, and plans to introduce in early summer, a four-channel player-recorder featuring a new cartridge for quarter-inch $3\frac{3}{4}$ ips tape. The record department of RCA has also announced that it will probably have stereo discs for distribution in the fall of the year.

RADIO PRODUCTION IN '57 BEST IN TEN YEARS--Radio set production during 1957 had its best year since 1948, according to Electronic Industries Association. Sales were up 12 per-cent over '56 . . . The phenomenal growth, many have said, has been due to the increasing interest and popularity of records, since radio has served to familiarize listeners with the latest releases . . . EIA records also indicated that 15.4-million radios were made during '57; 1.6-million were transistorized portables and 2.9-million were transistorized auto radios . . . The books also showed that over 50 per-cent of all the auto receivers made used transistors.

BRIGHTER RADAR DISPLAYS TO BE INSTALLED IN AIRPORT CONTROL STATIONS--Radar traffic controllers will soon direct aircraft from well-lighted rooms instead of from semi-darkness, according to CAA. Thirteen new scan-converter units providing this daylight viewing--costing over a half-million dollars--have been ordered . . . Heart of the equipment is a two-gun cathode-ray tube made in France by the Compagnie Generale de Telegraphie sans Fil de Paris. Until now CAA has been using old World War II surplus military horizontal scopes.

OPERATING TV STATIONS NOW OVER 500--As we went to press, the FCC records showed that there were 502 commercial TV stations operating. Of this number 418 were using the v.h.f. channels and 84 were on ultra-high . . . Bermuda's first commercial television station recently took to the air with the call letters ZBM-TV. The station boasts the smallest potential viewing audience of any TV station in the world but one of the richest markets. The resident 41,000 population owns an estimated 4000 TV sets. -30-

RCA Reg. $119.50 RADIATION COUNTER ON SALE AT McGEE for $29.95



WF-10A WF-12A

RCA Model WF-10A, Radiation Geiger counter for amateur and professional use. Explore for Uranium or check for atomic fall-out radiation. Complete with test sample. Simple to use, weighs only 5 lbs. In aluminum case. 7¾"x8½"x3½". Indicates presence of radioactivity in 3 ways, by meter, neon light and headphones. Requires 2—67½ volt Burgess XX45 "B" batteries and 3 ±2 flashlight cells. Battery kit, $5.29 extra. 3 sensitivity ranges, 0-100, 0-1000 and 0-10,000 counts per minute. A terrific value from McGee. RCA Model WF-10A with tubes and headphone, less batteries, $29.95. Battery kit, $5.29 extra.

MODEL WF-12A *Regular* $149.50—McGEE'S PRICE—$34.95

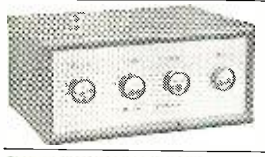
RCA Model WF-12A, Radiation Geiger counter. Similar to WF-10A, except has an external probe. Priced with tubes and headphones at $34.95, less batteries. Kit of 2—XX45 Burgess "B," plus 3 ±2 flashlight cells, $5.29 extra.

MODEL WF-11A *Regular* $154.50—McGEE'S PRICE—$37.95

RCA Model WF-11A, Radiation Geiger counter. Explore for Uranium or check for atomic fall-out. Uses extra sensitive Bismuth tube. Test sample included. Simple to use, weighs only 5 lbs. Weatherproof case 7¾"x8½"x3½". Indicates presence of radioactivity 3 ways, by meter, neon light and headphones. Requires 2 Burgess XX45 "B" batteries and 3 ±2 flashlight cells. Battery kit $5.29 extra. 3 sensitivity ranges, 0-200, 0-2000, 0-20,000 counts per minute. A terrific value. RCA WF-11A, Sale price, $37.95 with tubes and headphone. Battery kit, $5.29 extra. Similar size to WF-10.

RCA Model WF-15A (not illustrated). Has 10 sensitive tubes, 3 ranges to 100,000 counts per minute. Size, 11"x47⁄8"x7½". Weight 8 lbs. Original price, $475.00. McGee's Sale price, $99.50. Battery kit, $5.37 extra.

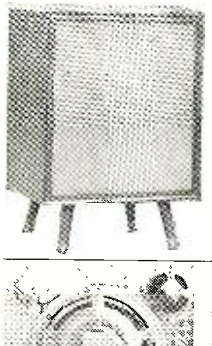
RCA Model WF-16A (not illustrated). Has 10 sensitive tubes, 3 ranges to 200,000 counts per minute. Size, 11"x47⁄8"x7½". Weight 8 lbs. Original price, $750.00. McGee's Sale price, $149.50. Battery kit, $5.37 extra.



16 Watts Factory Wired Hi-Fi Amp $34.95

Combination offers: Model 5L-20 with B-125X speaker board, $51.95; with new B-250X, 4 speaker board, $59.95; with Norelco 9762M, $69.95; with H-4H cabinet speaker system, $69.95.

New, 1958 model Imperial Slim-Line 16 watt high fidelity amplifier (20 watts peak), with built-in pre-amplifier. Full range audio response from 15 to 22,000 cps. Dual tone controls; full 18 db bass and full 15 db treble boost. Input for radio tuner, tape recorder and phono. Input compensation for the new 1958 model, 4 gram General Electric variable reluctance cartridges, as well as the famous G.E. RPX-050, RPX-052 and crystal phono cartridges. 5 position selector switch selects inputs and record compensation. Compensation for AES and RIAA phono records. A factory built amplifier at less than kit prices. Output impedance matches 8 or 16 ohm high fidelity PM speakers. Price includes tubes: 2—12AX7, 1—12AU7, 2—EL84 and 5Y3GT. Modern multi-color leatherette covered wood cabinet at no added cost; matches blond or mahogany finish speaker systems. Size: 5¼" tall, 11¼" wide, 8" front to back. Ship. wt. 15 lbs. Model SL-20 Imperial, List price, $69.50. McGee's Sale price, $34.95.



NEW 1958 "COMPLETE HI-FI SPEAKER SYSTEMS IN CABINETS"

The new, 1958 Hollywood 4-speaker systems are designed to give realistic reproduction from your Hi-Fi audio amplifier or FM-AM radio. Built-in Juke Box full bass response. Built-in LC crossover networks. Fully enclosed, acoustically lined. Standard models 35" tall, 19" deep and 25" wide. Deluxe models 37" tall, 27½" wide, 23½" front to back, $5.00 extra. Choice of Mahogany or Blond finishes. We will ship mahogany unless you specify blond.

MODEL H-4H SYSTEM, $39.95

Model H-4H Hollywood 4-speaker high fidelity speaker system. 20 watts, response 20 to 17,500 cps. Choice of Mahogany or Blond finish enclosure. Features a 12" Diffusion Cone 6.8 oz. Alnico V magnet, aluminum voice coil woofer, plus 6" mid-range and 2-5" tweeters. Built-in variable brilliance LC crossover network. Model H-4H, ship. wt. 55 lbs. Price, $39.95. Larger deluxe cabinet, $5.00 extra.

MODEL Z-4Z SYSTEM, $49.95

Model Z-4Z, Hollywood 4-speaker high fidelity speaker system. 25 watts, response from 18 to 17,500 cps. Choice of Mahogany or Blond finish enclosure. Features a 15", 21½ oz. Alnico V Utah heavy duty woofer, plus 6" mid-range and 2-5" tweeters. Built-in variable brilliance LC crossover network. Model Z-4Z, ship. wt. 57 lbs. Sale price, $49.95. Larger deluxe cabinet, $5.00 extra.

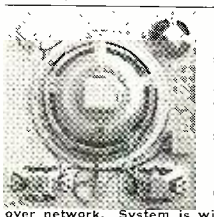
Imperial 81 and 91 systems are offered in the larger Blond or Mahogany cabinet, 37" tall, 27½" wide and 23½" front to back. Enclosure is acoustically lined to approach an infinite baffle. Ideal for any Hi-Fi system and priced at worth of speakers alone. LC crossover network and variable brilliance control. Features heavy woofers and horn tweeters.

IMPERIAL 81, $69.95

25 watts, response 18 to 20,000 cps. A complete speaker system in the above described enclosure, ready to connect to your Hi-Fi amplifier. Built-in LC, 3 way crossover network. Speakers included are 15", 21½ oz. Utah woofer, 8" 6.8 oz. mid-range and horn type Pioneer PT-3 tweeter. 8 ohms impedance. Stock No. Imperial 81, speaker system. Ship. wt. 80 lbs. Sale price, $69.95.

IMPERIAL 91, $89.95

Imperial 91, 30 watt speaker system with 5 speakers. Response, 18 to 20,000 cps. A complete speaker system in the above enclosure, ready to connect to the 8 ohm output of your high fidelity amplifier. Includes the 21 oz. Utah 15" woofer, two of the 8", 6.8 oz. mid-range speakers and two of the PT-3 Pioneer horn type tweeters. Built-in LC type, 3 way crossover network. Imperial 91, speaker system. Ship. wt. 90 lbs., Sale price, $89.95.



TREMENDOUS McGEE VALUE—NEW 1958 HI-FI SPEAKER SYSTEMS ON BAFFLE BOARDS

Model B-125-X, high fidelity 15-watt, 5-way speaker system, mounted on an 18" square baffle board. Has 12" High Efficiency woofer, 2—4x6" mid-range speakers, plus a 4" high-range and 3" tweeter; all with Alnico V magnets. Built-in crossover network with variable brilliance control. Ship. wt. 11 lbs. Stock No. B-125-X, 5-way, 15-watt Hi-Fi speaker system, AUDIOPHILE VALUE $30.00. SALE PRICE $18.95.

SALE PRICE $18.95

DELUXE HI-FI 25 WATT SPEAKER BOARD $29.95

Model B-250X, 4 matched Hi-Fi PM speakers mounted on a baffle board, 18" wide and 30" tall. For installation in your own cabinet or play as it comes. Features 15" woofer, 10" mid-range, 5½" and 5" tweeters; built-in pre-LC crossover network. System is wired ready to connect the two leads to any 8 ohm amplifier or FM-AM radio. 25 watts capacity, from 18 to 17,500 cps. AB matched for finest audio reproduction. $50.00 list value. McGee's sale price, $29.95.

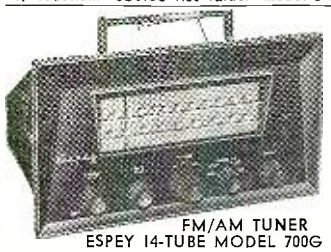
World Famous Imported from Holland NORELCO HI-FI PM SPEAKERS

12" Model 9762-M reg. $59.97 Sale Price $39.95
12" Model 9760 reg. $32.97 Sale Price $19.95
8" Model 9750 reg. $22.17 Sale Price $15.95

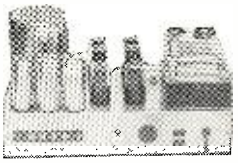
NORELCO Model 9762—12" wide range Hi-Fi PM speaker, res. 35 to 18,000 cps at 30-watts. Voice Coil imp. 8 ohms—new Alnico VI magnet gives 11,000 gauss. Regular $59.97 net, on sale at McGEE for only $39.95.

NORELCO Model 9760—12" wide range Hi-Fi PM speaker, res. 35 to 18,000 cps at 30-watts. Voice coil imp. 8 ohms—new Alnico VI magnet gives 8,000 gauss. Regular $32.97 net, on sale at McGEE for only $19.95.

NORELCO Model 9750—8" wide range Hi-Fi PM speaker, res. 50 to 20,000 cps at 10-watts. Voice coil 6 ohms—New Alnico VI magnet gives 13,500 gauss. Regular $22.17 net, on sale at McGEE for only $15.95; or 2 for $30.00.



FM/AM TUNER
ESPEY 14-TUBE MODEL 700G



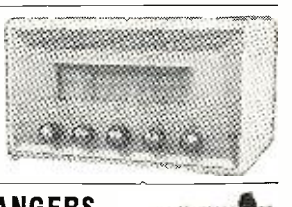
ESPEY 24 WATT
MODEL 501G AMPLIFIER

22 TUBE ESPEY FM-AM TUNER-AMPLIFIER SALE PRICE $99.95

Espey Model 700G-501G, complete 14 tube FM-AM tuner and matching 8 tube, 24 watt ultra-linear amplifier. A regular $199.50 value on sale at McGee for $99.95. Features AFC on FM. Receives broadcast 550 to 1700 kc and FM, 88 to 108 mc. Built-in preamplifier. Separate bass and treble controls, record equalization. Response, 10 cps to 20,000 cps, auxiliary input jacks. Tuner chassis is 14" long, 8½" high, 10" deep. (Leatherette cabinet for tuner only, $7.95 extra.) Amplifier 12"x8"x5" (push-pull, parallel 6V6 output tubes). Price includes all tubes, knobs and escutcheon plate. Shipping weight 42 lbs. A true McGee value.

Combination offer with Garrard RC-98 changer and 4G-052 G.E. cartridge, $174.95, no speaker included. Why not order a Norelco or our new B-250X speaker board with your Espey?

ESPEY 14 TUBE FM-AM WITH BUILT-IN HI-FI AUDIO $69.95



Espey Model HF-250C, 14 tube FM-AM chassis with push-pull 6V6, 10 watt audio. A true Hi-Fidelity receiver built by a nationally famous maker of fine custom chassis. Ultra-linear output used in Williamson type circuit gives frequency response of 10 to 22,000 cps. Output taps of 4, 8 and 16 ohms. Separate RF stages for FM and AM assure high sensitivity. Temperature compensated FM front end for minimum drift. Separate bass and treble tone controls. Pre-amp for all types of magnetic cartridges. 2nd input for crystal phono, tape recorder or TV. 3 position equalizer for accurate reproduction of all records. Built-in antennas for both FM and AM. Response plus or minus 1 db from 10 to 22,000 cps. Harmonic distortion less than 1%. Sensitivity: FM, 8 mv for 30 db quieting; AM, 75 mv for 6 db signal to noise ratio. Off-on-volume and equalizer are combined on a concentric control. Has 2 AC outlets on rear of chassis. Beautiful edge lighted flywheel inertia slide rule dial. Size: 3¾"x13½"x10" deep. Ship. wt. 24 lbs. (not mailable). Model HF-250C Sale price, $69.95.

Espey chassis with our P15-CR, 15" coaxial speaker, both $89.95.
Espey chassis with $54.95 list, model 9760M, 12" Phillips speaker, both for $89.95.
Espey chassis with $99.95 list, model 9762M, 12" Phillips speaker, both for $104.95.

24 INCH CUSTOM TELEVISION CHASSIS $129.95

McGee offers this nationally famous make 24" television chassis with aluminized picture tube at a terrific saving. Full power transformer operated with switch type cascode tuner. All regular wiring—no printed circuits. Chassis is mounted on a baseboard and shipped with picture tube installed. Area required for chassis; 28" wide, 20" high and 20" front to back. Safety glass size, 23 13/16"x19¾". Tuner and controls are mounted on a separate vertical bracket to make it easy to move when installing. Price includes all tubes and 24" 24YP4 aluminized picture tube. Knobs and safety glass included. Good quality audio. 2—8" and 2—5" speakers are furnished, mounted on a baffle board 24"x19¾". Stock No. MG75-02, with all tubes and 45 day picture tube warranty. Sale price, $129.95. Price with one year picture tube warranty, $133.95.

Stock No. MG75-02-HF10, same as MG75-02 except with push-pull 6V6 Hi-Fi amplifier and with 2—12" PM's and 2—5" tweeters on a baffle board, Sale price, $149.95.

Stock No. MG75-01, similar in appearance to the 24" model illustrated, except set includes a 21" 21ATP4A aluminized picture tube. McGee's sale price, $99.95 with 45 day picture tube warranty. 1 year picture tube warranty, $4.00 additional. 3 speed automatic Collaro record changer, plugs into any of the above TV chassis, $24.95 extra.

AUTOMATIC CHANGERS AT LOW PRICES

MONARCH
UA8H $27.95

VM-936HF
$32.95

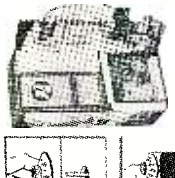
Special prices on VM 3 speed Hi-Fi record changers. Equipped with plug-in heads. Features 4 pole motor, intermixes 10" and 12" records of the same speed, shuts off after last record has played. Size: 13½"x 13¼". Ship. wt. 12 lbs. VM-935 and VM-936 are the same changer except the 936 is on a base as illustrated. Price includes 45 RPM spindle.

VM-935HF with RPX-050A G.E. VR cartridge, $29.95.
VM-936HF on base with RPX-050A G.E. VR cartridge, $32.95. 1 mil diamond needle, $8.95 extra.

Latest 4 speed English imported Monarch record changer. Features a 4 pole motor, 9" turntable with molded rubber record pallet. Balanced tone arm readily accepts most makes of Hi-Fi cartridges. Plays 16⅔, 33⅓, 45 and 78 RPM records. Intermixes 10" and 12" records of the same speed. Shuts off after last record has played. Compact size, 12¾"x 10⅞". Ship. wt. 15 lbs. Large 45 RPM spindle, $1.88 extra. Choice of blond or mahogany wood mounting base, $4.50 extra. Offered with several types of cartridges.
UA8-H with Ronette flip-over Hi-Fi crystal cartridge, $27.95.
UA8-4G050 with latest General Electric VR cartridge, $29.95.
UA8-4G052 with latest G.E. cartridge, 1 mil diamond and 3 mil sapphire stylus, $39.95.

Latest Garrard Renown II, RC-121 II, latest 1958 Garrard Hi-Fi, 4 speed changer with plug-in head shell, Net $42.50, with G.E. 4G-050 cartridge, $51.45, with G.E. 4G-052 cartridge, $61.80. 45 RPM spindle, $3.50 extra.

ALLIANCE "IT" T.V. TUNER REMOTE CONTROL REG. $19.50 LIST $4.94



McGee Special Purchase Sale! Alliance "IT" remote tuner for your TV set. A small battery operated motor turns your tuner clockwise or counter-clockwise. Attractive bakelite case fits palm of your hand. Made to sell at over $14.00 dealers net. McGee offers them for $4.94, 3 for $12.50 with flashlight batteries. Also adaptable to many other uses. Add 40¢ per unit for packing and postage.

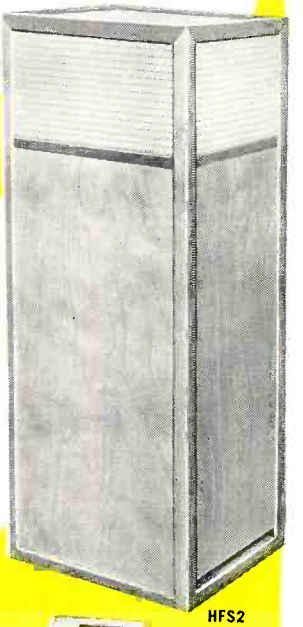
3 SPEED HI-FI COLLARO $27.95

Model RC-54, 3 speed (33⅓, 45 and 78 RPM) Collaro record changer. A late model High Fidelity record changer with a ceramic crystal cartridge (no pre-amplifier required). Features diamond 1 mil and sapphire 3 mil needle, 4 pole motor. Base size, ±2" x 13¼". For 110 volt, 60 cycle AC operation. These changers were intended for use by a nationally known Hi-Fi set manufacturer. McGee bought them at a substantial saving. Stock No. RC-54 Collaro changer with crystal cartridge, equipped with diamond 1 mil and sapphire 3 mil needle. McGee Sale Price, $27.95.

Tan leatherette covered wood base, 13 x 14½ x 37⁄8", shipped separate at $3.65 extra.

the experts say... in High Fidelity the best buys are EICO®

EICO KITS and WIRED



HFS2 Speaker System

BETTER ENGINEERING Since 1945 EICO has pioneered the concept of test instruments in easy-to-build kit form — has become world-famous for laboratory-precision instruments at low cost. Now EICO is applying its vast experience to the creative engineering of *high fidelity*. Result: high praise from such authorities as Canby of AUDIO, Marshall of AUDIOCRAFT, Holt of HIGH FIDELITY, Fantel of POPULAR ELECTRONICS, Stocklin of RADIO TV NEWS, etc. — as well as from the critical professional engineers in the field.†

SAVE 50% Mass purchasing, and a price policy deliberately aimed to encourage mass sales, make this possible.

EASY INSTRUCTIONS You need no previous technical or assembly experience to build any EICO kit — the instructions are simple, step-by-step, "beginner-tested."

DOUBLE 5-WAY GUARANTEE Both EICO, and your neighborhood distributor, guarantee the parts, instructions, performance . . . as well as *lifetime* service and calibration at nominal cost . . . for any EICO kit or wired unit.

BEFORE YOU BUY, COMPARE At any of 1200 neighborhood EICO distributors coast to coast, you may examine and listen to any EICO component. Compare *critically* with equipment several times the EICO cost — then *you* judge. You'll see why the experts recommend EICO, kit or wired, as best buy.

† Thousands of unsolicited testimonials on file.

HFT90 FM Tuner with "eye-tronic" tuning

HF61 Preamplifier

HF60, HF50 Power Amplifiers

MEMBER HIGH FIDELITY MANUFACTURERS, INC.

HFS2—Speaker System: Uniform loading & **natural** bass 30-200 cps achieved via **slot-loaded** split conical bass horn of 12-ft path. Middles & lower highs from front side of 8½" cone, edge-damped & stiffened for smooth uncolored response. Suspensionless, distortionless spike-shaped super-tweeter radiates **omni-directionally.** Flat 45-20,000 cps, useful to 30 cps. 16 ohms. HWD: 36", 15¼", 11½". ". . . rates as excellent . . . unusually musical . . . **really** non-directional" — Canby, AUDIO. "Very impressive" — Marshall (AUDIOCRAFT). **Walnut or Mahogany, $139.95. Blonde, $144.95.**

HFT90 FM Tuner equals or surpasses wired tuners up to 3X its cost. New, pre-wired, pre-aligned, temperature-compensated "front end"—drift-free. Sensitivity, 1.5 uv for 20 db quieting, is 6X that of other kit tuners. DM-70 traveling tuning eye. Response 20-20,000 cps ± 1 db. Cathode follower & multiplex outputs. **Kit $39.95*. Wired $65.95*. Cover $3.95.** *Less cover, excise tax incl.

HF61A Preamplifier, providing the most complete control & switching facilities, and the finest design, offered in a kit preamplifier, ". . . rivals the most expensive preamps . . . is an example of high engineering skill which achieves fine performance with simple means and low cost."—Joseph Marshall, AUDIOCRAFT. **HF61A Kit $24.95, Wired $37.95, HF61 (with Power Supply) Kit $29.95. Wired $44.95.**

HF60 60-Watt Ultra Linear Power Amplifier, with Acro TO-330 Output Transformer, provides wide bandwidth, virtually absolute stability and flawless transient response. ". . . is one of the best-performing amplifiers extant; it is obviously an excellent buy." —AUDIOCRAFT Kit Report. **Kit $72.95. Wired $99.95. Matching Cover E-2 $4.50.**

HF50 50-Watt Ultra-Linear Power Amplifier with extremely high quality Chicago Standard Output Transformer. Identical in every other respect to HF60 and same specifications up to 50 watts. **Kit $57.95. Wired $87.95. Matching Cover E-2 $4.50.**

HF30 30-Watt Power Amplifier employs 4-EL84 high power sensitivity output tubes in push-pull parallel, permits Williamson circuit with large feedback & high stability. 2-EZ81 full-wave rectifiers for highly reliable power supply. Unmatched value in medium-power professional amplifiers. **Kit $39.95. Wired $62.95. Matching Cover E-3 $3.95.**

HF-32 30-Watt Integrated Amplifier Kit $57.95. Wired $89.95.

HF52 50-Watt Integrated Amplifier with complete "front end" facilities and Chicago Standard Output Transformer. Ultra-Linear power amplifier essentially identical to HF50. The least expensive means to the highest audio quality resulting from distortion-free high power, virtually absolute stability, flawless transient response and "front end" versatility. **Kit $69.95. Wired $109.95. Matching Cover E-1 $4.50.**

HF20 20-Watt Integrated Amplifier, complete with finest preamp-control facilities, excellent output transformer that handles 34 watts peak power, plus a full Ultra-Linear Williamson power amplifier circuit. Highly praised by purchasers, it is established as the outstanding value in amplifiers of this class. **Kit $49.95. Wired $79.95. Matching Cover E-1 $4.50.**

Prices 5% higher in the West

HF12 12-Watt Integrated Amplifier, absolutely free of "gimmicks", provides complete "front end" facilities & true fidelity performance of such excellence that we can recommend it for any medium-power high fidelity application. Two HF12's are excellent for stereo, each connecting directly to a tape head with no other electronic equipment required. **Kit $34.95. Wired $57.95.**

HFS1 Two-Way Speaker System, complete with factory-built cabinet. Jensen 8" woofer, matching Jensen compression-driver exponential horn tweeter. Smooth clean bass; crisp extended highs. 70-12,000 cps ± 6 db. Capacity 25 w. Impedance 8 ohms. HWD: 11" x 23" x 9". Wiring time 15 min. **Price $39.95.**

THE HI-FI EXPERTS SAY:

"For those who have been looking for a well-engineered yet inexpensive power amplifier, the newly-released EICO Model HF20 unit might offer a simple solution to their problem. Not only does this unit provide 20 watts of power but the circuit incorporates a preamplifier and a variety of controls on a single chassis."
William A. Stocklin, Editor, RADIO TV NEWS

"The new EICO 'standard' speaker system . . . produces sound that to my musical ears rates as excellent, from high top to clean low bottom."
Edward Tatnall Canby, AUDIO Magazine

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HF52, HF20 Integrated Amplifiers

HF12 Integrated Amplifier

HF30 Power Amplifier

HFS1 Speaker System

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shows you HOW TO SAVE 50% on 50 models of top quality professional test equipment.

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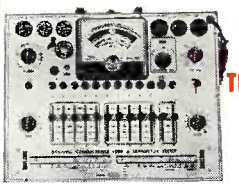


NEW! DYNAMIC CONDUCTANCE TUBE & TRANSISTOR TESTER #666

KIT $69.95 WIRED $109.95

COMPLETE with steel cover and handle.

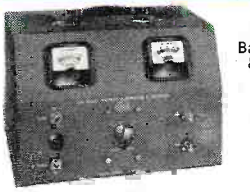
SPEED, ease, unexcelled accuracy & thoroughness. **Tests all receiving tubes** (and picture tubes with adapter). **Composite indication** of Gm, Gp & peak emission. **Simultaneous sel** of any 1 of 4 combinations of 3 plate voltages, 3 screen voltages, 3 ranges of continuously variable grid voltage (with 5% accurate pot). **New series-string voltages:** for 600, 450, 300 ma types. **Sensitive** 200 ua meter. **5 ranges meter sensitivity** (1% shunts & 5% pot). **10 SIX-position lever switches:** freepoint connection of each tube pin. **10 pushbuttons: rapid** insert of any tube element in leakage test circuit & speedy sel. of individual sections of multi-section tubes in merit tests. **Direct-reading** of inter-element leakage **in ohms. New gear-driven rollchart. Checks n-p-n & p-n-p transistors:** separate meter readings of **collector leakage current & Beta** using internal dc power supply. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet. **CRA Adapter $4.50**

5" PUSH-PULL OSCILLOSCOPE #425
KIT $44.95
Wired $79.95

7" PUSH-PULL OSCILLOSCOPE #470
KIT $79.95
Wired $129.50

TUBE TESTER #625
KIT $34.95
Wired $49.95
- tests 600 mil series string type tubes
- illuminated roll-chart

Pix Tube Test Adapter $4.50



6V & 12V Battery Elim & Charger #1050:
KIT $29.95
Wired $38.95

Extra filtered for transistor eqpt., #1060;
Kit $38.95 Wired $47.95

Sep. hi-gain RF & lo-gain audio inputs. Special noise locator. Calibrated wattmeter.
KIT $24.95
Wired $39.95

DELUXE MULTI-SIGNAL TRACER #147

20,000 Ohms/Volt MULTIMETER #565
KIT 24.95
Wired $29.95

1000 Ohms/Volt MULTIMETER #536
KIT $12.90
Wired $14.90

Reads 0.5 ohms —500 megs, 10 mmfd—5000 mfd, power factor.
KIT $19.95
Wired $29.95

R-C BRIDGE & R-C-L COMPARATOR #950B

VTVM PROBES	KIT	Wired
Peak-to-Peak	$4.95	$6.95
RF	$3.75	$4.95
High Voltage Probe-1		$6.95
High Voltage Probe-2		$4.95
SCOPE PROBES		
Demodulator	$3.75	$5.75
Direct	$2.75	$3.95
Low Capacity	$3.75	$5.75

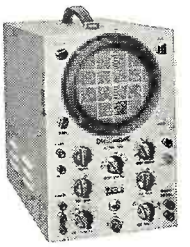
NEW! RF SIGNAL GENERATOR #324

KIT $26.95 WIRED $39.95

150 kc to 435 mc with ONE generator! Better value than generators selling at 2 or 3 times its cost! Ideal for IF-RF alignment, signal tracing & trouble-shooting of TV, FM, AM sets; marker gen.; 400 cps audio testing; lab. work. **6 fund. ranges: 150-400 kc, 400-1200 kc, 1.2-3.5 mc, 3.5-11 mc, 11-37 mc, 37-145 mc; 1 harmonic band 111-435 mc. Freq. accurate to ±1.5%;** 6:1 vernier tuning & excellent spread at most important alignment freqs. **Etched tuning dial,** plexiglass windows, **edge-lit hairlines.** Colpitts RF osc. **directly plate-modulated by K-follower for** improved mod. **Variable depth of int. mod. 0-50%** by 400 cps Colpitts osc. **Variable gain ext. amplifier:** only 3.0 v needed for 30% mod. **Turret-mounted coils slug-tuned** for max. accuracy. Fine & Coarse (3-step) RF attenuators. RF output 100,000 uv; AF sine wave output to 10 v. 50-ohm output Z. 5-way jack-top binding posts for AF in/out; coaxial connector & shielded cable for RF out. 12AU7, 12AV7, selenium rectifier; xmfr-operated. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet.

NEW! COLOR and Monochrome DC to 5 MC LAB & TV 5" OSCILLOSCOPE #460

KIT $79.95 WIRED $129.50

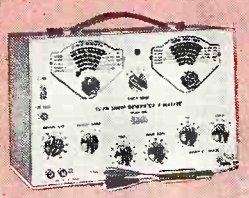


- **Features DC Amplifiers!**

Flat from DC-4.5 mc, usable to 10 mc. **VERT. AMPL.:** sens. 25 rms mv/in; input Z 3 megs; direct-coupled & push-pull **thruout;** K-follower coupling bet. stages; 4-step freq-compensated attenuator up to 1000:1. **SWEEP:** perfectly linear 10 cps-100 kc (ext. cap. for range to 1 cps); **preset TV V & H positions;** auto. sync. ampl. & lim. **PLUS:** direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; filter; bezel fits std photo equipt. High intensity trace CRT. 0.06 usec rise time. Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in volt. calib. Z-axis mod. Sawtooth & 60 cps outputs. Astig. control. Retrace blanking. Phasing control.

NEW! TV-FM SWEEP GENERATOR & MARKER #368

KIT $69.95 WIRED $119.95



Entirely electronic sweep circuit (no mechanical devices) with accurately-biased **inereductor** for excellent linearity. **Extremely flat RF output: new AGC circuit** automatically adjusts osc. for max. output on each band with min. ampl. variations. **Exceptional tuning accuracy:** edge-lit hairlines eliminate parallax. **Swept Osc. Range** 3-216 mc in **5 fund. bands. Variable Marker Range** 2-75 mc in **3 fund. bands;** 60-225 mc on harmonic band. **4.5 mc Xtal Marker Osc., xtal supplied.** Ext. Marker provision. Sweep Width 0-3 mc lowest max. deviation to 0-30 mc highest max. dev. 2-way blanking. Narrow range phasing. Attenuators: Marker Size, RF Fine, RF Coarse (4-step decade). Cables: output, 'scope horiz., 'scope vertical. Deep-etched satin aluminum panel; rugged grey wrinkle steel cabinet.

NEW! PEAK-to-PEAK VTVM #232 & UNI-PROBE (pat. pend.)

KIT $29.95 WIRED $49.95

Half-turn of probe tip selects DC or AC-Ohms.

Uni-Probe — exclusive with EICO — only 1 probe performs all functions!

Latest circuitry, high sensitivity & precision, wide ranges & versatility. **Calibration without removing from cabinet.** New balanced bridge circuit. High Z input for negligible loading. 4½" meter, can't burn-out circuit. **7 non-skip ranges on every function.** 4 functions: +DC Volts, −DC Volts, AC Volts, Ohms. Uniform 3 to 1 scale ratio for extreme wide-range accuracy. **Zero center.** One zero-adj. for all functions & ranges. **1% precision** ceramic multiplier resistors. Measure **directly** peak-to-peak voltage of complex & sine waves: 0-4, 14, 42, 140, 420, 1400, 4200. DC/RMS sine volts: 0-1.5, 5, 15, 50, 150, 500, 1500 (up to 30,000 v. with HVP probe & 250 mc with PRF probe). Ohms: 0.2 ohms to 1000 megs. 12AU7, 6AL5, selenium rectifier; xfmr-operated. Deep-etched satin aluminum panel, rugged grey wrinkle steel cabinet.

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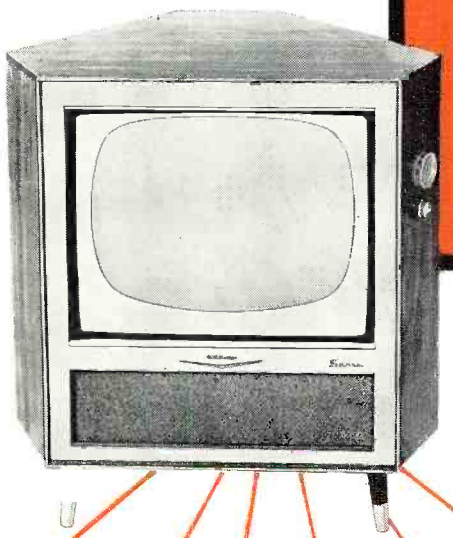
By
WALTER H. BUCHSBAUM
Television Consultant
RADIO & TV NEWS

New TV Circuits for '58



The RCA 21T847 (left) is especially designed for corner placement. The Emerson 1426 "Eldorado" (right) is one of many sets that feature channel-indicator windows to make tuning more convenient.

Short picture tubes, remote controls, packaged circuits—are there other recent trends in TV?

A SURVEY of the new designs of the major TV manufacturers shows that last year's trends are largely continued and additional emphasis is being placed on automatic features. Most set makers seem to have found that a variety of different models is still needed to suit each customer's taste. However, this generally means that the identical chassis is usually available in many different cabinet styles, tube sizes, and combination arrangements. Consumers' preferences for a particular finish, style, or color are becoming more important in determining choice, since set prices and performance do not vary as much among different manufacturers as they did years ago.

This is also evident from a study of the circuits of the latest TV receivers. There has been no radical change in circuitry for several years, although the use of 110° picture tubes and the addition of power tuning have affected design somewhat. A host of new tube numbers are appearing in the 1958 models, but none of these tubes is radically different from its predecessors. Internal construction and slightly improved characteristics, as well as more economical manufacturing techniques account for most of the variations. Controlled warm-up heaters have already been in use, especially in lower-priced sets and transformerless portables. Practically every manufacturer offers some power-tuning scheme with remote control as an optional accessory. There are, nevertheless, circuits as well as chassis and design features which are of interest to the service technician. Remote controls will not be discussed here since they have already been the subject of other articles in this magazine.

The Emerson Line

Emerson receivers 120380-H, 1203-77-C, and 120381-M feature a pentagrid noise-gate circuit, somewhat similar to many other sets except that here it alone provides all clipping and sync-separating action. A triode inverter feeds a very simple dual-selenium diode which acts as phase discriminator for the single-coil horizontal oscillator.

Another unusual arrangement in these sets is the vertical oscillator and output amplifier which uses a single triode and beam-power output tube *without* a blocking oscillator transformer. A similar circuit will be described later in more detail for the *RCA* receiver. In some of the *Emerson* models noted, the FM detector consists of two crystal diodes while in other models a 6DT6 quadrature type of detector, related to the gated-beam type, is used. The application of the horizontal-retrace blanking signal to the grid of the video amplifier differs from the usual practice of feeding blanking pulses direct to the picture tube socket. It is also interesting to note that all *Emerson* sets now use printed-wiring subassemblies.

Westinghouse Chassis

Another example of the use of printed wiring is the *Westinghouse* series of "Silver Safeguard" 110° and 90° deflection models. Here the printed wiring looks embossed or "deep-etched" and, in addition, a protective coating has been applied. This coating, an epoxy resin, is baked on to keep moisture and corrosion out. For the service technician, unfortunately, the epoxy coating is a mixed blessing. If it is necessary to replace a component, the coating may have to be removed to solder the leads to the board. In most repairs of this type, the service technician will prefer to clip off the leads of the defective part, scrape them clean, and connect the replacement to the old leads. In some instances this is not practical—the epoxy coating must be removed. Careful scraping with a sharp tool will tend to chip the coating off gradually. As with many a new service technique, this practice may result in some early difficulty and frustration, but will eventually become familiar.

Another method is to use a chemical solvent such as Desolv 292, made by *Ram Chemical Corp.*, but extreme care must be taken to avoid exposing other components to this solvent: it is powerful enough to ruin many capacitor and resistor coatings. The best method of applying the solvent to the required area is to soak a piece of cotton with it, and then to place the cotton over the epoxy coating. The solvent takes several hours to work and the cotton should be wetted again, possibly with a medicine dropper.

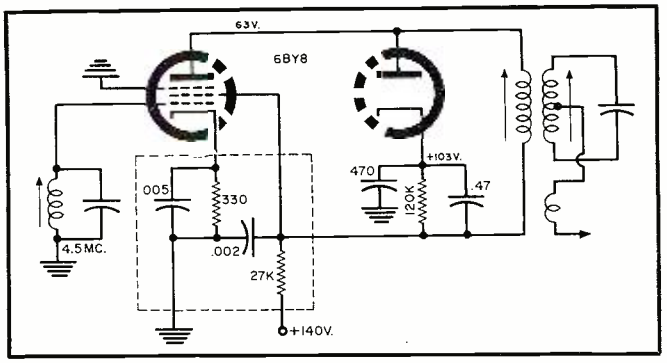


Fig. 1. Many Philco sets use a diode shunted across the intercarrier i.f. amplifier to provide limiting.

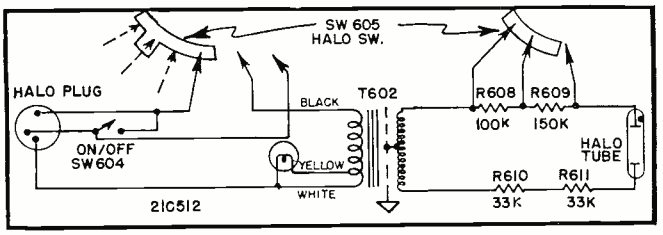


Fig. 2. Typical circuit for the Halolight feature, which has been continuingly popular in Sylvania TV receivers over the years.

After the repair has been made, the exposed printed wiring can be coated with coil dope or some similar material.

Other features of the *Westinghouse* receivers include the firm's first use of the new silicon diodes as power rectifiers for the "B+" supply. These rectifiers are quite small and are expected to be extremely stable and reliable. To overcome the problem of applying "B+" to the various tubes before the filaments have heated up, the *Westinghouse* receivers use a resistance-type time delay in series with the "B+" lead. As the tubes draw filament current, a resistor in series with the a.c. line is heated up. This heating bends a bi-metallic contact strip gradually towards a contact which then applies "B+". As long as filament power is drawn, the time-delay device remains activated; that is, continues to apply "B+".

Another interesting feature in the *Westinghouse* receivers is the arrangement of the tuner, tuning motor, and station-index wheel. The tuning motor is located at the upper right, just above the screen, and drives the tuner through a bead-chain link. Also linked to the tuner is a wafer-switch type of "tuning wheel." This wheel is adjusted by the installing service technician. It acts as a "local-fringe" switch and also determines which stations the power tuning should skip. As a station is tuned in, the wheel automatically switches the receiver gain to the desired individual setting.

The remote-control unit offered as optional equipment for all power-tuned models operates on the a.c. power line and does not connect directly to the receiver. Instead it transmits control signals, modulated on a carrier current, back into the power line. In turn, these are picked up by the TV receiver through its own a.c. cord. Some additional information about this system is included in the article entitled "New *Westinghouse* TV Circuits," which appeared in the February 1958 issue of this magazine.

The remote unit controls only volume and station selection. While this would seem to leave too many important adjustments out of the hands of the remote user, other features of the receiver itself tend to make additional adjustment unnecessary. The use of AFT (Automatic Fine Tuning), also described in the referenced article, eliminates the need for individual fine tuning. Also, the individual signal-strength adjustments for each channel dispense with the need for varying contrast and brightness controls.

To obtain reasonably good sound quality in limited space, some of the smaller receivers in the line use a rather novel loudspeaker, which measures 10 x 2⅝ inches and is mounted in front just over the picture-tube screen.

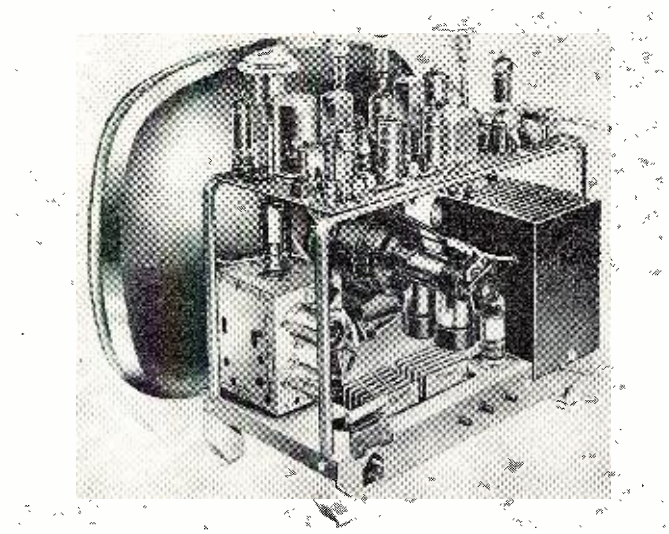


Fig. 3. The novel "two-story" chassis, with the top portion consisting of components mounted on a printed-wiring board, developed by Sylvania for narrow cabinet depth with 110° tubes.

Philco Innovations

With the exception of the 8H25 chassis all of the other new *Philco* models have some rather unique and new circuit features in the audio i.f. and vertical-sweep section. As shown in the circuit of Fig. 1, the pentode section of the 6BY8 operates as a 4.5-mc. sound amplifier and the diode section of the same tube is connected to the high side of the primary of the discriminator transformer. If the 4.5-mc. signal exceeds the diode bias voltage, the diode will clip or limit. Note that the cathode is at a d.c. potential of 103 volts due to rectified r.f., while the plate voltage on the diode is 63 volts. This means that the maximum amplitude of the 4.5-mc. sound i.f. across the discriminator-transformer primary will be kept to no more than 40 volts peak. In most sound sections, whatever limiting exists is accomplished through grid-leak bias on the grid of the last sound i.f. amplifier. Diode limiting of this type is not new, having been used before in some commercial and government equipment, but its use in TV audio circuits is an innovation.

In the vertical-sweep section, the *Philco* models all have a dual triode operating as both multivibrator and output amplifier. This practice, becoming established among many manufacturers, saves the price of the blocking-oscillator transformer. In the *Philco* circuit, the same grid-to-plate feedback exists as in a basic Eccles-Jordan multivibrator.

Another feature in all *Philco* sets is the universal use, not only of printed wiring, but also of packaged circuitry. An example is the horizontal phase-detector circuit shown in Fig. 6, which operates with a special selenium dual diode. All resistors and capacitors are encapsulated, with only the externally connected junctions being brought out. The reader will be familiar with the type of packaged circuit used in many vertical integrating networks for years, but this is the first time that a total of 10 separate such packages is found mounted on various printed-wiring boards. A service technician who does not have a complete stock of *Philco* replacement circuit packages might build up at least part of such a circuit with conventional components. Lead lengths must be kept to a minimum to avoid regeneration or other troubles.

In the *Philco* model 8H25 chassis, two germanium power-rectifier diodes are used in place of the selenium types. Connected in a voltage-doubler circuit, these diodes are mounted on a single frame. They are rated for 300 ma. and are expected to perform without aging over a very long period of time.

New Sylvania Models

The new *Sylvania* line of TV sets is not too different from the general trend as far as circuitry is concerned. Most models use a selenium horizontal phase detector of the type already shown in Fig. 6, and have a pentagrid noise gate, in this case the 3CS6. The chassis layout is rather novel as can be seen in Fig. 3. In place of the previous vertical or horizontal chassis below the picture tube, *Sylvania* has now split the chassis up and located the i.f and video section on an upper deck. This arrangement will be popular with service technicians since it makes most circuits accessible from several angles. It also permits overall reduction in receiver size and depth, especially helpful since the new 110° picture tubes are used. The top chassis consists of a single printed-wiring board and a total of four packaged circuits, including the audio de-emphasis circuit, vertical-retrace filter, and audio-coupling networks. For more information concerning the chassis, see "A Portable with the 110° CRT," May, 1957.

The *Sylvania* "Halolight" has been a popular feature for many years, but its circuit has rarely been published. In Fig. 2, we therefore present a typical "Halolight" circuit. Note that a separate transformer is used with internally grounded center tap and that several series resistors regulate the brightness. Open or shorted series resistors or a defective switch can sometimes become service calls, although generally speaking this is quite rare.

Setchell-Carlson 1958 Sets

Fig. 4 shows the outstanding features of the *Setchell-Carlson* models very clearly. Continuing a previously established policy, the new chassis is broken up into five major subassemblies, each of which can be removed and serviced separately. The tuner is just such a separate unit in most existing sets, but here the low- and high-voltage power supplies, video section, and audio section are also housed in separate units. The model 158-RP shown in Fig. 4 contains a built-in AM radio and provisions for phono connections. In the power supply sub-chassis, a transformer is used together with a selenium voltage doubler, and the vertical oscillator and output stage are located on the same chassis.

The center sub-chassis contains the i.f., video, and audio sections—the latter features push-pull output. In the horizontal-sweep and high-voltage section the a.f.c. circuit contains two 1N60 crystal diodes and a slightly atypical cathode-coupled multivibrator which employs a plate ringing coil.

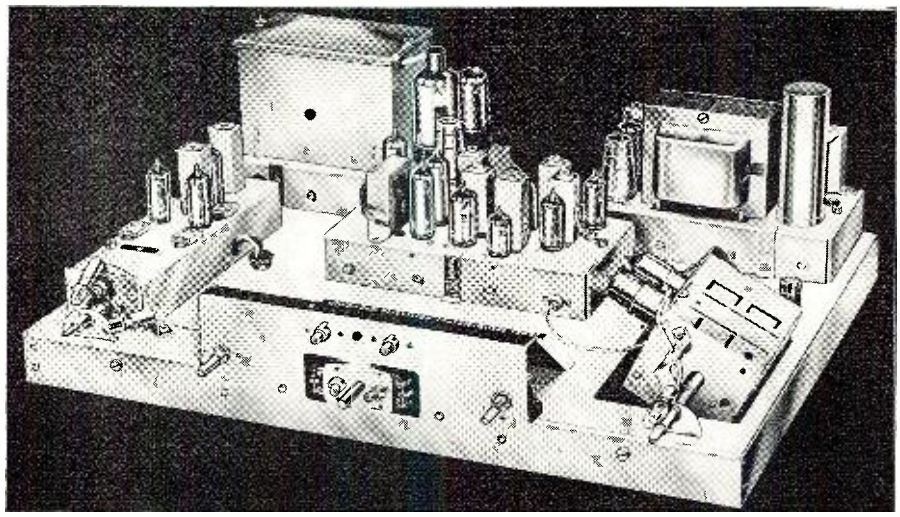


Fig. 4. The "unitized" Setchell-Carlson consists of five major subassemblies.

The ATR Line

Among the various TV set manufacturers, *ATR* is one of the few firms which does not use printed wiring. The stress in this line of receivers is obviously more on quality than on competitive pricing and this is apparent from the various circuit features as well. Fig. 5 shows part of the ratio-detector circuit and the location of the ratio-detector balance control. Correct setting of this potentiometer will provide minimum audio hum and the best sound-detection linearity. It should be set only during the sound i.f. alignment and is not intended for use by the customer. The sound output is through push-pull 6AQ5's, driven by push-pull 6AV6's.

While the vertical sweep uses a blocking oscillator circuit, the output stage is a 6CM6 beam-power tube with special linearity-compensating feedback from plate to cathode. A rather elaborate four-tube video i.f. section provides high adjacent channel rejection through tuned traps.

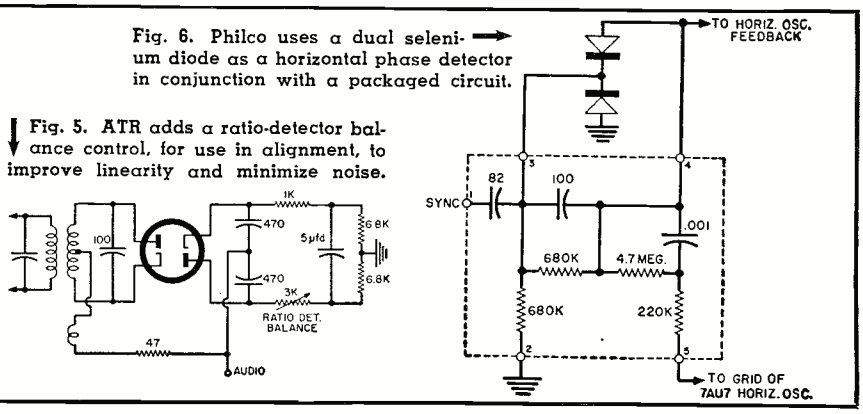
RCA KCS116B and Others

RCA has one model which is rather unusual in that it combines a table-model TV set with a 45-rpm record player. This model, the "Bellevue," contains a 14" receiver and a small phonograph in a very compact cabinet. Other *RCA* models follow more conventional practices and contain most of the same circuit features already described for other sets. The FM detector is the 6DT6 type, driving a 6DS5 output amplifier which feeds three separate speakers. Another interesting aspect of some recent *RCA* models is the introduction of the 5AS4A full-wave rectifier tube to take the place of the 5U4.

Printed-wiring boards are used throughout and three different packaged-circuit assemblies take the place of the audio limiter bias, sync filter, and vertical-sweep networks. The last of these is shown to the left in the circuit of Fig. 7, which is the previously mentioned vertical oscillator and output system used in a number of new TV receivers. In this illustration, only the essential components are shown, and such connections as those for vertical retrace elimination are omitted. The output amplifier in Fig. 7 is a 6CZ5 pentode, the grid bias of which determines the vertical linearity. Differentiated-pulse feedback from the plate of the output tube is applied to plate and grid of the 6CG7 in such a way as to linearize the oscillations due to grid-to-plate coupling in that tube. The 6CG7 circuit is basically that of a phase-shift oscillator triggered by the integrated vertical-sync pulses. The frequency of the phase-shift oscillator is regulated by varying the positive grid bias. This causes grid current to be drawn and

Fig. 6. Philco uses a dual selenium diode as a horizontal phase detector in conjunction with a packaged circuit.

Fig. 5. ATR adds a ratio-detector balance control, for use in alignment, to improve linearity and minimize noise.



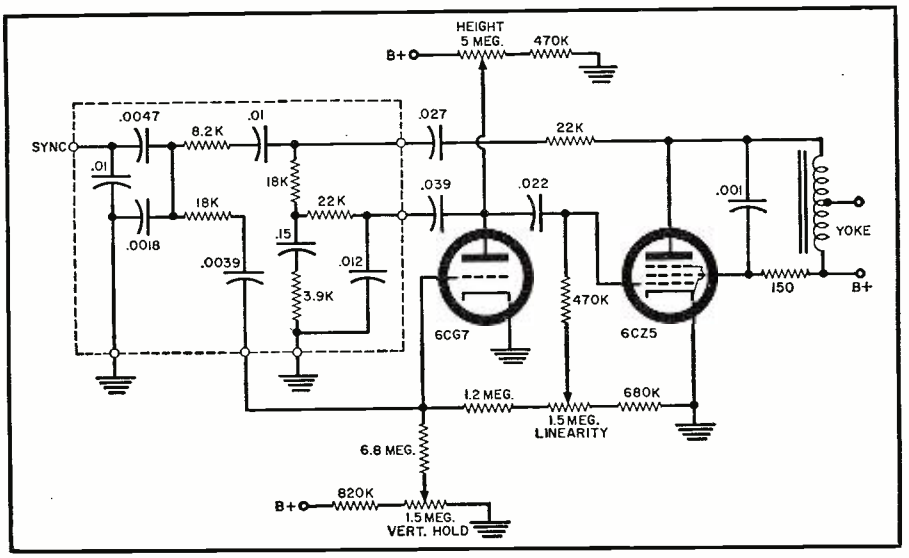


Fig. 7. Zenith uses an unusual vertical oscillator and output circuit.

sets up a negative bias. Variation of the oscillator plate voltage varies the height in the usual manner.

For the service technician, this type of circuit should not present any difficulty, especially if accurate waveforms and voltage data are available. In a set like the *RCA*, where a single package is used for five resistors and seven capacitors, a defect or change in value of any of them may require replacement of the entire package. Because good vertical sync and linearity depend on the correct values of these various integrating, differentiating, and phase-shifting components, replacement is possible only with a close-tolerance substitute.

Zenith 1958 Models

The absence of printed wiring and the use of power and remote-control tuning are the outstanding features of the new *Zenith* line. Among new tubes, *Zenith* uses a series-filament version of the 6BU8 sync-separator and a.g.c. amplifier, which is also found in the new *Olympic* and other sets. *Zenith* adds cooling fins to its power transformer which dissipate the heat generated inside the transformer.

New Motorola Chassis

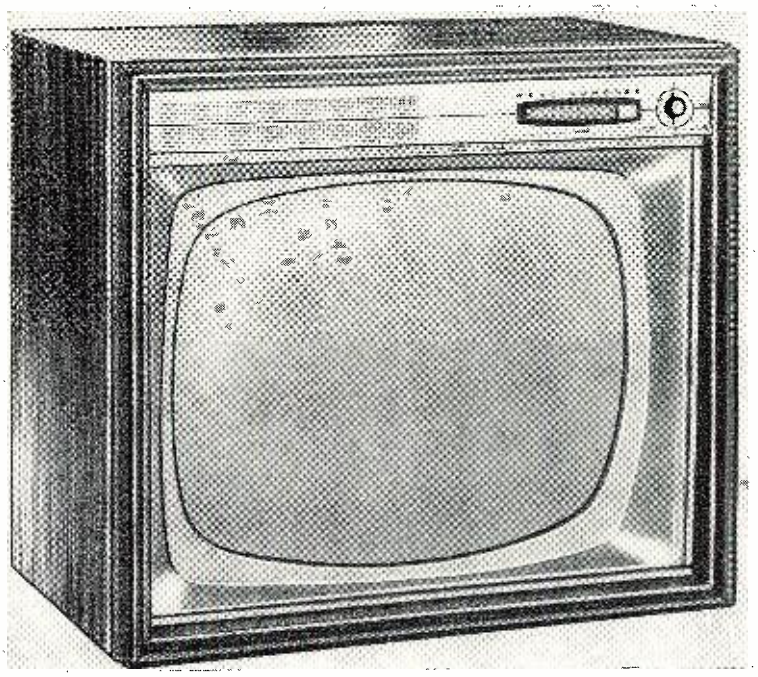
These models use the same type of vertical-sweep circuit as described in detail for the *RCA* sets and therefore do not have a vertical blocking-oscillator transformer. Except for the TS428 chassis, they do not employ printed wiring but do use some packaged circuits. In the TS425 and TS427, silicon diodes are used as power rectifiers and, as one of the exceptions in the industry, the TS425 model does not have a voltage doubler, using only a single silicon rectifier to provide "B+."

One unusual feature found in most new *Motorola* sets is the manner of adjusting the electrostatic focus. A 33,000-ohm resistor is located right in the picture-tube socket. The service technician can connect the focus element either to ground or to this resistor, which goes to "B+." This connection is made by soldering a shorting wire between the respective tube pins after it has been decided which connection gives best focus.

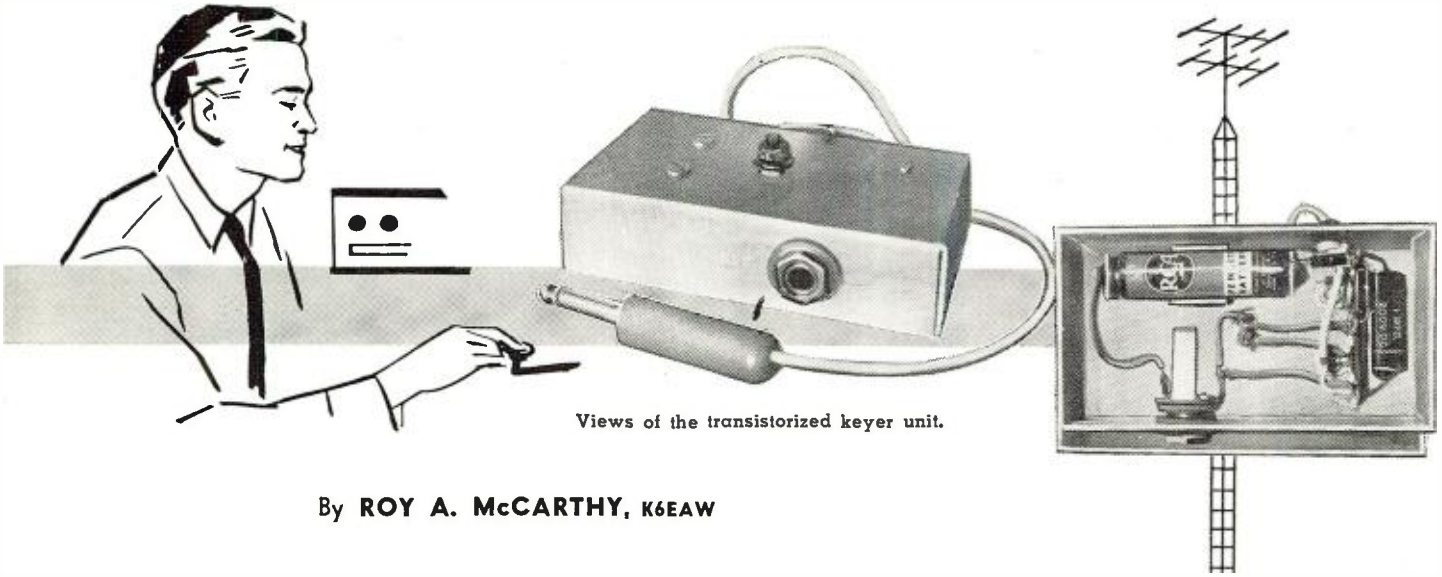
The Packard-Bell Line

All new *Packard-Bell* sets use power transformers but on some models, the rectifiers are the new silicon-diode types. In most other respects, these models are conventional and conform to the trends discussed. For example, the vertical sweep also employs the triode-pentode combination without a blocking-oscillator transformer as described for Fig. 7. One unique feature of the *Packard-Bell* models is the ANI control found in some of these chassis. This control sets the operating level of the automatic noise-inverter tube. As in most 1958 designs, this tube acts as sync clipper and noise-cancelling amplifier, but here a separate potentiometer is used to set the bias level and thus permit variation of the noise and sync action depending on local conditions. If this control is set for a low noise area and then the set is moved into a location where a lot of noise is experienced, the inverter will not perform correctly and sync will be unstable. The customer should be cautioned against tampering with this control. Although this adjustment was actually first introduced several years ago, it never came into general use. Most manufacturers were content to operate these stages at an arbitrarily fixed level. *Packard-Bell* has gone against this trend. —30—

The chassis of Fig. 4 mounts above the CRT in this Setchell-Carlson TV (left) while the Westinghouse set offers automatic fine tuning.



Simple Transistor Keyer Unit



Views of the transistorized keyer unit.

By **ROY A. McCARTHY, K6EAW**

Clickless keyer with negligible voltage drop can be used to key the low power stages of a ham transmitter.

MOST modern transmitters are designed to be keyed in the cathode of one of the low power stages, with clamp tubes or a similar device to protect the final amplifier. This is fine, except that it is usually rather difficult to shape the keying characteristics to obtain clickless, well-rounded code. It generally requires a combination of inductance, capacity, and resistance which is arrived at experimentally, if at all. The result is that a lot of otherwise modern transmitters are responsible for needless interference and hard-to-copy signals due to key clicks and thumps, etc.

This little transistor keyer unit will solve most of these problems, much in the same manner as a vacuum-tube keyer would, except it is much simpler, and eliminates loss of power due to a voltage drop in the keyer.

Circuit-wise, an inexpensive *p-n-p* transistor (2N135, etc.) is used as a power switch. That is, with the key up the transistor is cut off and so is the tube being keyed, incidentally. With the key down the transistor is saturated, hence the voltage drop across it is only a tenth of a volt or so, and you're on the air. (See Fig. 1.)

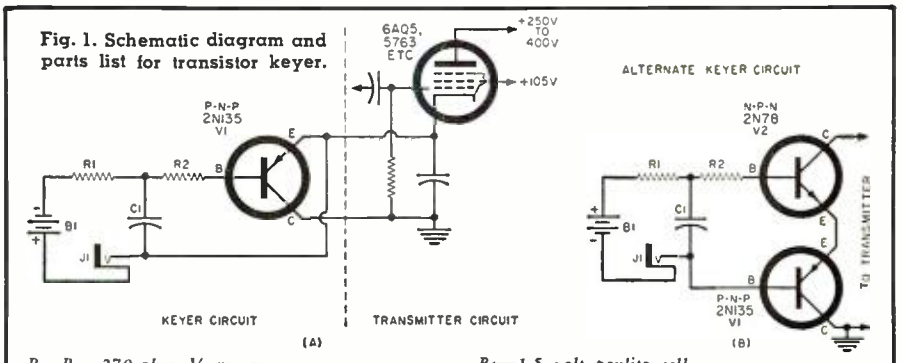
The *RC* network of R_1, R_2, and C_1 is to shape the keying characteristic and the resistors also limit the base current of the transistor to a reasonable value, since 1.5 volts is about the lowest battery voltage available. Since the base current is only one or two milliamps, there is virtually no local r.f. click at the key to be eliminated. With high power transmitters, however, an r.f. filter may be necessary to prevent r.f. pickup on the key from affecting the transistor. This would mean adding an r.f. choke or two and a bypass capacitor across the key leads inside the case, not at the key. The author is using the keyer unit on a five-watt v.f.o. final amplifier stage and obtaining T9X reports as contrasted to the usual T9 report.

Before jumping right in and adding the keyer unit to your transmitter, it is advisable to make a couple of checks first. 1. Connect a high impedance voltmeter (20,000 ohms-per-volt) across your transmitter key, with the key connected for normal cathode keying. If the voltage is greater than 20 or 25 volts, it may be necessary to reduce the screen voltage on the tube being keyed to about 105 to 150 volts. The screen voltage should be from a fixed source such as a voltage-regulated supply or voltage-divider network, rather than from a simple series resistor off the high-voltage supply. This is to insure that the tube will have a sharp bias cut-off point which naturally should not exceed the breakdown voltage of the transistor to be used. 2. Measure the current to be keyed by placing a milliammeter across the key. This current should not be much greater than 50 to 60 milliamperes, the less the better naturally. 3. Check the r.f. output of your rig if it was necessary to lower the screen voltage on the tube. If the r.f. output is too low, it may be necessary to return the screen voltage to normal and use two complementary transistors in series, back-to-back, as shown in the alternate circuit diagram below.

The Zener voltage breakdown point of the transistor can be checked without danger to the transistor by using a constant-current source consisting of a current-limiting resistor connected to a high-voltage source, with a high impedance voltmeter connected across the

(*Continued on page* 153)

Fig. 1. Schematic diagram and parts list for transistor keyer.

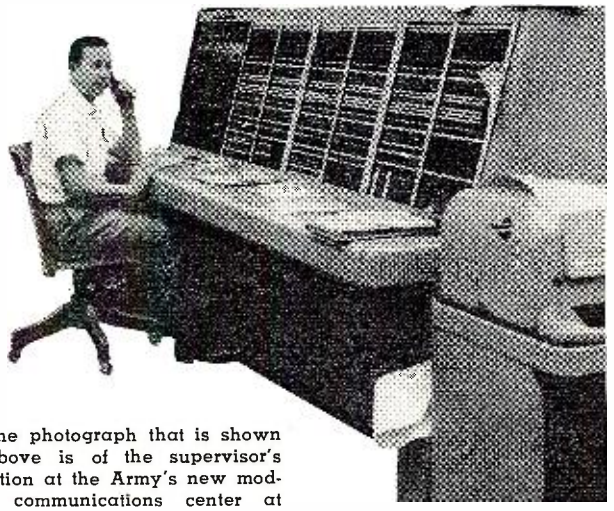


R_1, R_2—270 ohm, ½ w. res.
C_1—1 μfd., 200 v. capacitor
J_1—Open circuit key jack
B_1—1.5 volt penlite cell
V_1—"p-n-p" transistor (2N135, etc., see text)
V_2—"n-p-n" transistor (2N78)

Ultra-Modern

SIGNAL CORPS

First large-scale completely automatic Army teletypewriter and radio facility.



↑ The photograph that is shown above is of the supervisor's position at the Army's new modern communications center at Davis, California. The supervisor is seated at the large control board that enables him to exercise a maximum amount of control with the least amount of effort. The system currently in use actually routes the messages automatically instead of relying on hand routing which was formerly accomplished by a message clerk.

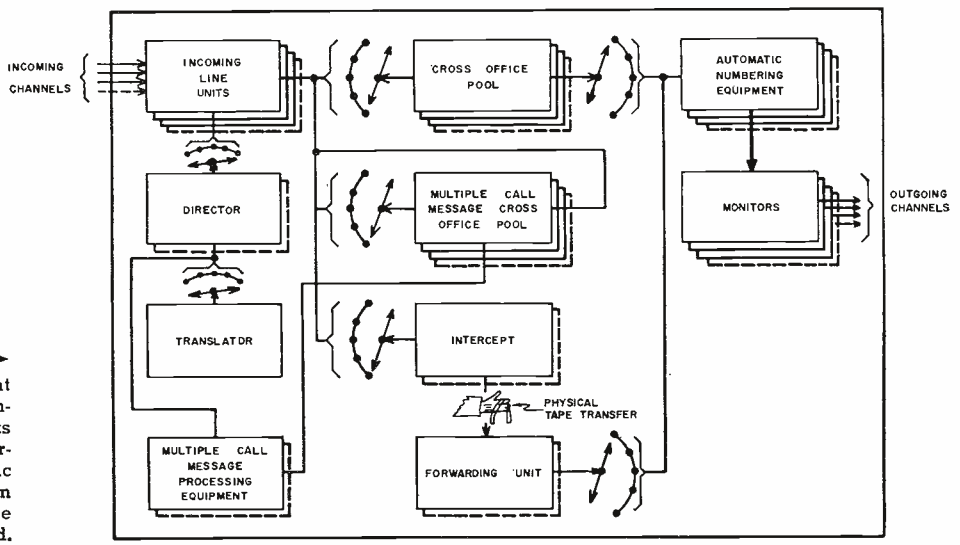
↑ Shown here is the main control console in the foreground. In the background may be seen the frequency shift exciters, the patch system, and the frequency counting equipment that is required at the communication center.

TAKING advantage of advances in electronic automation the Army has acquired a multi-million dollar, fully automatic teletypewriter switching and radio transmission facility capable of handling a prodigious amount of communication traffic generated in continental U. S. and overseas military installations. Located at Davis, Calif. approximately 90 miles from San Francisco, this first large scale switching center is the result of joint effort of the Signal Corps Engineering Laboratories and the *Automatic Electric Co.*

The hub and switching control for official Army teletypewriter messages west of the Mississippi River, it is also the jumping off point to the Pacific overseas area with high power radio channels to Honolulu, Tokyo, and connections from that point to all Army installations in the vast Pacific area. In the United States it ties Alaska, Seattle, Los Angeles, Chicago, San Antonio, and the Pentagon together at a common point where messages destined to or from these locations may be rapidly switched and relayed to their destinations.

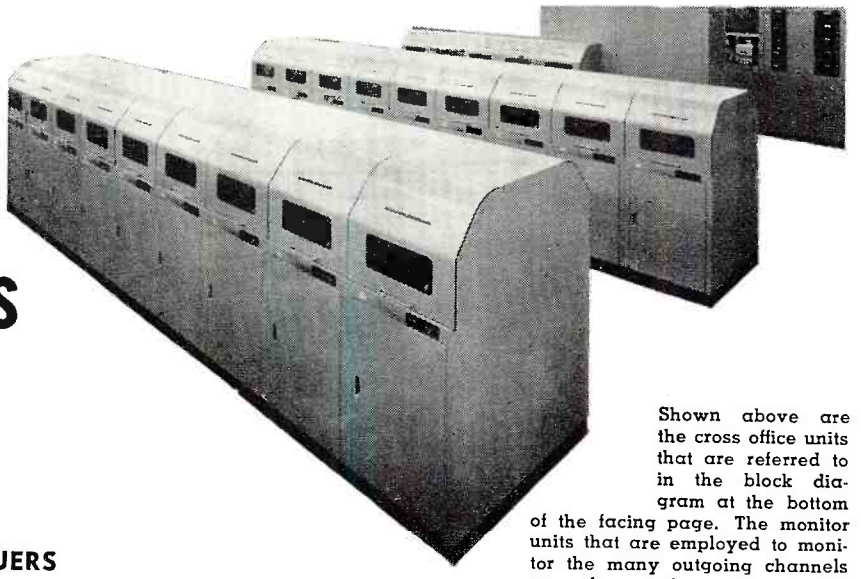
In the United States landline circuits are leased from commercial companies to provide dependable main and alternate message paths to insure uninterrupted communications. Equipped to provide protection for highly classified traffic originating in the White House, State Dept., Defense Dept., as well as other top agencies of the Government, it operates 24 hours per day, every day.

The difference between the new system and the one formerly used is somewhat comparable to the difference between a dial and manual telephone system. In the old



Block diagram of the automatic system currently in use. In this arrangement an electronic tape reader reads the incoming message tape and determines its destination by the combination of perforations on the tape and an electronic brain, called a director unit, sets up an electrical path across the room to the outgoing circuit that is to be employed.

Communications Center



Shown above are the cross office units that are referred to in the block diagram at the bottom of the facing page. The monitor units that are employed to monitor the many outgoing channels are also partly shown in the background of photograph.

By **LT. COL. CHARLES J. SCHAUERS**
Chief, Communications Engr. Div., Headquarters, Sixth U. S. Army

system, circuit connections were effected by the route clerk carrying the teletypewriter tape across the room to a transmitter. In the present fully automatic system the message "dials" its own path to the addressee. All instances of unusual conditions or circumstances, trouble or requirements for special handling are called to the attention of supervising attendants by an automatic arrangement. A large panel board with switches and lights keeps the attendants informed of the status of all circuits.

The major advantage of the new system is that it provides a speed of handling which cannot be approached in the old manual system and does it with an increase in accuracy and reliability. Supervisors are trained at the *Automatic Electric Co.'s* school especially set up for this purpose. Operations personnel are trained in classes conducted at the Davis Station.

Although the radio transmission facilities are located at Davis, receiving facilities are about 37 miles away at Middletown, Calif. Signals received there are transmitted by microwave and landline to the switching center at Davis.

All modes of transmission are utilized, including single-sideband. Transmitter powers up to 50 kw. are employed. A large number of trained engineers are required to maintain and operate the transmitters.

While this system has cost the Army a great amount of money for research, manufacturing, and installation, it is expected to pay for itself rapidly in the reduction of operating personnel required and in the decrease in service message handling time and cost.

Coordination of engineering for the system is the responsibility of the Communications Engineering Division, Signal Section, Headquarters Sixth U. S. Army, Presidio of San Francisco, California.

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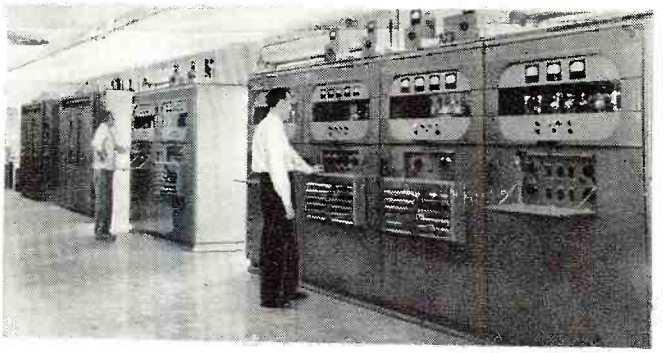
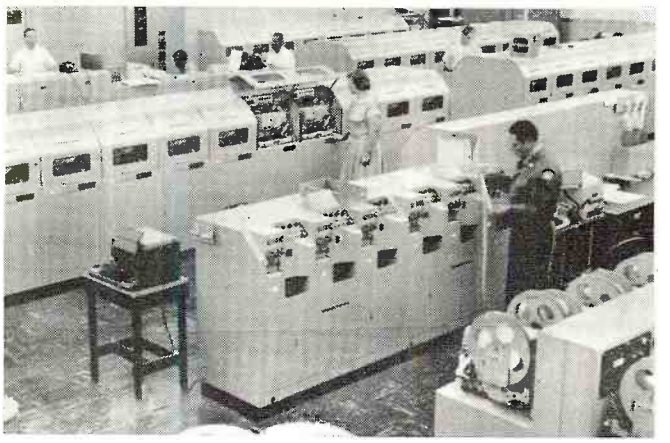


Transmitter engineers are shown here in front of some of the 15 and 40 kilowatt transmitters that are employed at the center.

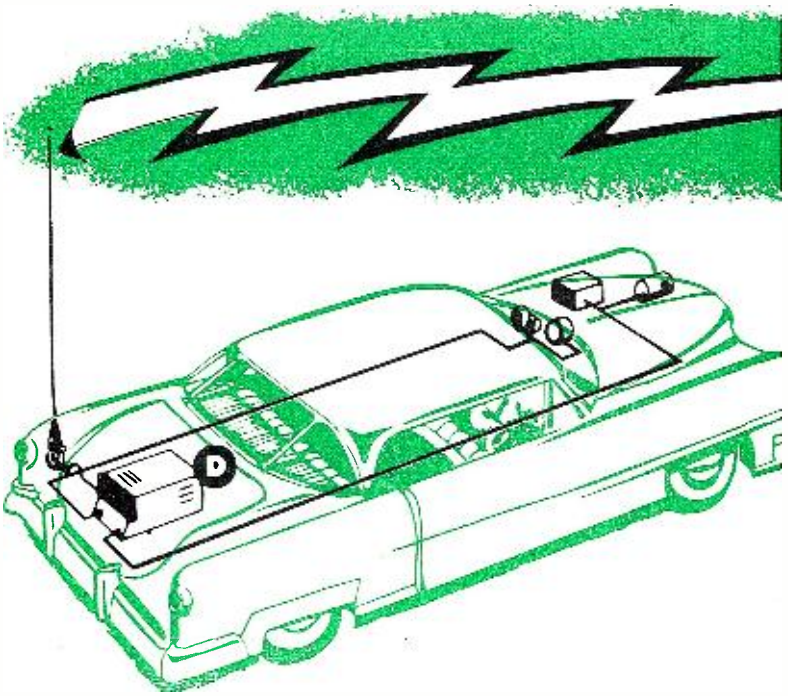


Shown in this view is the relay center general operating area with the many tape machines that are employed. With this new system it is possible to accomplish switching in a matter of milliseconds thereby allowing the first part of a message to be started on its way to its destination while the latter portion of the message is still being received at the Davis, California center.

Shown here is the control console of the message center. If all the outgoing circuits are busy, the equipment will automatically hold the message until the circuit becomes available. This is accomplished automatically in a matter of a few seconds; no routing clerks are required for this.

BASIC FACTS on Mobile Radio

Background information includes some practical material on installation, maintenance, and equipment repair.



MOBILE RADIO is a "natural" field for the TV service technician. Many of the circuits encountered resemble those found in TV receivers. Transmitters are new to most service people, as well as some receiver circuits, but mobile radio has a number of advantages as a new field.

Modern mobile radios are well designed; reliability is built-in as far as possible. Many servicing troubles commonly found in radio and TV receivers seldom occur in mobile equipment because of this ruggedness. Some of the test equipment now in your shop can be used for mobile work such as meters, scopes, and tube testers. Some new items will be needed, but there are excellent types on the market which are not high-priced. Such instruments as a modulation meter or a highly accurate signal generator will soon pay for themselves.

Mobile radio is the fast-growing, two-way voice-communication service between two stations, at least one of which is mobile or moving. About 900,000 transmitters have been authorized in this service. (Not all of these are actually operating, as figures noted later will show.) Usually each installation has both a transmitter and a receiver. Frequency modulation or amplitude modulation may be used. Both types are on the market, but FM is more common.

Every mobile communicating system is assigned a certain frequency on which to operate, as in commercial broadcasting. The most simple system has a base (fixed) station and at least one mobile station.

As the need for increased traffic arises, a system of mobile communications is expanded, using repeater stations located at several strategic points, in order to gain greater coverage. These stations pick up all messages and rebroadcast at greater power.

EDITOR'S NOTE: *Readers of "The Two-Way Mobile Service Business," which appeared in our February issue, who have become interested in this area will find their curiosity further satisfied in this article. Here is additional background information as well as material on installation, service, and repair.*

In many installations there is a need for several channels on one system. There are systems with multi-frequencies. A typical case would be a large installation where vehicles may be speaking to each other while, at the same time, the base station wishes to call a third mobile unit on a different frequency.

Mobile radio has many possible uses. Fig. 2 illustrates a police unit in use. A delivery truck is reporting to its office for instructions in Fig. 3. The use of radio in public utility field work is shown in Fig. 4. These are only some of the applications. The use of mobile communications has proved itself a time-, money-, and, in many cases, a life-saving service. Its unusual versatility lends itself to practically every industry and service.

Fig. 1 shows a typical basic system. Base station *A* is located at any point near the fixed antenna. Dispatching or two-way conversation may be originated from a local control point at the base station, or from one or more of the remote-control units at *B*, or from both the local and remote-control position. The remote-control points at *B* permit two-way conversation through the base station to any vehicle. A floor-control switch, which frees both hands of the operator, is shown. A monitoring unit (*C*) permits personnel to hear both the transmitted and received messages of the base station. The vehicle, equipped with mobile unit *D*, may also speak to the other vehicles on the road.

Frequency bands which are of greatest current interest and activity are 25 to 54 mc., 146-174 mc., and 450 to 470 mc. for all emergency services (including Police and Fire), construction, municipalities, low-power industrial, utilities, trucking, taxis, etc.

Frequency assignments in each band are usually on a non-exclusive basis; that is, several transmitters may share the same frequency although they are geographically close together. The Federal Communications Commission in Washington, D. C., is the agency responsible for licensing and controlling mobile radio just as it does with AM and FM radio and television broadcasting. The FCC approves commercial mobile equipment, issues the station licenses, and provides the licenses for operating and maintenance technicians.

FM is becoming increasingly important as the method of transmission, but AM is still in use. FM (phase modulation changed to FM) has important advantages over AM for mobile use. Probably the most important single advantage is the relative freedom from noise that can be obtained, which is important in low-power operation particularly.

Mobile land communication has a long and interesting history: Early

Fig. 2. A mobile police unit in use.

By **ALLAN LYTEL**
Author, "U.H.F. Practices and Principles"

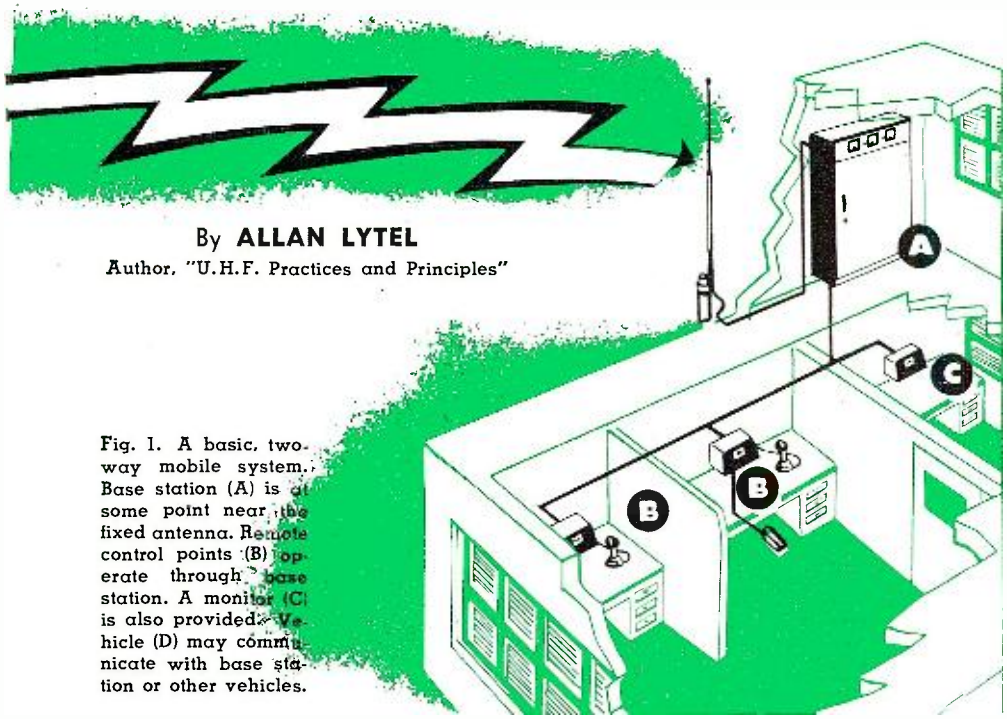


Fig. 1. A basic, two-way mobile system. Base station (A) is at some point near the fixed antenna. Remote control points (B) operate through base station. A monitor (C) is also provided. Vehicle (D) may communicate with base station or other vehicles.

spark transmitters were installed in Signal Corps vehicles in 1904. Air-to-ground communications operated experimentally in 1908. In 1921, station KOP (Detroit Police Dept.) was active in land-mobile radio. FM entered the radio industry in 1936 and, in 1941, the FCC authorized FM for vehicular communications. During World War II, many excellent FM communication sets served all branches of the armed forces; since the end of the war, mobile FM radio has grown very rapidly.

The gradual emphasis has been toward higher frequencies, which have certain advantages. Those above 100 mc., for example, have a limited range. This can be desirable, since stations on the same frequency do not normally interfere even when they are only 50 to 100 miles apart. Because mobile radio channels are on a shared basis, it is important to minimize interference between transmitters on the same frequency.

Citizens Radio Service is an important branch of mobile radio. It is intended for private or personal short distance radio communication. Any citizen of the United States who is 18 or more years old may obtain a station license in this service (providing, of course, that his application meets the general requirements of the Commission's Rules and Regulations governing the Citizens Radio Service). The licensee may authorize the use of his station (or stations) by other persons, but he is still responsible for operation.

The increased use of mobile radio has brought this field its most important technical problem: how to allow more transmitters on the air in the assigned bands, which are already crowded. Some possible solutions to this are sharp i.f. filters for greater selectivity; two-level power operation where reduced transmitter power is used whenever possible; or possible single-sideband operation for reduced bandwidth. The trend is toward more narrow-band equipment to allow more transmitters without interference, but some of the techniques are still to be proven in the field. Some would say that none are yet completely satisfactory from the viewpoint of low cost, simplicity, and ease of maintenance.

Who Uses Mobile Radio?

The growth of two-way radio communication has been rapid; according to the FCC, mobile radio more than doubled from 300,000 transmitters to 640,000 transmitters in the three years from 1952 to 1955. An increase of 115,000 in a single recent year was chalked up, indicating the impressive rate of growth for those who are seeking a promising activity.

Police departments were among the first to use mobile radio and it has become an important tool in law enforcement. Present users include police and fire departments, utilities such as gas and electric companies, such services as fuel delivery, wreckers, taxis, auto clubs; emergency types of service such as doctors, ambulances, and highway departments; as well as aircraft—both commercial and private—farmers, general truckers, mining companies, loggers, fishing boats, and construction companies. The increased use has created a demand for more competent service personnel particularly those with proper FCC licenses, for maintenance and repair.

Typical Mobile Radios

There are a great many variations in mobile radio equipment. A fixed (non-mobile) base station is usually operated from a.c. power lines and has a transmitter power of between 30 and 250 watts. A mobile station is operated from the vehicle's battery, which is 6 or 12 volts d.c. In most cases, the mobile transmitter is between 5 and 30 watts. There are usually several mobile stations for each base station. Fig. 5 shows several typical vehicular radio mountings. *A* is with front-mounting. *B* and *C* are variations of trunk-mounting. In each case, the microphone, speakers, and operating controls are mounted near the driver-operator.

Fig. 3. A truck driver gets route changes from his office.

Fig. 4. Two-way radio is used in public-utility field work.

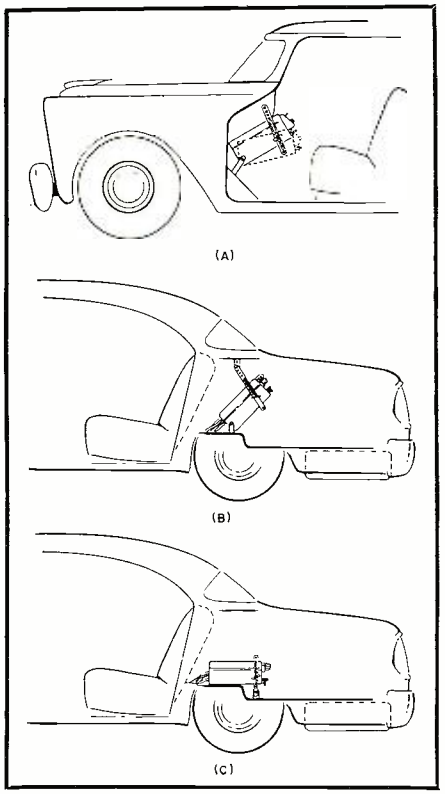
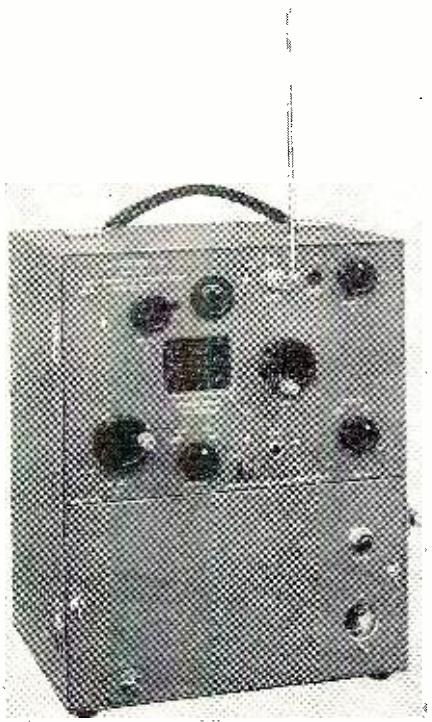


Fig. 5. Typical vehicular mounting techniques include (A) front mounting and two forms of trunk mounting (B, C).

Receivers are single-frequency tuned, but provisions can be made for two-channel operation using two different local oscillators. The receivers are adjusted at the factory to receive only their assigned frequency. Typical receivers have crystal control for the local oscillator frequency—some sets have automatic frequency control

Fig. 6. Typical v.h.f. frequency meter used for two-way is extremely accurate.



systems. Single, double, and triple superheterodynes are used. Selectivity is between 20 and 40 kc. or better and sensitivity of one microvolt or better is common. Mobile radio receivers have squelch circuits, to prevent an output from the speaker when no transmission is being received. Some receivers have selective-calling arrangements to enable the base station to choose among several receivers on the same frequency.

One interesting feature is the great number of different equipment systems that can be made up from a very few basic units. The beginner may be overwhelmed by the number of different types of equipment in the line of a given manufacturer. As an example — a basic transmitter-and-receiver combination is a single mobile unit. Any number of different operating frequencies can be used. Any transmitter can have any of several different power ratings. Power sources such as vibrators, dynamotors, combinations of these, and 117-volt a.c. power (for base stations) each make an installation different. Equipment can also be mounted in one of several ways.

All of these variations mean that a single basic combination can be used in many different ways. But, from the servicing point of view, there is fortunately a great similarity: aside from minor considerations, an entire class may be treated in the same way.

Servicing and Repair

A radio or television service technician going into the mobile radio business will have some of the necessary test equipment, but not all of it. Repairing mobile radio is more exacting than ordinary radio or television repair for several reasons. The technician making the required frequency checks on transmitters, by law, is responsible to the FCC for the accuracy of his work.

Since a mobile radio is an integral part of the business of the user, and not a medium for entertainment, the customer needs the radio for everyday use and his equipment must have periodic checks. True, if he is a trucker he can still use the truck although the radio does not work, but the loss of income because of missed pickups or half-empty trucks is serious and he will be satisfied only with a rapid return to service of his radio. In a sense, the mobile-radio user considers periodic checks and preventive maintenance in much the same way he considers the lubrication of his truck. Both are required for uninterrupted service.

Mobile radio servicing has both greater rewards for the repairman and also greater responsibility. One part of this responsibility concerns the use of test equipment. This equipment must be accurate, reliable, and suitable to the special requirements of mobile radio. Test equipment such as a tube tester, a v.t.v.m., a multimeter, r.f. and a.f. signal generators, a battery eliminator, and a capacitor checker are normally found in a television repair shop and are useful for some aspects of mobile radio work. The signal generator should, of course, cover the necessary frequency ranges but, for some servicing, it must be far more accurate than ordinary test equipment. Other equipment, not used for television or radio servicing, is also required.

A frequency meter covering all bands is needed to keep the transmitter on the proper frequency so that it will be received by other stations and so that it will not interfere with stations assigned to a different frequency. Fig. 6 shows a frequency meter designed for mobile radio work. This meter is accurate to 0.001%; it covers the band from 20 to 640 mc.

A modulation meter is needed both for AM and FM. The modulation meter in FM measures the deviation (bandwidth) of the FM carrier. This deviation must not exceed 15 kc. and the meter must respond to *peaks* of the audio voltage, not average values. A typical meter is shown in Fig. 7.

Dummy r.f. loads are also required to simulate actual conditions of operation and, at the same time, to prevent any radiation of the signal. A grid-dip meter is also very useful; this is a calibrated resonant circuit which permits the measurement of a tuned circuit without applying power to the equipment.

Other measuring equipment for bench work includes various bridges, meters, and an oscilloscope.

Mobile radio needs more competent service technicians, properly licensed, who understand mobile transmitters and receivers. —30—

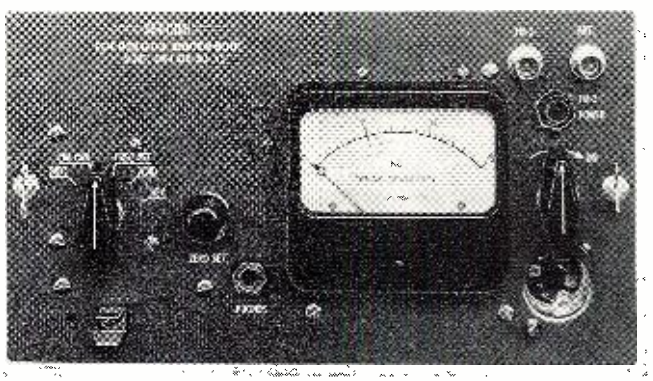


Fig. 7. A modulation meter, like this unit made by Gertsch, is used to measure peak deviation of the FM carrier (bandwidth).

Tube Checkers Promote Service

Putting a tube tester in front of the layman is not enough when his set goes bad. An essential third ingredient is the skilled electronic specialist.

One strategy for winning back the tube sales that have been spirited away by the drug store.

JUST A FEW years ago, service associations were urging upon their members the necessity to drop the practice of free tube testing. Time was required to perform such tests —valuable time—and, if the service dealer failed to place a proper valuation on it, he as good as told his customers that he did not think much of his own services. Thus, the argument went, the dealer was entitled to a nominal charge of five or ten cents per tube to cover his costs and to establish tube testing as a professional service. The underlying argument is as sound today as it ever was, but there is no longer the same unanimity in carrying it to the stated conclusion as far as tube testing is concerned. The context in which the argument is made has been changed too much by many factors, some of them out of the control of the service industry.

The rage for do-it-yourself activity is too far advanced in all fields for service to ignore its effects or pretend that it doesn't exist. Furthermore, there are now many tube checkers whose operation has been so simplified that the non-technical may operate them with reasonable reliability. Most important, service now lives in a strange merchandising atmosphere that marks, in many ways, a return to the philosophy of the general store, on a much grander scale. Five-and-dime stores are selling foodstuffs and clothing. Food supermarkets are selling books and records. Drug chains are selling appliances, house furnishings—and tubes.

The defective tube—or the one, rather, that turns out not to be defective—is the legitimate starting point for a more complicated service call. Even the tube sale itself, when that is the only thing needed to put a set back in operation, is an important personal-contact and income factor to the service shop. In answer to the inroads made by the drug store, the supermarket, and other businesses, many service dealers now say, "If you can't beat 'em, join 'em."

Such dealers are themselves making use of testers that can be operated by the customer. Thus cancelling out the one great competitive advantage offered by other sellers of tubes, they go on to press the many additional advantages of coming to established service shops when TV sets go bad.

Service shops can be counted on to sell reliable tubes of known quality. They will employ legitimate simplified testers rather than those in which accuracy has been sacrificed for the sake of easy operation. Since even the best inanimate checker cannot pass judgment in those many "twilight" cases as to whether the tube should be changed or the circuit should be investigated, the skilled professional is always at hand for consultation. We do not know whether this approach is the long-term answer to the problem of encroachment. At least, however, the battle has been joined. —30—

THIS MONTH'S COVER

THE TV set owner on this month's cover has strolled into Sil-Rad Laboratories, located on New York City's Second Avenue, with some tubes from his defective set. Along with a check of some suspicious tubes, he has the advantage of consulting with Arthur Silverberg, Sil-Rad proprietor, whose many years of experience in electronic servicing speak for the reliability of his advice.

The tube checker on the counter is the Hickok Dynamic Mutual Conductance Tube Tester, Model 123. Despite its high degree of accuracy in measuring tube quality, plus the ability to measure gas and leakage or shorting, the tester is simple enough to operate so that it may be entrusted to the set owner on a "test-it-yourself" basis. Using punched cards, numbered to correspond to the tube types, to set up all switching and connections automatically, the unit combines speed and simplicity with reliability. (Ektachrome by Daniel Rubin Studios)

The WEAKEST Link

By **HERMAN BURSTEIN**

Advice to audiophiles seeking hi-fi perfection —look to your program sources for distortion.

MUCH has been said about the "weakest link" in audio. We have often been told that it is not the tuner, phonograph, preamplifier, or amplifier, but the last link, the speaker. Conceivably, however, we have been looking at the wrong end. There is room to argue that the weakest link is at quite the opposite end, namely the program source.

This argument applies about equally to each of the three sources that customarily furnish musical fare to the high-fidelity enthusiast: FM, disc, and tape. The material from these sources is not always consistent with high-fidelity standards, falling down in two very important respects: distortion and frequency balance.

Since modern audio components typically encompass the range of 40 to 15,000 cycles or better, noise (including hum) is a greater bogey than in the days when few home systems exceeded 80 to 5000 cycles. Therefore, it is generally sought to maximize the audio signal in order to improve the ratio between this signal and noise both in the source and in the reproducing system. But the state of the art imposes limitations on the extent to which the signal-to-noise ratio can be raised. As these limitations are exceeded, distortion becomes offensive.

A high signal-to-noise ratio is, of course, important and is one of the principal attributes of high-fidelity reproduction. But when it calls for an undue sacrifice in terms of increasing the distortion level, then it is desirable to accept something less in the way of signal-to-noise ratio. It appears that too often the balance is weighted in favor of less noise and more distortion.

Let us see how distortion may arise as the result of the quest for a high signal-to-noise ratio, as well as in other ways.

In FM, excessive audio modulation of the radio-frequency carrier often takes place. Understandably, a loud audio signal (high modulation) means that the recipient can turn down the gain control of his audio system, thus reducing hum and noise produced by the transmitting station and his tuner and other components, which enhances the vaunted quietness of FM reception.

The Federal Communications Commission stipulates that audio modulation shall not swing the carrier frequency more than 75 kc. up or down. Yet many FM stations transmit a signal containing substantially more modulation. Confirmation of this has been obtained from several engineers who are with leading manufacturers of FM equipment. Overmodulation breeds distortion both in the transmitter and receiver (FM tuner). Assuming that maximum modulation is ± 75 kc., an FM tuner should theoretically have a bandwidth of about 240 kc. Few, if any, commercial receivers have a bandwidth more than 200 kc., but if the tuner is well aligned this bandwidth can still permit very satisfactory reception. Many tuners have bandwidths that are 3 db down at 180 kc. and some at even 150 kc. In such cases the tuners are already seriously flirting with distortion even though station modulation is within ± 75 kc. In all events, appreciable distortion will occur in the tuner when modulation exceeds ±75 kc.

Overmodulation is not the only cause of distortion in FM broadcasting. There is a fairly long chain of equipment between the pickup stylus or microphone and the transmitting antenna, and distortion can arise due to the design and/or alignment of such equipment. For a long time, 5% maximum harmonic distortion was considered an acceptable limit in the radio field, even though this may correspond to as much as 15% or more intermodulation distortion. Whereas high-fidelity standards impose much more rigorous requirements, not all FM broadcasters have followed suit.

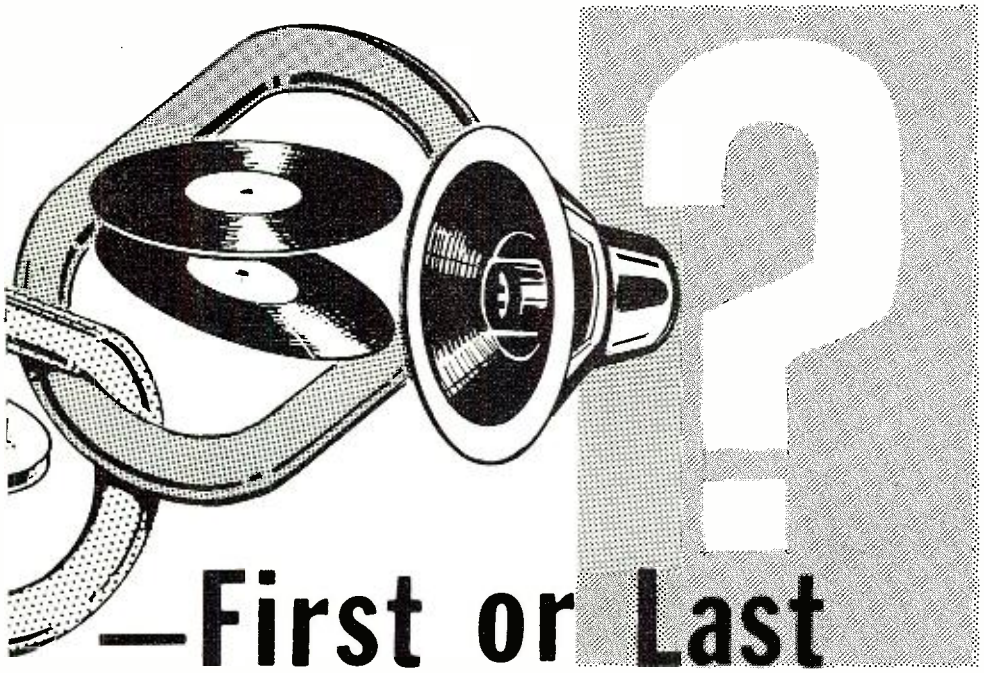
It should further be pointed out that the cause of distortion in FM programs may lie in the records that the stations play. Some are quite worn and perhaps were not good even to begin with; some of the new ones may not be worthy of the designation "high-fidelity." Futhermore, the cartridges employed for playing the discs are not always of top caliber.

All records have an inherent amount of noise due to irregularities, dust, etc. in the grooves. Obviously, the more signal impressed on the groove, the greater is the signal-to-noise ratio for the record itself. To the extent that the audio system generates appreciable hum and noise, the signal-to-noise ratio for the system is reduced. However, high amplitude signals generate distortion due to non-linearity of the cutting stylus, overcutting of adjacent grooves (unless variable pitch recording is employed), and the difficulty experienced by the playback stylus in tracing the sharp turns which occur when high frequencies are cut into the groove (pinch effect).

Although heralded as superior to discs, a good many recorded tapes exhibit considerable distortion. While high recording levels may not breed more than 2 or 3% harmonic distortion—the customary *rated* maximum recording level of many tape recorders —yet the corresponding IM distortion may be on the order of 10 to 20%. Actually, some recorded tapes are made at levels quite a few db above those which would produce 2 or 3% harmonic distortion and in these instances IM becomes rather fantastic on peaks and quite substantial on moderate passages.

Some tape recording companies record a lot of signal in order to provide a decent signal-to-noise ratio for the customer who parts with $5 to $15 for a recorded tape and expects it to be at least as quiet as a less expensive disc. Some home tape machines do not have a really good signal-to-noise ratio. Whereas a ratio of about 55 db is required to keep background noise suitably low for high-fidelity purposes, all too often the ratio is no more than 45 db and sometimes even as low as 40 or 35 db. If the manufacturer of recorded tape puts an extra 10 db of signal onto the tape then, as far as signal-to-noise ratio is concerned, he wrests professional performance out of the "garden variety" tape machines.

The maker of recorded tape must



—First or Last

contend with the fact that processing from master tape to commercial copy involves four or five successive duplications—"generations" as they are called. Each generation breeds more noise, particularly tape hiss. Thus, even if all tapes were played back on machines with signal-to-noise ratios of 55 db or thereabouts, a compelling reason would still exist for the manufacturer to maximize the recorded level.

Another factor bearing on tape distortion is the large quantity of treble boost used in recording 7.5 ips tapes. To keep response within a few db of flat out to 15,000 cycles, treble boost must be such as to reach about 23 db at this frequency when NARTB equalization is followed, as is usually done. If a lower turnover frequency were employed than the NARTB one—say 1590 cycles instead of the NARTB 3180 cycle turnover (which is the case for the CCIR equalization used in Europe)—substantially less treble boost would be needed in recording. This would result in less distortion. Moreover, a 1590 cycle turnover would also require less bass boost in playback, thus reducing hum (the most serious obstacle to a good signal-to-noise ratio) and therefore lessening the need for extremely high recording levels.

If the standard speed for home use were 15 instead of 7.5 ips, a very considerable improvement could be had in tape with respect to distortion. Part of the improvement would result from the reduction in treble boost when recording; no more than roughly 10 db boost would be needed at 15,000 cycles. Furthermore, at 15 ips larger amounts of bias current could be used in recording, with resultingly less distortion.

So much for distortion. Now let us turn to the subject of improper frequency balance, another major flaw often discerned in high-fidelity program sources. It seems that the industry has not yet completely rid itself of the notion that enormous bass and piping treble are the hallmarks of high-fidelity. Admittedly, these qualities are very likely to gain the audiophile's initial attention—particularly when he is wandering down the corridors of an audio show—but they do not necessarily keep him happy very long.

One might think that the audiophile could restore proper balance by use of the bass and treble controls in his audio system. Frequently, however, this cannot be done, because the recording engineer has access to tone controls which shape the audio spectrum in a manner quite different from the audiophile's controls. The typical home music system can only provide a gradual bass or treble boost or cut. But the broadcast or recording engineer can accentuate or de-emphasize particular bands of the audio spectrum, even though they be as narrow as an octave or less. For example, if he feels that the program material needs added brilliance of an easily perceivable kind, he may boost the 3000 to 6000 cycle region. If he wants more apparent bass, but without getting into the problems of overcutting grooves at the extreme low end, he may emphasize the 100 to 200 cycle region. The usual kind of tone controls on the audiophile's high-fidelity rig just cannot de-emphasize such limited-range boost without cutting response at frequencies where no cut is wanted.

One might wonder why recording engineers don't just let the tone controls alone. The probabilities are strong that if they did, the results on the whole would be considerably worse. It is the engineer's task to compensate for acoustics of the recording site, for microphone characteristics and placement, for characteristics of various equipment associated with the recording process. Unfortunately, sometimes he also compensates for imperfections of his monitoring speakers and environment, for imperfections of his hearing, and for his own predilections in musical balance.

Imbalance occurs on tapes and FM as well as discs. Not long ago, four persons very much interested in high-fidelity, of which the writer was one, devoted a long evening to listening to two groups of new tape recordings, each group made by a different company. While there were all kinds of reactions to the musical aspects of the material, there was universal agreement on just one thing: The group B tapes sounded much more natural and therefore pleasing than group A. The listeners soon tired of group A, although they stuck it out long enough to hear representative portions of at least half a dozen of these tapes, but were inclined to go on listening to group B until only the late hour compelled them to stop. After the session it was revealed that the recording engineer for the group B tapes was a well-trained musician.

In the case of FM, not all stations provide correct compensation for the records they play. Some do not provide the treble cut required for RIAA (and other) recordings, preferring to broadcast the record "flat," which really means with a good deal of treble boost, reaching about 17 db at 15,000 cycles in the case of RIAA recordings. This they do in order to compensate for presumed treble losses in the listener's audio system or to make the sound seem more "hi-fi." Also, if network programs are being listened to, especially those duplicated on AM, the interconnecting phone lines that are most commonly used are equalized to handle only those frequencies between 100 and 5000 cps.

Even live FM is often not all that it might be, sometimes because of inadequate compensation for the characteristics of the hall or of the microphone or of line losses. For example, some high grade microphones not only cover the entire audio range but also have an appreciably rising characteristic over the treble portion. While this may be very good for intelligible speech, it makes for thin sound on music. On the other hand, some microphones have poor high-end response, with consequent "tubbiness" of reproduction that almost sound "boomy."

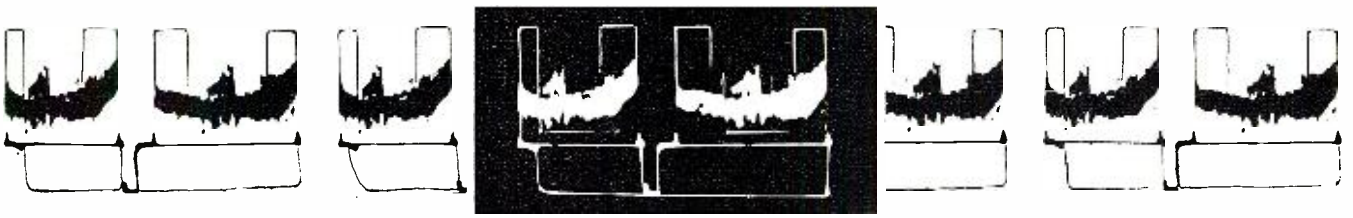
It should be clearly understood that the foregoing is not meant as a disparagement of high-fidelity. It is simply offered in the way of helpful criticism. There is no intention to discourage anyone from buying high-fidelity equipment and using it to avail himself of the riches on disc, tape, and FM. The writer, for one, has heard FM, live and otherwise, that on occasion was so breathtaking as to make up for all the unrewarding times. Similarly he has heard discs

(*Continued on page* 133)

New TV Test Signals Aid Servicing

By **JOSEPH A. RISSE**
International Correspondence Schools

Fig. 1. An ABC studio monitor (right) shows the normally concealed reference-white signal at the top. The waveform below shows two lines of horizontal scan that contain this reference signal. Also see Fig. 4.



Reference standards, now "hidden" in TV transmissions by broadcasters for their own use, may become official. They are also valuable for judging TV set performance.

SINCE the early days of television, broadcast engineers have wanted a method of telling immediately whether their studio and transmitter gear was operating properly, without taking the program off for testing or having to wait until the degradation became serious enough to be noticed. The telephone companies, since they relay the video signal cross-country, also would like some simple method of evaluating operation while the program is on. Add to this the wish of the FCC for a better and immediate means of determining whether a particular station is maintaining operation in accordance with good engineering practices—for example, whether sync percentage, modulation depth, and frequency response are within specifications. Last but not least, an automatic indicator built into the signal would be a great boon to the service technician in troubleshooting and adjustment.

It now appears likely that a standard transmission test signal of some sort will be adopted in the foreseeable future. This article will describe these test signals in general. Then the ones being experimentally used at the present time will be discussed in detail, since it is these you will most likely have an opportunity to observe now.

Need for Reference Signal

One of the most difficult things to accomplish in the whole TV transmission process is the maintaining of consistent video levels and modulation depth. As far back as 1950, stations and networks were experimenting with amplitude-reference test signals. These were generally inserted during the vertical interval, specifically at the end of vertical blanking out before the first active line in the picture. L. Stantz, at WNBF-TV (Binghamton, N. Y.) in 1950 was using a test signal, called then the "white pilot" signal. Fig. 2A shows a sketch of the vertical interval as it is normally; Fig. 2B, after two full horizontal lines of this reference-white test signal are added. Fig. 6 illustrates how these signals would show up on the oscilloscope. This signal served quite well in helping to keep video levels consistent between studio and transmitter.

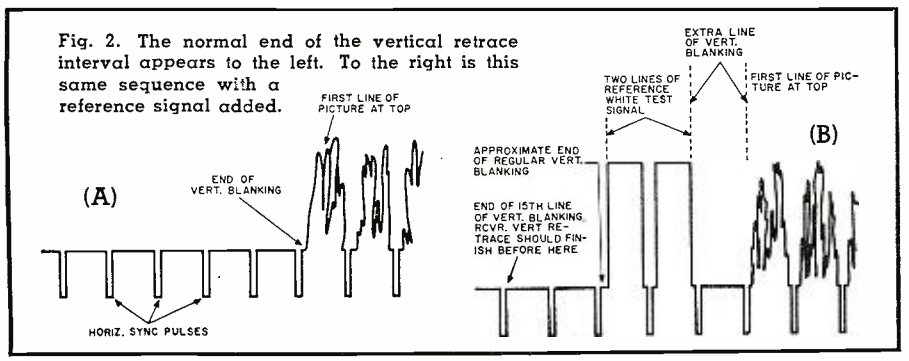


Fig. 2. The normal end of the vertical retrace interval appears to the left. To the right is this same sequence with a reference signal added.

You might ask, "just what does this reference-white signal do?" As you know, the amount and intensity of white and black in representative TV program scenes is continuously changing. At the beginning of each new program, it is hard for the transmitter engineer to judge whether his video level is set to the proper amplitude. He may not be aware, for example, that an opening scene is a little darker than average and he might adjust his video gain too high. Then when the program shifts later to a normally bright scene, amplifiers may overload or the excessive whites may drive the transmitter to zero carrier, causing clipped whites and audio buzz. With a reference-white signal as a permanent part of the video signal, transmitter personnel need only adjust levels using this reference-white signal as a standard. The engineer controlling the signal at the camera will also be using this as a standard and will not permit his video level to exceed the reference-white signal. In other words, a reference-white test signal establishes a standard peak video level for the convenience of technicians at the studio or transmitter or, in the case of network programs, at the relay points along the way. The signal can be set to the proper level at the program's beginning, irrespective of light level of the scene, with no further adjustment required.

Many other test signals and combinations are possible. The most useful for monochrome testing are of the

same general type as just described. These can be used as standards for observing transmission-system amplitude linearity characteristics. Important, too, are test signals that can be used for evaluating frequency and phase response.

Test Signals Now in Use

American Broadcasting Company is presently experimenting with a test signal, one line of which is shown in Fig. 4. This reference-white signal, instead of occupying two *full* horizontal lines in each field, appears only for a few microseconds at the beginning and a few microseconds at the end of each of the two lines. This arrangement permits "hiding" the reference-white behind the receiver mask curvature, in the left and right corners at the top of the raster. Hiding is desirable to avoid the possibility of disturbing the viewer with activity in the picture that is not part of the program.

Fig. 1 shows a photograph, taken directly from a studio picture monitor, of a typical *ABC* program scene as it appeared on the studio monitor. The scope waveform is displayed at one-half line rate (7875 cps) directly below. At the left and right top of the picture can be seen the reference-white signals. These are visible here because of the normal practice of underscanning the monitor picture tube, therefore permitting the complete picture to be seen at all times by control room technicians. (This is the reverse of the practice of overscanning, or pushing the top and bottom of the picture slightly beyond the limits of the tube face, as is normally the case with home receivers. In this way, the reference signals will not be seen by the ordinary viewer.) In the waveform beneath, the reference-white signals appear as square waves or pulses. The flat tops of these pulses represent the level which is not to be exceeded in amplitude by the video signal. (If the test signal of Fig. 2B were used, the white bars would appear as one continuous white line across the top of the picture in Fig. 1.)

Having experimented with reference and test signals since early TV days, *Columbia Broadcasting System,* in August 1957, began using an on-air test signal during live programs from New York. Fig. 5 illustrates the details and

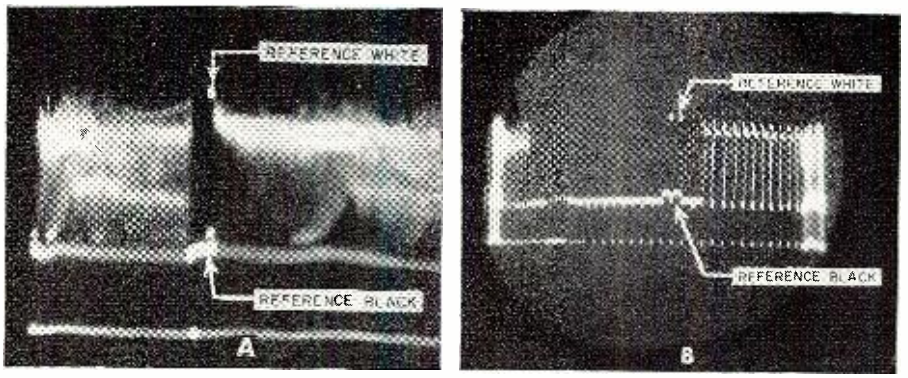


Fig. 3. CBS test signal including reference-white and reference-black levels. The scope waveform is at the vertical rate in (A), expanded vertical in (B).

Fig. 3A shows the scope waveform at the vertical rate. Fig. 3B shows this waveform expanded in the vicinity of the vertical interval. The reference-white signal might be just barely discernible in this photograph, but a reference-black pulse is quite apparent. A reference-black pulse is used primarily to adjust clipping circuits in station transmitting equipment; for proper operation there should be no picture blacks extending below reference-black which, in turn, should be at a point above the blanking level equal to about 1/10 the blanking-to-full-white amplitude. Let's state this another way. If we designate the vertical distance on the oscilloscope waveform between blanking and the reference-white level as 100, the blanking will be at zero level, the reference-black will be at 10% and reference-white will be at 100%. The video information is, at all times, kept within the 10 to 100% region of the waveform.

Fig. 7, a photo of an actual *CBS* program scene, shows just where (upper right-hand corner) the reference-white test signal apears in the raster. Notice that the test signal occupies only a very

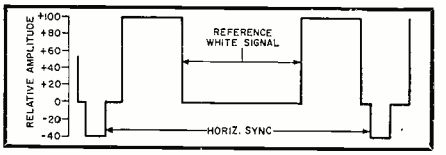


Fig. 4. Diagram of the ABC reference signal. Also compare this with Fig. 1.

short portion of each line in which it appears. This permits the use of other optional signals, as may eventually be deemed necessary (as for color) in the areas marked *A* in Fig. 5. The vertical-interval portion of the picture, greatly expanded vertically, is shown in Fig. 8. Here, reference-black is not too noticeable since there is only a 10% difference in contrast between it and blanking. Clearly shown are the four lines (two in each field) of vertical blanking between test signals and beginning of active picture.

National Broadcasting Company is using six lines (three per field) of the test signal shown in Fig. 9. *NBC* also alternates this one with at least two other types of test signals, not too much different from the one in Fig. 9. In each case, the test signals appear after

Fig. 5. Horizontal lines of the CBS test signal, containing both reference-black and reference-white. Compare with Fig. 3.

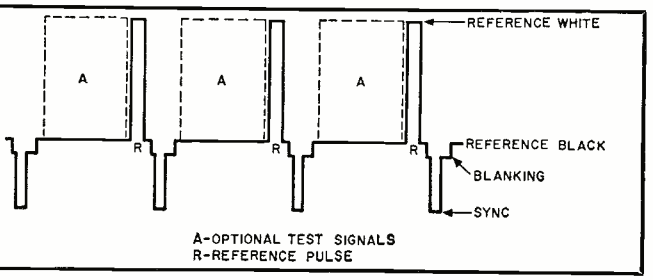


Fig. 6. Scope waveforms of the test signal in Fig. 2 show reference-white (A) at the vertical rate, (B) at the horizontal rate, and (C) at a portion of the vertical trace of (A) that has been expanded horizontally to bring out detail.

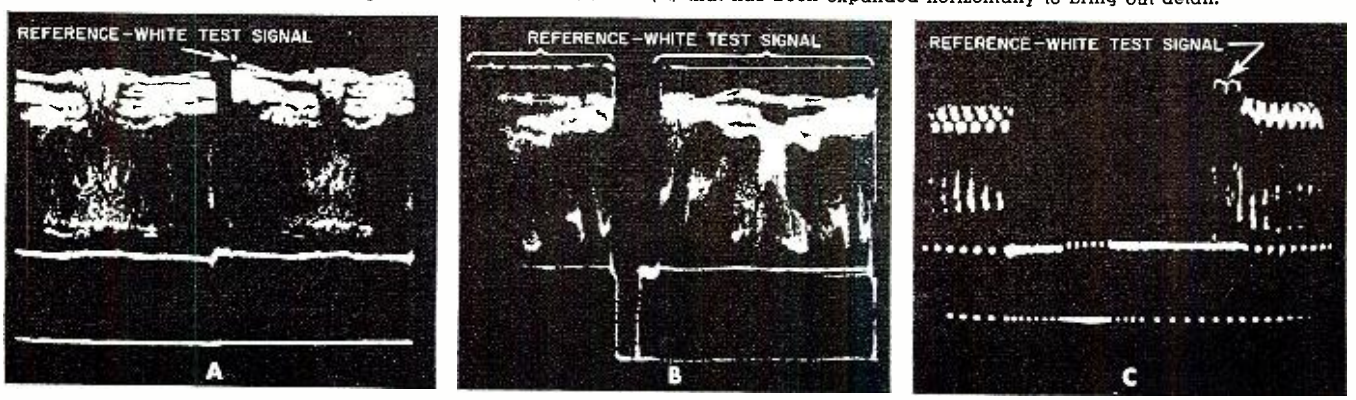


Fig. 7. Photo of an actual CBS program, showing the position in the raster of the reference-white signal, upper right.

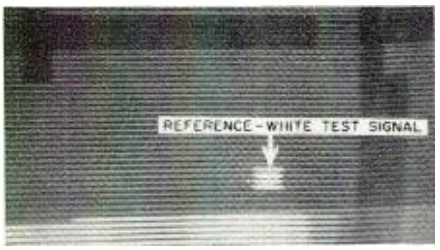


Fig. 8. Vertically expanded portion of the raster to show white test signal.

the normal, minimum, vertical-blanking period. One inactive line appears between the test signal and the first line at the top of the picture. The test signal of Fig. 9 consists essentially of three stair-steps, the steps being equivalent to one half of peak amplitude, black, and white, respectively. Following the horizontal-sync pulse is the color flag burst. The half-amplitude bar is the same type of pulse as reference-white, but is placed at half the blanking-to-white amplitude. Because a half-amplitude bar is approximately the same as the a.c. axis of the video signal, it will suffer less than any other type from amplifier and transmitter non-linearity. This makes it easy to determine whether there is any compressing or stretching of whites or blacks. The half-amplitude bar must, at all times therefore, be halfway between white and blanking.

In the middle of the half-amplitude step of the signal of Fig. 9, there is superimposed 10 microseconds of 3.579-mc. signal phased 180 degrees from the flag burst. In the middle of the next step, representing black, is superimposed 10 microseconds of 3.579-mc., phased to magenta. The step representing white has, superimposed in the middle of it, 10 microseconds of 3.579-mc. signal phased to cyan. As far as the step corresponding to white is concerned, its 3.579-mc. sine waves are shifted downward so that the peaks correspond to white; thus no part of the over-all test signal exceeds peak white. It can be seen that this signal serves the multiple purpose of evaluating white, black, and mid-amplitude linearity, as well as differential gain, differential phase, and low-to-middle frequency response (by using corners and leading and trailing edges of stair steps).

The frequency-burst test signal shown in Fig. 10 includes a reference-white signal and several bursts of test frequencies, all transmitted at identical amplitudes. This signal is now widely used for in-plant testing, but it obviously would be useful if adopted as part of a standard test signal. The frequency bursts, of course, are for evaluating the frequency response of the whole TV transmitting system. The frequencies of this test signal are, in the order shown after reference-white, .5, 1.5, 2.0, 2.4, 3.6, and 4.2 megacycles. Other frequencies can be inserted if desired. This signal could be particularly useful for receiver alignment work. Under favorable conditions it could alleviate the need for connecting a sweep or single-frequency generator.

Service Applications

The signals which have been proposed for evaluating transmission performance might be useful also to the TV service technician. He could tell, for example, by use of a high-quality scope, whether or not he has poor amplifier linearity in the r.f., i.f., or video circuits. Also, by observing for sync or white clipping, the effects of different settings of a.g.c. may be observed. Loss or compression of sync could be established or located. Various other applications of these test signals will doubtless develop once a standard signal is adopted.

There is not much likelihood that these test signals will have any undesirable effect on normal TV receiver operation. They occur close to vertical sync, but well after the sync pulse has ended, so there should be no erratic vertical triggering. The test signals might show up during vertical retrace, but, even without test signals, slow receiver vertical retrace results in foldover or in the appearance of video information before the finish of vertical blanking. Normal vertical blanking specifications call for at least 9 full lines of blanking per field, after the end of vertical sync. Most stations transmit closer to 12 lines after the end of sync. The maximum number according to EIA specifications is 16 (including three lines of trailing equalizing pulses). Between the minimum of 9 and the maximum of 16, there are 7 lines that can be used for test signals without danger of hurting receiver performance. However, none of the plans call for using more than the final three or four vertical blanking lines.

Since most stations do not now use the maximum vertical-blanking period, it will be merely a matter of adding the test signals to the number of blanking lines now existing in each case. The test signals might cause intercarrier buzz—if whites in the normal program cause buzz in a particular receiver—because parts of the test signal are white. However, the test signal will be present in every vertical field and any buzz will therefore be continuous, making the receiver trouble easier to eliminate.

At the moment, we might conclude that receiver performance will not suffer. Rather, the end result should be beneficial. It might be worth your while, if you are able to observe a video signal containing the test signals on a scope, to become familiar with the appearance, with the scope sweep set to both line and field rates. A scope good enough to pass all the video frequencies should be used for best results. Elaborate scopes have a line-selecting feature, but any standard wide-band service scope will show the test signals effectively. Details of the vertical interval can be seen by turning up horizontal gain.

A variety of other test signals is possible. However, until there is formal adoption of these signals in one form or another, discussion beyond what has been covered here would best wait for some future date. —30—

Fig. 9. Proposed NBC test signal, now in use, can be used for checking color as well as black-and-white receivers.

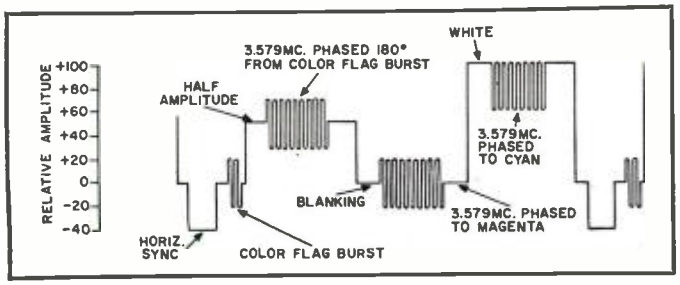
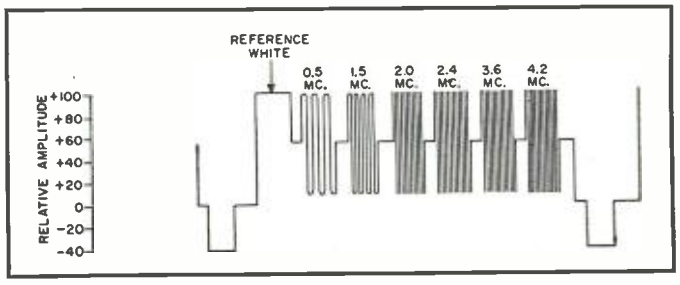
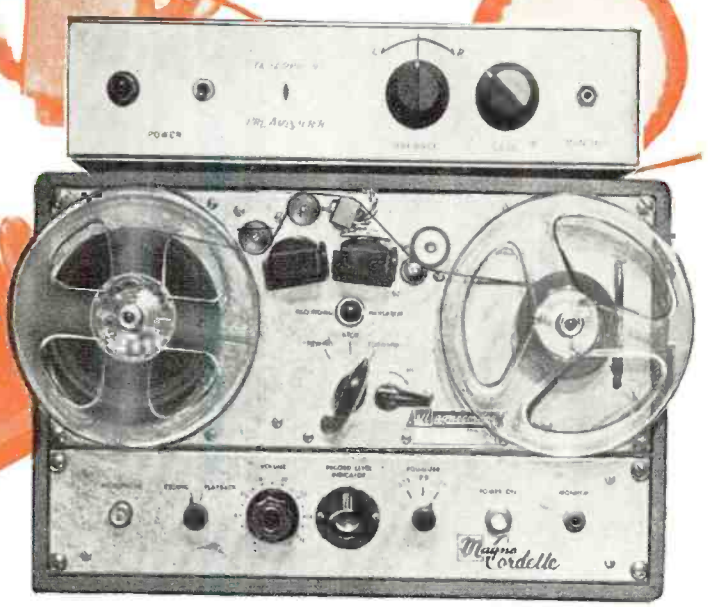


Fig. 10. This train of test bursts at different frequencies would enable a check of TV receiver response and bandwidth.



Adding a Stereo Tape Head and Preamp

By **FRANCIS A. GICCA**
Raytheon Mfg. Co.



Over-all view of tape recorder with the stereo head mounted on the front panel. The companion preamplifier is located atop the tape recorder.

Enjoy stereo sound by adding another tape head and its companion hi-fi preamp to your present tape recorder.

UNTIL recently, the three-dimensional reproduction of sound was a spectacle to be marvelled at in high-fidelity shows. But time has changed all this. Last year *RCA Victor* reported increased interest in three-dimensional, or stereophonic, sound and increased sales of *RCA* stereo tapes. Actually, the entry of *RCA* into the recorded stereo tape market did much to increase interest in stereo. Today, a number of companies are actively producing stereo tapes, including *RCA Victor, Westminster, Mercury, Sonotapes, Phonotapes, Concert Hall, HMV,* and others.

However, the major deterrent to wide-spread public participation in stereo has been, and still is, the high cost of stereo tape players. About the only economical way to overcome this drawback is to add a stereophonic tape head and preamplifier to your present single-channel tape player or recorder. Even this solution has been costly because of the expense of good quality stereo tape heads. Just recently, the *Nortronics Company,* 1015 South Sixth Street, Minneapolis, Minn. has begun selling its model TLD stereo head. This head makes it possible, for the first time, to add stereo playback to your present tape machine at low cost. The new "TLD" head is of the in-line type, which is destined to become standard; has excellent response characteristics; and sells for only $23.50, audiophile net, from the manufacturer.

With a bit of ingenuity, this new head can be added to any good quality tape transport mechanism with excellent results. This article will describe how to add the "TLD" head to your recorder, and how to construct a high-fidelity stereo preamplifier for it.

(EDITOR'S NOTE: *Other manufacturers, such as* Dynamu, Viking, *probably* Brush, *and* Pentron *also have in-line stereo heads or conversion kits available. Although the author has confined his construction to the "TLD" head, the same general principles apply to the other heads. It is suggested that the manufacturers of these units be contacted for specifications and further details.*)

Adding the "TLD" Stereo Head

If you own a medium-priced recorder such as the *Viking, Pentron, Bell,* or similar machines the "TLD" head can be used as a direct substitute for the existing head. Properly connected, the "TLD" head will perform as well, or better, than your recorder's present head, as well as allowing stereo playback of tapes. To begin, simply remove the present head and substitute the "TLD" head in its place. As is the case with many heads used in medium-priced recorders, the "TLD" head mounts with a single 6-32 screw, making replacement easy. For proper operation be sure to orient the "TLD" head's magnetic gap so that it's in the same relative position as the gap of the head replaced.

It will be necessary for you to install a switch between the stereo head and your present tape amplifier to allow you to switch the head from this amplifier to a stereo preamplifier (see Fig. 2). If your present recorder is a half-track machine, use the switching arrangement shown in Fig. 2A, and if your recorder is full-track, use the arrangement of Fig. 2B. For least hum pickup, wrap three #22 rubber-covered wires tightly together to form a cable. You'll need two such cables. Attach one wire of each cable to a ground lug and mount the lug under the 6-32 screw mounting the "TLD" head, if such a ground lug exists under your present head. If not, find a convenient screw near the head

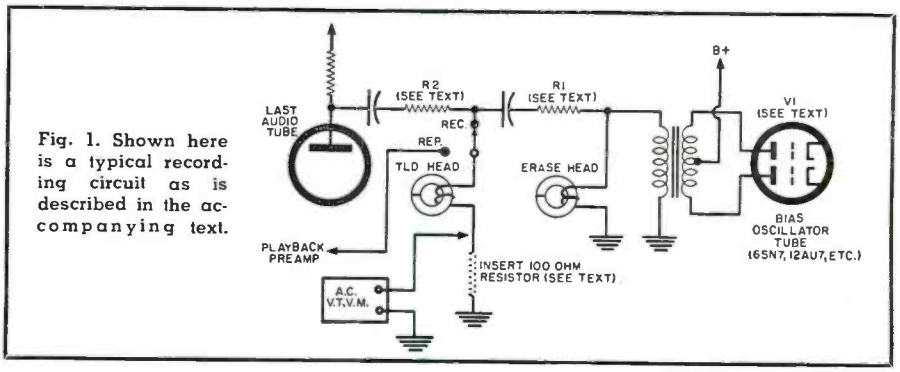
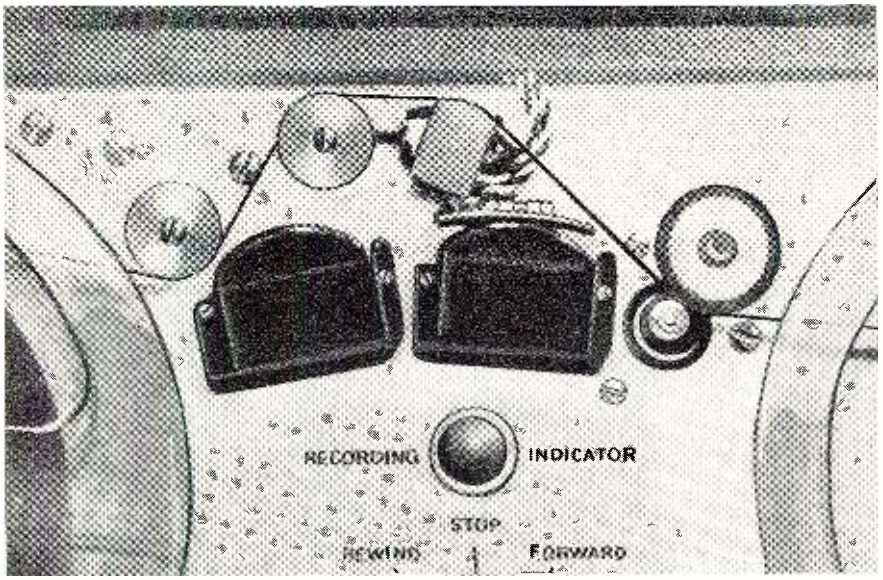


Fig. 1. Shown here is a typical recording circuit as is described in the accompanying text.



Closeup view showing stereo head mounting just above the recorder's original heads.

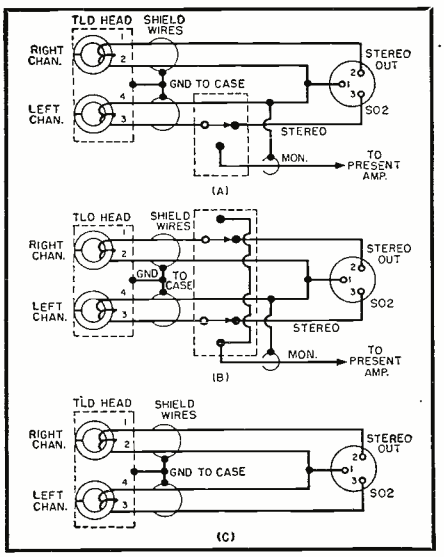


Fig. 2. (A) Connections for half-track recorders, (B) for full-track recorders, and (C) for professional recorders.

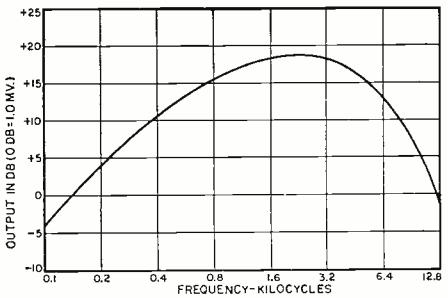
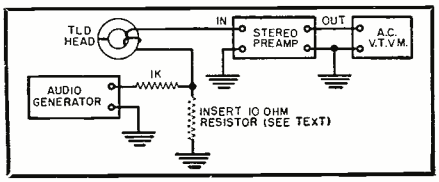


Fig. 3. "TLD" head's constant current characteristics at 7.5 ips, using 3M type 111 magnetic oxide recording tape.

Fig. 4. Setup that is employed for the stereo preamplifier adjustment procedure.



and place the ground lug under this screw. Connect the ground wire to this lug *only*. Do *not* connect this wire to SO_2. The remaining two wires of each cable go to pins 1 and 2 and pins 3 and 4, respectively. Be extremely careful when soldering leads to the "TLD's" terminals. Heat can easily damage the head since a hair-thin wire is used for the head's pickup coils. The terminals also tend to loosen under heat and the head used by the author was almost ruined when the leads were soldered for just this reason. A pencil type soldering iron is strongly suggested or, better still, use terminal clips. The switch should be a ceramic-wafer type and it should be mounted inside a shielded case.

Amplifier Adjustments

To insure proper single-channel operation of your present recorder with its new stereo head, a few simple adjustments should be made to the record and playback circuits. Most medium-priced recorders contain recording circuitry similar to that shown in Fig. 1. As shown, insert a 100-ohm resistor in the ground lead from the head. Turn the record level control to zero and switch the recorder to "Record." With an a.c. v.t.v.m. measure the bias voltage across the 100-ohm resistor. If your machine is half-track, the bias voltage across this resistor should be 0.06 volt r.m.s. If your machine is full-track, the bias voltage should be 0.12 volt r.m.s. In either case, adjust the value of resistor R_1 to achieve proper bias.

The next important adjustment is the setting of the record level. Leave the recorder in the "Record" position and remove the bias oscillator tube, V_1. Connect an audio generator set to 1 kc. to your machine's "record" input and adjust the generator's output level and the record level control until the record level indicator indicates maximum record level (0 vu). At this point, the voltage across the 100-ohm resistor should be 0.005 volt r.m.s. for half-track machines and 0.01 volt r.m.s. for full-track machines. Resistor R_2 should be adjusted for this level. Remove the 100-ohm resistor and replace the bias oscillator tube.

For maximum high-frequency response from your recorder the "TLD" head's azimuth alignment should be adjusted so that the gap is perpendicular to the tape. The best way to make this adjustment is to use a standard tape recorded with a 10 kc. alignment signal. *Omegatape* demonstration tape D-1 (7.5 ips) contains such an alignment signal, as does the *Ampex* standard alignment tape A-1993 (15 ips). Connect an a.c. v.t.v.m. to the playback output of your recorder and play either of the alignment tapes. If your machine has such a control, adjust the azimuth control for maximum output when playing the alignment tape. If your machine does not have an azimuth alignment control, loosen the 6-32 nut mounting the "TLD" head slightly and rock the head back and forth until you find the point of maximum output. Using pieces of paper, shim the head in the position with maximum output and tighten the 6-32 mounting nut.

Professional Tape Recorders

The "TLD" stereo head should not be used as a direct replacement in professional recorders like the *Ampex, Magnecord*, and *Berlant* because of its relatively high impedance. For such recorders it is suggested that the "TLD" head be mounted either alongside the other heads or the tape rerouted for stereo playback as was done on the *Magnecord* PT6 mechanism shown in the photographs. Modifying the "Magnecorder" was easy because of the simplicity in re-routing the tape path to pass over the stereo head. In addition, the "Magnecorder" has a 6-32 screw in an ideal position for mounting a small block upon which the "TLD" head was fastened. The two *Magnecord* tape guide rollers should be reversed so that the roller with tape guide flanges is on top. This accurately positions the tape onto the "TLD" head. It is suggested that a third guide roller be added to the "Magnecorder" following the head to further guide the tape. This guide roller is *Magnecord* part 91A9 and may be obtained from the manufacturer for $4.00. This extra roller has been ordered for the mechanism the author modified and will be added as soon as it arrives.

For other makes of professional recorders, a bit of ingenuity must be used in devising a new tape path so that it can pass over the stereo head. The head should be located in a position where the tape can make contact with the head for 15 degrees on either side of the gap. Be sure to set the height of the "TLD" head so that the tape straddles the two pole-pieces. The pole-pieces come to the very edge of the tape so it is easy to see whether

the head height is right by checking if either pole-piece extends beyond the tape. Where tape tension is rather accurately controlled, as it is on most professional machines, there is no need for pressure pads. Pressure pads should be added, however, if the tape output wavers up and down during playback, indicating insufficient tape contact with the head. Since there is no need to switch the head on a professional machine, modified as described, connect the "TLD" head as shown in Fig. 2C. Again, be very careful not to apply excessive heat to the head's terminals when wiring. Terminal clips are always best.

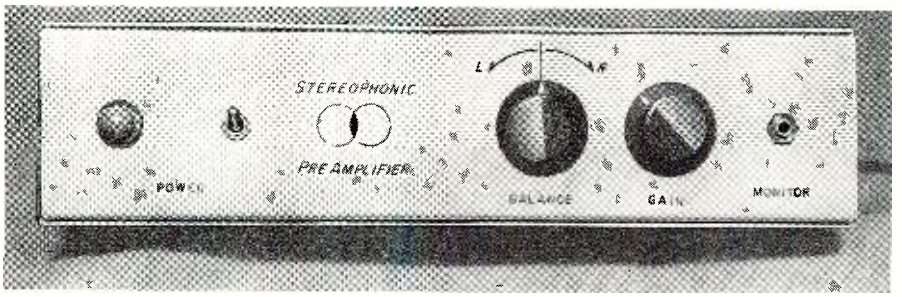
The Stereo Preamplifier

The "TLD" head has excellent constant-current characteristics (see Fig. 3) making it relatively simple to design a preamplifier capable of reproducing the entire audio spectrum. The physical gap of the "TLD" head is only 0.0002 inch, corresponding to a wavelength cut-off frequency of 37.5 kc. at 7.5 inches-per-second. The high-frequency response is therefore limited only by capacitative head losses of the "TLD" head. It then becomes very important that leads from the head to the preamplifier be kept extremely short and low-capacitance, shielded cable be used from the head to the preamp.

For optimum high-frequency response a low-to-high impedance input transformer would appear desirable for the preamplifier. However, this was ruled out because of the high cost of two good input transformers, and the problem of hum pickup by the transformers. It was decided to keep the preamp's input impedance high and keep the leads from the head as short as possible.

A triode was chosen as the preamplifier's input tube to keep tube noise at a minimum. However, a triode's higher input capacitance, when compared to a pentode, also dictates the use of short input wiring. To help keep hum and noise low the input 12AX7, V_1, should be a low-noise type, such as made by *Amperex, Mullard,* or *Telefunken.*

Equalization in the preamplifier is obtained by a simple *RC* network in the plate of the second 12AX7. By adjustment of the two 10,000-ohm potentiometers, the standard NARTB playback curve can be obtained within 1 db, including the head's high-frequency losses. If desired, the two 10,000-ohm potentiometers may be ganged on a single shaft and used as an equalization control. On the preamplifier unit constructed by the author, the two pots were left as nominal adjustments within the case. They were set up to follow the NARTB curve, and then locked in position. Most pre-recorded tapes (with the exception of *HMV*) follow the NARTB curve so that further adjustment is unnecessary unless the 10,000-ohm pots are to be used as "tone" controls to vary the equalization to taste. Either approach is acceptable, since it's the final listening that counts.



Front panel view of the stereo preamplifier with its balance and gain controls.

Two cathode-followers form the output stage of the preamplifier. The output impedance of these cathode-followers is about 500 ohms, so over a hundred feet of shielded cable may be used from the preamplifier to two power amplifiers. The preamp provides sufficient output to drive any power amplifier to full output and operate crystal headphones as a monitor.

The final circuit for the preamplifier is shown in Fig. 5. The preamp alone has a flat frequency from 10 to over 30,000 cycles within 1 db, has a signal-to-noise ratio of 60 db, and has less than 0.5% distortion at full output.

Constructing the Preamp

The preamplifier built by the author uses two wiring panels for most of the circuitry. This method allows extremely short wiring leads and has worked very well. Point-to-point wiring with terminal strips can be used as well, as long as the wiring is kept short, especially to V_1. Be sure to plan your layout so that the wiring for each channel is kept separated. The farther apart, the better, as long as the leads are kept short. Any cross-talk from one channel to the other will reduce the stereophonic effect. The author's wiring was arranged with the two wiring panels opposite each other, about three inches apart, with the tube sockets mounted in the middle.

Keep the power transformer and filter choke on the end of the chassis farthest from the input 12AX7, V_1. It is a good idea to place a Mumetal shield across the chassis separating the amplifier from the power supply. The largest amount of extraneous noise in this preamplifier is stray hum pickup from the power supply, so care should be taken to isolate all leads carrying power supply a.c. All filament leads should be twisted and run down the center of the tube sockets. Make these leads shielded, as well. Connections to the power switch and pilot light should be made using two-conductor shielded cable.

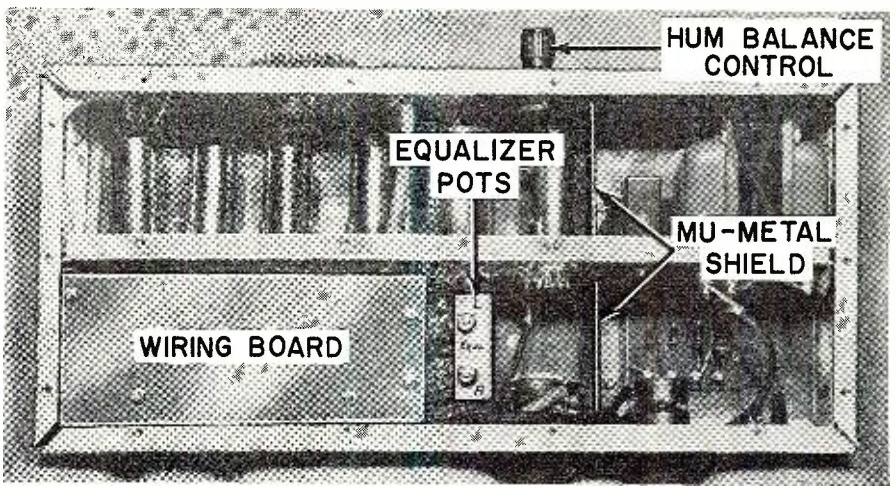
Each channel's grounds should not be connected to the chassis, but should be connected to a ground wire connected to the chassis only at the input socket, SO_1.

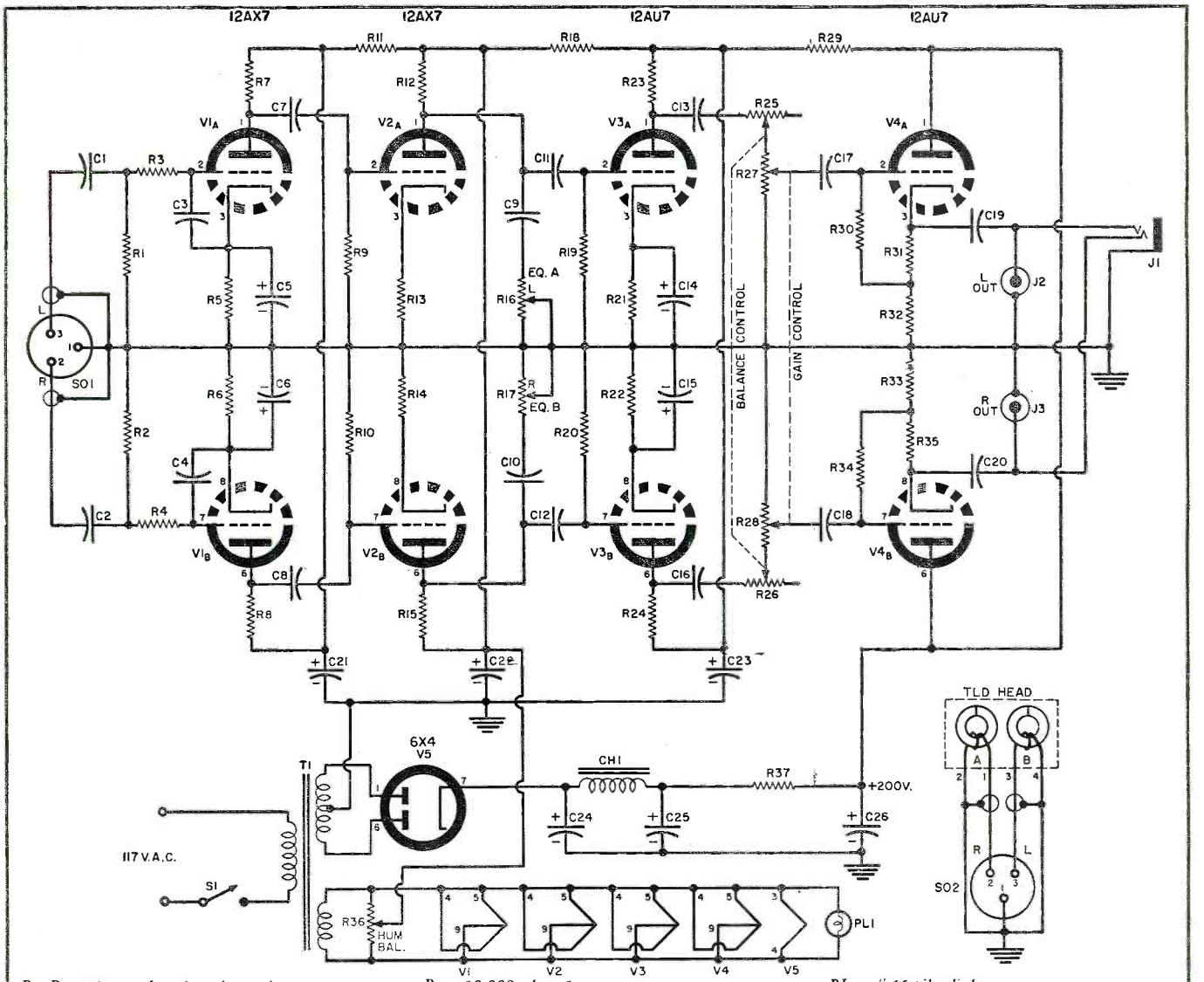
Low-noise wirewound or deposited-carbon types should be used for all resistors in the input stage or excessive thermal noise will result. An alternative is to use two-watt resistors. Two-watt resistors must be used for the two 10-megohm grid resistors (R_1, R_2), since this value is not available as a wirewound or deposited-carbon type.

The balance control is a two-gang 250,000-ohm linear potentiometer that should be wired so that the resistance in the left channel increases as the resistance in the right channel decreases and *vice versa.* The gain control is also a two-gang potentiometer, a 100,000-ohm, audio taper type. The gain control should be wired so that the output of both channels increases together.

To prevent microphonics from reaching V_1, shock mount the tube's socket by inserting two rubber grommets on

View inside stereo preamplifier with top cover removed. See text for details.





R_1, R_2—10 megohm, 2 w. low-noise res.
R_3, R_4—2200 ohm, ½ w. low-noise res.
R_5, R_6—200 ohm, ½ w. low-noise res.
R_7, R_8—220,000 ohm, ½ w. low-noise res.
R_9, R_{10}—2.2 megohm, ½ w. low-noise res.
R_{11}—10,000 ohm, ½ w. res.
R_{12}, R_{15}—220,000 ohm, ½ w. res.
R_{13}, R_{14}—5600 ohm, ½ w. res.
R_{16}, R_{17}—10,000 ohm linear-taper pot
R_{18}, R_{23}, R_{24}—100,000 ohm, ½ w. res.
R_{19}, R_{20}—2.2 megohm, ½ w. res.
R_{21}, R_{22}, R_{31}, R_{35}—2200 ohm, ½ w. res.
R_{25}, R_{26}—Dual-section 250,000 ohm linear-taper ganged pot
R_{27}, R_{28}—Dual-section 100,000 ohm audio-taper ganged pot
R_{29}—10,000 ohm, 1 w. res.
R_{30}, R_{34}—1 megohm, ½ w. res.
R_{32}, R_{33}—47,000 ohm, 1 w. res.
R_{36}—250 ohm wirewound pot
R_{37}—24,000 ohm, 2 w. res.
C_1, C_2—.1 μfd., 100 v. capacitor
C_3, C_4—51 μμfd., 500 v. mica capacitor
C_5, C_6, C_{14}, C_{15}—40 μfd., 30 v. elec. capacitor
C_7, C_8, C_{11}, C_{12}—.033 μfd., 400 v. capacitor
C_9, C_{10}—.022 μfd., 400 v. capacitor
C_{13}, C_{16}—.1 μfd., 400 v. capacitor
C_{17}, C_{18}, C_{19}, C_{20}—.1 μfd., 200 v. capacitor
C_{21}, C_{22}, C_{23}—20/20/20 μfd., 250 v. elec. capacitor
C_{24}, C_{25}, C_{26}—40/30/20 μfd., 350 v. elec. capacitor
PL_1—#46 pilot light
SO_1, SO_2—3-conductor socket (Cannon XL-3-13)
J_1—3-conductor phone jack
J_2, J_3—RCA phono jack
CH_1—10 hy., 50 ma. filter choke (Triad C-3X)
S_1—S.p.s.t. toggle switch
T_1—Power trans. 250-0-250 v. @ 40 ma.; 6.3 v. @ 2 amps (Triad R-4A)
V_1—Low-noise 12AX7 tube (Amperex, Mullard, or Telefunken)
V_2—12AX7 tube
V_3, V_4—12AU7 tube
V_5—6X4 tube

Fig. 5. Complete schematic diagram for the stereo preamp. The unit contains its own built-in power supply for a.c. operation.

the socket's mounting screws between the socket and the chassis. Remember to use a low-noise tube type for the 12AX7, V_1.

Once completed, the entire preamp should be totally enclosed in a metal case. There is no need to provide holes or vents in the case, because very little heat is generated.

Adjustment of the Preamp

Connect the stereo preamp to the "TLD" head's output, SO_2, using a short length of three-conductor shielded cable terminated in *Cannon* XL-3-14 plugs. *Alpha* type 1713 is an ideal cable for this application.

The preamp should now be adjusted so that its equalization follows the NARTB curve. To do this, insert a 10-ohm resistor in the ground lead from the "TLD" head, as shown in Fig. 4. Adjust the equalization first for the left channel. Connect an audio generator to this 10-ohm resistor through a 1000-ohm resistor, as shown. Connect an a.c. v.t.v.m. to the output of the left channel. Turn the preamp's gain control about half way up, set the generator to 1 kc., and adjust the generator's output so that the v.t.v.m. reads 0.1 volt r.m.s.

Set the audio generator to the frequencies listed on the graph of Fig. 6. By adjusting the equalization control, set the outputs to match those listed on the chart or on the curve. Each time the equalization control is adjusted, return the generator to 1 kc. and re-adjust its output for a reading of 0.1 volt r.m.s.

Remove the 10-ohm resistor and repeat the procedure for the preamp's right channel. The preamplifier is now adjusted to the standard NARTB playback curve.

If the "TLD" head has been added to a professional recorder, be sure to adjust its azimuth alignment by playing a standard alignment tape and shimming the head for maximum output in either channel. It is unnecessary to repeat this procedure if you

(*Continued on page* 107)

The Complete TV Remote Control

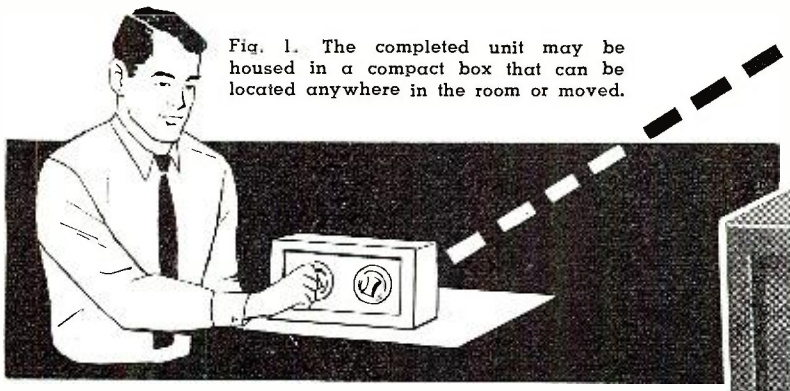
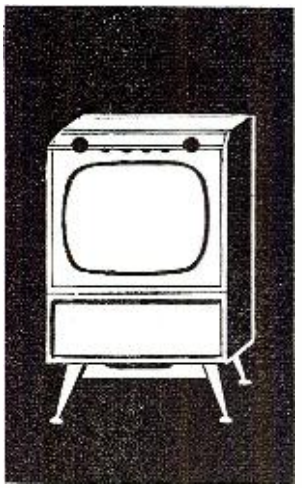
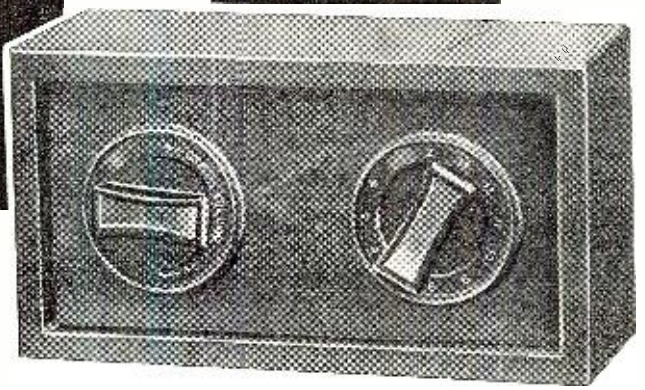


Fig. 1. The completed unit may be housed in a compact box that can be located anywhere in the room or moved.





An unusually flexible wired unit that can be custom-built to work with most TV receivers.

By **DANIEL P. PETERS**

ONCE the television receiver, like any respectable piece of electronic equipment, contained a number of well marked controls. Apparently these half-dozen or so knobs caused great terror among the viewing public, with only children of less than ten years of age courageous enough to undertake their adjustment. To alleviate this condition, the manufacturers launched a simplification campaign. About one knob a year disappeared until even the most timid of adults were no longer frightened.

Now that the receiver no longer instilled fear, the American housewife looked closer at this new entertainment medium and found that the few remaining controls displeased her aesthetic sense. The manufacturer once again answered the call, this time with various camouflaging techniques. Knobs were hidden behind name plates, decorative trim, and even behind secret doors that would make any Swiss woodcarver jealous. This led to the embarrassment of many TV technicians who were forced to ask the customer how to turn the set on.

The viewer, realizing that he had the manufacturer on the run, next desired the controls removed from the set entirely. This ushered in the present period of remote-control units. We now have Flash-O-Matic tuning, Space-O-Matic tuning, and possibly the future will bring Hydromatic tuning.

The author viewed this trend with amusement until he realized that friends considered him a has-been as a creator of electronic devices. Why? Simply because his TV receiver did not contain a remote-control unit.

The time had come to surrender to the trend. Before starting to work, a review of the commercial units was undertaken. The following requirements were considered necessary for a really effective remote system:

1. Continuous rather than on-off types of controls: This immediately eliminated all of the systems that made no electrical connection to the set, unless complicated techniques were resorted to.

2. Since some form of connecting cable was now necessary, it was thought desirable to have several outlets for the remote-control unit about the room. In the interest of economy, as few conductors as possible were considered desirable in the connecting cable.

3. The remote unit was to be as small as feasible. This requirement ruled out the split-chassis type remote unit, in which an important portion of the receiver's circuitry is part of the remote.

4. Control of all normal receiver adjustments was necessary.

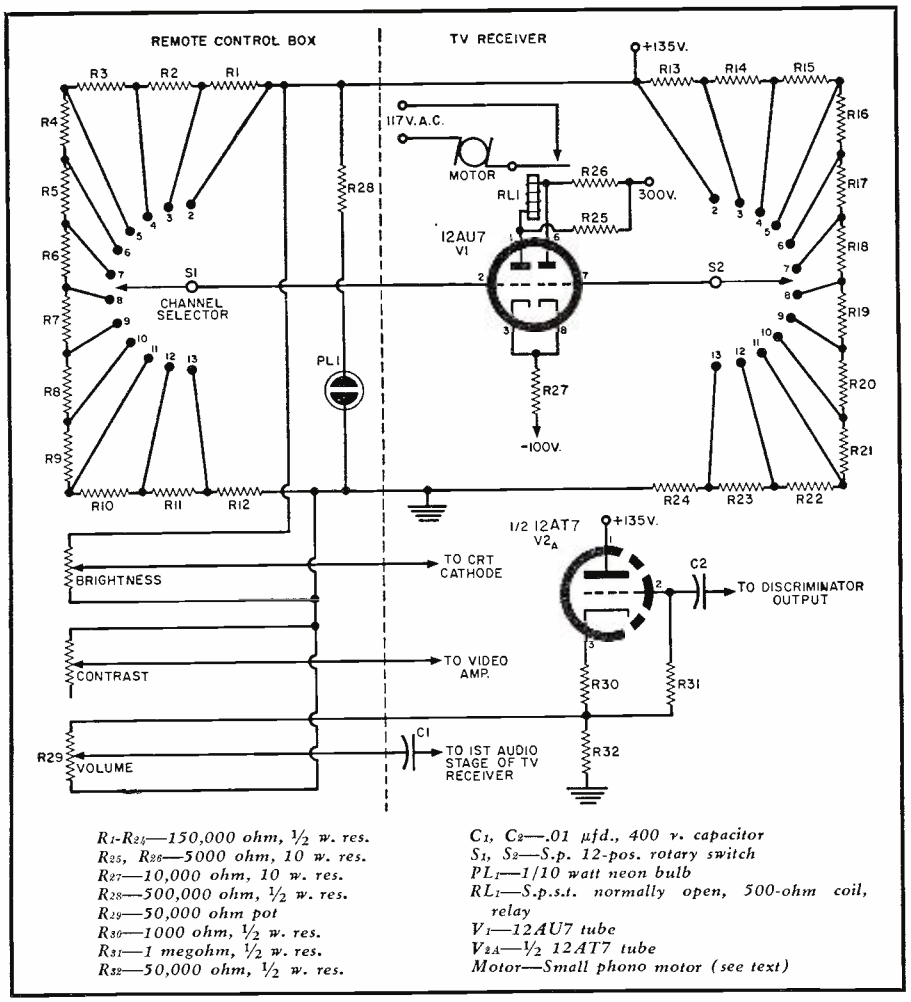
No commercial unit met the requirements, so the unit to be described was constructed and housed in the compact box of Fig. 1. Since the particulars will vary from set to set, the general method of attack will be emphasized more than particulars.

EDITOR'S NOTE: *Many set owners ask their service dealers about the possibility of adding remote-control devices to their receivers or of adding refinements to those already in existence. Obviously, the price of building up one as complete as the unit described would be high. However, it will be necessary only in rare cases. In modern sets, many of the adjustments provided in the author's complete remote may not be necessary or the individual user may not consider them important. One viewer may be satisfied with a simple means of remotely controlling sound level. Another may already have a remote device that permits control of, say, coarse channel selection, leaving him with an annoyingly mistuned picture. The fine tuning circuit described, either remote or automatic, could be enough to solve this problem.*

Channel Selection

Figs. 6 and 7 show the channel-selector drive as installed on a *Standard Coil* tuner. Mechanical power to rotate the tuner was derived from a small phono motor. To build up the necessary torque, a 400:1 gear train was added between the motor and the tuner. This arrangement requires 15 seconds for a complete rotation. The mechanical arrangement used is not critical: one of the tuner-drive arrangements currently being sold by the mail order houses would also serve nicely.

The commercially available tuner drives have one disadvantage or another. Either they will only advance one channel when a button is pressed or they use a multi-wired cable with enough conductors to wire a computer. To enable selecting a specific channel with the minimum of leads, the system shown in the upper portion of Fig. 2 was devised. Operation is



R1-R24—150,000 ohm, ½ w. res.
R25, R26—5000 ohm, 10 w. res.
R27—10,000 ohm, 10 w. res.
R28—500,000 ohm, ½ w. res.
R29—50,000 ohm pot
R30—1000 ohm, ½ w. res.
R31—1 megohm, ½ w. res.
R32—50,000 ohm, ½ w. res.

C1, C2—.01 μfd., 400 v. capacitor
S1, S2—S.p. 12-pos. rotary switch
PL1—1/10 watt neon bulb
RL1—S.p.s.t. normally open, 500-ohm coil, relay
V1—12AU7 tube
V2A—½ 12AT7 tube
Motor—Small phono motor (see text)

Fig. 2. Complete schematic of the remote control unit (to the left of the broken line) and the associated, added circuits or connections in the receiver (to the right of the line). Other refinements are shown in Figs. 4 and 5.

relatively simple. Resistors R_{25} and R_{26} and triodes V_{1A} and V_{1B} form a bridge with relay RL_1 the sensing device. As long as switches S_1 and S_2 are in the same respective positions, V_{1A} and V_{1B} have the same grid potentials and the bridge is close to balance. Rotating S_1, located at the remote unit, to a position differing from that of S_2, unbalances the bridge, setting up a potential across RL_1. This closes the relay, thus starting the motor, which rotates the tuner. Switch S_2, coupled to the rear of the tuner shaft, as seen in Fig. 6, also rotates. When S_1 reaches the same respective position as S_2, the bridge returns to balance, causing the relay to drop out and stopping the motor at the desired channel.

Since several milliamperes are required to pull in RL_1, there is no need for the bridge to be in exact balance. This alleviates the need for precision resistors or balancing circuits.

The only precautions are mechanical rather than electrical. First; before building anything permanent, check the motor you intend using to be sure that it will have sufficient power. Second; since the motor and tuner will coast slightly when power is removed it is necessary to adjust the coupling between the tuner and S_2 so that the relay opens slightly *before* the desired channel.

To insure that the tuner detent, rather than S_2 controls the exact position of the tuner, a coupling such as diagrammed in Fig. 3 appears between the tuner shaft and the drive gears. With this type of coupling, once the motor has rotated the tuner to the *approximate* position and stopped, the tuner's detent can then pull the tuner into exact register.

For those constructors who have continuous type tuners, such as used on *DuMont* sets, a war surplus Selsyn or similar synchro drive works out well. There is a precaution to observe however. If the synchro is connected directly to the tuner shaft, a source of ambiguity results. Since these tuners require 5 or 10 turns to cover the entire TV band, synchronism is lost any time the remote synchro is revolved more than ½ turn when the unit is shut off. There are two methods of solving this problem. The first consists of gearing the unit so that the synchro makes one revolution for the 5 or 10 turns of the tuner. Unfortunately, the torque necessary with this arrangement requires a very large synchro.

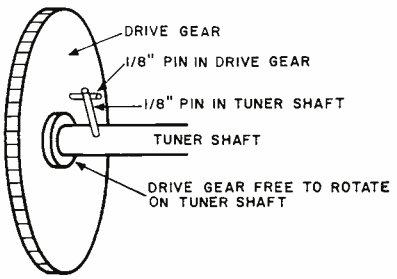
The second solution is the addition of a mechanical locking arrangement that prevents the remote unit from turning when the set is turned off.

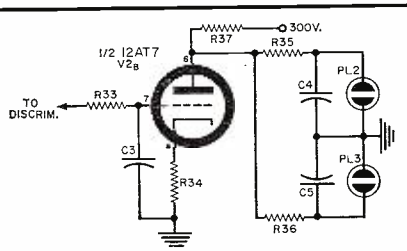
Fine Tuning

Rather than devise a mechanical drive for the fine tuning control, electrical means were resorted to. Since most tuners use a form of capacitive variation for fine tuning, an electrically adjustable capacitor was desired. A review of the literature[1] revealed that the dielectric constant of a neon tube varies with changes in current. This was just what was needed. The metal plate forming the capacitor on the Standard Coil tuner was removed, as was the fine tuning shaft. A new plate was cut out of brass and mounted to cover the two

Fig. 4. The need for fine tuning can be eliminated entirely with this circuit for automatic tuner control.

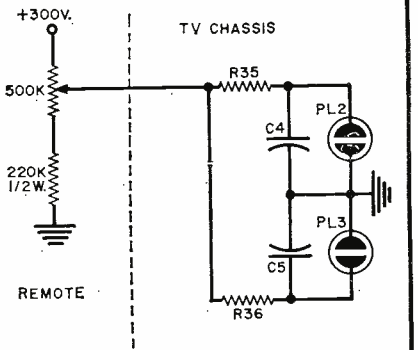
Fig. 3. The type of coupling between tuner shaft and drive gear shown here lets tuner detents lock in channels.





R33—10 megohm, ½ w. res.
R34—1000 ohm, ½ w. res.
R35, R36—1 megohm, ½ w. res.
R37—100,000 ohm, ½ w. res.
C3, C4—.01 μfd., 400 v. capacitor
C4, C5—50 μμfd. ceramic capacitor
PL2, PL3—1/10 watt neon bulb
V2B—½ 12AT7 tube

Fig. 5. This circuit permits remote fine tuning without adding problems.



1/10-watt neon lamps. This arrangement is shown in Fig. 7. The simple electrical circuit shown in Fig. 5 enabled the 500,000-ohm potentiometer to perform the function of fine tuning.

Satisfaction with the simplicity of this tuning arrangement was so great, it was decided to carry the circuit one step further and adapt the set for a.f.c., thereby eliminating the fine-tuning control entirely. The circuit shown in Fig. 4 was tried and has been working admirably for over a year. V_2 acts as an amplifier which uses the variations in d.c. voltage available at the output of the sound discriminator to control the current through neon lamps. In a few sets, it may be necessary to wire bulbs across R_{37} rather than from the plate to ground, as shown. This will depend upon the choice of local-oscillator frequency and discriminator connections. It is advised that the type of circuit shown be tried and then, if instability is encountered, connections can then be changed.

Other Controls

The volume control could have been transferred directly to the remote chassis, but this would have involved such problems as hum pickup and frequency discrimination in connection with long, shielded lines in a high-impedance circuit. To avoid such potential trouble, a cathode-follower stage was inserted at the receiver chassis between the discriminator and the normal first audio amplifier. This stage, shown at the bottom right in Fig. 2, enabled the use of a long line to the remote volume control, shown at the bottom left (R_{29}), without complications.

As for the brightness and contrast controls, signal is not carried by the first and usually not carried by the second either. In this case, there is simply the problem of extending leads and mounting potentiometers at the remote unit with values equal to those originally used at the main chassis. On the 630 chassis used by the author, the brightness control was originally in the CRT grid, which required a negative voltage (see Fig. 8A). Since positive voltage was already available at the remote unit, the brightness control was moved to the cathode circuit (Fig. 8B), to keep down the number of leads required. This problem will not arise in most cases.

Where the contrast control is a bypassed cathode potentiometer, it can also be remoted with little difficulty. If it is an unbypassed cathode pot, it will be a low-impedance point with signal present. Since the frequencies involved go rather high, deterioration of picture quality is quite possible with appreciable lengths of line. If this becomes objectionable, it may be just as well to dispense with remote control of contrast. Normal a.g.c. action plus some remote adjustment of the brightness control may be more than enough to achieve whatever compensation is necessary in switching from one channel to another.

The general method outlined in this article will no doubt be modified by the individual constructor. However, as noted earlier, this is not intended to be a rigid plan that will work in all cases. It cannot be. It does indicate the method of attack with certain problems in setting up remote control that are more or less basic, irrespective of the vagaries of any particular receiver. For one who is willing to tackle the problem of providing such remote operation without having all the answers ready-made in advance, the approaches worked out here can save considerable time. Also, the results are rewarding.

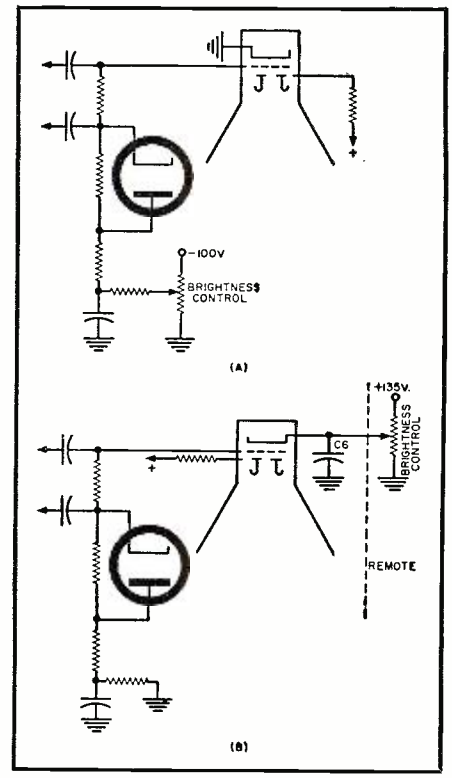


Fig. 8. To avoid extra leads in the remote, a brightness control circuit relying on a negative supply (A) was altered to the one in (B) so that it could operate from a positive source.

In the author's case, the control cable was run around the room and terminated with *Jones* plugs at a number of different points. Thus, wherever the viewer wishes to sit in the room, he can connect the remote unit nearby.

REFERENCE

1. Gordon, J. J.: "Electrically Variable Gas Dielectric Capacitor," Electronics, January, 1956.

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Fig. 6. This view up toward the bottom of the TV chassis shows how the tuner drive motor and control switch S_2 may be coordinated with the tuner itself, becoming part of the receiver rather than the remote.

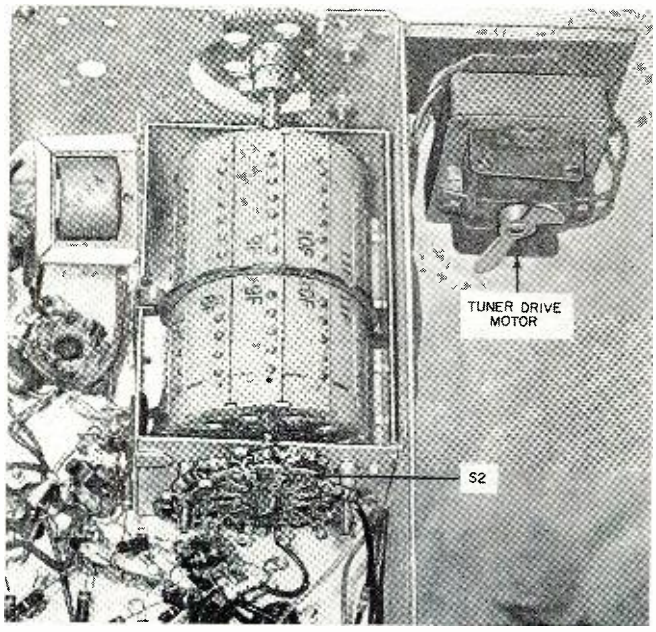
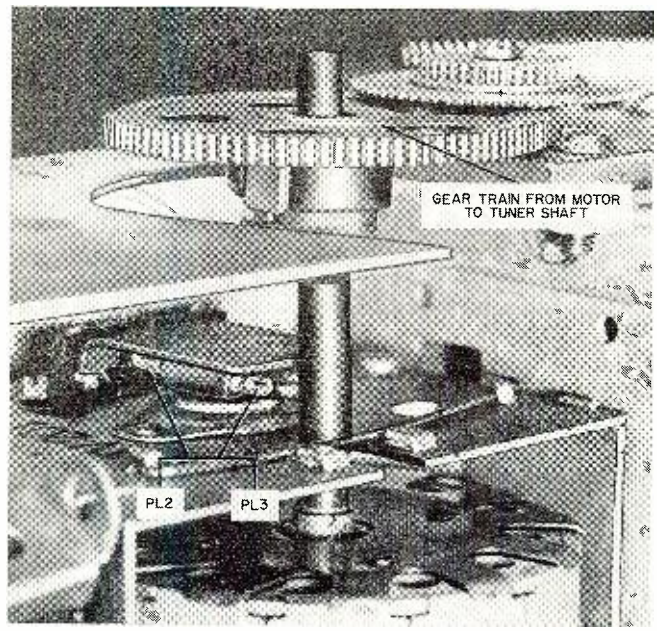
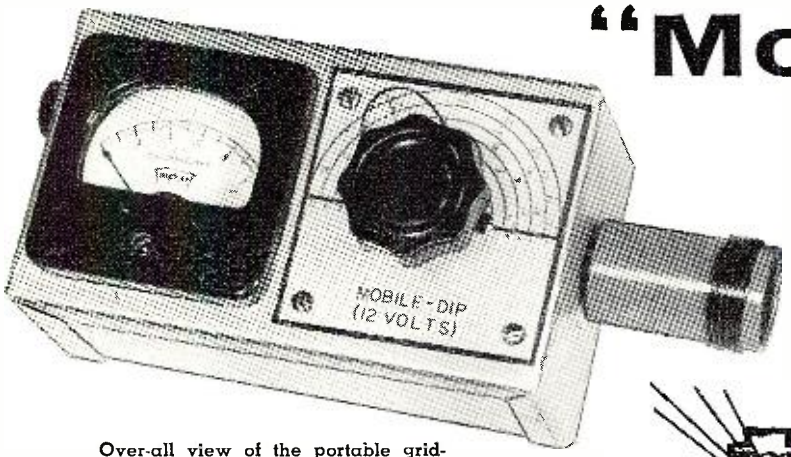


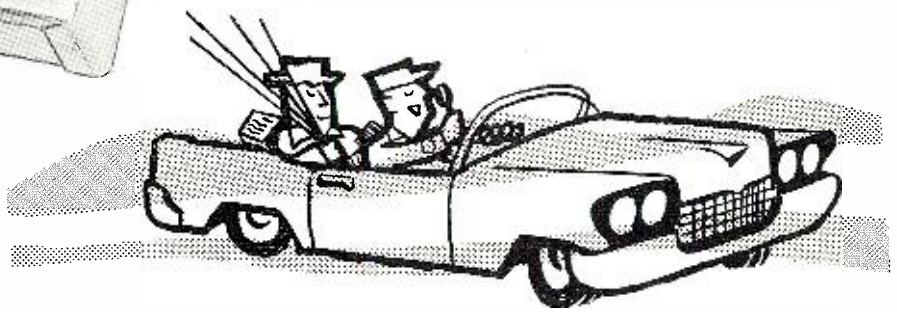
Fig. 7. This close-up of the front of the tuner shows the location of the neon lamps for automatic fine tuning and the gear train to the tuner shaft. For details of the arrangement under drive shaft, see Fig. 3.



"Mobile-Dip" a Portable Grid-Dip Meter



Over-all view of the portable grid-dip meter that is described below.



A compact and useful ham accessory which will work directly off the car's 12-volt battery.

By **HOWARD BURGESS**

TWO-WAY radio has taken to the highways, the waterways, and the air. To some this means operating with the bare minimum of equipment, but to others it means a "pack-rat's" holiday when everything that is not nailed down is carried along in hopes of making a new contact or hearing some fresh ignition noise. In either case there are a few gadgets that are handy to have around. These little extras become more interesting if they are inexpensive and easy to build.

The new series of tubes which have been designed to operate with 12 volts on the heater and 12 volts on the plate have much to offer to the mobile operator. Many interesting and inexpensive pieces of test equipment can be built to operate on the 12-volt battery systems now used in many automobiles, boats, and aircraft. The use of these tubes eliminates the need for a vibrator or dynamotor.

A grid-dip meter is a useful tool for pruning coils and other construction work at the home shop, but it can be just as useful in tuning up a mobile transmitter or antenna and perhaps for an emergency repair of a receiver.

Circuit Selection

Several problems are encountered in low-plate-voltage operation of grid-dippers. Many of the ordinary oscillator circuits will work with less than 12 volts on the plate if components are carefully selected and balanced. However, success may depend upon individual tube selection. Of course, another problem is that of low grid current. Many dippers using more than 100 volts on the plate have less than 100 microamperes grid current.

If the plate voltage is reduced to low values, the meter required to read the very low grid current becomes both expensive and too delicate for mobile work. Another desirable feature is the use of two-terminal coils. Elimination of feedback coils and taps in the tuned circuits speeds up construction, and simplifies winding.

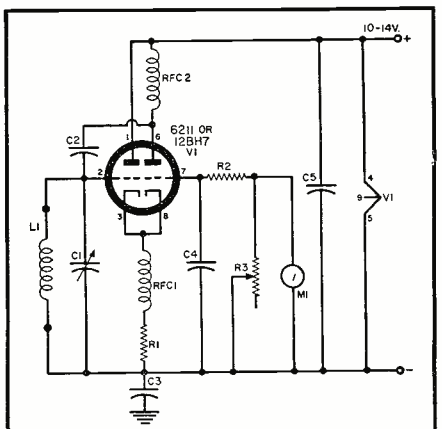
When all of these limitations were tossed into the pot, one possible circuit that came out is shown in Figs. 1 and 2. A second look at this circuit will show that it is just a cathode follower, followed by a grounded-grid amplifier. The grounded-grid stage performs the feedback functions usually accomplished by the plate coil or cathode tap in the average oscillator. Where the ordinary oscillator will have some loss in the feedback circuit, this one will have a little gain and thus enable it to operate on much lower plate voltages. Under ideal conditions this circuit will oscillate with as little as two volts on the plate. With higher plate voltages, resistors could be used in the plate and cathode circuit. However with only twelve volts available very little voltage loss can be tolerated. Using r.f. chokes with low d.c. resistance and high impedance is the answer.

In the ordinary 12-volt battery system it is not unusual for the voltage to go above 14 volts. Before the first unit was completed, there was some doubt about the effect of this large change on the frequency stability. However, upon completion it was found that a change of several volts did not change the frequency as much as overcoupling will on the conventional dipper. By the very nature of its use, a grid-dip meter cannot be used as a frequency standard.

Construction Details

Construction of the Mobile-Dip was kept simple and rugged. It may be well to mention at this point that components are not critical and their placement can be varied, within reason, without affecting operation. The entire unit is housed in a 3" x 2" x 5" aluminum box. Component values were chosen to permit the use of a one ma. meter which is both rugged and low-priced. If for some reason it is desirable to use a more sensitive meter, this can be done by increasing the cathode resistor until the grid current is reduced to the desired value.

The tuning capacitor chosen for this model was picked because of its small size and rugged construction but this means sacrificing a linear dial calibration and also having less tuning range



R_1—56 ohm, ½ w. res.
R_2—2000 ohm, ½ w. res.
R_3—1000 ohm pot
C_1—50 μμfd. tuning capacitor (see text)
C_2—43 μμfd. mica capacitor
C_3—.01 μfd., 200 v. capacitor
C_4—.002 μfd., 200 v. capacitor
C_5—.005 μfd., 200 v. capacitor
RFC_1—2 mhy. r.f. choke
RFC_2—1 mhy. r.f. choke
L_1—3.49-6 mc.—36 t. #26 en.; 5.9-10.5 mc. —20 t. #22 en.; 10.5-18.5 mc.—10 t. #18 en.; 18.5-32 mc.—5 t. #18 en. (Coils close-wound on 1" dia. forms)
M_1—0-1 ma. meter
V_1—6211 or 12BH7 tube

Fig. 1. Complete schematic of grid-dipper.

per coil. As shown in the illustrations, the tube socket is mounted on a small aluminum angle in such a position that the tube is behind the milliammeter. The rear mounting spacers on the tuning capacitor can serve as supports for small parts as they are insulated from the active parts of the capacitor.

Coil forms are always a problem. If #1, 3, and 5 pins are removed from a standard five-pin tube base or coil form, the remaining pins (2 and 4) will fit a large size crystal socket with ¾-inch spacing. This combination was used for the plug-in tuning coils.

Perhaps you will notice the variable control on the end of the case opposite the coil. In grid-dip meters using higher plate voltages, various means can be used to give constant grid current on all ranges. This is more of a problem when very low plate voltage is used. To correct this, a simple shunt is placed across the meter movement. With this control the current can be adjusted to any convenient value.

The schematic shows that no connection is made direct to the case. Only a capacitor completes this part of the circuit. If no direct wire connection is made to the metal case, the dipper can be used on battery systems having either a positive or negative ground.

The frequency range chosen covers the most used mobile bands. The use of the small tuning capacitor restricts the range that can be covered with a single coil and four coils are required to cover the range between 3.49 megacycles and 32 megacycles.

The number of turns may vary slightly from those given in the parts list due to placement of parts and leads. The turns on the highest frequency coil were spaced about one-half the diameter of the wire to give the correct frequency range. It is well to remember that in systems using a positive ground the coils are above ground by 12 volts. As a safety factor a layer of *Scotch* tape over the wire might be in order.

When a nine-pin tube socket is wired as shown, there are a number of dual triode tubes that will operate in this circuit. The two types that have given the most satisfactory results so far are the 12BH7 and the 6211. The 6211 is preferred. Other common dual triodes will work but some types will require careful selection to find a tube that will operate on low voltage.

The type of dial selected depends on the builder, but the one shown was made with a little cardboard and black ink. The calibration points can be filled in by listening to the r.f. output with an all-band receiver. As with all grid-dip meters, the coupling to the circuit being checked should be kept to the minimum that will give good indication.

For those who like to change the layout in order to use parts that are available, this instrument does not seem to be critical. When completed, the gadget can be clipped across any 12-volt battery system and you will be in business. (Don't forget to observe polarity.) Although not originally intended for home use, it has been found that it functions very well by just clipping across the secondary of any 10- or 12-volt filament transformer. No rectifier is required. When operated this way tuning is a little broader due to a.c. on the plate, but it is perfectly usable. In many cases the 60-cycle modulation is an asset.

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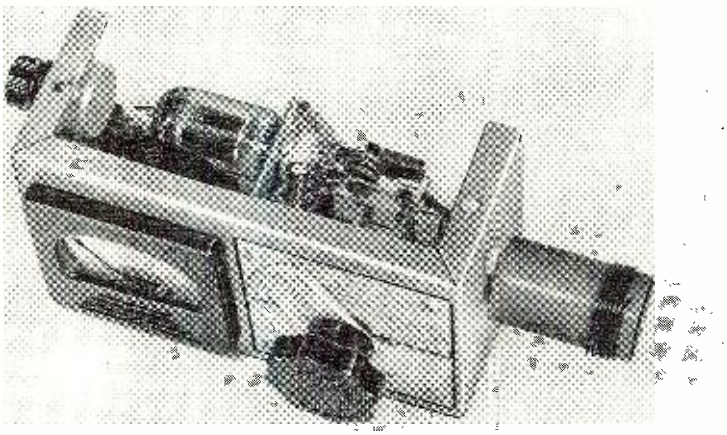
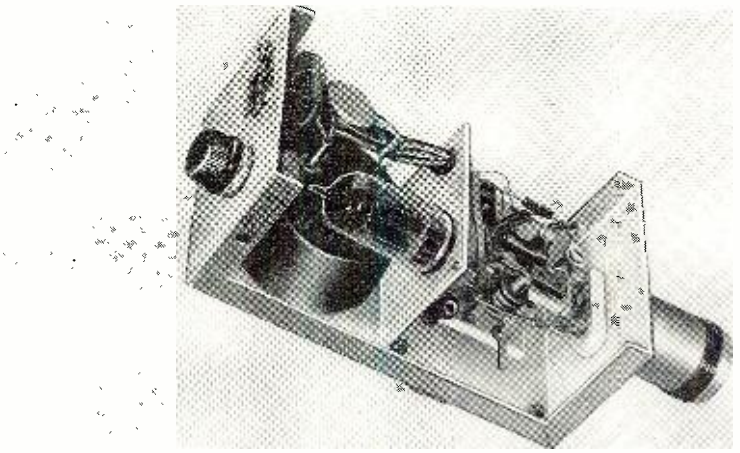
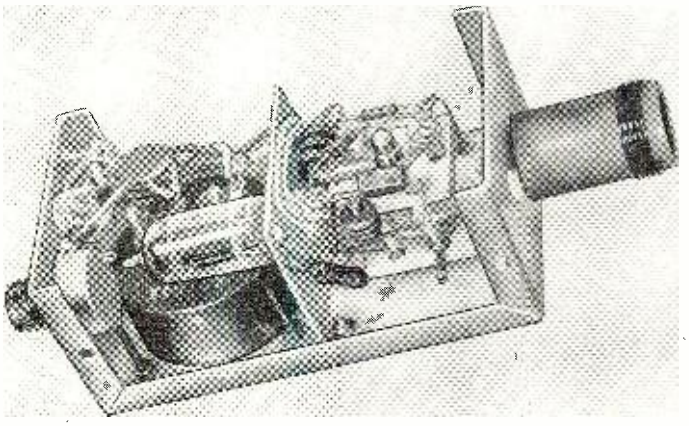


Top view of the portable grid-dipper shown here with the back cover removed.

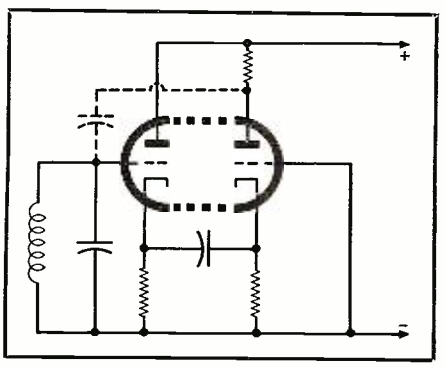


This rear view clearly shows the mounting of the single tube that is employed.

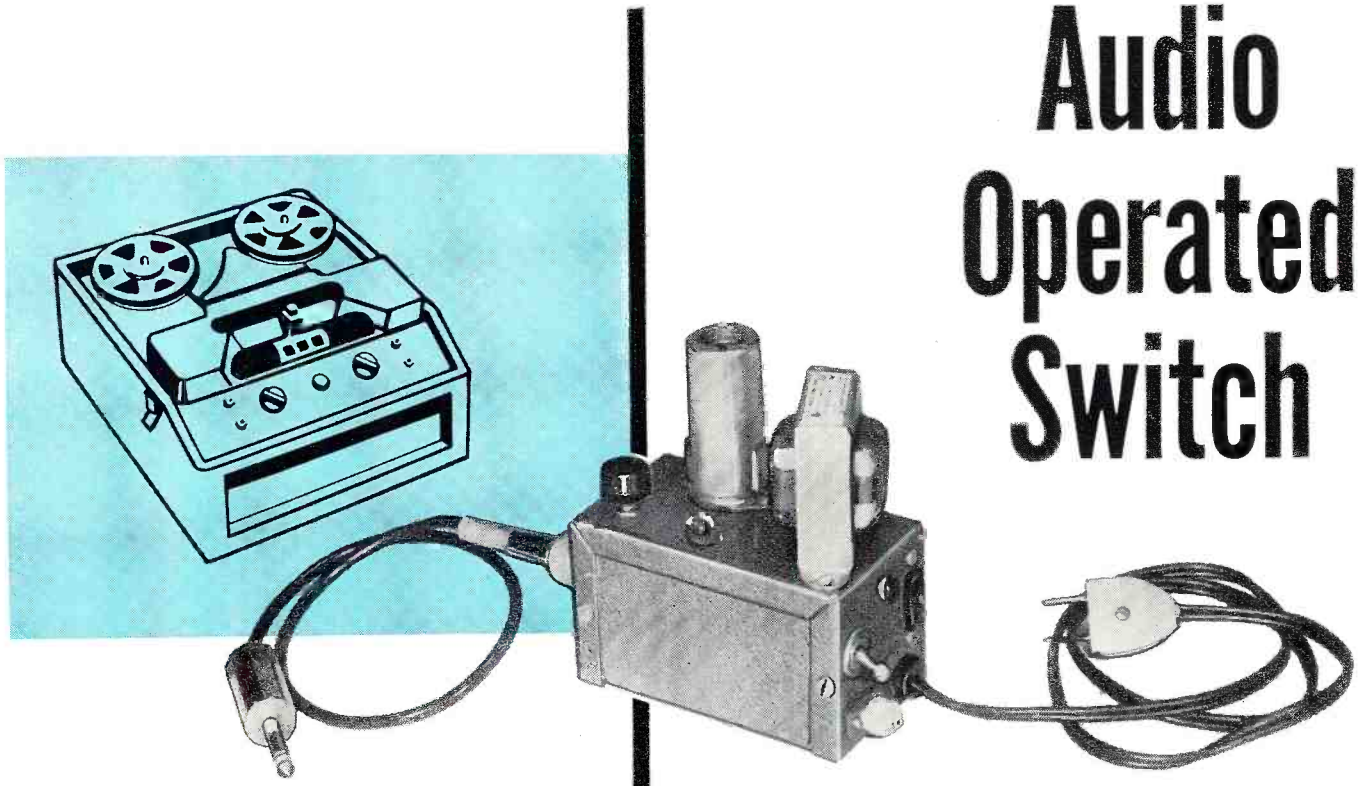


Another rear view of the unit is shown here, this time looking up from bottom.

Fig. 2. The basic circuit of the dipper.



Audio Operated Switch



By **HAROLD REED**

Over-all view of the completed switching unit.

Simple, compact unit uses single tube and transistor to start and to stop a tape recorder automatically.

COMMERCIAL voice-operated relay devices have been offered to automatically start and stop tape-recorders. The circuits have been designed to amplify the minute outputs from microphones to actuate a switching relay and, in conjunction with timing networks, to hold the relay closed for predetermined time intervals. Other circuits operate from the audio signal at the output of an amplifier, *i.e.,* the low impedance output designed for loudspeaker operation. Most of these circuits require a number of tube stages to accomplish this purpose and the price of such a device is quite high.

General Features

The unit described in this article uses just one tube and one *n-p-n* junction transistor. It is very inexpensive to build and its small size, the metal case measures 2¼" x 2¼" x 4", makes it extremely convenient for portable work since it can be tucked in a corner of a compartment of a tape recorder case.

It incorporates a pilot lamp to indicate when the relay is open and closed. A small connector is included on the case for connection to a remote indicating lamp. Thus, when recording out of visual range of, say, a recorder tape transport, the lamp will tell when the recorder mechanism is running and when it is stopped.

The current drawn by the unit is 12.5 ma. and this, together with the required 6.3 volts a.c. for the heater, may in many cases be furnished by the equipment being controlled. Therefore, the device can be made even smaller. A unit was constructed without the self-contained power supply on a 1⅝" x 2½" x 2¾" metal case. However, since in some installations this power may not be available, a simple built-in power supply has been included with the unit described.

Fig. 1 is the schematic diagram of the device. The tube used is a 12AX7, the first section connected in the cathode follower configuration. A miniature 1-megohm potentiometer is employed in the input grid circuit as a sensitivity control. This stage provides a high impedance input circuit which may be bridged across other audio circuits with negligible loading effects. The output of this stage provides a low impedance for the other half of the tube which is wired as a diode. The output of the diode is fed to the base of a grounded-emitter *n-p-n* junction transistor circuit using a type 2N35 unit. An *RC* timing network is inserted between the output of the diode and the transistor.

A sensitive switching relay is employed in the collector leg of the transistor. The "on-off" indicating lamp and remote lamp are operated by the relay contacts and will indicate when the controlled device is, or is not, in operation. The remote indicator lamp is useful in setups when the device is remotely located.

Circuit Analysis

An audio signal is applied to the input of the switching unit through the sensitivity control, R_1. This control is then adjusted to obtain the correct signal level at the input grid for proper operation of the device. An audio signal voltage then appears at the junction of C_2 and R_4 and is applied to the diode section of the 12AX7. A rectified signal, or d.c. voltage, is accordingly available at the cathode of the diode section. This d.c. voltage is applied to the base of the grounded-emitter transistor stage, which functions as a d.c. amplifier. The resulting increased current flow in the collector circuit serves to actuate the sensitive switching relay. The *RC* timing network, composed of R_7 and C_3, together with R_8 in the transistor base circuit, determines the length of time the relay remains closed after the audio signal is removed. Power for the transistor is obtained from the voltage divider network consisting of R_5 and R_6.

Constructional Details

The parts of the device are all mounted on the 2¼" x 2¼" x 4" metal case. See the photographs. There is nothing critical about parts placement or wiring except that it is desirable to keep the audio input leads away from a.c. wiring. Therefore, the constructor need not follow the exact layout.

A shielded, single-conductor cable, fitted with a metal shell-type phone plug, is used for the audio input signal. This cable should be kept as short as possible. A phone jack for picking up the signal may be mounted on the recorder amplifier chassis or other device. The cable may be wired in permanently without the jack if desired. The other end of this cable is terminated in a mating connector for the connector on

the switching unit. See photograph below.

A small transistor socket is used for the 2N35. The power switch, power pilot lamp, power cord, and all a.c. connectors are attached at one end of the case. The two small connectors for supplying a.c. power to the controlled apparatus and to the remote indicating lamp can be seen in the photos.

The moving contact, or armature, of the specified relay is mechanically connected to the relay framework. Since this would cause one side of the 117-volt a.c. supply to be shorted to the metal case and be hazardous, the relay was first mounted on a small piece of plastic, using flat-head countersunk screws, and then the plastic mounting plate was attached to the metal case. This provided the needed isolation. Also. small squares of Bakelite were slipped over the mounting screws to hold the plastic mounting plate about ⅛ inch away from the chassis so that the transformer leads can pass.

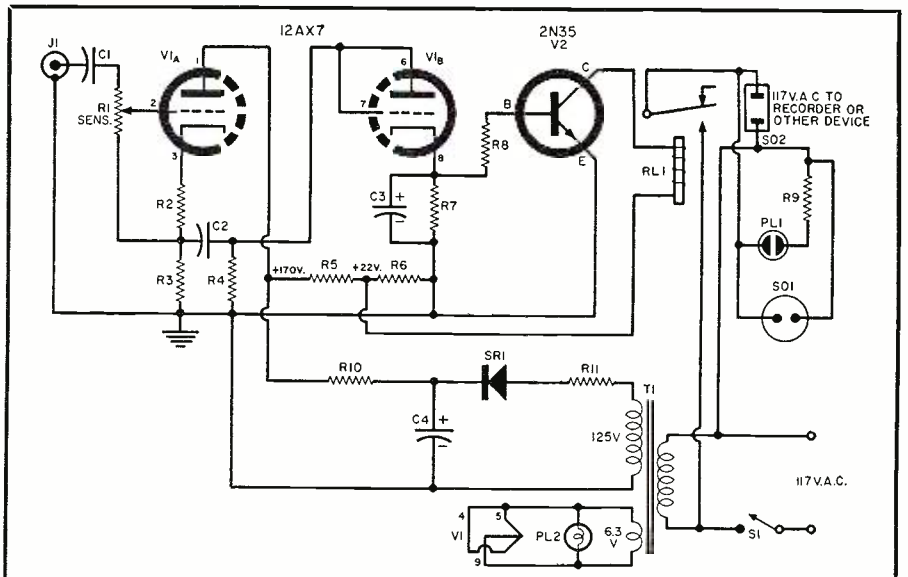
The indicator lamp is a type NE-2. It fits tightly in a rubber grommet mounted in a hole in the case. A 200,000-ohm resistor must be used in series with this lamp.

A photograph was taken before the unit was wired since location of the various parts can be more clearly seen. The resistors and capacitors were wired in last and hide many of the other components. These are wired in, point-to-point and when finished the little box is quite full. The photo on the previous page shows the finished unit.

Installation and Operation

As mentioned previously, the switching unit may, in some installations, obtain heater and d.c. supply from the audio system or tape recorder amplifier with which it is used. Then, the built-in power supply will not be required. In this case, the 6.3 volts a.c. for the heater may be taken off any of the amplifier tube socket terminals. The "B+" supply, when taken from an amplifier, may be adjusted to the correct value by using an appropriate series dropping resistor between the amplifier and the switching unit, to bring the "B+" voltage to the right value. It may seem at first that the "B+" value obtained in this way would not be critical but, it should be remembered, that the transistor is powered by the voltage divider resistors, R_5 and R_6, connected between "B+" input and ground. When the "B+" supply, as furnished by the built-in power supply, is 170 volts, the d.c. voltage at the junction of these resistors is +22 volts and this is applied to the collector circuit through the relay coil. If the d.c. supply is greater than 170 volts, then care must be exercised to make certain that R_5 and R_6 are adjusted so that the d.c. supply for the transistor collector circuit does not exceed the maximum rating for the transistor, which is 25 volts for the collector.

With the voltage values given in the schematic diagram, the current through the relay and collector circuit was 0.3 ma. with no audio signal at the input.



R1—1 megohm pot
R2, R10—1800 ohm, ½ w. res.
R3, R4—47,000 ohm, ½ w. res.
R5—8200 ohm, 2 w. res.
R6—1500 ohm, ½ w. res.
R7—1 megohm, ½ w. res.
R8—75,000 ohm, ½ w. res.
R9—200,000 ohm, ½ w. res.
R11—56 ohm, 1 w. res.
C1, C2—.04 μfd., 200 v. capacitor
C3—6 μfd., 25 v. elec. capacitor
C4—40 μfd., 250 v. elec. capacitor
PL1—NE-2 neon lamp
PL2—#47 pilot lamp
SR1—65 ma. selenium rectifier
SO1—Remote connector (Lafayette MS-284)
SO2—Connector (117 volt a.c. output)
S1—S.p.s.t. switch (power on-off)
J1—Mike connector (audio input)
T1—Power trans. 125 v. @ 15 ma.; 6.3 v. @ .6 amp. (Stancor PS8415 or equiv.)
RL1—8000-ohm-coil relay (Sigma 4F)
V1—12AX7 tube
V2—"n-p-n" junction transistor (Sylvania 2N35)
1—Metal case, 2¼" x 2¼" x 4"

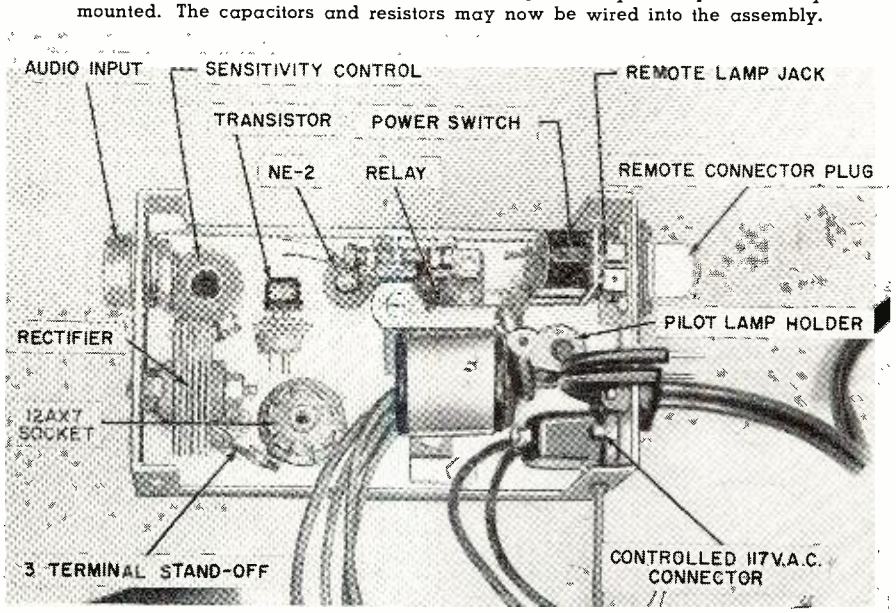
Fig. 1. Circuit of audio actuated switch. Components R_7, R_8, and C_3 in the transistor input determine how long the relay stays closed after signal removal.

An example of the operating conditions, when the device was used with a commercially available tape recorder amplifier, follows.

The audio input signal for the device was obtained between the plate and ground of an intermediate stage of the amplifier. With voice signal from a microphone or music from a radio tuner fed to the input of the amplifier, the gain control of the amplifier was adjusted so that the recorder eye tube just closed, which was normal for correct recording level. This condition produced audio peak signals of 7 volts to the switching unit input and the sensitivity control was adjusted so that these peaks produced relay peak currents of 2 ma. The relay pulled in when this current reached a value of 1.5 ma. One word spoken into the microphone would produce a peak current of 2 ma. With a sustained note, such as obtained by whistling into the microphone or when using a 1000-cycle tone signal produced from an oscillator, the relay would pull in with

(*Continued on page* 134)

Underside of the switching unit chassis with a good many of the parts already mounted. The capacitors and resistors may now be wired into the assembly.



Are You in a Rut?

By **WILLIAM LEONARD**

To avoid aimless drifting with the tide, service dealers need ideas to shape their own destinies.

YEARS ago, when a graveled surface made any road a "first class highway" in the southwest, motorists traveling through southern Oklahoma were likely to find highway signs that read something like this, "Pick your rut carefully. You'll be in it for the next thirty miles."

Some drivers liked ruts, if they started straight and were not deep. More venturesome souls preferred to dig their own ruts, even at the risk of ending up in a ditch. They gambled on their own steering ability rather than take a chance on getting stuck on high center in someone else's rut.

There are no paved highways that a man can breeze along in the management of an electronic service business. The road the service dealer travels is full of ruts. And the most inviting ruts are usually the ones that get deeper the longer he stays in them. Once he gets deep in a rut he seldom has the will and determination to pull himself out of it.

Although service basically is a *promotion* business, the average service dealer's leaning is toward the technical aspects. This acts as an opiate that dims his vision about the changing promotional needs of his business. There is a strong tendency to follow the line of least resistance in the management of a shop as a business. As a result, most of the things that should be done to keep the business alive, promotion-wise, are neglected.

Service is a product that must be constantly and continually sold. It is something that customers do not want to buy. When they are forced to buy it, they are inclined to do so grudgingly. Yet, when it is promoted with the right flair and supported by good, common-sense customer relations, the dealer can win loyal, satisfied customers. Set owners will stay loyal to a dealer whose promotions and customer relations leave with them the impression that they got good value for the dollars they spent for service.

When a man starts a retail business that depends entirely on the sale of new products and merchandise for its income, he usually realizes that its success will depend entirely on his ability to keep a constant flow of new customers patronizing his store.

"The main thing a small dealer must be," said a successful small retailer, "is an *idea factory*. He must be able to continually come up with new and novel ways to keep his business in the public eye. He must be alert for new ways to bring more customer dollars into his store. If he doesn't, he is sunk."

Ideas are the things that keep a business from falling into a rut. They are the roller bearings that keep the business moving ahead without wasted power. They are the motivating force that helps the owner to continually regenerate his own interest in his activity. They are the gems that add sparkle to management.

Where do you get ideas? One dealer, who never seems stuck for an idea, said: "My pet method is to look at what other businessmen in other fields are doing whenever my own idea factory slows down. When I feel lost, floundering for an idea, I know I can't wait around indefinitely to think up something original. So I start looking into what other fellows are doing in my town.

Most of their ideas fit their lines of business only, but you would be surprised how many can, with a little imagination, be adapted to service.

"Any idea that builds business in one line can do it in another with a few simple changes. Another thing I find is that, once my mind has this other fellow's idea to work with, it starts working on ideas again. By the time the idea is ready to be put to use, I usually have worked out so many changes to fit my own business that the original borrowed idea has disappeared."

In another city, a group of service dealers constantly "feed" ideas to each other. Located in different parts of the city, their businesses are not directly competitive.

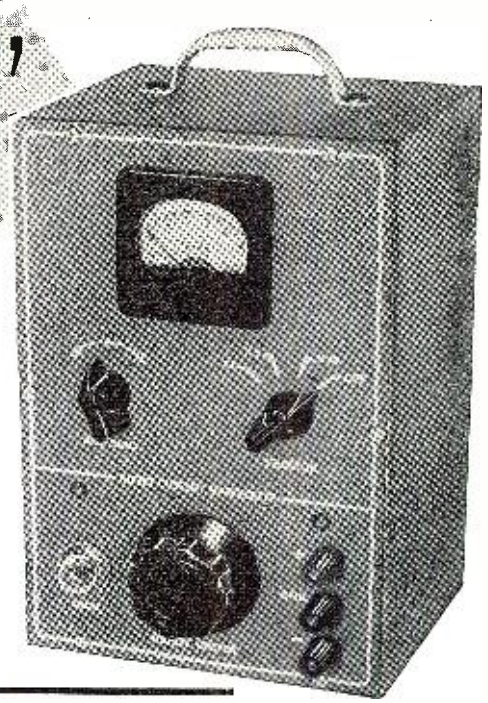
After they kick an idea for a new promotion around among themselves and have worked the bugs out of it, they all put it to use at the same time. They claim that, when an idea is used by several shops simultaneously, it has far greater impact than if it were used by just one shop. "It's similar to the ratio of speed to the force of the impact when two cars collide," one dealer said. "The impact is four times greater at forty miles an hour than it is at twenty miles an hour. When all of us use the same new promotion at the same time, it compares with the promotions of big, national companies because we just about blanket the area where our shops are located."

The ability to generate new ideas or to modernize old ones is something that every service dealer must cultivate or he will sooner or later get stuck on high center. Competition in the TV and radio service business has

(*Continued on page* 126)

The "D.C. Varivolter"

An Ultra-Versatile Wide-Range Power Supply



Front-panel view of the "D.C. Varivolter."

By **FRANK H. TOOKER**

Simple, inexpensive, variable-output power supply continuously adjustable from 0 to 240 v. at 50 ma.

SO MANY articles on variable-output power supplies have appeared in print during the past few years that, at first thought, it would seem almost impossible to design anything different or better. A careful search of such literature will, however, reveal several serious disadvantages which severely limit the application of these units. Thus, the majority are incapable of performing the multitude of tasks a variable-output supply really should be able to do. For instance, many designs will not permit the output voltage to be adjusted all the way down to zero. Of those which can be adjusted to zero, many are so critical in adjustment over the low-voltage range that it's virtually impossible to set the control accurately anywhere near one or two volts output. A few designs require special components (or makeshift substitutes) for control purposes, while others are overly expensive or complicated for the results obtained, and some are much too large and heavy to be moved about easily from place to place on the workbench.

The "D.C. Varivolter" power supply to be described was designed specifically not only to eliminate these faults but also to make an instrument that is as versatile as possible—with the many, widely diversified needs of experimenters, students, service technicians, and development engineers uppermost in view. The output from the "Varivolter" is continuously variable from zero to 300 volts open-circuit and from zero to 240 volts at the maximum rated output of 50 milliamperes. With this little unit and a simple twist of a single control knob, you can get one or two volts to test a low-level transistor circuit, or a couple of hundred volts for checking out a vacuum-tube setup—*and the output can be set as quickly and easily, and as accurately, at the one- or two-volt level as it can at one- or two-hundred!* The same applies for all outputs between these extremes—you can get 3, 6, 9, 22½ volts in a split second with no more time or effort involved than that required to set the meter to the proper range and turn the output control. You can drop the output down to any level you please to determine exactly how your bench jobs or transistor gadgets will perform as the batteries deteriorate with age. Or you can start at zero and move up, if you're working with a new or doubtful circuit and you're not quite sure whether it will work properly or draw far too much current when the intended voltage supply is connected.

As an astonishing demonstration of the absolute control which one has over the output from the "Varivolter," the unit can be set for zero output *and a 0-1 milliammeter connected directly across the output terminals. By advancing the "Varivolter's" output control slowly, any desired milliampere reading may be obtained!* And the adjustment isn't at all critical. At 0.1 on the milliammeter the output is actually 0.003 to 0.005 volt, depending on the internal resistance of the meter. This order of control seems almost miraculous in a unit which can also deliver over 200 volts and up to 50 milliamperes at any voltage setting. Actually, this is more than just a demonstration of the "Varivolter's" extraordinary versatility. It is a practical method for testing milliammeters.

A panel control is included on the "Varivolter" for precise setting of the zero (when working with low-level transistor circuits) and a built-in voltmeter and two multipliers permit the output voltage to be read accurately at all levels. The "Varivolter" takes up little space on the work bench; it's light enough to be moved about with ease; and it's inexpensive to build, especially when one considers the cost of the several units that would be necessary to replace it.

How It Works

The complete schematic diagram of the "Varivolter" is given in Fig. 1. A pair of 12B4A miniature power triodes are used as grid-controlled rectifiers in a full-wave circuit. Primarily, the output voltage from the unit is determined by the grid-to-cathode bias applied to these tubes. This bias is obtained through the "Adjust Output" control potentiometer R_1. When the

arm of R_4 is set at the end connected to the cathodes of the tubes, the grid bias is zero and the output voltage is maximum. When the arm of R_4 is set at the opposite extreme of its rotation, a negative bias, obtained through selenium rectifiers SR_1 and SR_2 and developed across C_1 and R_5, is applied to the grids of the power tubes to reduce their current flow to a very low value. The voltage which would appear across R_6 and the output terminals, as a result of this small current flow, is balanced out by a portion of the negative bias voltage applied in opposite polarity across R_6 through the voltage-divider action of R_4 and R_6. With the meter set at its "X30" position and no load across the output terminals, the normal cancelling potential is approximately 22% of the grid bias.

Potentiometer R_3 is the "Adjust Zero" control. Varying the setting of this control varies the value of negative voltage applied to the lower end of R_4. Thus R_3 determines the maximum bias at the grids of the power tubes as well as the portion of cancelling potential applied across R_6—the combination of both of which permits the output from the "Varivolter" to be set exactly at zero when the "Adjust Output" control, R_4, is turned to the maximum counterclockwise end of its rotation. With R_3 and R_4 set for zero output, the cancelling potential adjusts itself automatically to maintain the zero at all loads up to and including a short circuit of the output terminals.

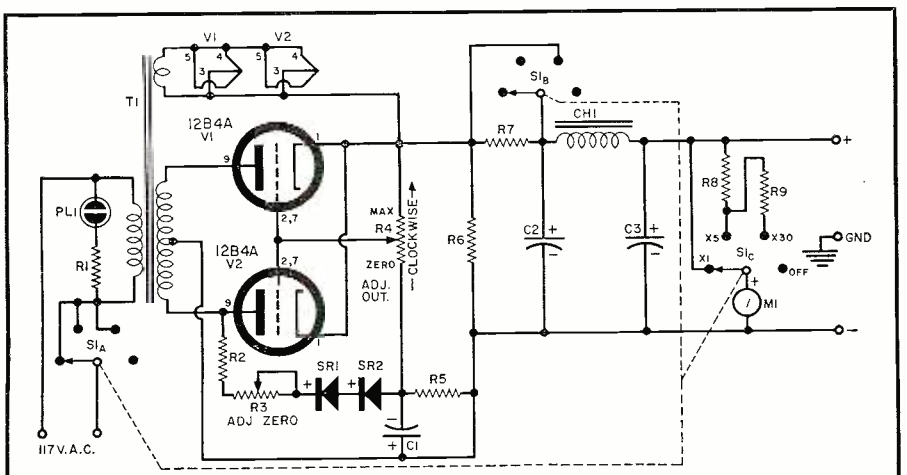
"Selector" switch S_1 performs several important functions. Section S_{1C} of the switch selects the full-scale voltmeter ranges: 10, 50, and 300 volts. Section S_{1B} inserts a heavy-duty power resistor, R_7, in series with the output in the 10- and 50-volt ranges of the voltmeter and shorts out the resistor in the 300-volt range. This resistor is an important part of the "Varivolter" for its duty is to radiate power that would otherwise have to be dissipated in the tubes when low voltage at the full 50 milliamperes is being taken from the instrument. It also transfers the filter type from capacitor-input at high voltages to resistor-input at low voltages, thereby limiting the peak current through the tubes at low-voltage output levels. Without R_7, current drawn at these low-voltage outputs would have to be limited to keep from exceeding the maximum power dissipation rating of the 12B4A's. On the other hand, at high-voltage outputs, where vacuum tubes are being operated from the "Varivolter," most of the power is dissipated in the external circuit, so R_7 is shorted out in the 300-volt range position of the voltmeter.

Section S_{1A} of the switch performs the "on-off" function. A shorting type switch is used to prevent interrupting the current to the power transformer primary while switching from one voltmeter range to another. The "off" position is located at the extreme right, adjacent to the "X30" multiplier position (300-volt range) of the voltmeter to prevent the unit from being switched immediately to the sensitive "X1" position when it is turned on.

An important and desirable feature of the "Varivolter" is that its d.c. internal impedance is relatively low at high-voltage output and high at low-voltage output. Thus, the instrument tends to approach the ideals of a constant-voltage source for vacuum-tube circuits and a constant-current source for transistors.

The filters and the voltmeter circuit are conventional. No ground is made internally since versatility is increased when this connection can be made either positive or negative, as desired, at the output terminals. A milliammeter is not included in the "Varivolter" because experience has shown that current measurements are usually better made with individual meters at various points in the circuit under test.

Fig. 1. Complete schematic diagram and parts listing for the d.c. "Varivolter."



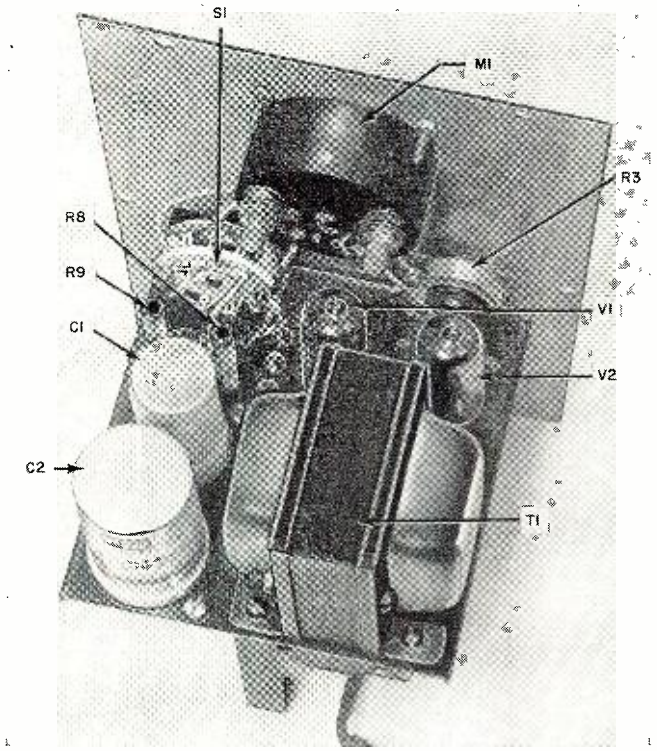
R_1—100,000 ohm, ½ w. res.
R_2—22,000 ohm, 2 w. res.
R_3—10,000 ohm wirewound pot (Mallory Type "C," "Adjust Zero" control)
R_4—150,000 ohm wirewound pot (Mallory Type "E" "Adjust Output" control)
R_5—33,000 ohm, 2 w. res.
R_6—50,000 ohm, 10 w. res.
R_7—2000 ohm, 20 w. res.
R_8—40,000 ohm, 1 w. res. ±1%
R_9—250,000 ohm, 1 w. res. ±1%
C_1—20 μfd., 150 v. elec. capacitor
C_2, C_3—30/30 μfd., 450 v. elec. capacitor
CH_1—3.5 hy., 50 ma. filter choke
M_1—0-10 v., 1000 ohms-per-volt voltmeter
S_1—3-pole, 4-pos. shorting-type ceramic rotary switch
SR_1, SR_2—130 v. @ 50 ma. selenium rectifier
T_1—Power trans. 240-0-240 v. @ 70 ma.; 6.3 v. @ 3 amps (Stancor PC8419 or equiv.)
PL_1—NE-51 neon lamp
V_1, V_2—12B4A tube

Construction Details

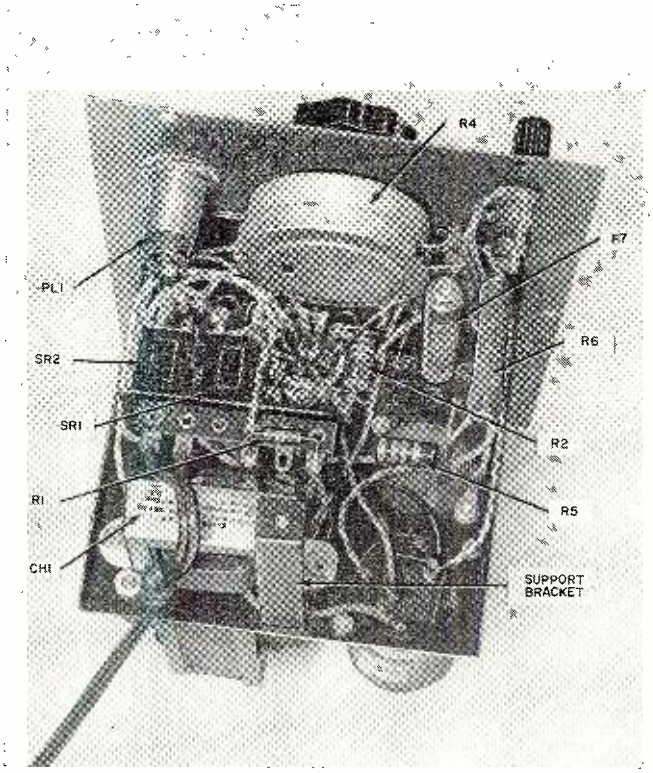
Any truly versatile unit is seldom a "stay-put" instrument. Thus, the "Varivolter" was designed to be portable. It is assembled in a 5"x6"x9" aluminum carrying case, and takes up no more space than the average v.t.v.m. The principal points to be observed in its construction are: (1) Allow plenty of ventilation around the power triodes and dissipation resistor R_7. For this purpose, drill a number of holes at appropriate places in the chassis and in the bottom, sides, and rear panel of the carrying case. (2) Keep these particular heat-producing components well separated from the electrolytic capacitors and the selenium rectifiers. (3) Follow the panel layout shown in the photos as closely as possible, since this particular arrangement gives a neat, "factory-assembled" appearance to the instrument and, at the same time, permits maximum ease and convenience in its operation. (4) For the same reasons, use a large knob on the "Adjust Output" potentiometer, R_4.

When the unit is completely assembled and wired, set the "Selector" switch at "off", set the "Adjust Zero" control at about mid-scale, and turn the "Adjust Output" control fully counterclockwise. Plug in the power cord, turn the "Selector" switch to its "X30" position and leave it there for a minute or two to permit the instrument to warm up. The voltmeter needle should swing slightly to the left of zero when the unit is turned on and then drift slowly back to zero as the tube cathodes come up to temperature. Set the "Selector" switch at its "X1" position and vary the "Adjust Zero" control for zero reading on the meter. This adjustment is inclined to be a little sluggish due to the capacitance in the circuit. Rotate the control slowly to obtain an accurate setting. (Components in this part of the circuit have been carefully selected as to value to prevent damage to the meter, even when the "Adjust Zero" control is grossly misadjusted.) The setting of the "Adjust Output" control is also inclined to be slightly sluggish when the "Varivolter" is not delivering current to an external circuit due to the charge and discharge time of the filter capacitors. Advancing this control *slowly* during the initial checking of the instrument and at any time when little or no current is being delivered externally is also desirable, primarily as a precaution against overloading the voltmeter and/or an externally connected circuit and as a time saver in making accurate adjustments.

When the output terminals of the "Varivolter" are open-circuited, and the "Selector" switch is set at its "X30" position, the "Adjust Output" control



Top view of the variable-output power supply showing the tube placement and the mounting arrangement that is employed. The power transformer and the two electrolytic capacitors are on the rear of the chassis while the rectifier tubes are in front of the transformer. Selector switch and zeroing pot are seen.



View beneath the chassis of the power supply is shown here. Note the arrangement of the wiring and the placement of the parts. The filter choke is mounted below the power transformer while the two selenium rectifiers are located in front of the choke. Note the large output-adjustment potentiometer.

may be used to swing the output all the way from zero to 300 volts. When current is being taken from the instrument, however, the "X5" or "X1" meter positions should be used for outputs of 50 volts and below—both to obtain the more accurate meter reading and to insert R_7 in the circuit to prevent excessive dissipation in the power triodes.

How to Use It

With transistor circuits: (1) Set the "Adjust Output" control fully counterclockwise (minimum output). (2) Set the "Selector" switch to "X1". (3) Vary the "Adjust Zero" control carefully for zero reading on the voltmeter. (4) Connect the transistor circuit to the output terminals. Be sure to observe polarity just as you would with a battery power source. (5) Advance the "Adjust Output" control until the meter reads the value of voltage you desire to have applied to the transistor circuit. Since the "Varivolter" is capable of delivering considerable voltage and current, as well as very little, it is recommended that these simple steps be followed each time the instrument is made ready for use with transistors to prevent feeding an overvoltage to any transistor setup.

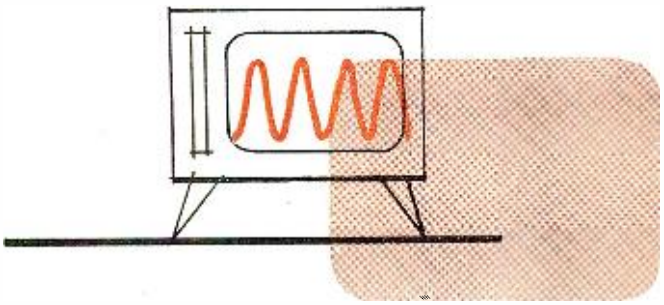
When working with a new or doubtful transistor circuit and you're not quite sure that it's wired correctly, or in need of adjustment, or perhaps has a faulty component, connect a milliammeter in series with the circuit and the "Varivolter" *before* you begin advancing the "Adjust Output" control. Then, advance the "Adjust Output" control *slowly* while observing the milliammeter as well as the voltmeter on the "Varivolter." These two readings can often tell you much about a transistor circuit's performance. For instance: (1) If the milliammeter reading rises much too rapidly with a small applied voltage, the chances are something is definitely wrong in the transistor circuit. Set the "Adjust Output" control back to zero and check the wiring, polarity of connections, quality of the transistors and electrolytics, etc. (2) If the meter needles tend to fluctuate rapidly and you're working with a transistorized amplifier, the unit is probably motorboating—and a new or larger filter capacitor may be needed somewhere in the circuit. (3) If the milliammeter reading tends to *increase,* and the voltmeter reading tends to *decrease,* either slowly or rapidly with the passage of time, a transistor is probably heating up. In a simple, uncompensated transistor circuit, particularly, even small temperature changes will show up in the meter readings. Set the "Adjust Output" control immediately to zero and check the circuit in detail; especially consult the transistor specifications, look for leaky electrolytics, off-value resistors, etc., to make certain maximum power dissipation is not being exceeded anywhere in the circuit.

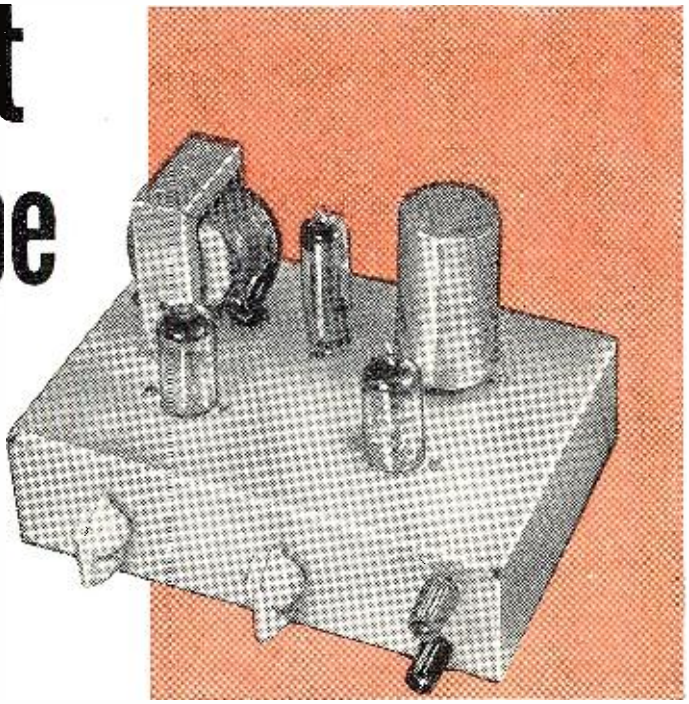
One thing to keep in mind is that, due to the heating time of the power triodes, the "Varivolter" will tend to reverse polarity for a few seconds when it is first turned on. This is a matter of about 20 volts, at a relatively high impedance, and it occurs even when the "Adjust Output" control is set at zero —so, to be on the safe side, always make sure the instrument is warmed up and the "Adjust Zero" control is properly set before connecting the output to a transistor circuit. Also, remember to set the "Adjust Output" control to zero on the meter before connecting or disconnecting any transistor circuit. It helps to prevent transistor damage through transients. Generally, you have to take your chances with transients when you're working with a new or doubtful transistor circuit and a battery supply, but you can forget your fears on this score when you are using the "Varivolter"—just by getting in the habit of twisting the output control fully counterclockwise.

Another reason for setting the "Adjust Output" control to zero before making or breaking a transistor circuit is that the "Varivolter" has a fairly high internal resistance and thus tends toward a constant-current source at the lower voltage levels. This is a desirable condition in a power source that is to supply many different transistor circuits, especially experimental setups, but of necessity, it must result in the output voltage rising, sometimes considerably, when the transistor circuit is disconnected. Should the circuit be reconnected without setting the output to zero, this higher voltage could damage a transistor before the filter capacitors become discharged down to the normal working level of the circuit.

(*Continued on page* 170)

Use Your TV Set As An Oscilloscope





Over-all view of the converter used with a TV receiver to produce patterns below.

By **GLEN SOUTHWORTH**

Put your big screen to work doing double duty with this simple, two-tube pulse-position converter.

IN THE event that TV Westerns no longer exert a fatal fascination for you, the thought may have crossed your mind of how nice it would be to put that big, 21-inch cathode-ray tube to work producing bright, clean-cut, oscilloscope waveforms. And, if your pioneering instincts have prompted you to go forward along this pathway, chances are that you've achieved the bright trace, accompanied by much work and expense, coupled with poor response on the part of the set and the rest of your household as well.

Although a 21-inch scope is a beautiful thing to behold, and very useful in demonstrating the mysteries of electronics to classrooms and audiences, a conventional conversion runs into several technical and economic snags, due primarily to the fact that magnetic deflection is employed in the sweep circuits of the conventional TV set. Inasmuch as these circuits, as well as the deflection yoke, were designed for frequencies of 60 and 15,750 cps only, the problem of conversion is a little difficult, although one successful approach was made recently through use of push-pull, paralleled 807 power amplifiers in both the vertical and horizontal deflection circuits.[1]

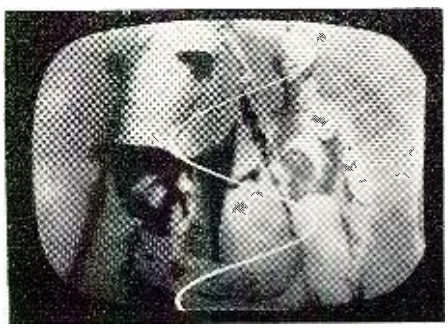
By using an unconventional technique we can have our electronic cake and eat it too. In other words we can use the family set as an oscilloscope of modest capabilities without tearing it up, altering it, or reducing its ability to render gunsmoke and commercials. In fact, in an emergency, you can use the oscilloscope feature simultaneously with the viewing of your favorite show.

Sounds interesting, doesn't it? The secret is to forget about the deflection system of the TV set entirely, and apply the proper signal to the *grid* of the cathode-ray tube with the result that the normal scanning of the tube causes a trace to appear, just as if the local TV station had one of their cameras focused on an oscilloscope screen. The circuit to do this is simplicity itself and uses only two dual triodes, plus fourteen resistors and seven capacitors. The schematic is easy to locate, because it's the only one in this article.

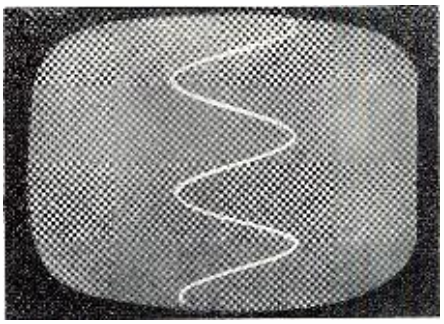
In essence, the two-tube converter is a pulse-position modulator which produces a series of pulses at the horizontal scanning rate of the receiver, namely 15,750 times per second. These pulses are locked to the horizontal sweep of the set and appear as a vertical line, the position of which depends upon the amount of delay (approximately 5 to 55 microseconds) introduced by the converter. Introducing an audio voltage into the converter causes the amount of pulse delay to vary in accordance with the impressed signal and the consequence is an oscilloscope-like pattern with the normal X and Y axes apparently reversed, as shown in the accompanying photos.

Let's take the foregoing a little bit slower and refer to the schematic this time. Horizontal pulses from the TV

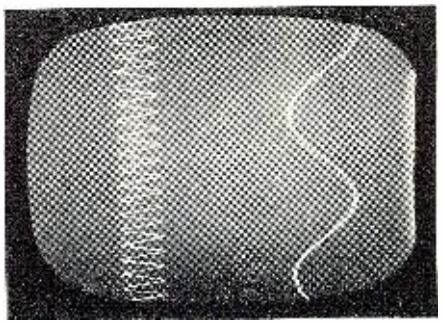
Off-screen photo showing scope pattern produced simultaneously with TV program.

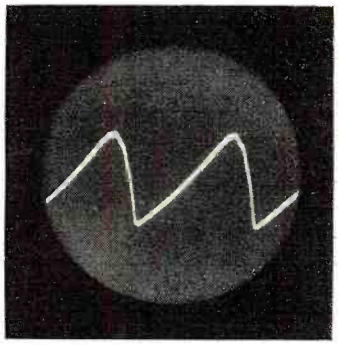


Off-screen photo showing only the oscilloscope-type trace that may be produced.

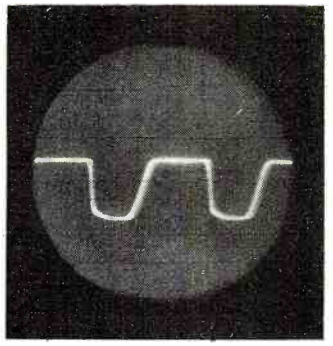


Twin traces, such as those shown, produced by adding extra stage to converter.

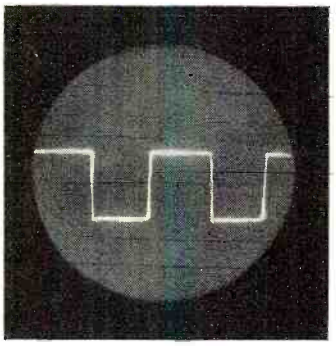




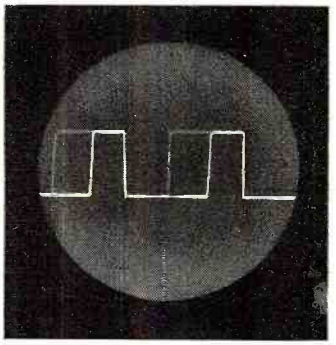
(A) Oscilloscope pattern of 15,750 cps saw-tooth waveform that is produced at pin 6 plate of the 12AU7.



(B) Output of 12AT7 dual triode with .1 μfd. capacitor between first plate and second grid removed.



(C) Output of the 12AT7 clipper with capacitor replaced. Note fast rise time and good square wave.



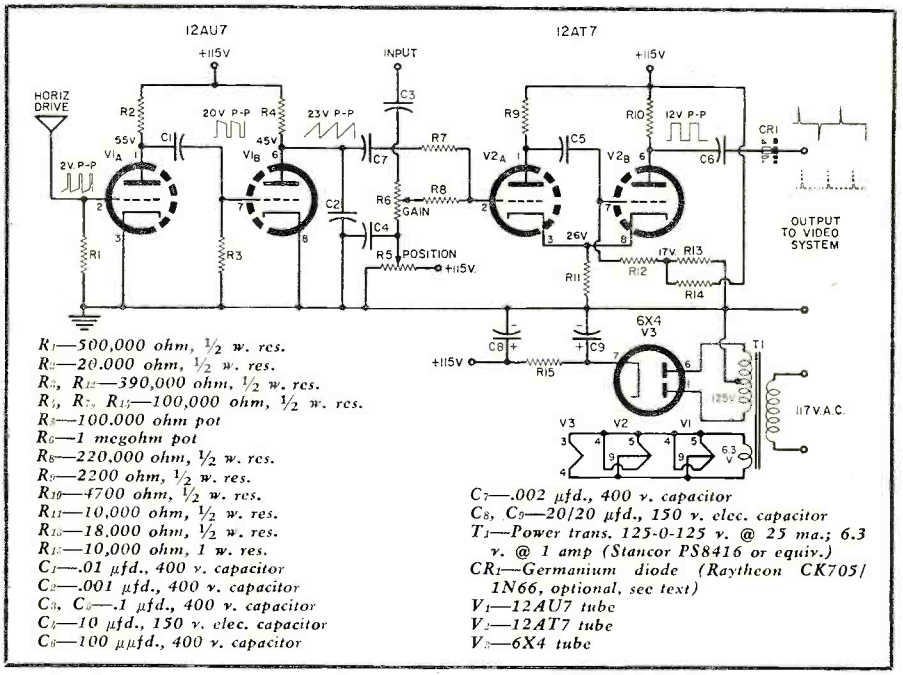
(D) Output of clipper when audio signal is mixed with saw-tooth causing duty cycle to vary at a rapid rate.

set are obtained by loosely coupling the grid of a 12AU7 to the horizontal output stage. These pulses are amplified and applied to the grid of the second half of the 12AU7 which acts as a discharge tube producing a 15,750 cps saw-tooth waveform. The saw-tooth is then introduced to the grid of a 12AT7, which acts as a two-stage clipper, removing a small segment of the saw-tooth to produce a nearly square wave, the duty cycle of which will depend upon what portion of the saw-tooth waveform is clipped. A variable, positive bias is applied to the first grid of the 12AT7 by the "Position" control and when the saw-tooth is clipped in the center the resulting trace will be near the center of the TV screen, while clipping near the top or the bottom of the saw-tooth will cause the trace to move either to the right or the left. When an audio signal is applied to the first grid of the 12AT7, it will cause the clipping of the saw-tooth to take place at different levels, thus moving the trace back and forth across the screen in accordance with the signal voltage. Inasmuch as the TV set itself is already scanning at a 60-cycle vertical rate, we have the effect of an oscilloscope with a 60-cycle sweep.

The effectiveness of the 12AT7 clipper is greatly improved by the addition of the .1 μfd. capacitor (C_3) between the plate of the first section and the grid of the second. This introduces regeneration and causes the square-wave output to have a very rapid rise time, under one microsecond. If the output of the second half of the tube is fed directly to the TV set video, then part of the screen will appear light and the other part dark, due to the square wave existing at this point in the circuit. In order to achieve a thin line on the screen the square wave must be differentiated, or converted to pulses, which is easily done by means of a small coupling capacitor of about 100 μμfd. This will produce a positive- and a negative-going spike when fed into a load of about 5000 or 10,000 ohms; although it may be desirable to remove the negative-going spike by means of a crystal diode, as shown in the diagram.

In operation, horizontal pulses may be often obtained merely by stringing

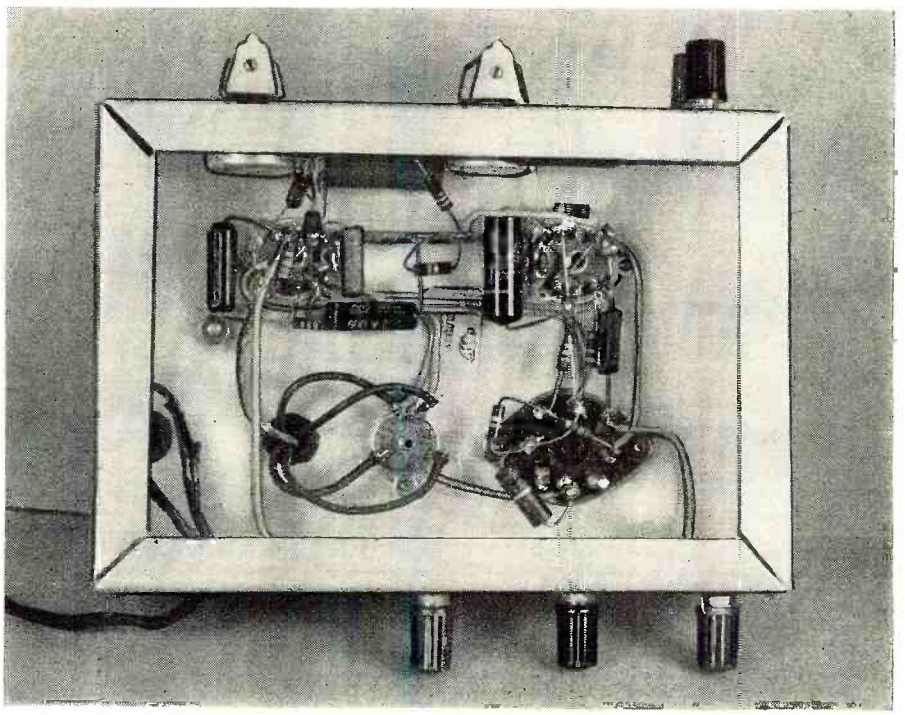
(*Continued on page* 158)



R1—500,000 ohm, ½ w. res.
R2—20,000 ohm, ½ w. res.
R3, R11—390,000 ohm, ½ w. res.
R4, R7, R13—100,000 ohm, ½ w. res.
R5—100,000 ohm pot
R6—1 megohm pot
R8—220,000 ohm, ½ w. res.
R9—2200 ohm, ½ w. res.
R10—4700 ohm, ½ w. res.
R12—10,000 ohm, ½ w. res.
R14—18,000 ohm, ½ w. res.
R15—10,000 ohm, 1 w. res.
C1—.01 μfd., 400 v. capacitor
C2—.001 μfd., 400 v. capacitor
C3, C5—.1 μfd., 400 v. capacitor
C4—10 μfd., 150 v. elec. capacitor
C6—100 μμfd., 400 v. capacitor
C7—.002 μfd., 400 v. capacitor
C8, C9—20/20 μfd., 150 v. elec. capacitor
T1—Power trans. 125-0-125 v. @ 25 ma.; 6.3 v. @ 1 amp (Stancor PS8416 or equiv.)
CR1—Germanium diode (Raytheon CK705/1N66, optional, see text)
V1—12AU7 tube
V2—12AT7 tube
V3—6X4 tube

Circuit diagram and parts list for device that produces scope patterns on TV screen.

Bottom view of pulse-position modulator unit whose circuit diagram is shown above.



By JOHN T. FRYE

A GOOD RADIO

BARNEY stopped short in the door of the service department and pointed a long, thin finger at the gleaming cabinet resting on a shelf above the service bench.

"What's that?" he demanded of Mac, his employer, who was perched in front of the bench on a high stool listening to the music that floated from the beautiful two-tone cabinet of hand-rubbed light and dark woods.

"A radio, and a darned good one," Mac replied. "You are too young to know, but radio manufacturers here used to put out a lot of these 'large table model' sets. Actually, what they did was to place a fine console chassis in a large table model cabinet with a somewhat smaller speaker than was used in the console. This radio would do everything the console set would do except reproduce the lower frequencies—due, of course, to a lack of adequate baffle. However the table model sold for substantially less than the console, and I've always been convinced it gave the buyer the most radio for his dollar he ever got."

"How did you latch on to this set?"

"It's made in West Germany for export. A friend of mine imported it and brought it over for me to play with for a few days. He wants my opinion of it."

"Well, what do you think?"

"I think it's most interesting to see what has been accomplished by engineers who continued concentrating on improving radios instead of being lured into other electronic fields. I'm sure our boys could build a set as good as this one, but they've not done so because they know a fine, expensive radio would be hard to sell in competition with TV, hi-fi installations, etc. Still, I get a large charge out of getting my hands on a really fine radio again."

"What's so terrific about it? I'll admit it is a beautiful piece of cabinet making, and that tone makes the little a.c.-d.c. jobs sound rather sad; but what else is special about the radio?"

"In brief, it is a ten-tube set with fifteen watts of undistorted output claimed for it. It tunes the broadcast band, the FM band, the short-wave band from 5 to 19.5 megacycles, and a long-wave band from 150 to 350 kilocycles. Notice there are two dial pointers controlled by separate knobs. One tunes the short-, long-wave, and broadcast bands, and the other tunes the FM band and serves as a bandspread tuner for the s.w. band. It has a built-in ferrite antenna for the broadcast band that can be rotated by this knob here. Notice there are pushbuttons to allow the amplifier to be used with a tape recorder and a phono pickup."

"How do they wangle such superduper tone out of that small cabinet?"

"Candidly, I'm not quite sure; but I think the heavy wood cabinet has something to do with it. Then, too, the radio uses four speakers: two five-inch, a special high-frequency speaker, and a 4"x6" oval job. Notice there are push-button controls for 'speech,' 'orchestra,' and 'jazz' listening. These are backed up by continuously variable bass and treble controls.

"And now get a load of this," he said as he pushed a broad button marked "Stereophonic" on the front of the set. Instantly there was a subtle change in the tone quality. Instead of coming from the radio itself, the music seemed to emanate from all over the room.

"Hey, that *is* something!" Barney exclaimed. "One thing still bothers me, though: why does the set have two tuning eyes? This bottom one seems to work conventionally, but that top one, marked 'Dynamic,' seems to close on loud passages of the music."

"This is going to take a little explaining, but it's worth it; so listen carefully," Mac admonished. "You may or may not know that the dynamic range of sound in many symphonies is terrific. The ratio of the loudest to the weakest sound may be as much as 10,000 to 1. Neither a record nor a broadcast station can accommodate such a range; so volume compression is used to bring up the weak sounds until they can be heard while the loud passages are reduced until they will not overmodulate the station or overcut the record. This telescoped sound is what you ordinarily hear from a radio. This set, though, has a built-in automatic volume expander that restores the compressed sound to its original full range. Let me show you: right now these three buttons marked 'low,' 'medium,' and 'high' are all out and the volume-expander is inoperative. I'll turn up the volume until the dynamic eye, which measures the level delivered to the speakers, is just closing on the loudest passages. Watch what happens when I push in the 'low' button. See; the loud passages are now over-closing the eye. When I push in the 'medium' button this over-closing is increased; and it is still more evident when I push this 'high' button that provides maximum volume expansion."

"Yeah, and I don't need to watch the eye to note the difference," Barney remarked. "Those loud passages are really belting it out now."

"You have to play around with the set for a while before you fully appreciate what the volume expansion does for music," Mac observed. "Naturally its effect is much more pronounced on some music than it is on others.

"We've got to get to work," he remarked as he glanced at the clock; "but before I shut off the receiver I want to show you one more thing. Set that bandspread pointer to '0' in the middle of the dial and then set the main pointer exactly on 10 megacycles on the short-wave band. OK; now push the short-wave button."

Barney carried out the instructions; and when the button that switched the receiver to the short-wave band was pressed, the familiar steady tone and regular ticking of WWV came in perfectly.

"How's that for accurate dial calibration?" Mac demanded with a grin. "It's that good all over the dial on all bands, too. I've seen communications receivers that didn't equal that."

"So have I," Barney agreed. "It is certainly some receiver. How much does it cost?"

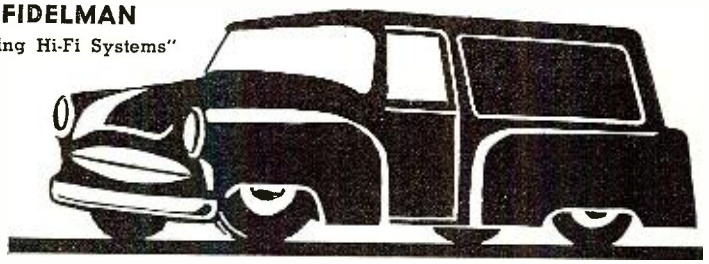
"About the same as a good 21" table model TV set," Mac replied. "That's the catch to selling them in this TV saturated country. Most people would buy a hi-fi installation complete with AM and FM tuner before they would put that much money in what is essentially just a fine radio. However, there are some people who are not interested in record playing and just want an extra-good radio with tone quality far superior to what they can get from an a.c.-d.c. receiver. This is for them."

"I don't imagine that market is too large," Barney said; "but, of course,

(*Continued on page* 137)

Field Hi-Fi Service

By **DAVID FIDELMAN**
Author of "Repairing Hi-Fi Systems"



The technician new to hi-fi service can do much before becoming involved with special equipment.

ONE OF THE big problems in the field of high-fidelity servicing and repair is the number and variety of test instruments necessary to do a really thorough job. In addition to the usual complement of voltmeters, ohmmeters, tube testers, and other facilities found in every service shop, the complete servicing and testing of a high-fidelity sound reproducing system may require most or all of the instruments listed in Table 1A. This is a considerable amount of equipment. Even if it is assembled from the various commercially available kits, the cost of such a full complement is enough to frighten many prospective audio repairmen out of the high-fidelity field.

It is often overlooked, however, that a very large proportion of the failures or malfunctions in hi-fi systems can be serviced without such special equipment. In fact, many repairs must be made with an absolute minimum amount of equipment. An example of this type of repair is the case of large and complicated installations where it is impractical to dismantle the complete system and take it to the repair shop. Very often, troubles are due to the system itself rather than to individual units and must, therefore, be serviced in the home with a minimum amount of equipment. When a system that has been operating satisfactorily suddenly develops severe distortion or becomes completely inoperative, the trouble is often due to a tube or component failure that can easily be located and repaired with few instruments.

However, this must not be interpreted to indicate that *all* high-fidelity servicing can be done without complete equipment. The question is one of how complete a job is to be done. For final and complete testing of a high-fidelity system, a majority of the instruments listed in Table 1A are necessary and many types of high-fidelity servicing cannot be done at all without a fairly complete assortment. This is especially true of routine maintenance, where it is necessary to detect and measure subtle differences and slight deteriorations. However, *repair* can be performed with much less equipment than is required for maintenance.

Although certain repairs can be made with little more than a screwdriver and a set of spare tubes, there is a certain minimum amount of equipment without which one should not attempt these jobs. A list of such minimum equipment is given in Table 1B. Most of the failures in audio systems can be serviced with these instruments if the proper techniques and procedures are used.

The procedure is basically one of signal tracing, disturbance checking, and logical analysis. The primary objective is to localize a specific failure to a particular unit in the high-fidelity system, then to localize it to a particular section of that unit. Once the failure has been localized to a specific portion of the circuit, the defective component may be located either by inspection, by measurement with a voltohmmeter, or by substitution of the suspected components.

Although test instruments are necessary for the accurate measurement of quality of sound reproduction *after* the system has been repaired, a considerable amount of information can be obtained about its performance without instruments, by listening to it while playing the proper test records.

Localization

When a failure occurs, a logical approach, illustrated in Fig. 1, using the proper systematic servicing technique, can greatly simplify localization and eliminate many common servicing faults and errors. There are several methods which have proved extremely useful in reducing the time and effort required to locate the failure with a minimum amount of test equipment. Some of these are:

Logical analysis: Initial diagnosis and isolation of the trouble can generally be done by listening to the system and switching the various units. If the trouble (either complete non-operation or severe distortion, hum, noise, etc.) persists for different settings of the switches, then it is likely to be somewhere between the switching point and the output. If the symptom occurs on only one switch position, then the cause lies in that input channel. In cases of severe distortion, vary the volume-control setting to check whether the distortion is present at all levels, or whether it changes with gain. If it is present at all levels, it originates ahead of the volume control; otherwise it originates after the control. Similarly, if hum or noise varies with the gain control, it originates ahead of the control; if it is constant for all settings, it originates

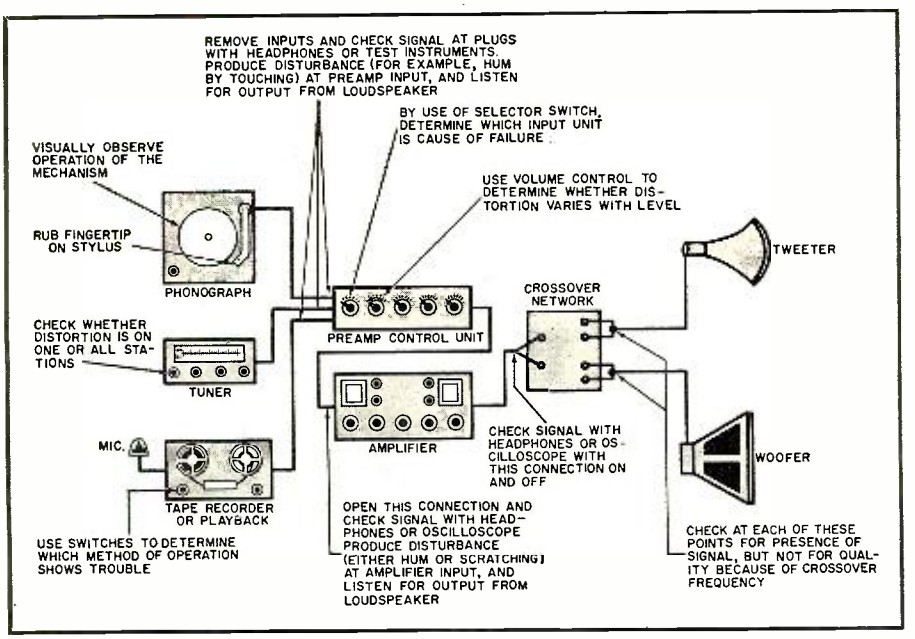


Fig. 1. Rapid checks that can be made to aid in servicing hi-fi systems. Techniques for localizing symptoms to one part of the system are stressed.

after the control. Switching to the various input units or channels, varying the gain controls, and listening to the trouble, can quickly eliminate many possibilities.

Inserting a disturbance: This method is especially useful in cases where there is no output from the loudspeaker for any input signal. Two simple methods of introducing a signal into the system at any fairly low-level input are: (*a*) touching the input terminal directly with your finger, or through a clip lead, to introduce a 60-cycle hum into the signal path, or (*b*) scratching the input with a screwdriver to introduce a characteristic sound into the signal path. Start by introducing this disturbance at the highest level input available and work backwards from the loudspeaker to the lowest level inputs. The failure occurs in the system between the last point in the signal path from which the disturbance is heard in the loudspeaker and the first point from which it produces no sound in the speaker. While this type of test is useful in locating the point where the signal disappears completely or becomes very weak, it cannot be used for locating such faults as hum or noise pickup or severely distorted output.

Short-circuiting the channel: If the defect in the system is a high hum or noise level, its source can be located by short-circuiting or disconnecting the signal channel at various points. Start at the output end of the system and work back toward the input. Disconnect the input of the power amplifier and listen to the loudspeaker. If the noise disappears, replace the connection and repeat the procedure, working back toward the input of the system until the unit or section is found in which the noise originates. If the electronic system is a single-chassis unit, or if it is otherwise impractical to disconnect the various units of the system, then short-circuit to ground the different interconnecting points. This has the same effect as disconnecting, except that it will not eliminate any ground loops that may exist in the wiring. (Be careful that any points being grounded are not in the plate circuit of a tube or do not carry d.c. voltage.)

Signal tracing: The best method of localizing the source of severe distortion is the signal-tracing technique. The simplest way is to play any type of program material that exhibits the distortion or other failure in the system, then listen with a good pair of high-impedance crystal headphones at all accessible points in the system, starting at the *input* in this case, and proceeding toward the output. At some point, the distortion will become noticeable for the first time; it therefore originates between the last point at which it is absent and the first point at which it is present. A more precise method of signal tracing, which will give a more positive indication for most forms of distortion, is to feed a steady sine wave into the input of the system, and to trace it through the system with an oscilloscope. Signal tracing is an extremely useful audio servicing technique and can be used for localizing the source of most types of failures.

Once failure has been narrowed to a specific unit or section, that unit must then be serviced in greater detail, using the same methods that have been described for the complete system. Failure may then be localized to a specific part of a circuit containing relatively few components. It then becomes fairly easy to determine which of the components is the cause of the failure. The procedure for localizing a failure in a typical audio amplifier is illustrated in Fig. 2. Final isolation of the defective component is performed with conventional service techniques, which will not be elaborated here.

Some general suggestions concerning signal tracing, relative to Fig. 2, may be helpful. Moving in order from point *1A* to point *9A*, headphones or an oscilloscope are used to check for distortion. Be sure to use an isolating capacitor to protect the headphones at high "B+" point. Signal levels are measured with a v.t.v.m. or a calibrated oscilloscope. When checking for a source of hum or other noise, points *1A* to *6A* may be grounded, using either a jumper wire with a clip lead or a screwdriver. Points *7A* and *8A* are grounded through a capacitor rated at no less than 400 volts. In disturbance testing, points *1A* through *6A* may be touched directly with the finger or through a clip lead.

Voltages preceded by a plus sign and shown directly near points in the circuit are d.c. potentials. Voltages appearing without polarity markings, in somewhat larger numbers, near the identifying circles, are signal voltages normally found in an amplifier of this type with the indicated quarter of a volt input. The amplifier shown is sufficiently representative so that the typical readings can be generally helpful.

Servicing Precautions

When servicing high-fidelity equipment, it is especially important to avoid a number of common errors which can cause a considerable amount of extra work and waste of time.

First, make sure that all volume controls and tone controls are set in positions used when the system was operating properly. Serious distortion and overloading may be due to improper adjustment of the relative gain of the different units or by frequency response distortion due to improper tone-control settings.

Check for all *obvious* causes of trouble. If there is no output at all, make sure that the power plugs are in, that no fuses are blown, and that the loudspeaker is connected to the output of the power amplifier. If any one unit in the system is not operating, make certain that it is receiving its own required power, is properly connected, etc. In general, check to make sure that all the units in the system are connected to the proper inputs or outputs, that no wires are broken loose, and no tubes out of their sockets.

Note the symptoms of the failure very carefully, since proper analysis and checking against the schematic and service notes can very often eliminate a considerable amount of unnecessary testing in parts of the system that could not cause the failure and can often lead directly to the circuit in which the failure originates.

Make sure to localize the section in which the failure occurs before making any voltage and resistance measurements, otherwise a considerable

(A) EQUIPMENT FOR COMPLETE TESTING OF HI-FI SYSTEMS

1. Electronic test equipment
   - (a) Variable-frequency sine-wave and square-wave oscillator
   - (b) Audio-frequency vacuum-tube voltmeter
   - (c) Oscilloscope
   - (d) Intermodulation distortion analyzer
   - (e) FM sweep generator
   - (f) Voltohmmeter
2. Optional electronic test equipment
   - (a) Harmonic distortion and noise meter
   - (b) Wow and flutter meter
   - (c) Audio sweep generator
3. Acoustic and electromechanical test equipment
   - (a) Standard test records
   - (b) Stroboscope disc
   - (c) Calibrated microphone
4. Accessory equipment
   - (a) Good high-fidelity amplifier
   - (b) Good FM tuner
   - (c) High-quality three-speed transcription turntable with transcription arm, and magnetic and crystal cartridges
   - (d) Full-range loudspeaker or loudspeaker system in good enclosure

(B) MINIMUM EQUIPMENT FOR TESTING OF HI-FI SYSTEMS

1. Electronic test equipment
   - (a) Variable-frequency sine-wave oscillator
   - (b) Oscilloscope
   - (c) Voltohmmeter
2. Acoustic and electromechanical test equipment
   - (a) Standard test records
   - (b) Stroboscope disc
3. Accessory equipment
   - (a) Headphones

Table 1. To the left is a tabulation of the test instruments that would ordinarily be needed to embark on a full-fledged career in hi-fi service. Directly above is the minimum equipment needed for the basic work to handle most complaints.

amount of time can be spent studying the wrong part of the circuit without ever disclosing the true cause of the failure.

Replace the tubes before replacing any other components, and be sure that the new tubes are good. As with radio and TV sets, the tubes are more likely to fail than other components.

Never replace parts haphazardly in the circuit. Try to make sure that the component is defective, either by visual observation or by voltage and resistance tests, before replacing it. There will be some cases, however, in which all the evidence points to a specific component that cannot be tested with the instruments available. (For example, a carbon resistor may become noisy with no measurable change in resistance value.) In such cases, the best procedure is to substitute a new component for the suspected one.

When replacing components in high-fidelity systems, always be sure to use an exact replacement. Many of the components in high-fidelity circuits are critical and failure to make an exact replacement may result in poor performance.

If the repair of the system does not correct the trouble, recheck the repair that has been made to see that it has been done correctly. In some cases, a "new" trouble may appear that had existed previously, but had been masked by the failure that was corrected, hence the service procedure must be repeated with this new failure.

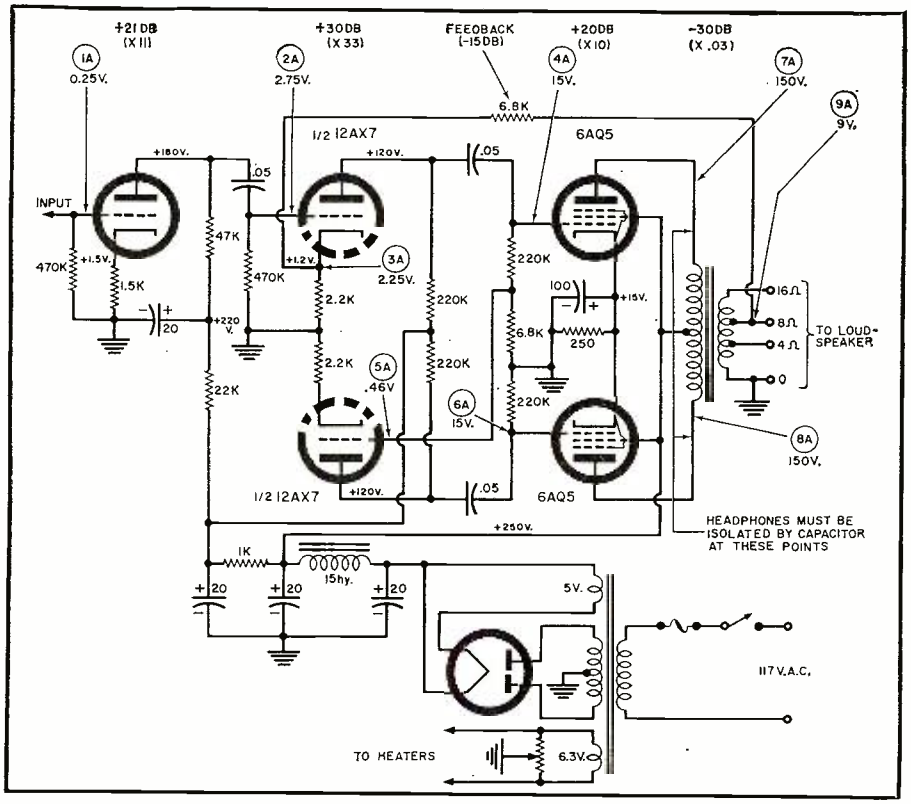
Test Records

The procedures that have been described can be used for all failures sufficiently obvious to be readily heard by the ear and will be useful for most of the major failures that occur in high-fidelity systems. However, the more subtle failures, such as deterioration in system performance, require a more intensive servicing procedure. Generally, increased distortion in a high-fidelity system must be measured with the proper test instruments listed in Table 1A, in fact, these are absolutely necessary when quantitative measurements are required. However, a considerable amount of information can be obtained about the performance of a system without test instruments by listening to the sound reproduced by the system when playing the proper test records.

The primary test of the system is, of course, to listen to its performance with several high-quality recordings of musical selections. The music on these records should contain a wide range of frequencies and some sharp transients to test the response of the system, and should also include some records that are typical of the sort of music to which the owner of the system will be listening. The instruments might include triangle or cymbal for the high frequencies, pipe organ or double bass for the low frequencies, tympani for the transients, etc. Listen at a higher level than normal, and listen particularly for distortion, hangover (*i.e.*, lack of crispness), inadequacy of low-frequency response, and acoustic feedback.

For more detailed examination of specific types of distortion in the system, a number of specialized test records are available. These test records furnish different types of test signals and many are designed for testing by ear with no additional test instruments.

Fig. 2. Typical amplifier test points for signal tracing and disturbance tests, along with d.c. and signal-voltage readings and stage-gain notations.



MAKER	CATALOGUE NUMBER	APPLICATIONS
Components Corp.	1106	Wow and flutter (100 and 3000 cps)
	1107	Stylus wear
	1108	Turntable rumble (1000 cps at different levels)
	1109	Tone arm resonance (gliding frequency 10 to 100 cps)
	1110	Vertical/lateral pickup response
	1111	Hum at different levels
Cook Laboratories, Inc.	Series 10; Series 10-A	Frequency response and IM tests
	Series 20	Thermal (white) noise
	Series 30	Binaural tests
	Series 50	NA beam distortion test
	Series 60	Chromatic scale test
	bn 1000	Introduction to binaural
Elektra	Playback System Calibration Record	Frequency response measurement
Folkways	FPX 100	Frequency response, distortion, and square-wave response
RCA	12-5-5	Variable-frequency
	12-5-19; 12-5-31; 12-5-41; 12-5-49; 12-5-51	Bands at different frequencies
	12-5-25	Frequency response and IM tests
	12-5-37; 12-5-39	IM tests
	12-5-9	Constant tones
	12-5-1; 12-5-3	Unmodulated grooves
	12-5-65	Wow and rumble
	12-5-15; 12-5-17	Warble bands
	(Also several types of record-changer test records)	
Urania	UPS-1	Popular Science test record (frequency response, distortion, and demonstration)
	UPS-2	Popular Science test Record No. 2 (musical frequency and distortion test)
Westminster	TRC	Frequency and dynamic tests

Note: Further information on these records should be obtained from the manufacturers.

Table 2. Widely available test records and the uses to which they can be put.

Frequency-response records consist of sets of bands of different frequencies. The record is played back through the system and the response measured, either with a v.t.v.m. (or an audio power meter), or aurally by listening for the highest frequency that can be heard through the system. When using frequency-response records, it is important to take account of the relative equalizations of the test record and the playback system. For example, the frequency response of a system equalized for the RIAA playback characteristic when playing back a test record having a 500-cps turnover frequency, with constant amplitude below and constant velocity above this frequency, is shown in Fig. 3. If the test disc used cannot be equalized exactly on the system under test, allowance should be made for this fact.

Intermodulation test records are available for checking a system with instruments or by ear. Records designed for measurement with an intermodulation analyzer provide the standard intermodulation test signal (consisting of a low-frequency tone and a high-frequency tone in a 4-to-1 ratio). A test record designed specifically for testing intermodulation by ear is the "NA" distortion test record, in which the tone changes from dot-dash to dash-dot when the intermodulation in the system exceeds 2%.

White-noise records consist of recordings of pure thermal noise covering all frequencies in the audible range, generally with a series of noise bands of different cut-off frequencies for testing the frequency response of the system by ear. Such records are useful in estimating frequency response, transient response, room acoustics, and a wide variety of other characteristics of audio systems.

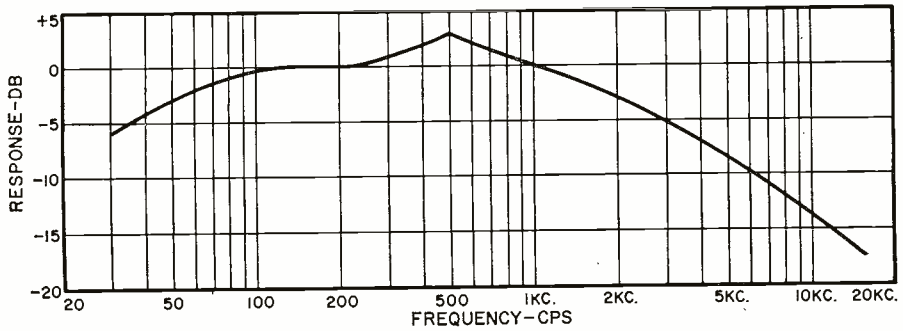
Unmodulated-groove records can be used for detecting moderate wear of the pickup stylus (that is, wear sufficient to produce serious distortion and damage records, but not enough to be seen under the microscope), as well as hum, rumble, and noise level of the turntable. Wear is noted by observing the unmodulated groove before and after play with a suspected stylus to observe whether any changes occur after play.

Many other characteristics of the cartridge and the turntable can be determined from test records by ear. Poor tracking of the stylus at high frequencies is heard as apparent modulation of a constant tone, caused by the variations of the contact the stylus makes with the groove. Wow and flutter in a turntable can be detected by ear. A helpful fact is that the seriousness of flutter can be estimated by the frequency at which it can be detected. The higher the frequency at which flutter can be barely detected, the more stable will be the turntable. When listening at an approximate level of 40 db above minimum audibility, these rough indications will be useful: if the flutter is not detectable below 1000 cps, the record player is good; if it is not detectable at 100 cps, the player is fair. If flutter can be noted at 100 cps or below, the player speed stability is poor.

A listing of some typical test records, which are readily available, is given in Table 2.

When test records are used to determine performance of a high-fidelity system, certain precautions must be taken, both in the actual use of the records and in the interpretation of the results. For best results, use the highest practical sound levels from the loudspeaker. When testing frequency response of the system by ear, be sure that you yourself can hear the frequencies at which you are testing; otherwise you may be testing your own hearing rather than the system. Make sure that any test records used are in good condition and not too worn, since worn records will themselves develop distortion and lose high-frequency response. Always remember that aural tests with test records are, at best, useful in indicating *major* deteriorations in system performance and the need for system maintenance and adjustment. They cannot take the place of accurate instrumentation for measuring small amounts of distortion that originate in the amplifier or other such parts of the system, or for making comparative measurements between different systems that are in good operating condition. —30—

Fig. 3. When a system equalized for one recording characteristic is used to play a test disc recorded with another, an irregular curve, like the one shown, will be obtained. Guard against misinterpreting a result of this kind.



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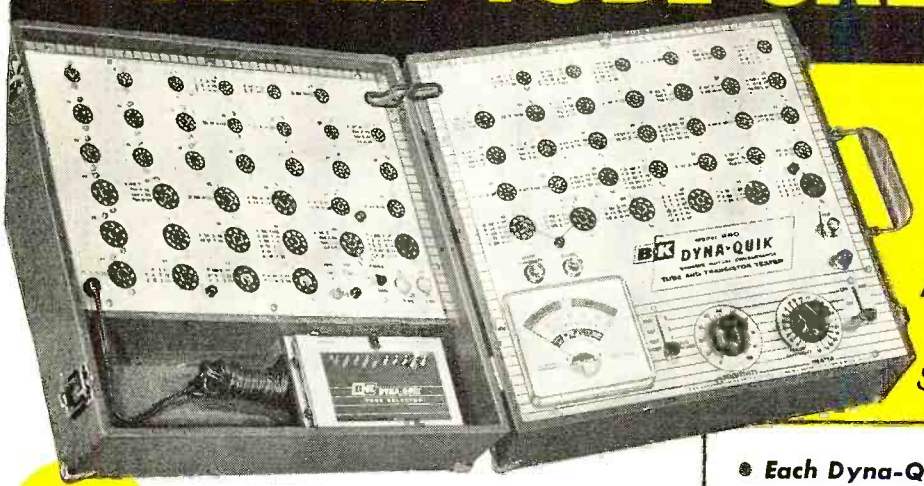

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Checks over 99% of the tubes most widely used in television receivers, plus popular home and portable radio tubes. Tests over 500 tube types. Lists over 125 tube types, with settings, on socket panels for maximum operating speed. Complete listing in fast telephone-index type selector. Includes 16 spare sockets and sufficient filament voltages for future new tube types. **Tests each section of multiple tubes separately** for Gm—Shorts—Grid Emission—Gas Content—and Life. Provides instantaneous Heater Continuity check. Shows tube condition on "Good-Bad" scale and in micromhos. Special bridge assures automatic line compensation. No multiple switching—No roll chart. Includes pin straighteners. **Transistor Tester** checks junction, point contact and barrier transistors, germanium and silicon diodes, selenium and silicon rectifiers. Net, **$169.95**

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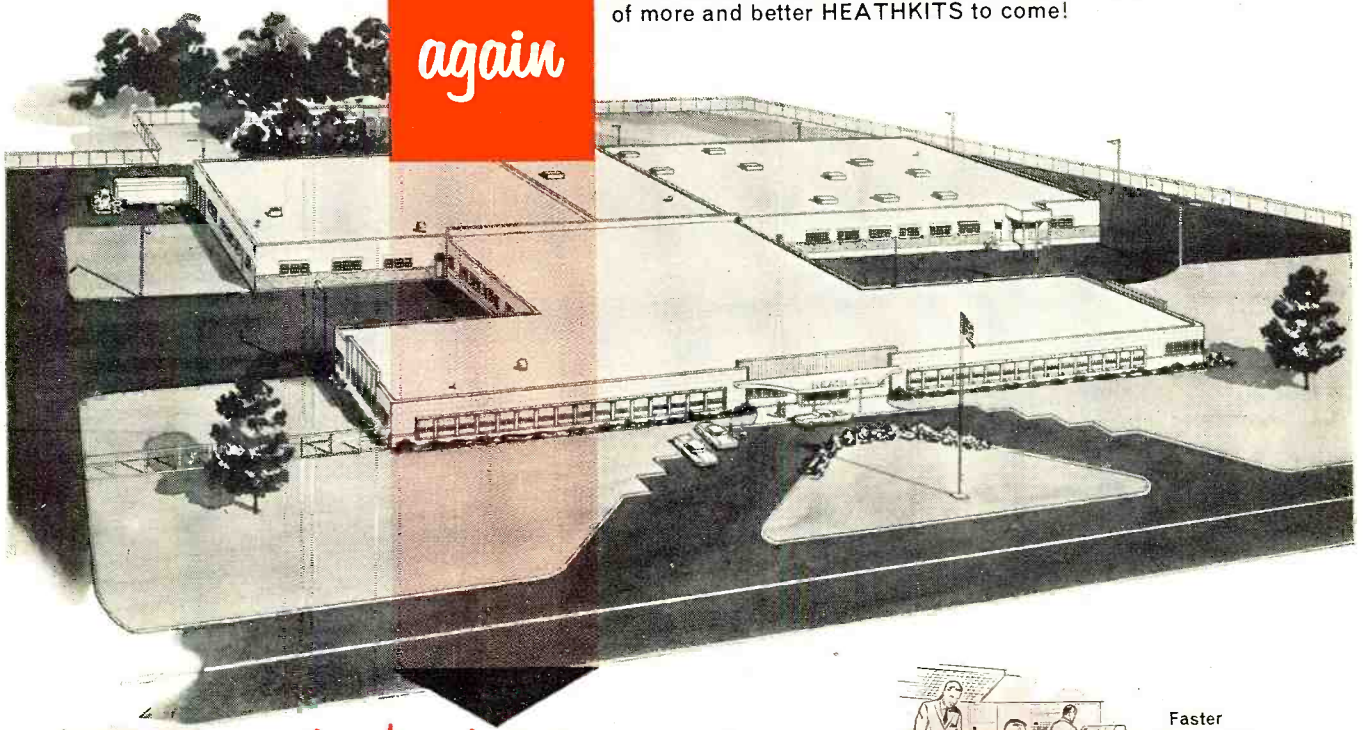

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HEATHKIT EXTRA PERFORMANCE 70-WATT AMPLIFIER KIT

For really high performance, with plenty of reserve power, the W-6M is a natural. The full 70-watts output will seldom, if ever, be required. However, this reserve insures distortion-less sound on power peaks. The W-6M will loaf along at normal listening levels and yet is always ready to extend itself when program material demands it, without the least amount of strain. The output circuit employs 6550 tubes with a special-design Peerless output transformer for maximum stability at all power levels. A quick-change plug selects 4, 8 and 16 ohms or 70-volt output and the correct feedback resistance. A variable damping control is also provided for optimum performance with any speaker system. Extremely good power supply regulation is possible through the use of a heavy-duty transformer along with silicon-diode rectifiers, which are noted for their very long life, and yet are smaller than a house fuse. Frequency response at 1 watt is ±1 db from 5 cps to 80 kc with controlled hf rolloff above 100 kc. At 70 watts output harmonic distortion is below 2%, 20 to 20,000 cps and IM distortion below 1%, 60 and 6,000 cps. Hum and noise 88 db below full output. In addition to high performance, its fine appearance makes it a pleasure to display in your living room. Proper layout of chassis insures ease of assembly by eliminating those cramped and difficult places to get at. Clear instructions—and top-quality components. Get started now and make this amplifier the heart of your hi-fi system. Shipped express only. Shpg. Wt. 50 lbs.

MODEL W-6M

$109.95

MODEL W-6: Consists of W-6M kit, plus WA-P2 preamplifier. Express only. Shpg. Wt. 59 lbs. $129.70

HEATHKIT HIGH FIDELITY FM TUNER KIT

This tuner can bring you a rich store of FM programming, your least expensive source of high fidelity material. It covers the complete FM band from 88 to 108 mc. Stabilized, temperature-compensated oscillator assures negligible drift after initial warmup. Features broadbanded circuits for full fidelity, and better than 10 uv sensitivity for 20 db of quieting, to pull in stations with clarity and full volume. Employs a high gain, cascode RF amplifier, and has AGC. A ratio detector provides high-efficiency demodulation without sacrificing hi-fi performance. IF and ratio transformers are prealigned, as is the front end tuning unit. Special alignment equipment is not necessary. Edge-lighted glass dial for easy tuning. Here is FM for your home at a price you can afford. Shpg. Wt. 8 lbs.

MODEL FM-3A

$25.95 (with cabinet)

HEATHKIT BROADBAND AM TUNER KIT

This AM tuner was designed especially for high fidelity applications. It incorporates a special detector using crystal diodes, and the IF circuits feature broad band-width, to insure low signal distortion. Audio response is ±1 db from 20 cps to 9 kc, with 5 db of preemphasis at 10 kc to compensate for station rolloff. Sensitivity and selectivity are excellent, and tuner covers complete broadcast band from 550 to 1600 kc. Quiet performance is assured by 6 db signal-to-noise ratio at 2.5 UV. Prealigned RF and IF coils eliminate the need for special alignment equipment. Incorporates AVC, two outputs, two antenna inputs, and built-in power supply. Edge-lighted glass slide-rule dial for easy tuning. Your "best buy" in an AM tuner. Shpg. Wt. 8 lbs.

MODEL BC-1A

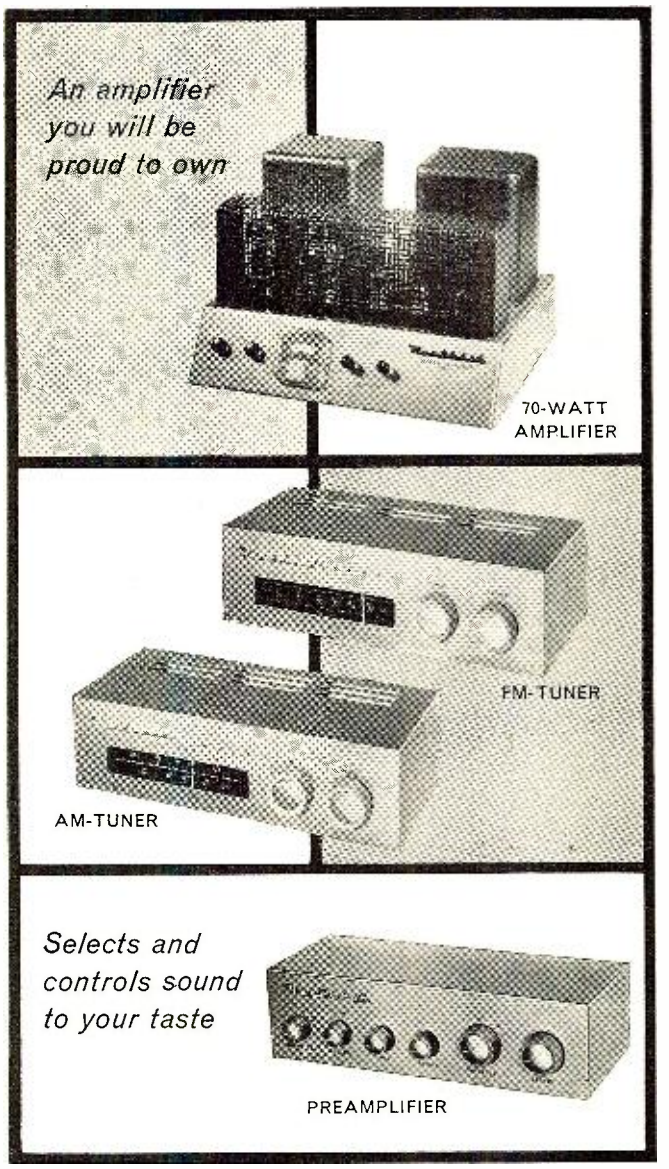
$25.95 (with cabinet)

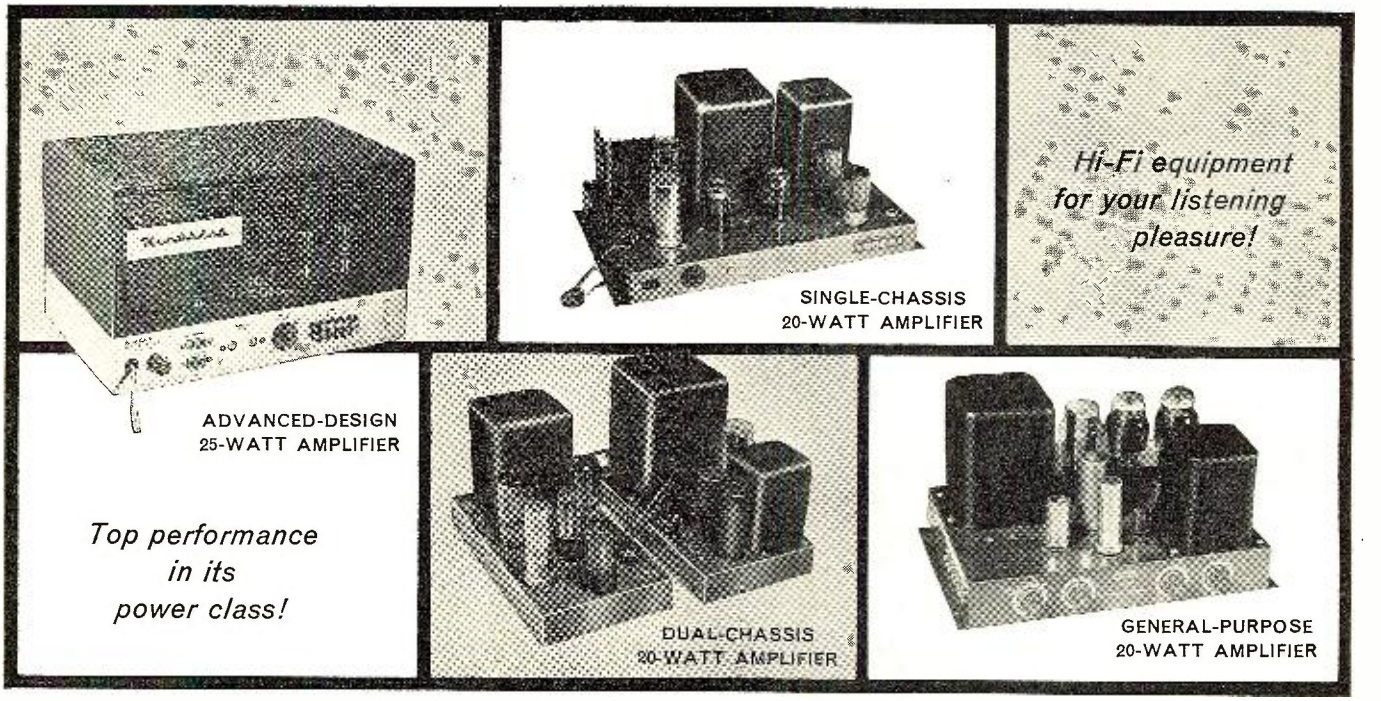
HEATHKIT MASTER CONTROL PREAMPLIFIER KIT

Designed for use with any of the Williamson-type amplifiers, the WA-P2 has five switch-selected inputs, each having its own level control to eliminate blasting or fading while switching through the various inputs, plus a tape recorder output. A hum control allows setting for minimum hum level. Frequency response is within ±1½ db from 15 to 35,000 cps. Equalization provided for LP, RIAA, AES, and early 78's. Separate bass and treble controls. Low impedance cathode follower output circuit. All components were specially selected for their high quality. Includes many features which will eventually be desired. Shpg. Wt. 7 lbs.

MODEL WA-P2

$19.75 (with cabinet)





HEATHKIT ADVANCED-DESIGN 25-WATT HIGH FIDELITY AMPLIFIER KIT

Designed especially to satisfy critical audio requirements, the W-5M incorporates the extra features needed to compliment the finest in program sources and speaker systems. Faithful sound reproduction is assured with a frequency response of ±1 db from 5 to 160,000 cps at 1 watt, and harmonic distortion is less than 1% at 25 watts, with IM distortion less than 1% at 20 watts. Hum and noise are a full 99 db below rated output, assuring quiet, hum-free operation. Output taps are 4, 8 and 16 ohms. Exclusive Heathkit features include the "tweeter saver", and the "bas-bal" balancing circuit, requiring only a voltmeter for indication. Years of reliable service are guaranteed through the use of conservatively rated, high quality components. KT66 tubes and Peerless output transformer are typical. Shipped express only. Shpg. Wt. 31 lbs.

MODEL W-5: Consists of W-5M kit above plus model WA-P2 preamplifier. Express only. Shpg. Wt. 38 lbs. $79.50

MODEL W-5M
$59.75

HEATHKIT SINGLE-CHASSIS 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model W4-AM Williamson-type amplifier will amaze you with its outstanding performance. A true Williamson circuit, featuring extended frequency response, low distortion, and low hum levels, this amplifier can provide you with many hours of listening enjoyment with only a minimum investment compared to other units on the market. 5881 tubes and a special Chicago-standard output transformer are employed to give you full fidelity at minimum cost. Frequency response extending from 10 cps to 100 kc within ±1 db at 1 watt assures you of full coverage of the audio range, and clean clear sound amplification takes place in circuits that hold harmonic distortion at 1.5% and IM distortion below 2.7% at full 20 watt output. Hum and noise are 95 db below full output. Taps on the output transformer are at 4, 8 or 16 ohms. Shipped express only. Shpg. Wt. 28 lbs.

MODEL W-4A: Consists of W-4AM kit above, plus model WA-P2 preamplifier. Express only. Shpg. Wt. 35 lbs. $59.50.

MODEL W4-AM
$39.75

HEATHKIT DUAL-CHASSIS 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model W3-AM is a Williamson-type amplifier built on two separate chassis. The power supply is on one chassis, and the amplifier stages are on the other chassis. Using two separate chassis provides additional flexibility in installation. Features include the famous acrosound model TO-300 "ultralinear" output transformer and 5881 tubes for broad frequency response, low distortion, and low hum level. The result is exceptionally fine overall tone quality. Frequency response is ±1 db from 6 cps to 150 kc at 1 watt. Harmonic distortion is less than 1% and IM distortion is less than 1.3% at 20 watts. Hum and noise are 88 db below 20 watts. Designed to match the speaker system of your choice, with taps for 4, 8 or 16 ohms impedance. A very popular high fidelity unit employing top quality components throughout. Shipped express only. Shpg. Wt. 29 lbs.

MODEL W-3A: Consists of W-3AM kit above plus model WA-P2 preamplifier. Express only. Shpg. Wt. 37 lbs. $69.50

MODEL W-3AM
$49.75

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HEATHKIT GENERAL-PURPOSE 20-WATT HIGH FIDELITY AMPLIFIER KIT

The model A-9C will provide you with high quality sound at low cost. Features a built-in preamplifier with four separate inputs, and individual volume, bass and treble controls. Frequency response covers 20 to 20,000 cps within ±1 db. Total harmonic distortion is less than 1% at 3 db below rated output. Push-pull 6L6 tubes are used, with output transformer tapped at 4, 8, 16 and 500 ohms. A true hi-fi unit using high-quality components throughout, including heavy-duty "potted" transformers. Shpg. Wt. 23 lbs.

MODEL A-9C
$35.50

HEATHKIT "BASIC RANGE" HI-FI SPEAKER SYSTEM KIT

The extremely popular Heathkit model SS-1 Speaker System provides amazing high fidelity performance for its size. Features two high-quality Jensen speakers, an 8" mid-range woofer and compression-type tweeter with flared horn. Covers from 50 to 12,000 CPS within ±5 db, in a special-design ducted-port, bass reflex enclosure. Impedance is 16 ohms. Cabinet measures 11½" H x 23" W x 11¾" D. Constructed of veneer-surfaced plywood, ½" thick, suitable for light or dark finish. All wood parts are precut and predrilled for easy, quick assembly. Shpg. Wt. 30 lbs.

MODEL SS-1

$39.95

HEATHKIT "RANGE EXTENDING" HI-FI SPEAKER SYSTEM KIT

Extends the range of the SS-1 to ±5 db from 35 to 16,000 CPS. Uses 15" woofer and super-tweeter both by Jensen. Kit includes crossover circuit. Impedance is 16 ohms and power rating is 35 watts. Measures 29" H x 23" W x 17½" D. Constructed of veneer-surfaced plywood ¾" thick. Easy to build! Shpg. Wt. 80 lbs.

MODEL SS-1B

$99.95

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HEATHKIT SINE-SQUARE GENERATOR

The new AG-10 provides high quality, sine and square waves over a wide range, for countless applications. Some of these are; radio and TV repair work, checking scope performance, as a variable trigger source for telemetering and pulse work, and checking audio, video and hi-fi amplifier response. Frequency response is ±1.5 db from 20 CPS to 1 MC on both sine and square waves, with less than .25% sine wave distortion, 20 to 20,000 CPS. Sine wave output impedance 600 ohms, square wave output impedance 50 ohms, (except on 10v ranges). Square wave rise time less than .15 usec. Five-position band switch—continuously variable tuning—shielded oscillator circuit—separate step and variable output attenuators in ranges of 10, 1, and .1 volts for both sine and square wave, with extra range of .01 volt on sine wave. Both sine and square wave can be used at the same time without affecting either wave form. Power supply uses silicon-diode rectifiers. Shpg. Wt. 12 lbs.

MODEL AG-10

$49.95

HEATHKIT AUDIO ANALYZER KIT

The AA-1 is actually three instruments in one compact package. It combines the functions of an AC VTVM, an audio wattmeter, and an intermodulation analyzer. Input and output terminals are combined, and high and low frequency oscillators are built in. VTVM ranges are 0-.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts (RMS). Wattmeter ranges are .15 mw, 1.5 mw, 15 mw, 150 mw, 1.5 w, 15 w and 150 w. IM scales are 1%, 3%, 10%, 30% and 100%. Provides internal load resistors of 4, 8, 16 or 600 ohms. A tremendous dollar value. Shpg. Wt. 13 lbs.

MODEL AA-1

$49.95

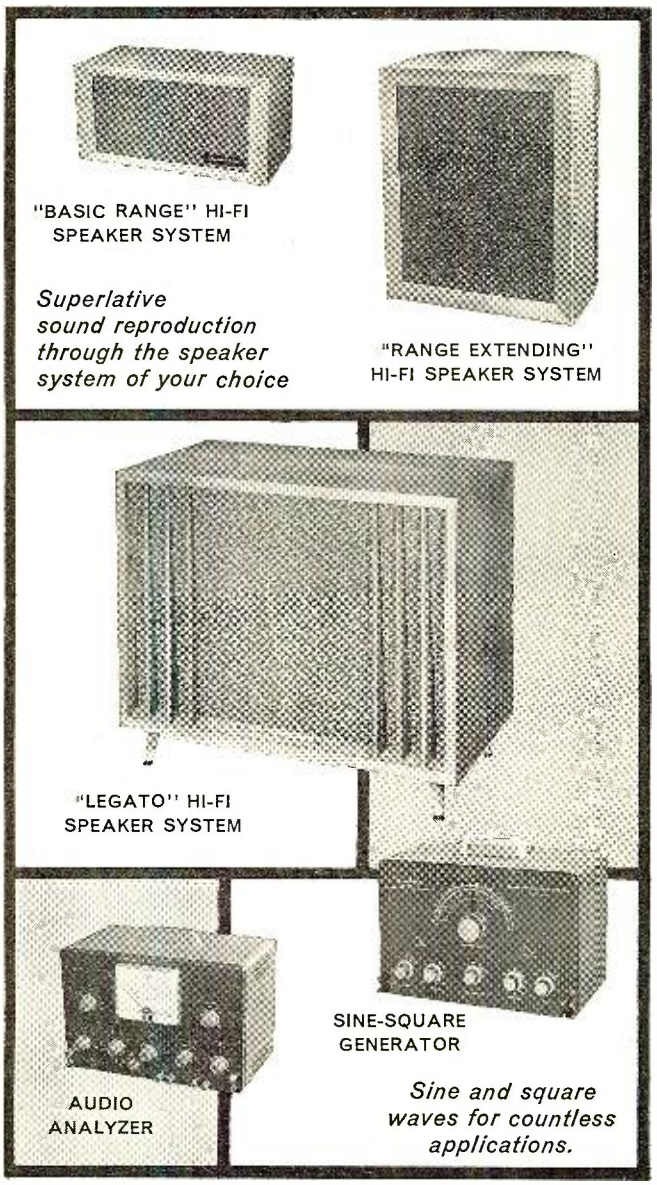
HEATHKIT "LEGATO" HIGH FIDELITY SPEAKER SYSTEM KIT

The quality of the Legato, in terms of the engineering that went into the initial design, and in terms of the materials used in its construction, is matched in only the most expensive speaker systems available today. The listening experience it provides approaches the ultimate in esthetic satisfaction. Two 15" theater-type Altec Lansing speakers cover 25 to 500 CPS, and an Altec Lansing high-frequency driver with sectoral horn covers 500 to 20,000 CPS. A precise amount of phase shift in the crossover network brings the high frequency channel into phase with the low frequency channel to eliminate peaks or valleys at the crossover point, by equalizing the acoustical centers of the speakers. The enclosure is a modified infinite baffle type, especially designed for these speakers. Cabinet is constructed of veneer-surfaced plywood, ¾" thick, precut and predrilled for easy assembly. Frequency response 25 to 20,000 CPS. Power rating, 50 watts program material. Impedance is 16 ohms. Cabinet dimensions 41" L x 22¼" D x 34" H.

Choice of two beautiful cabinets. Model HH-1-C in imported white birch for light finishes, and HH-1-CM in African mahogany for dark finishes. Shpg. Wt. 195 lbs.

MODEL HH-1-C
MODEL HH-1-CM

$325.00 EACH



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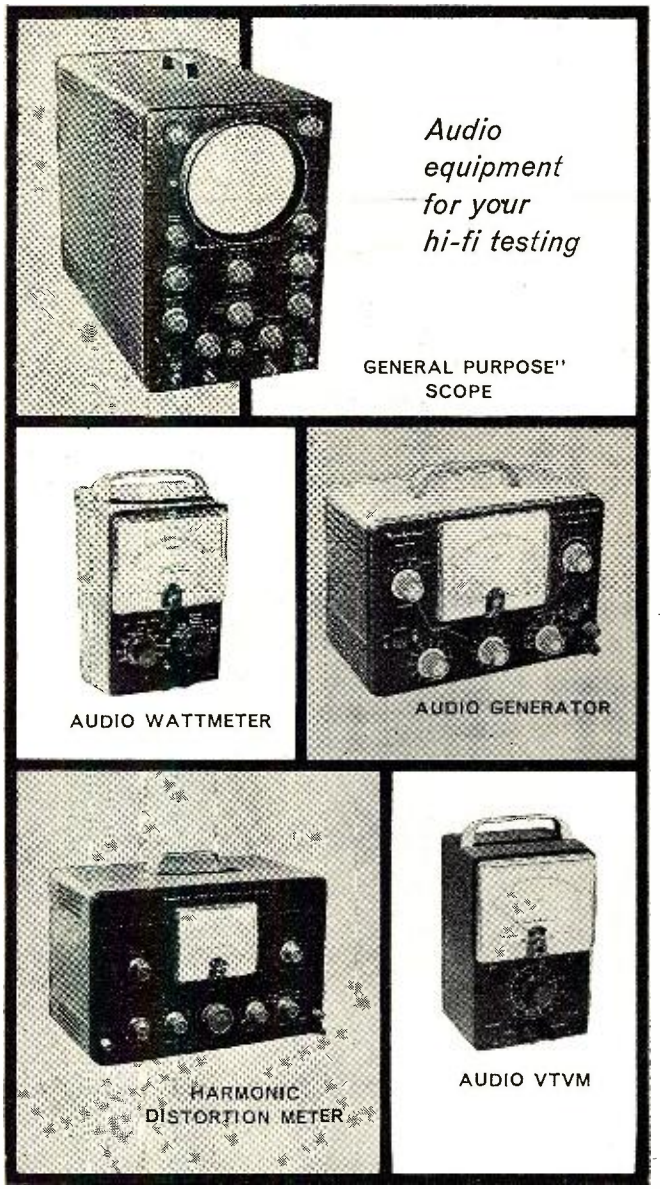


HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

The model OM-2 Oscilloscope is especially popular with part-time service technicians, students, and high fidelity enthusiasts. It features good vertical frequency response ±3 db from 4 cps to over 1.2 mc. A full five-inch crt, and sweep generator operation from 20 cps to over 150 kc. Stability is excellent and calibrated grid screen allows precise signal observation. Extra features include external or internal sweep and sync, 1-volt peak-to-peak calibrating reference, 3-position step-attenuated input, adjustable spot shape control, push-pull horizontal and vertical amplifiers, and modern etched-metal circuits. Easy to build and a pleasure to use. Ideal for use with other audio equipment for checking amplifiers. Shpg. Wt. 21 lbs.

MODEL OM-2

$42.50

HEATHKIT AUDIO WATTMETER KIT

The AW-1 Audio Wattmeter can be used in any application where audio power output is to be measured. Non-inductive LOAD resistors are built in for 4, 8, 16 or 600 ohms impedance. Five power ranges cover 0-5 mw, 50 mw, 500 mw, 5 w, and 50 w full scale. Five switch-selected db ranges cover −10 db to +30 db. All indications are read directly on a large 4½" 200 microampere meter. Frequency response is ±1 db from 10 cps to 250 kc. Precision type multiplier resistors used for high accuracy, and crystal diode bridge for wide-range frequency response. This meter is used in many recording studios and broadcast stations as a monitor as well as servicing. A fine meter to help supply the answers to your audio operating or power output problems. Shpg. Wt. 6 lbs.

MODEL AW-1

$29.50

HEATHKIT AUDIO SIGNAL GENERATOR KIT

The model AG-9A is "made to order" for high fidelity applications, and provides quick and accurate selection of low-distortion signals throughout the audio range. Three rotary switches select two significant figures and a multiplier to determine audio frequency. Incorporates step-type and a continuously variable output attenuator. Output indicated on large 4½" panel meter, calibrated in volts and db. Attenuator system operates in 10 db steps, corresponding to meter calibration, in ranges of 0-.003, .01, .03, .1, .3, 1,3 and 10 volts RMS. "Load" switch permits use of built-in 600-ohm load, or external load of different impedance. Output and frequency indicators accurate to within ±5%. Distortion less than .1 of 1% between 20 and 20,000 cps. Total range is 10 cps to 100 kc. Shpg. Wt. 8 lbs.

MODEL AG-9A

$34.50

HEATHKIT HARMONIC DISTORTION METER KIT

All sounds consist of dominant tones plus harmonics (overtones). These harmonics enrich the quality and brightness of the music. However, additional harmonics which originate in the audio equipment, represent distortion. Used with an audio signal generator, the HD-1 will accurately measure this harmonic distortion at any or all frequencies between 20 and 20,000 cps. Distortion is read directly on the panel meter in ranges of 0-1, 3, 10, 30 and 100% full scale. Voltage ranges of 0-1, 3, 10 and 30 volts are provided for the initial reference settings. Signal-to-noise ratio measurements are also permitted through the use of a separate meter scale calibrated in db. High quality components insure years of outstanding performance. Full instructions are provided. Shpg. Wt. 13 lbs.

MODEL HD-1

$49.50

Heathkits...

By DAYSTROM

are well known for their high quality and reliability.

HEATHKIT AUDIO VTVM KIT

This new and improved AC Vacuum Tube Voltmeter is designed especially for audio measurements and low-level AC measurements in power supply filters, etc. Employs an entirely new circuit featuring a cascode amplifier with cathode-follower isolation between the input and the amplifier, and between the output stage and the preceding stages. It emphasizes stability, broad frequency response, and sensitivity. Frequency response is essentially flat from 10 cps to 200 kc. Input impedance is 1 megohm at 1000 cps. AC (RMS) voltage ranges are 0-.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts. Db ranges cover −52 db to +52 db. Features large 4½" 200 microampere meter, with increased damping in meter circuit for stability in low frequency tests. 1% precision resistors employed for maximum accuracy. Stable, reliable performance in all applications. Shpg. Wt. 5 lbs.

MODEL AV-3

$29.95

HEATHKIT COLOR BAR AND DOT GENERATOR

The CD-1 combines the two basic color service instruments, a Color Bar Generator and White Dot Generator in one versatile portable unit, which has crystal-controlled accuracy and stability (no external sync lead required). Produces white-dots, cross hatch, horizontal and vertical bars, 10 vertical color bars, and a new shading bar pattern for screen and background adjustments. Variable RF output on any channel from 2 to 6. Positive or negative video output, variable from 0 to 10 volts peak-to-peak. Crystal controlled sound carrier with off-on switch. Voltage regulated power supply using long-life silicon rectifiers. Gain knowledge of a new and profitable field by constructing this kit. Shpg. Wt. 12 lbs.

MODEL CD-1
$59.95

Heathkits...

By DAYSTROM

are guaranteed to meet or exceed advertised specifications

HEATHKIT TV ALIGNMENT GENERATOR KIT

This fine TV alignment generator offers stability and flexibility difficult to obtain even in instruments costing several times this low Heathkit price. It covers 3.6 mc to 220 mc in four bands. Sweep deviation is controllable from 0 to 42 mc. The all-electronic sweep circuit insures stability. Crystal marker and variable marker oscillators are built in. Crystal (included with kit) provides output at 4.5 mc and multiples thereof. Variable marker provides output from 19 to 60 mc on fundamentals and from 57 to 180 mc on harmonics. Effective two-way blanking to eliminate return trace. Phasing control. Kit is complete, including three output cables. Shpg. Wt. 16 lbs.

MODEL TS-4A
$49.50

HEATHKIT "EXTRA DUTY" 5" OSCILLOSCOPE KIT

This fine oscilloscope compares favorably to other scopes costing twice its price. It contains the extra performance so necessary for monochrome and color-TV servicing. Features push-pull horizontal and vertical output amplifiers, a 5UP1 CRT, built in peak-to-peak calibration source, a fully compensated 3-position step-type input attenuator, retrace blanking, phasing control, and provision for Z-axis modulation. Vertical amplifier frequency response is within +1.5 and −5 db from 3 CPS to 5 MC. Response at 3.58 MC down only 2.2 db. Sensitivity is 0.025 volts RMS/inch at 1 kc. Sweep generator covers 20 CPS to 500 kc in five steps, five times the usual sweep obtained in other scopes through the use of the patented Heath sweep circuit. Etched-metal circuit boards reduce assembly time and minimize errors in assembly, and more importantly, permit a level of circuit stability never before achieved in an oscilloscope of this type. Shpg. Wt. 21 lbs.

MODEL O-11
$69.50

HEATHKIT ELECTRONIC SWITCH KIT

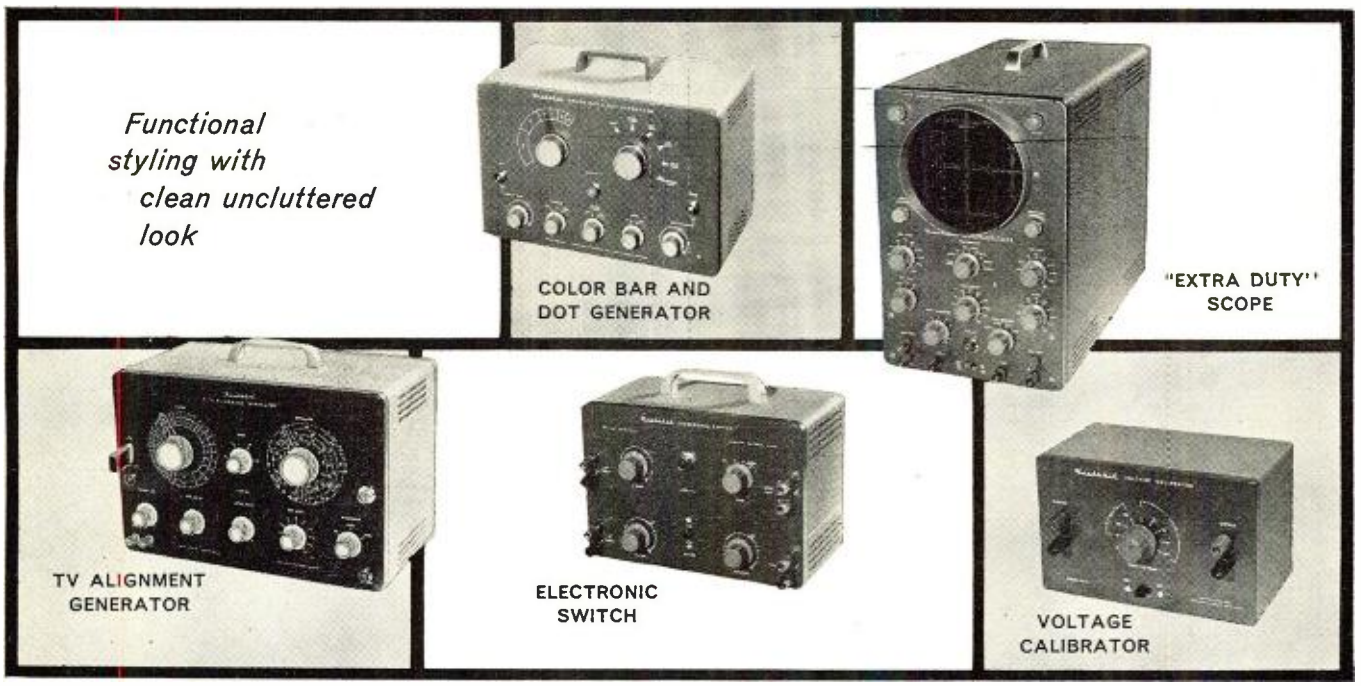
A valuable accessory for any oscilloscope owner. It allows simultaneous oscilloscope observation of two signals by producing both signals, alternately, at its output. Four switching rates. Provides gain for input signals. Frequency response ±1 db, 0 to 100 kc. A sync output is provided to control and stabilize scope sweep. Ideal for observing input and output of amplifiers simultaneously. Shpg. Wt. 8 lbs.

MODEL S-3
$21.95

HEATHKIT VOLTAGE CALIBRATOR KIT

This unit is an excellent companion for your oscilloscope. Used as a source of calibrating voltage, it produces near-perfect square wave signals of known amplitude. Precision 1% attenuator resistors insure accurate output amplitude, and multivibrator circuit guarantees good sharp square waves. Output frequency is approximately 1000 CPS. Fixed outputs selected by panel switches are; .03, 0.1, 0.3, 1.0, 3.0, 10, 30 and 100 volts peak-to-peak. Allows measurment of unknown signal amplitude by comparing it to the known output of the VC-3 on oscilloscope. Shpg. Wt. 4 lbs.

MODEL VC-3
$12.50



HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT TUBE CHECKER KIT

Eliminate guesswork, and save time in servicing or experimenting. The TC-2 tests tubes for shorted elements, open elements, filament continuity, and operating quality on the basis of total emission. It tests all tube types encountered in radio and TV service work. Sockets are provided for 4, 5, 6 and 7-pin, octal, and loctal tubes, 7 and 9 pin miniature tubes, 5 pin hytron miniatures, and pilot lamps. Tube condition indicated on 4½" meter with multicolor "good-bad" scale. Illuminated roll chart with all test data built in. Switch selection of 14 different filament voltages from .75 to 117 volts. Color-coded cable harness allows neat professional wiring and simplifies construction. Very easy to build, even for a beginner. Shpg. Wt. 12 lbs.

MODEL TC-2

$29.50

HEATHKIT HANDITESTER KIT

The small size and rugged construction of this tester makes it perfect for any portable application. The combination function-range switch simplifies operations. Measures AC or DC voltage at 0-10, 30, 300, 1000 and 5000 volts. Direct current ranges are 0-10 ma and 0-100 ma. Ohmmeter ranges are 0-3000 (30 ohm center scale) and 0-300,000 (3000 ohm center scale). Very popular with home experimenters, electricians, and appliance repairmen. Slips easily into your tool box, glove compartment, coat pocket, or desk drawer. Shpg. Wt. 3 lbs.

MODEL M-1

$17.95

HEATHKIT PICTURE TUBE CHECKER KIT

The CC-1 can be taken with you on service calls so that you can clearly demonstrate the quality of a customer's picture tube in his own home. Tubes can be tested without removing them from the receiver or cartons if desired. Checks cathode emission, beam current, shorted elements, and leakage between elements in electromagnetic picture tube types. Self-contained power supply, and large 4½" meter. CRT condition indicated on "good-bad" scale. Relative condition of tubes fluorescent coating is shown in "shadowgraph" test. Permanent test cable with CRT socket and anode connector. No tubes to burn out, designed to last a lifetime. Luggage-type portable case. Shpg. Wt. 10 lbs.

MODEL CC-1

$24.95

HEATHKIT ETCHED-CIRCUIT VTVM KIT

This multi-purpose VTVM is the world's largest selling instrument of its type—and is especially popular in laboratories, service shops, home workshops and schools. It employs a large 4½" panel meter, precision 1% resistors, etched metal circuit board, and many other "extras" to insure top quality and top performance. It's easy to build, and you may rely on its accuracy and dependability. The V7-A will measure AC (RMS) and DC voltages in ranges of 0-1.5, 5, 15, 50, 150, 500 and 1500. It measures peak-to-peak AC voltage in ranges of 0-4, 14, 40, 140, 400, 1400 and 4000. Resistance ranges provide multiplying factors of X 1, X 10, X 100, X 1000, X 10k, X 100k, and X 1 megohm. Center-scale resistance readings are 10, 100, 1000, 10k, 100k, 1 megohm and 10 megohms. A db scale is also provided. The precision and quality of this VTVM cannot be duplicated at this price. Shpg. Wt. 7 lbs.

MODEL V7-A

$24.50

Heathkits...

By DAYSTROM

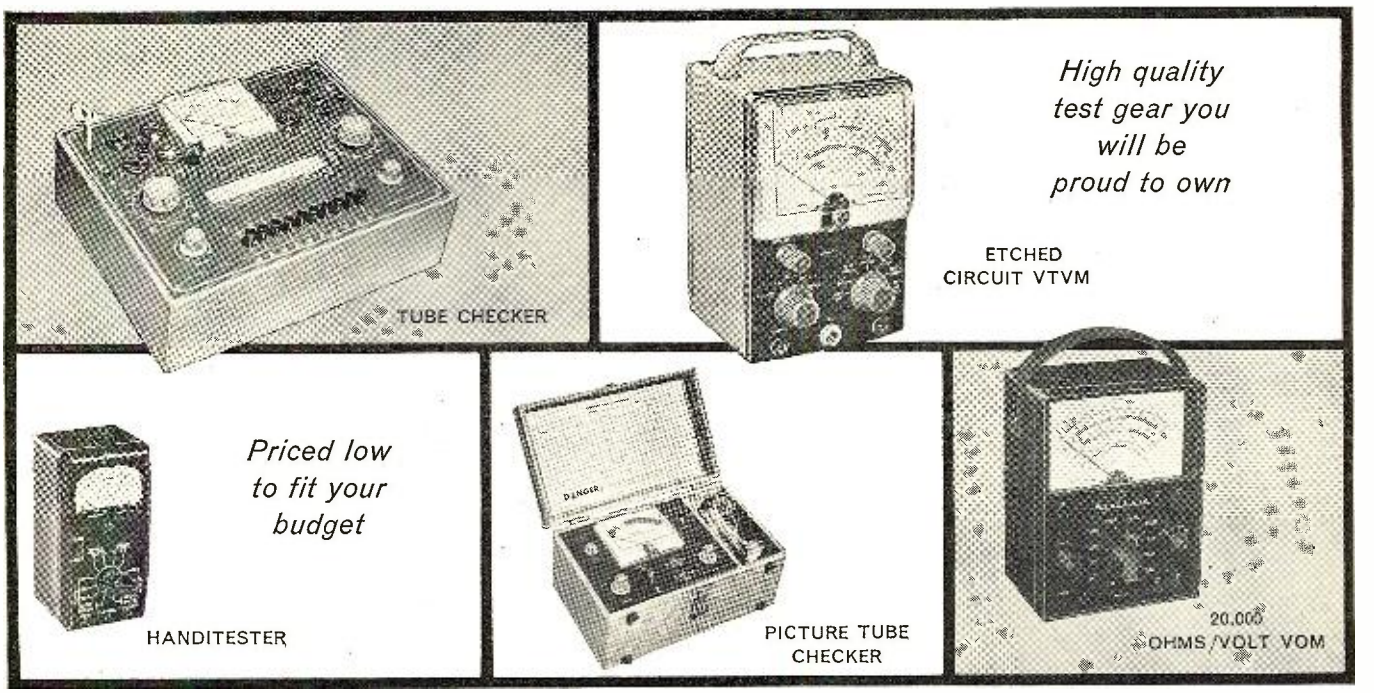
let you fill your exact needs from a wide variety of instruments

HEATHKIT 20,000 OHMS/VOLT VOM KIT

This fine instrument provides a total of 25 meter ranges on its two-color scale. It employes a 50 ua 4½" meter, and features 1% precision multiplier resistors. Requires no external power. Ideal for portable applications. Sensitivity is 20,000 ohms-per-volt DC and 5000 ohms-per-volt AC. Measuring ranges are 0-1.5, 5, 50, 150, 500, 1500 and 5000 volts, AC and DC. Measures direct current in ranges of 0-150 ua, 15 ma, 150 ma, 500 ma and 15 a. Resistance multipliers are X 1, X 100 and X 10,000, with center-scale readings of 15, 1500 and 150,000 ohms. Covers −10 db to +65 db. Easy to build and fun to use. Attractive bakelite case with plastic carrying handle. Shpg. Wt. 6 lbs.

MODEL MM-1

$29.95



HEATHKIT RF SIGNAL GENERATOR KIT

Even a beginner can build this prealigned signal generator, designed especially for use in service work. Produces RF signals from 160 kc to 110 mc on fundamentals in five bands. Covers 110 mc to 220 mc on calibrated harmonics. Low impedance RF output in excess of 100,000 microvolts, is controllable with a step-type and continuously variable attenuator. Selection of unmodulated RF, modulated RF, or audio at 400 CPS. Ideal for fast and easy alignment of radio receivers, and finds application in FM and TV work as well. Thousands of these units are in use in service shops all over the country. Easy to build and a real time saver, even for the part-time service technician or hobbyist. Shpg. Wt. 8 lbs.

MODEL SG-8

$19.50

HEATHKIT LABORATORY RF GENERATOR KIT

Tackle all kinds of laboratory alignment jobs with confidence by employing the LG-1. It features voltage-regulated B+, double shielding of oscillator circuits, copper-plated chassis, variable modulation level, metered output, and many other "extras" for critical alignment work. Generates RF signals from 100 kc to 30 mc on fundamentals in five bands. Meter reads RF output in microvolts or modulation level in percentage. RF output available up to 100,000 microvolts, controlled by a fixed-step and a variable attenuator. Provision for external modulation where necessary. Buy and use this high-quality RF signal generator that may be depended upon for stability and accuracy. Shpg. Wt. 16 lbs.

MODEL LG-1

$48.95

HEATHKIT DIRECT-READING CAPACITY METER KIT

Here's a fast, simple capacity meter. A capacitor to be checked is merely connected to the terminals, the proper range selected, and the value read directly on the large 4½" panel meter calibrated in mmf and mfd. Ranges are 0 to 100 mmf, 1,000 mmf, .01 mfd, .1 mfd full scale. Not affected by hand capacity. Shpg. Wt. 7 lbs.

MODEL CM-1

$29.50

Heathkits...

By DAYSTROM

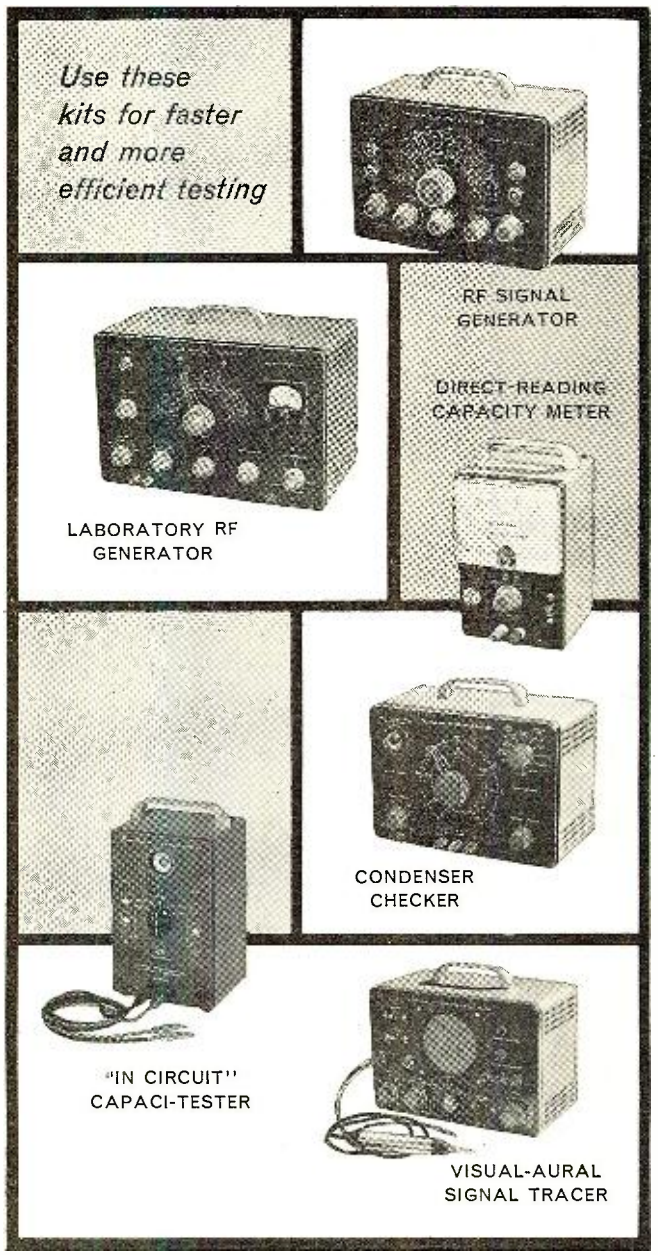
are educational
as well as functional

HEATHKIT "IN-CIRCUIT" CAPACI-TESTER KIT

With the CT-1 it is no longer necessary to disconnect one capacitor lead to check the part, you can check most capacitors for "open" or "short" right in the circuit. Fast and easy—to save your valuable time in the service shop or lab. Detects open capacitors from about 50 mmf up, so long as the capacitor is not shunted by excessively low resistance value. Will detect shorted capacitors up to 20 mfd (not shunted by less than 10 ohms). (Does not detect leakage.) Employs 60 cycles and 19 megacycle test frequencies. Electron beam "eye" tube used as indicator. Compact, easy-to-build, and inexpensive. Test leads included. Shpg. Wt. 5 lbs.

MODEL CT-1

$7.95



HEATHKIT CONDENSER CHECKER KIT

This handy instrument uses an electron beam "eye" tube as an indicator to measure capacity in ranges of .00001 to .005 mfd, .5 mfd, 50 mfd and 1000 mfd. Also measures resistance from 100 ohms to 5 megohms in two ranges. Checks paper, mica, ceramic and electrolytic capacitors. Selection of five polarizing voltages. Shpg. Wt. 7 lbs.

MODEL C-3

$19.50

HEATHKIT VISUAL-AURAL SIGNAL TRACER KIT

Although designed originally for radio receiver work, the T-3 finds application in FM and TV servicing as well. Features high-gain channel with demodulator probe, and low-gain channel with audio probe. Traces signals in all sections of radio receivers and in many sections of FM and TV receivers. Built-in speaker and electron beam eye tube indicate relative gain, etc. Also features built-in noise locator circuit. Provision for patching speaker and/or output transformer to external set. Shpg. Wt. 9 lbs.

MODEL T-3

$23.50

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT IMPEDANCE BRIDGE KIT

The model IB-2A employs a Wheatstone Bridge, a Capacity Comparison Bridge, a Maxwell Bridge, and a Hay Bridge in one compact package. Measures resistance from 0.1 ohm to 10 megohms, capacitance from 100 mmf to 100 mfd, inductance from 0.1 mh to 100 h, dissipation factor (D) from 0.002 to 1, and storage factor (Q) from 0.1 to 1000. A 100-0-100 ua meter provides for null indications. The decade resistors employed are of 1% tolerance for maximum accuracy. Completely self-contained. Has built in power supply, 1000-cycle generator, and vacuum-tube detector. Special two-section CRL dial insures convenient operation. Instruction manual has entirely new schematic that clarifies circuit functions in various switch positions. A true laboratory instrument, that will provide you with many years of fine performance. Shpg. Wt. 12 lbs.

MODEL IB-2A

$59.50

HEATHKIT "LOW RIPPLE" BATTERY ELIMINATOR KIT

This modern battery eliminator incorporates an extra low-ripple filter circuit so that it can be used to power all the newest transistor-type circuits requiring 0 to 12 volts DC, and the new "hybrid" automobile radios using both transistors and vacuum tubes. Its DC output, at either 6 or 12 volts, contains less than .3% AC ripple. Separate output terminals are provided for low-ripple or normal filtering. Supplies up to 15 amps on 6 volt range or up to 7 amps on 12 volt range. Output is variable from 0 to 8 or 0 to 16 volts. Two meters constantly monitor output voltage and current. Will also double as a battery charger. Shpg. Wt. 23 lbs.

MODEL BE-5

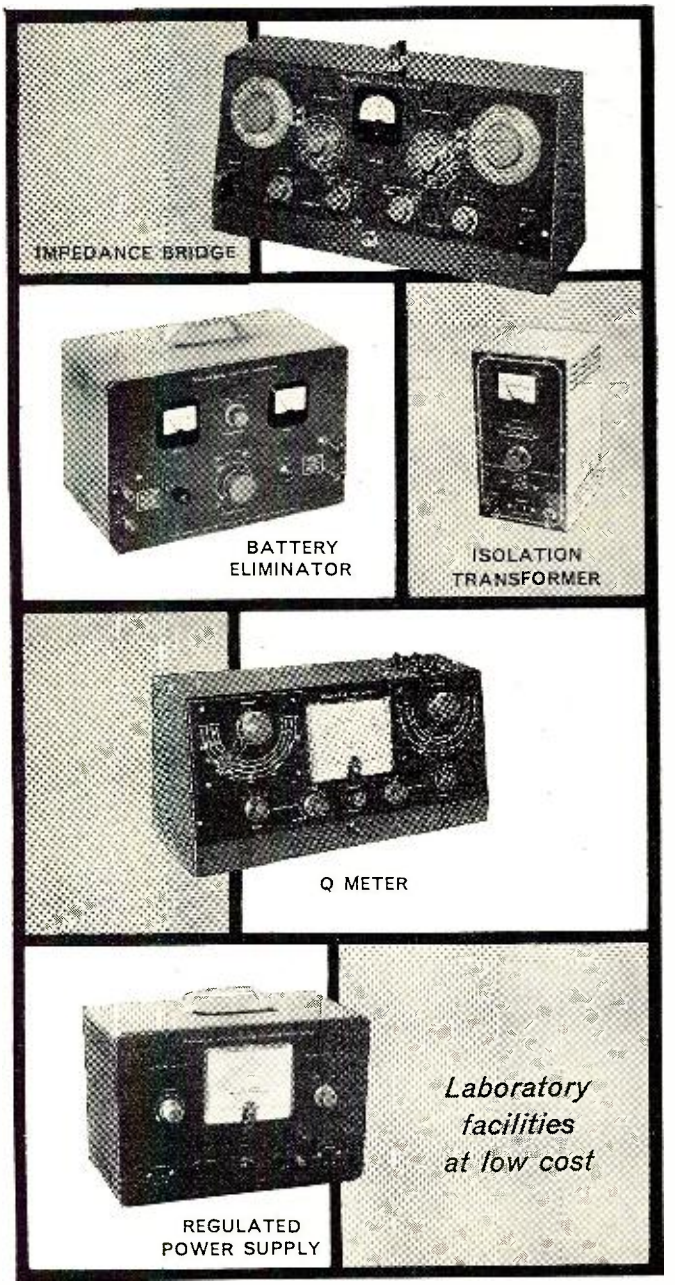
$39.95

HEATHKIT ISOLATION TRANSFORMER KIT

The model IT-1 is one of the handiest units for the service shop, home workshop or laboratory. Provides complete isolation from the power line. AC-DC sets may be plugged directly into the IT-1 without the chassis becoming "hot". Output voltage is variable from 90 volts to 130 volts allowing checks of equipment under adverse conditions such as low line voltage. Rated for 100 volt amperes continuously or 200 volt amperes intermittently. Panel meter monitors output voltage. Shpg. Wt. 9 lbs.

MODEL IT-1

$16.50



Heathkits...

By DAYSTROM

are designed with high-quality, name-brand components to insure long service life

HEATHKIT "Q" METER KIT

At this price the laboratory facilities of a Q Meter may be had by the average service technician or home experimenter. The Q Meter permits measurement of inductance from 1 microhenry to 10 milihenry, "Q" on a scale calibrated up to 250 full scale, with multipliers of 1 or 2, and capacitance from 40 mmf to 450 mmf ± 3 mmf. Built in oscillator permits testing components from 150 kc to 18 mc. Large 4½" panel meter is featured. Very handy for checking peaking coils, chokes, etc. Use to determine values of unknown condensers, both variable and fixed, compile data for coil winding purposes, or measure RF resistance. Also checks distributed capacity and Q of coils. No special equipment is required for calibration. A special test coil is furnished, along with easy-to-follow instructions. Shpg. Wt. 14 lbs.

MODEL QM-1

$44.50

HEATHKIT REGULATED POWER SUPPLY KIT

Here is a power supply that will provide DC plate voltage and AC filament voltage for all kinds of experimental circuits. The DC supply is regulated for stability, and yet the amount of DC output voltage available from the power supply can be controlled manually from 0 up to 500 volts. At 450 volts DC output, the power supply will provide up to 10 ma of current, and provide progressively higher current as the output voltage is lowered. Current rating is 130 ma at 200 volts output. In addition to furnishing B+ the power supply also provides 6.3 volts AC at up to 4 amperes for filaments. Both the B+ output and the filament output are isolated from ground. Ideal unit for use in laboratory, home workshop, ham shack, or service shop. A large 4½" meter on the front panel reads output voltage or output current, selectable with a panel switch. Shpg. Wt. 17 lbs.

MODEL PS-3

$35.50

Terrific values in amateur equipment!

DX-100 TRANSMITTER

DX-20 TRANSMITTER

DX-40 TRANSMITTER

HEATHKIT DX-20 CW TRANSMITTER KIT

The Heathkit model DX-20 "straight-CW" transmitter features high efficiency at low cost. It uses a single 6DQ6A tube in the final amplifier stage for plate power input of 50 watts. A 6CL6 serves as crystal oscillator, with a 5U4GB rectifier. It is an ideal transmitter for the novice, as well as the advanced-class CW operator. Single-knob band switching is featured to cover 80, 40, 20, 15, 11 and 10 meters. Pi network output circuit matches various antenna impedances between 50 and 1000 ohms and reduces harmonic output. Top-quality parts are featured throughout, including "potted" transformers, etc., for long life. It has been given full "TVI" treatment. Access into the cabinet for crystal changing is provided by a removable metal pull-out plug on the left end of the cabinet. Very easy to build from the complete step-by-step instructions supplied, even if you have never built electronic equipment before. If you appreciate a good, clean signal on the CW bands, this is the transmitter for you! Shpg. Wt. 18 lbs.

MODEL DX-20

$35.95

Heathkits...

By DAYSTROM

are designed by licensed ham-engineers, especially for you

HEATHKIT DX-40 PHONE AND CW TRANSMITTER KIT

A most remarkable power package for the price, the new DX-40 provides both phone and CW facilities for operation on 80, 40, 20, 15, 11 and 10 meters. A single 6146 tube is used in the final amplifier stage to provide full 75 watt plate power input on CW, or control carrier modulation peaks up to 60 watts for phone operation. Modulator and power supplies are built right in and single knob bandswitching is combined with a pi network output circuit for complete operating convenience. The tight fitting cabinet presents a most attractive appearance, and is designed for complete shielding to minimize TVI. A 4-position switch provides convenient selection of three different crystals or a jack for external VFO. The crystals are reached through access door at rear of cabinet. You can build this rig yourself and be proud to show it off to your fellow hams. Get your DX-40 now for many hours of operating enjoyment. Shpg. Wt. 25 lbs.

MODEL DX-40

$64.95

HEATHKIT DX-100 PHONE AND CW TRANSMITTER KIT

Listen to any ham band between 160 meters and 10 meters and note how many DX-100 transmitters you hear! The number of these fine rigs now on the air testifies to the enthusiasm with which it has been accepted by the amateur fraternity. No other transmitter in this power class combines high quality and real economy so effectively. The DX-100 features a built in VFO, modulator and power supplies, complete shielding to minimize TVI, and pi network output coupling to match impedances from approximately 50 to 600 ohms. Its RF output is in excess of 100 watts on phone and 120 watts on CW, for a clean strong signal on all the ham bands from 10 to 160 meters. Single-knob band switching and illuminated VFO dial and meter face add real operating convenience. RF output stage uses a pair of 6146 tubes in parallel, modulated by a pair of 1625's. High quality components are used throughout, such as "potted" transformers, silver-plated or solid coin silver switch terminals, aluminum heat-dissipating caps on the final tubes, copper plated chassis, etc. This transmitter was designed exclusively for easy step-by-step assembly. Shpg. Wt. 107 lbs.

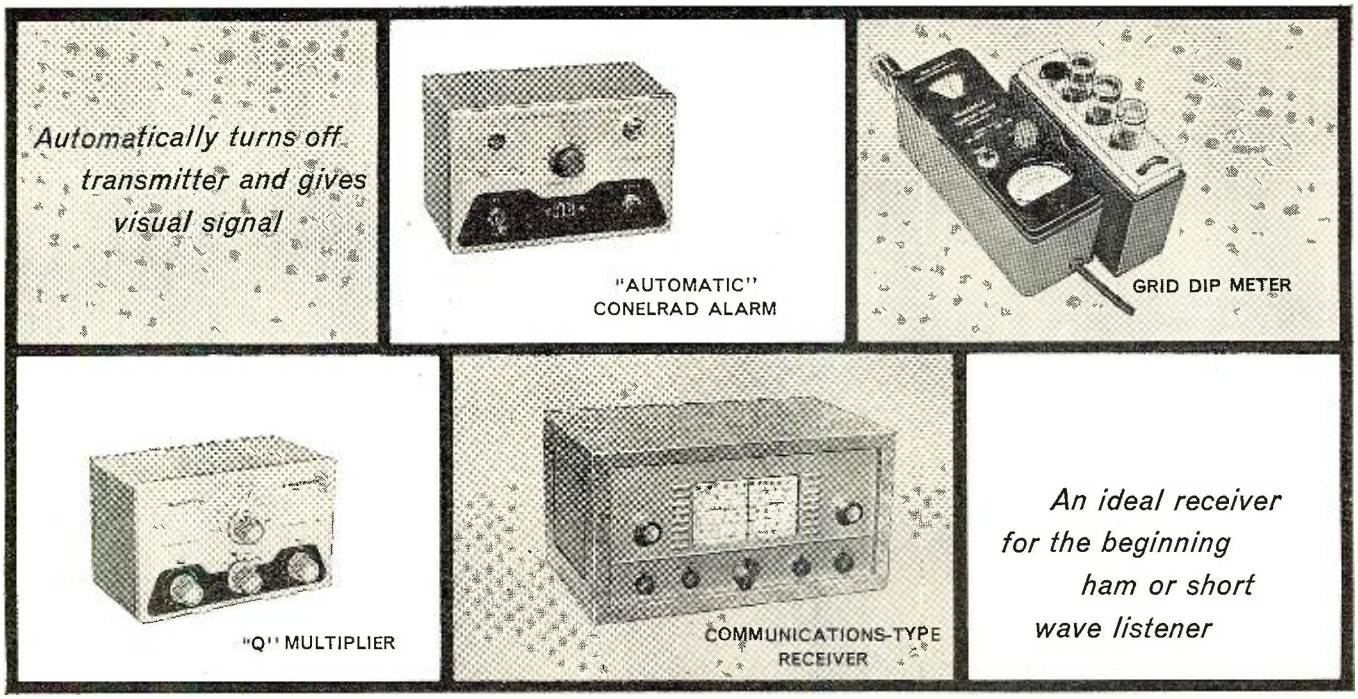
MODEL DX-100

$189.50

FUNCTIONAL DESIGN . . .

The transmitters described on this page were designed for the ham, by hams who know what features are desirable and needed. This assures you of the best possible performance and convenience, and adds much to your enjoyment in the ham shack.

HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**



HEATHKIT "AUTOMATIC" CONELRAD ALARM KIT

This conelrad alarm works with any radio receiver; AC-DC-transformer operated—or battery powered, so long as the receiver has AVC. Fully complies with FCC regulations for amateurs. When the monitored station goes off the air, the CA-1 automatically cuts the AC power to your transmitter, and lights a red indicator. A manual "reset" button reactivates the transmitter. Incorporates a heavy-duty six-ampere relay, a thyratron tube to activate the relay, and its own built-in power supply. A neon lamp shows that the alarm is working, by indicating the presence of B+ in the alarm circuit. Simple to install and connect. Your transmitter plugs into an AC receptacle on the CA-1, and a cable connects to the AVC circuit of a nearby receiver. A built-in sensitivity control allows adjustment to various AVC levels. Receiver volume control can be turned up or down, without affecting alarm operation. Build a Heathkit CA-1 in one evening and comply with FCC regulations now! Shpg. Wt. 4 lbs.

MODEL CA-1
$13.95

HEATHKIT "Q" MULTIPLIER KIT

The Heathkit Q Multiplier functions with any AM receiver having an IF frequency between 450 and 460 KC, that is not "AC-DC" type. It derives its power from the receiver, and needs only 6.3 volts AC at 300 ma (or 12 VAC at 150 ma) and 150 to 250 volts DC at 2 ma. Simple to connect with cable and plugs supplied. Adds additional selectivity for separating signals, or will reject one signal and eliminate heterodyne. A tremendous help on crowded phone and CW bands. Effective Q of 4000 for sharp "peak" or "null". Tunes any signal within IF band pass without changing the main receiver tuning dial. A convenient tuning knob on the front panel with vernier reduction between the tuning knob and the tuning capacitor gives added flexibility in operation. Uses a 12AX7 tube, and special high-Q shielded coils. Instructions for connecting to the receiver and operation are provided in the construction manual. A worthwhile addition to any communications, or broadcast receiver. It may also be used with a receiver which already has a crystal filter to obtain two simultaneous functions, such as peaking the desired signal with the crystal filter and nulling an adjacent signal with the Q Multiplier. Shpg. Wt. 3 lbs.

MODEL QF-1
$9.95

HEATHKIT GRID DIP METER KIT

A grid dip meter is basically an RF oscillator for determining the frequency of other oscillators, or of tuned circuits. Extremely useful in locating parasitics, neutralizing, identifying harmonics, coil winding, etc. Features continuous frequency coverage from 2 mc to 250 mc, with a complete set of prewound coils, and a 500 ua panel meter. Front panel has a sensitivity control for the meter, and a phone jack for listening to the "zero-beat." Will also double as an absorption-type wave meter. Shpg. Wt. 4 lbs.

MODEL GD-1B
$21.95

Low Frequency Coil Kit: Two extra plug-in coils to extend frequency coverage down to 350 kc. Shpg. Wt. 1 lb. No. 341-A. $3.00

HEATHKIT ALL-BAND COMMUNICATIONS-TYPE RECEIVER KIT

This communications-receiver covers 550 kc to 30 mc in four bands, and provides good sensitivity, selectivity, and fine image rejection. Ham bands are clearly marked on an illuminated dial scale. Features a transformer-type power supply—electrical band spread—antenna trimmer—headphone jack—automatic gain control and beat frequency oscillator. Accessory sockets are provided on the rear of the chassis for using the Heathkit model QF-1, Q Multiplier. Accessory socket is handy, also, for operating other devices that require plate and filament potentials. Will supply +250 VDC at 15 ma and 12.6 VAC at 300 ma. Ideal for the beginning ham or short wave listener. Shpg. Wt. 12 lbs.

MODEL AR-3
$29.95
(Less cabinet)

Cabinet: Fabric covered cabinet with aluminum panel as shown. Part no. 91-15A. Shpg. Wt. 5 lbs. $4.95.

Heathkits...

By DAYSTROM

are outstanding in performance and dollar value

HEATHKIT REFLECTED POWER METER KIT

The Heathkit reflected power meter, model AM-2, makes an excellent instrument for checking the match of the antenna transmission system, by measuring the forward and reflected power or standing wave ratio. The AM-2 is designed to handle a peak power of well over 1 kilowatt of energy and may be left in the antenna system feed line at all times. Band coverage is 160 meters through 2 meters. Input and output impedances for 50 or 75 ohm lines. No external power required for operation. Meter indicates percentage forward and reflected power, and standing wave ratio from 1:1 to 6:1. Another application for the AM-2 is matching impedances between exciters or R.F. sources and grounded grid amplifiers. Power losses between transmitter output and antenna tuner may be very easily computed by inserting the AM-2 in the line connecting the two. No insertion loss is introduced into the feeder system, due to the fact that the AM-2 is a portion of coaxial line in series with the feeder system and no internal connections are actually made to the line. Complete circuit description and operation instructions are provided in the manual. Cabinet size is 7-3/8" x 4-1/16" x 4-5/8". Can be conveniently located at operating position. Shpg. Wt. 3 lbs.

MODEL AM-2

$15.95

HEATHKIT VARIABLE FREQUENCY OSCILLATOR KIT

Enjoy the convenience and flexibility of VFO operation by obtaining the Heathkit model VF-1 Variable Frequency Oscillator. Covers 160-80-40-20-15-11 and 10 meters with three basic oscillator frequencies. Better than 10 volt average RF output on fundamentals. Plenty of output to drive most modern transmitters. It features voltage regulation for frequency stability. Dial is illuminated for easy reading. Vernier reduction is used between the main tuning knob and the tuning condenser. Requires a power source of only 250 volts DC at 15 to 20 miliamperes and 6.3 volts AC at 0.45 amperes. Extra features include copper-plated chassis, ceramic coil forms, extensive shielding, etc. High quality parts throughout. VFO operation allows you to move out from under interference and select a portion of the band you want to use without having to be tied down to only two or three frequencies through use of crystals. "Zero in" on the other fellow's signal and return his CQ on his own frequency! Crystals are not cheap, and it takes quite a number of them to give anything even approaching comprehensive coverage of all bands. Why hesitate? The model VF-1 with its low price and high quality will add more operating enjoyment to your ham activities. Shpg. Wt. 7 lbs.

MODEL VF-1

$19.50

Heathkits...

By DAYSTROM

are the answer for your electronics hobby.

HEATHKIT BALUN COIL KIT

The Heathkit Balun Coil Kit model B-1 is a convenient transmitter accessory, which has the capability of matching unbalanced coax lines, used on most modern transmitters, to balance lines of either 75 or 300 ohms impedance. Design of the bifilar wound balun coils will enable transmitters with unbalanced output to operate into balanced transmission line, such as used with dipoles, folded dipoles, or any balanced antenna system. The balun coil set can be used with transmitters and receivers without adjustment over the frequency range of 80 through 10 meters, and will easily handle power inputs up to 250 watts. Cabinet size is 9" square by 5" deep and it may be located any distance from the transmitter or from the antenna. Completely enclosed for outdoor installation. Shpg. Wt. 4 lbs.

MODEL B-1

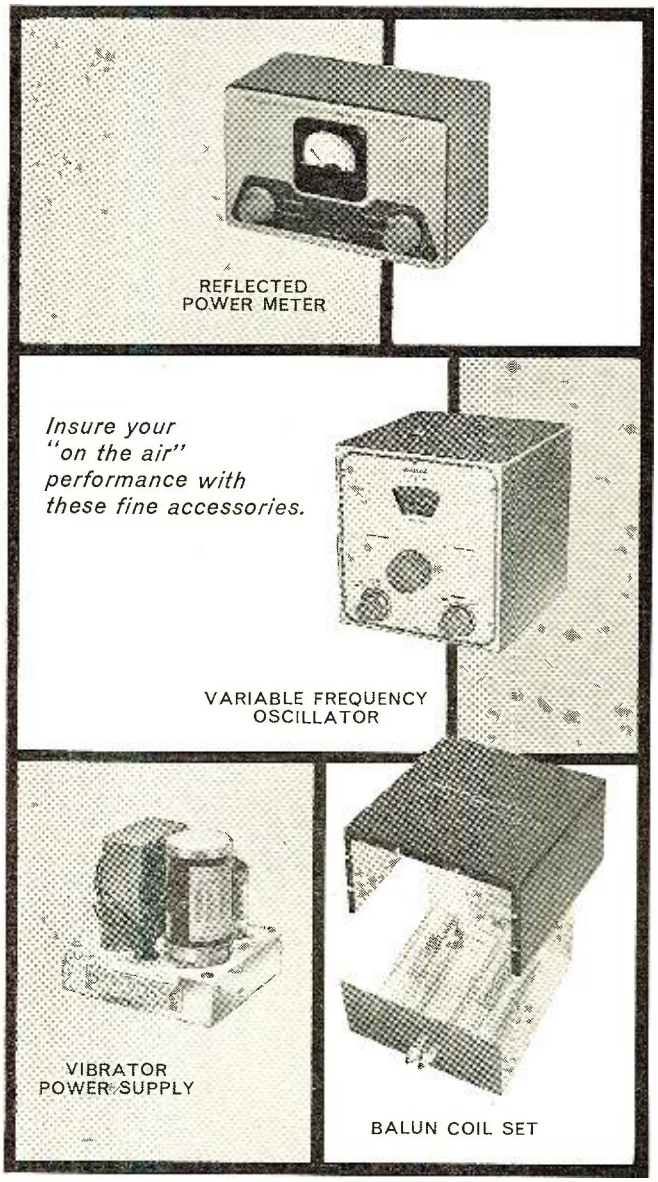
$8.95

HEATHKIT 6 OR 12 VOLT VIBRATOR POWER SUPPLY KITS

These little power supply kits are ideal for all portable applications with 6 volt or 12 volt batteries, when you are operating electronic equipment away from power lines. By replacing the power supplies of receivers, small public address systems, or even miniature transmitters with these units, they can be used with conventional 6 or 12 volt batteries. Use in boats, automobiles, light aircraft, or any field application. Each unit provides 260 volts DC output at up to 60 miliamperes. More than one power supply of the same model may be connected in parallel for increased current capacity at the same output voltage. Everything is provided in the kit, including a vibrator transformer, a vibrator, 6X4 or 12X4 rectifier, and the necessary buffer capacitor, hash filter, and output filter capacitor. Shpg. Wt. 4 lbs.

6 VOLT MODEL VP-1-6
12 VOLT MODEL VP-1-12

$7.95 Each



HEATH COMPANY *A Subsidiary of Daystrom, Inc.* **BENTON HARBOR 15, MICH.**

HEATHKIT ELECTRONIC IGNITION ANALYZER KIT

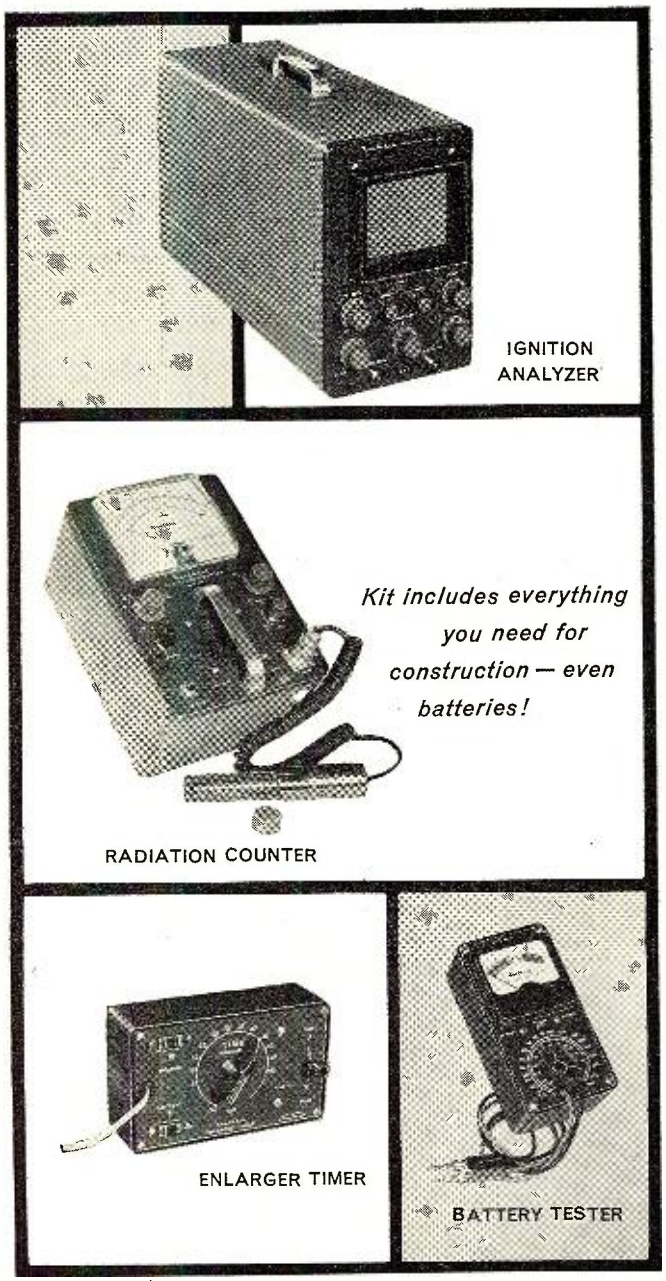
Previous electronic experience is not necessary to build this fine ignition analyzer. The construction manual supplied has complete step-by-step instructions plus large pictorial diagrams showing the exact placement and value of each component. All parts are clearly marked so that they are easily identified. The IA-1 is an ideal tool for engine mechanics, tune-up men, and auto hobbyists, since it traces the dynamic action of voltage in an ignition system on a cathode-ray tube screen. The wave form produced is affected by the condition of the coil, condenser, points, plugs, and ignition wiring, so it can be analyzed, and used as a "sign-post" to ignition system performance. This analyzer will detect inequality of spark intensity, a poor spark plug, defective plug wiring, breaker-point bounce, an open condenser, and allow setting of dwell-time percentage for the points. An important feature of this instrument is its ability to check dynamic performance, with the engine in operation (400 to 5000 RPM). It will show the complete engine cycle, or only one complete cylinder. Can be used on all types of internal combustion engines where breaker-points are accessible. Use it on automobiles, boats, aircraft engines, etc. Shpg. Wt. 18 lbs.

MODEL IA-1
$59.95

HEATHKIT PROFESSIONAL RADIATION COUNTER KIT

This Heathkit professional-type radiation counter is simple to build successfully, even if you have never built a kit before. Complete step-by-step instructions are combined with giant-size pictorial diagrams for easy assembly. By "building it yourself" you can have a modern-design, professional radiation counter priced far below comparable units. Provides high sensitivity with ranges from 0-100, 600, 6000 and 60,000 counts-per-minute, and 0-.02, .1, 1 and 10 miliroentgens-per-hour. Employs 900-volt bismuth tube in beta/gamma sensitive probe. Probe and 8-foot expandable cable included in kit price, as is a radiation sample for calibration. Use it in medical laboratories, or as a prospecting tool, and for civil defense to detect radioactive fallout, or other unknown radiation levels. Features a selectable time constant. Meter calibrated in CPM or mR/hour in addition to "beep" or "click" from panel-mounted speaker. Prebuilt "packaged" high voltage power supply with reserve capacity above 900 volt level at which it is regulated. Merely changing regulator tube type would allow use of scintillation probe if desired. Employs five tubes (plus a transistor) to insure stable and reliable operation. Kit price includes batteries. Shpg. Wt. 8 lbs.

MODEL RC-1
$79.95



Heathkits...

By DAYSTROM

are supplied with comprehensive instructions that eliminate costly mistakes and save valuable time

HEATHKIT ENLARGER TIMER KIT

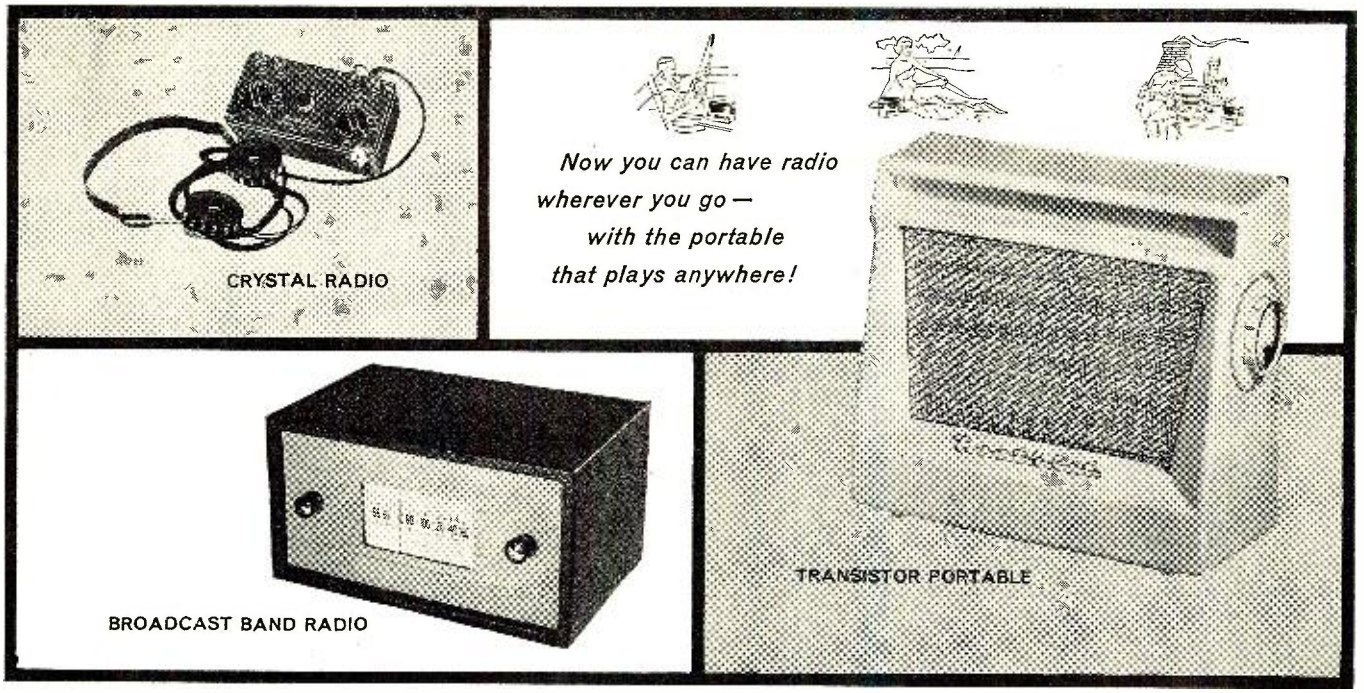
The ET-1 is an easy-to-build electronic device to be used by amateur or professional photographers in timing enlarger operations. The calibrated dial on the timer covers 0 to 1 minute, calibrated in 5-second gradations. The continuously variable control allows setting of the "on" cycle of your enlarger, which is plugged into a receptacle on the front panel of the ET-1. A "safe light" can also be plugged in so that it is automatically turned "on" when the enlarger is turned "off." Handles up to 350 watts with built-in relay. All-electronic timing cycle insures maximum accuracy. Timer does not have to be reset after each cycle, merely flip lever switch to print, to repeat time cycle. A control is provided for initial calibration. Housed in a compact plastic case that will resist attack of photographic chemicals. A fine addition to any dark room. Shpg. Wt. 3 lbs.

MODEL ET-1
$11.50

HEATHKIT BATTERY TESTER KIT

The BT-1 is a special battery testing device that actually "loads" the battery under test (draws current from it) while it is being tested. Weak batteries often test "good" with an ordinary voltmeter but the built-in load resistance of the BT-1 automatically draws enough current from the battery to reveal its true condition. Simple to operate with "good-weak-replace" scale. Tests all kinds of dry cell batteries within ranges of 0-15 volts and 0-180 volts. Slide switch provides for either 10 ma or 100 ma load, depending on whether you're testing an A or B battery. Not only determines when battery is completely exhausted, but makes it possible to anticipate failure by noting weak condition. Ideal for testing dry cell hearing aid, flashlight, portable radio, and model airplane batteries. Test batteries in a way your customers can understand and stimulate battery sales. Shpg. Wt. 2 lbs.

MODEL BT-1
$8.50



HEATHKIT CRYSTAL RADIO KIT

The Heathkit model CR-1 crystal radio is similar to the "crystal sets" of the early radio days except that it has been improved by the use of sealed germanium diodes and efficient "high-Q" coils. The sealed diodes eliminate the critical "cats whisker" adjustment, and the ferrite coils are much more efficient for greater signal strength. Housed in a compact plastic box, the CR-1 uses two tuned circuits, each with a variable tuning capacitor, to select the local station. It covers the broadcast band from 540 to 1600 kc. Requires no external power whatsoever. This receiver could prove valuable to emergency reception of civil defense signals should there be a power failure. The low kit price even includes headphones. Complete step-by-step instructions and large pictorial diagrams are supplied for easy assembly. The instruction manual also provides the builder with the basic fundamentals of signal reception so that he understands how the crystal receiver functions. An interesting and valuable "do-it-yourself" project for all ages. Shpg. Wt. 3 lbs.

MODEL CR-1
$7.95

Heathkits...

By DAYSTROM

are easy and fun to build, and they let you learn by "doing-it-yourself"

HEATHKIT TRANSISTOR PORTABLE RADIO KIT

Heath engineers set out to develop a "universal" AM radio, suitable for use anywhere. Their objective was a portable that would be as much "at home" inside as it is outside, and would feature top quality components for high performance and long service life. The model XR-1 is the result of these efforts. Six name-brand (Texas Instrument) transistors were selected for extra good sensitivity and selectivity. A 4" by 6" PM speaker with heavy magnet was chosen to insure fine tone quality. The power supply was designed to use six standard size "D" flashlight cells because they are readily available, inexpensive, and because they afford extremely long battery life (between 500 and 1000 hours). Costs you no more to operate from batteries than what you pay for operating a small table-model radio from the power line. An unbreakable molded plastic was selected for cabinet material because of its durability and striking beauty. Circuit is compact and efficient, yet components are not excessively crowded. Transformers are prealigned so it is ready for service as soon as construction is completed. Has built in rod-type antenna for reception in all locations. Cabinet dimensions are 9" L x 8" H x 3¾" D. Comes in holiday gray, with gold-anodized metal speaker grille. Compare this portable, feature by feature, to all others on the market, and you'll appreciate what a tremendous dollar value it represents! Shpg. Wt. 4 lbs.

MODEL XR-1
$34.95
(Less batteries)
(With cabinet)

HEATHKIT BROADCAST BAND RADIO KIT

This table-model broadcast radio is fun to build, and is a fine little receiver for your home. It covers the standard broadcast band from 550 to 1600 kc with good sensitivity and selectivity. The 5½" PM speaker provides surprisingly good tone quality. High-gain IF transformers, miniature tubes, and a rod-type built in antenna, assure good reception in all locations. The power supply is transformer operated, as opposed to many of the economy "AC-DC" types. It's easy to build from the step-by-step instructions, and the construction manual includes information on operational theory, for educational purposes. Your success is assured by completely detailed information which also explains resistor and capacitor color codes, soldering techniques, use of tools, etc. A signal generator is recommended for final alignment. Shpg. Wt. 10 lbs.

Cabinet: Fabric covered cabinet with aluminum panel as shown. Shpg. Wt. 5 lbs. Part no. 91-9A. $4.95.

MODEL BR-2
$18.95
(Less cabinet)

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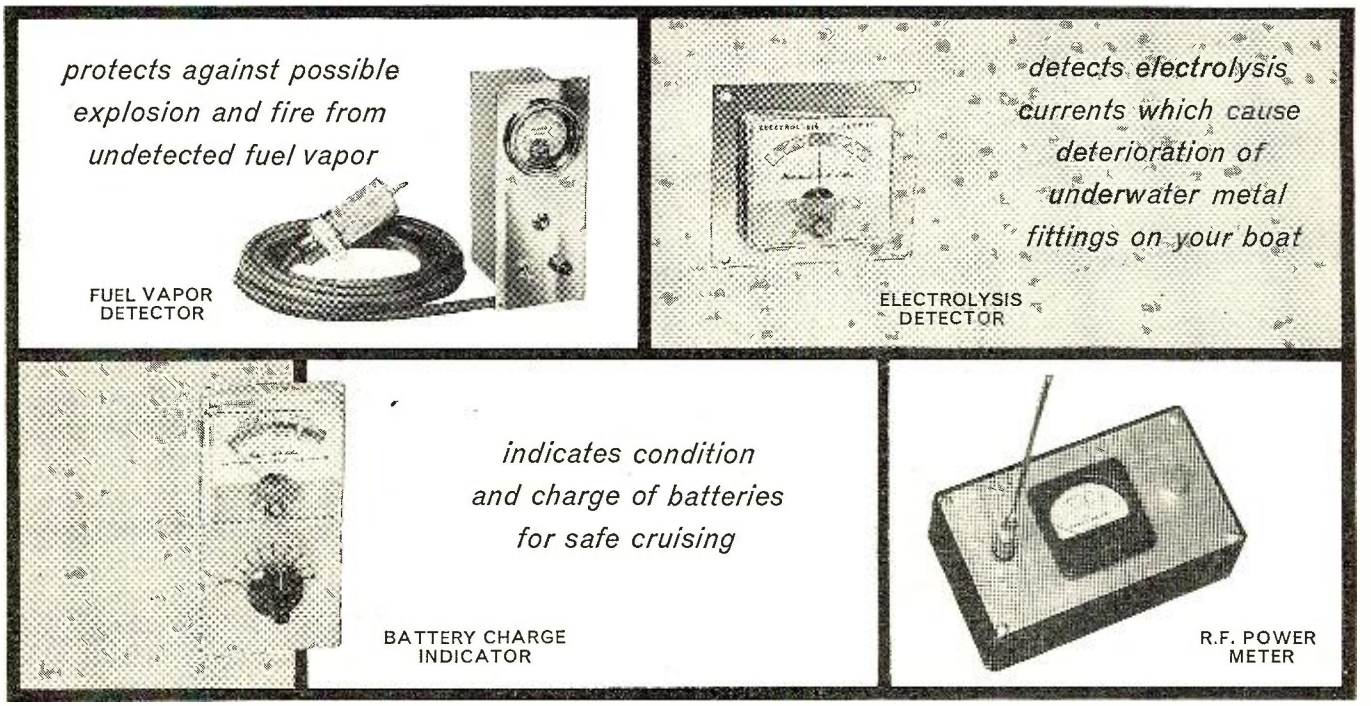

HEATHKIT FUEL VAPOR DETECTOR KIT

Protect your boat and its passengers against fire or explosion from undetected fuel vapor by building and using one of these fine units. The Heathkit Fuel Vapor Detector indicates the presence of fumes on a three-color "safe-dangerous" meter scale and immediately shows if it is safe to start the engine. A pilot light on the front panel shows when the detector is operating, and it can be left on continuously, or just used intermittently. A panel control enables initial calibration of the detector when installed. Features a hermetically-sealed meter with chrome bezel, and a chrome-plated brass panel. It is very simple to build and install, even by one not having previous experience. Models FD-1-6 (6 volts DC) and FD-1-12 (12 volts DC) operate from your boat batteries. The kit is complete in every detail, even to the inclusion of a spare detector unit. Shpg. Wt. 4 lbs.

6 volt MODEL FD-1-6
12 volt MODEL FD-1-12
$35.95 EACH

HEATHKIT BATTERY CHARGE INDICATOR KIT

The Heathkit model CI-1 Marine Battery Charge Indicator has been designed especially for the boat owner, although it has found use in service stations, power stations, and radio stations where banks of batteries are kept in reserve for emergency power. It is intended to replace the hydrometer method of checking storage batteries, and to eliminate the necessity for working with acid in small, below-decks enclosures. Now it is possible to check as few as one, or as many as eight storage batteries, merely by turning the switch and watching the meter. A glance at the meter tells you instantly whether your batteries are sufficiently charged for safe cruising. Dimensions are 2-7/8"W x 5-11/16" H x 2" D. Operates on either 6 or 12 volt systems using lead-acid batteries, regardless of size. Simple installation can be accomplished by the boat owner in fifteen minutes. Shpg. Wt. 3 lbs.

MODEL CI-1
$16.95

HEATHKIT ELECTROLYSIS DETECTOR KIT

The Heathkit model ED-1 Electrolysis Detector indicates the extent of electrolysis currents between the boat's common ground and underwater fittings, except on boats having metal hulls. These currents, undetected, could cause gradual corrosion and deterioration of the propeller or other metal fittings below the water line. It is particularly helpful when installing electrical equipment of any kind, or to determine proper polarity when power is obtained from a shore supply. Easy-to-build, the model ED-1 consists of a hermetically-sealed, waterproof meter, special sensing plate, and sufficient wire to install, including the necessary hardware. Mounts on instrument panel where it can be easily seen. Requires no power for operation, and gives instant warning to guard your boat for a lifetime. Shpg. Wt. 2 lbs.

MODEL ED-1
$9.95

HEATHKIT RF POWER METER KIT

The Heathkit RF Power Meter Kit is designed to sample the RF field in the vicinity of your transmitter, whether it be marine, mobile, or fixed. Output meter is merely placed in some location close to the transmitter, to pick up RF radiation from the antenna. Requires no batteries, electricity, nor direct connection to the transmitter. It provides you with a continuing indication of transmitter operation. You can easily detect if power is dropping off by comparing present meter readings with past ones. Operates with any transmitter having output frequencies between 100 kc and 250 mc, regardless of power. Sensitivity is 0.3 volts RMS full scale, and a special control on the panel allows for further adjustment of the sensitivity. Meter is a 200 ua unit, mounted on a chrome-plated brass panel. The entire PM-1 measures only 3¾" W x 6¼" L x 2" D. An easy way to put your mind at ease concerning transmitter operation. Shpg. Wt. 2 lbs.

MODEL PM-1
$14.95

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now offer you completely modern marine equipment with outstanding design features

HEATHKIT TRANSISTOR RADIO DIRECTION FINDER KIT

The Heathkit Transistor Radio Direction Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit). The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7½" W x 5⅞" H x 5⅜" D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 5 lbs.

MODEL DF-1

$54.95

TRANSISTOR
RADIO DIRECTION FINDER

Heathkits...

By DAYSTROM

are sold only by direct mail, passing middleman profits on to you

Pioneer in "do-it-yourself" electronics

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The Heath Company maintains a technical consultation service, should you experience some sort of difficulty in construction or operation. Although only a very small percentage of our customers ever have occasion to use this service (usually only beginners in electronics) it is still reassuring to know that technical help is available when needed. A service department is also available, should you wish a complete factory check of operation and alignment or repair. After you build your first Heathkit you'll realize how easy it is.

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By BERT WHYTE

I HAD hoped that by the time this column was due, the RIAA would have announced their decision in regard to stereo disc standards. No matter if the official pronunciamento doesn't come for a few days . . . I can tell you with almost 100 per-cent certainty that the decision will be in favor of the *Westrex* "45-45" system. The engineering committee has already recommended the adoption of the "45-45" and this is tantamount to a "green light" for the stereo disc.

At this point it might be wise to interject a note of caution. As I have reported to you I have heard a number of stereo disc demonstrations and the results, if not spectacular, could honestly be termed "commercial." But you must remember that I heard these demonstrations under careful laboratory control conditions.

Record company engineers have had a chance to experiment with their *Westrex* cutters and from some conversations I have had with these people, the stereo disc isn't all "beer and skittles." There have been problems encountered . . . some of which were half expected and others quite beyond ordinary disc-cutting experience. There is little doubt that these problems will be resolved, but it is going to take time. In spite of many indications to the contrary, such as the heavy activity in stereo 45-45 cartridges, stereo preamps, and the like . . . the stereo disc may yet be many months away. No, I'm not trying to throw cold water on the whole idea! It is merely that in the first flush of enthusiasm for the stereo disc, imprudent things were said and imprudent ideas were tried by many people who should have known better.

A case in point is the business of "compatibility." When the 45-45 first made its appearance, the notion was fostered that this method would allow for the production of a "universal" pressing. The idea was that the disc could be played with a regular 1 mil monaural stylus, producing a balanced single-channel sound and then when it was played by the special cartridge it would produce a stereo signal. One of the points in the argument was that a person not yet equipped for stereo could buy the "universal" disc and play it monaurally until he switched to stereo. Well it sure sounded like a dandy idea . . . that is until some investigators from *RCA* looked into the situation and concluded that the average monaural pickup would damage a stereo disc. They further concluded that although a stereo cartridge could be used to play regular monaural LP's without damage, the reproduction would not be as good as could be obtained with the standard monaural pickup. There are exceptions to this, of course. Some of the very high quality hi-fi cartridges have sufficiently high lateral and vertical compliance to play stereo discs with little or no damage. Naturally the number of these pickups in use is quite minute and, by and large, it looks like we will not see the "universal" disc nor a "universal" pickup cartridge. This point is particularly important to the record retailers, many of whom have been having nightmares about being "stuck" with "unsalable" monaural LP's. Now they have nothing to fear . . . and there is no reason for any retailer to cut or restrict his buying of the present monaural record. The stereo disc will make its appearance and co-exist with the standard LP. After all, the public does not yet have the means to play these stereo discs and it will be some time before there is really any appreciable market. Retailers should take comfort in this fact . . . we've had ten years of the 33⅓ rpm long play record and, according to some recent statistics, there are still some 4 million phonographs in use in this country that will play nothing but 78 rpm records!

By the time you read this, the San Francisco and Los Angeles Hi-Fi Shows will have been held and, unless my spies are wrong, here is where the stereo disc and the equipment to play the disc will get its public baptism of fire. Most certainly, West Coast fans will hear the new *Electro-Voice* stereo ceramic cartridge, and they'll hear a number of new *Audio Fidelity* stereo discs. It is likely that the *ElectroSonic* and *Fairchild* stereo cartridges will make their appearance. *Pickering* and *Weathers* are both ready and, if the RIAA decision comes in time, will probably demonstrate their stereo pickups. Well, whether these prognostications are right or wrong, your old Uncle Bert has been fortunate enough to secure an *Electro-Voice* stereo cartridge and some stereo discs! Come what may, I expect to be set up in time to bring you the first stereo disc reviews in next month's column!

BRAHMS
CONCERTO FOR VIOLIN AND ORCHESTRA IN D MAJOR
Yehudi Menuhin, violinist, with Berlin Philharmonic Orchestra conducted by Rudolph Kempe. Capitol PA09410. Price $4.98.

This 17th LP recording of the Brahms violin concerto arrived in *Capitol's* new book-type, double fold record jacket. I've heard pros and cons about this cover. Some people thought it was "clumsy," others like the more copious program information it affords, others thought it was silly to adopt something that would occupy more space than a conventional LP shuck. My own feeling is that in spite of the increased bulk, it will catch on, because of the protection it affords the records. In this type of cover, warpage

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.

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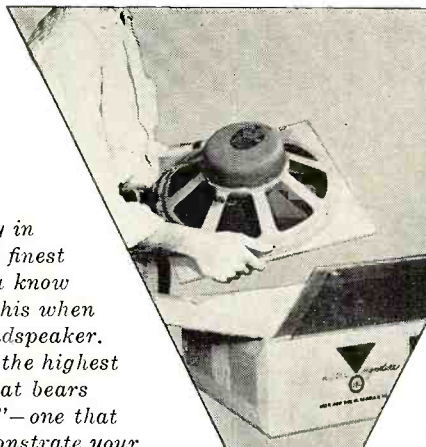

MODEL D123
12" EXTENDED RANGE LOUDSPEAKER

An outstanding value, the D123 at first glance is most unusual because of its shallow structure—only 3⅝". More unusual is the crisp, clean bass it generates. Listening will develop great respect for the D123's smooth response, excellent handling of transients, and pleasingly lucid highs.

MODEL D208/D216
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A thrilling piece of miniaturized precision craftsmanship. As perfect in its details as larger JBL units. A true precision transducer in every sense of the term. Properly enclosed, the D208 (eight ohms, D216 is 16 ohm model) gives impressive, rich, full range coverage of audio frequency range.

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Exciting to behold, the precision-machined 075 embodies a new concept in high frequency reproduction. A ring, rather than a diaphragm, radiates sound energy into the annular throat of an aluminum exponentially tapered horn. Above 2500 cps, 075 sets a new standard for linear reproduction.

MODEL D130 15" EXTENDED RANGE LOUDSPEAKER

The only speaker of its kind... only one made with a 4" voice coil... only single unit speaker to give you complete, true high fidelity coverage of the entire audio spectrum. Your basic speaker. Use alone at first, later add JBL high frequency unit and dividing network for supreme excellence of JBL 2-way system.

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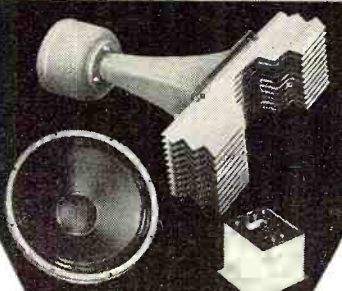

MODEL 086 KIT OF PROFESSIONAL COMPONENTS

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is far less of a problem, and today with LP records being pressed on very thin vinylite, this can *really* be a problem.

Menuhin is congenial with this score and he acquits himself very well considering the high-voltage competition he is up against. His approach is more lyrical than most and he makes full use of his lush rich tone to abet this conception. Soundwise this rates among the best. Every element is very clean, the violin/orchestra balance excellent with the violin slightly favored. Very round, full acoustics add a high degree of naturalism to this interpretation.

BACH, J. S.
MAGNIFICAT IN D
CANTATA #50
Mimi Coertse and Margaret Sjostedt, sopranos; Hilde Rossl-Majdan, alto; Anton Dermota, tenor; Fredrick Guthrie, bass, with Chorus and Orchestra of the Vienna State Opera conducted by Felix Prohaska. Vanguard-Bach Guild BG555. Price $4.98.

The 5th LP recording of Bach's magnificent "Magnificat" and by all odds the best and most successful. Prohaska is authoritative without being stuffy or pedantic and he lets the work unfold majestically. The two sopranos are relative unknowns, but they sing with very clean line and singular purpose. The rest of the soloists are well-known for their work in cantatas, oratorios, and the like, and on this disc they practice their art most pleasingly. We have needed a well-sung "Magnificat" with really good hi-fi sound for some time and this recording fills the bill very nicely. In over-all cleanness, choral-solo-orchestral balance, dynamics, and effectively "live" acoustic perspective, this recording is without equal. Add the distinguished performance and we have what is clearly the recording of choice.

FESTIVAL CASALS DE PUERTO RICO 1957
Columbia ML5236. Price $3.98.

This is a rather poignant recording, which documents some of the 1957 Casals Festival. The great Casals himself is heard rehearsing the Festival Orchestra in the first movement of Schubert's "Unfinished" symphony. It was just after this first movement that Casals suffered a heart attack and was unable to continue for the duration of the Festival. This sobering reminder of Casals' advanced years is reflected in the rehearsal, where to illustrate points of performance he sings a few bars of the score, in a voice thin and quavery with age. Thus one marvels all the more at the man's consummate musicianship as he molds and shapes the performance, always striving for that last little fillip that might spell perfection.

Also heard on the disc is a Bach "Capriccio" played by Rudolph Serkin and Bach's "Suite #1 in C Major" with Alexander Schneider conducting the Festival Orchestra. The sound on the disc is fair, being hampered by odd acoustics which at times makes the music sound very thin and strident. If one listens closely, it is evident that difficulty must have been encountered in keeping out street noises. In spite of the shortcomings, a fascinating glimpse into the demanding world of the symphony conductor.

GRANADOS
SPANISH DANCES (COMPLETE)
Eduardo del Pueyo, pianist. Epic LC3423. Price $3.98.

The 12 dances that make up this work, employ some of the most exotic scoring ever conceived for piano. The work is highly idiomatic and simply reeks of Iberian atmosphere. Its proper execution demands a pianist with exceptional insight and understanding and such a man is Eduardo del Pueyo. His playing is the soul of expression and he makes these Dances newly interesting. Piano sound is recorded fairly close up and in a moderately spacious acoustic situation. All is quite clean, and it is easy to predict that these Dances will win many new friends.

SCHUBERT
SYMPHONY #8 (UNFINISHED)
MENDELSSOHN
OVERTURE AND INCIDENTAL MUSIC FOR "MIDSUMMER NIGHT'S DREAM"
Philadelphia Orchestra conducted by Eugene Ormandy. Columbia ML5221. Price $3.98.

Ormandy in fairly sympathetic performances of these well-flogged warhorses. The conducting is slick, professional, but rather lacking in depth and expression. The prime values here are the really superb string tone of the Philadelphia Orchestra, especially notable in the "Dream," and the rich smooth sound. The opening of the "Unfinished" is productive of some magnificently sonorous contrabass and, throughout both works, matters of balance and acoustics are handled with quite exceptional skill.

BACH, J. S.
CONCERTO IN D MINOR FOR TWO VIOLINS
TRIO SONATA IN C MAJOR FOR TWO VIOLINS AND CEMBALO
TARTINI
TRIO SONATA IN F MAJOR FOR TWO VIOLINS AND CEMBALO
VIVALDI
CONCERTO GROSSO IN A MINOR
David and Igor Oistrakh, violinists, with Gewandhaus Orchestra of Leipzig conducted by Franz Konwitschny. Decca DL9950. Price $3.98.

This recording is a showcase for the talents of David Oistrakh and his brilliant son, Igor. The selections are well chosen for the job and the display of violin gymnastics, sumptuous tone, and over-all virtuosity is simply dazzling. The sound, too, is very bright and clean and was recorded at high level. One of the most "hi-fi" sounds yet produced by *Deutsche Grammophon* and a "must" for lovers of the violin.

BEETHOVEN
CONCERTO FOR PIANO AND ORCHESTRA #5 (EMPEROR)
Clifford Curzon, pianist, with Vienna Philharmonic Orchestra conducted by Hans Knappertsbusch. London LL1757. Price $3.98.

Solomon, pianist, with Philharmonia Orchestra conducted by Herbert Menges. Victor LM2108. Price $4.98.

Two new "Emperor" concertos, which are quite divergent both as to sound and performance. The *London* disc is easily the better of the two and is, in addition, a reading strong enough to challenge the top competition on LP. Curzon is at his brilliant best on this disc and his performance is very vital and alive, surging with immense power, but with restraint and good taste exercised when the score demands. The real plum on this disc is the sound, being well ahead of any previous edition. The piano was miked medium-close, slightly overriding the orchestra. It had a very lovely, clean and liquid tone, with transients which were sharp without being harsh. The string tone of the Vienna Philharmonic is butter-smooth and the precision of the ensemble work outstanding. In some sections, however, I found one of the few faults . . . the first strings were given a shade too much prominence which tended to obscure the contrabass ground. Throughout the disc, the woodwind and brass

were sharp and cleanly articulate and percussion was weighty and accurate. The wide dynamics and frequency response add their measure of "presence."

The Solomon recording is characterized by his fine tone, but rather slow-paced performance. The sound, too, has its shortcomings. Piano is recorded up close and the sound of the piano hammer-action can be plainly and annoyingly heard. Then we have the reverse situation from the *London* disc . . . here the contrabass overpower the first strings now and then. At times the brass also obscures the strings. In general, the bass end is very heavy and tends to be thick-textured. The fairly wide dynamics and reasonably spacious acoustics were helpful, but could not dispel the fact that this recording is not what it should be. Actually this is one of the last items in the *HMV* catalogue, which *Victor* issued, before the *HMV-Victor* break-up. In any case, the *London* wins hands down and those who have been looking to replace a dated recording of the "Emperor" should investigate this splendid version.

SAINT-SAENS
CONCERTO #3 FOR VIOLIN AND ORCHESTRA
INTRODUCTION AND RONDO CAPPRICCIO
HAVANAISE (OP. 83)

Arthur Grumiaux, violinist. Epic LC3399. Price $3.98.

The "Introduction" and the "Havanaise" are performed with taste and style, but the prize on this disc is a gorgeous reading of the popular 3rd violin concerto. Grumiaux has never received the recognition he deserves as one of our really top-dog virtuosos. Lately, however, on the strength of several successful recordings he has been more widely appreciated and with this recording he should hit the top. In the concerto, Grumiaux displays a big, singing tone coupled with ultra-facile technique. He is in fine rapport with Fournet, who conducts the Lamoureux Orchestra in a congenial, well-integrated accompaniment. The sound is exemplary . . . a very high level affair, with very forward projection, good wide dynamics, clean in every element.

ALBENIZ
IBERIA
(ORCHESTRATED BY ARBOS)
FALLA
INTERLUDE AND DANCE #1
(LA VIDE BREVE)

Minneapolis Symphony Orchestra conducted by Antal Dorati. Mercury MG50146. Price $4.98.

This, friends, is the lulu of the month! What a recording! It has just about everything the most avid hi-fi nut could ask for . . . exotic Spanish music, alive with color and rhythm, music that demands a large and unusual percussion battery, music that is rich in brass, lavish in woodwind, extravagant with strings. "Iberia" was originally scored for piano, but feeling that the piano was too restrictive for its vast drama, Albeniz had the score orchestrated by the well-known Spanish conductor, Enrique Arbos. In the orchestration, the original 12 piano pieces were made into a five-section suite, which is what we hear on this disc. Every one of the sections is fascinating and loaded with exciting sound, but the section called "El Corpus en Sevilla" is nothing short of astonishing. Here in a gigantic outpouring of sound of immense dynamic range, everything literally explodes! Here is percussion in all sizes and shapes, little tinkly high percussives, huge thuds of tympani and awesome blasts of bass drum augmented by the clangor of bells. The din is terrific and only the biggest

and best hi-fi systems can do this sound full justice.

The excerpt from "La Vida Breve" is also very colorful, even if not possessed of such extreme dynamics as "Iberia." It is familiar to most concert-goers, being a staple of the "pop" classical repertoire.

Dorati is in his element in scores like these and his reading leaves little to be desired. His wonderful Minneapolis Orchestra responds magnificently to his urgings and they sail through this difficult music with poised assurance. If you hear nothing else this month, hear this recording for a super hi-fi treat!

STRAVINSKY
THE FIREBIRD
PETROUCHKA
Philharmonic Symphony Orchestra of London conducted by Hermann Scherchen. Westminster XWN18530. Price $3.98.

This is a fabulous coupling and a fabulous buy! This recording is one of the finest ever issued by *Westminster,* and that is saying a lot with a company that is noted for the general excellence of its sound. Of the two, "Petrouchka" is far and away the best recording and the most successful performance. Scherchen's ideas about the "Firebird" aren't quite in accordance with the views held by other conductors, especially in regard to tempi. Be that as it may, his is one of the most exciting "Firebird's" in the catalogue with recording that puts it well up on the list.

With "Petrouchka," we have a superb performance at least equal to Monteux's and even approaching the lofty plane of the original Ansermet reading. In matters of sound, this is one of the most outstanding recordings ever made. From any viewpoint—of frequency response, lack of transient or any other distortion, dynamics, orchestral balance, acoustic perspective . . . it is just tremendous. Strings, brass, woodwind . . . all are bright and ultra-clean. And as for percussion, there are triangles and cymbals and other stuff on the high end, and snares, tympani and bass drum on the low end used in profusion and heard in so many ways and fashions you hardly believe it. There are percussive sounds on this "Petrouchka" which constitute one of the most severe tests of a speaker system (and pickup, amplifier, etc.) you can imagine. In one section there are big bass drum blasts which are very hard to track, and then there is a section about halfway through where the scoring is very sparse . . . just bassoon, muted trumpets, contrabass, stroked cymbals and a very low, very soft bass drum. I have heard some big speakers, with big reputations fail to reproduce this soft (approx.) 30-cycle note, and of all the recordings in the LP catalogue, I think this one with that section is the most useful for determining just how good your speaker bass really is! This disc is worth the price for that test bass alone, but its other virtues are equally compelling.

OUT ON A LIMB
Pete Rugolo and his All Stars. EmArcy MG36115. Price $3.98.

Pete Rugolo is loose with his crew again and that means some fireworks in his high octane, progressive manner. Pete has practically a "Who's Who" of jazz blowing for him on this disc . . . to mention just a few there is Maynard Ferguson with the high-flyin' trumpet, Barney Kessel on the guitar, Shelley Manne on the skins, Dave Pell, tenor sax, etc., etc. Pete and the boys give with some standards like the "Boy Next Door," "Smoke Gets In Your Eyes," "Sunday, Monday, or Always" as well as a number of those unique Rugolo originals. The most interesting of the originals from a sonic viewpoint is "Ballade for Drums." In this Shelley Manne whips up quite a storm but the very last

minute of this piece resolves itself strictly into the high percussives where various cymbals and some bells are struck and/or brushed in varying intensities. Some of these sounds are almost nothing but very soft, faint, metallic "swishes." If your record is not well-cleaned, and every last vestige of hum or hiss not removed from your system, the noise will override the music.

As always, Pete is given a superbly clean recording by *EmArcy*, with just the right amount of reverb to lend maximum liveness.

ALL THROUGH THE NIGHT
Fred Waring and the Pennsylvanians. Capitol T936. Price $3.98.

Fred Waring has been knocking out hit albums for years now, so this is nothing new. But since Fred has been with *Capitol*, he has been getting such magnificent recording that whenever a new album arrives, it's like meeting someone new and fresh. This impression is further heightened in the stereo tape, and if you've got a chance to hear the Waring brand of stereo, don't miss it! On this disc Fred is in a quiet and mellow mood and gives you such things as "Autumn Leaves," "If I Had My Way," "Dear Hearts and Gentle People," "Drink To Me Only With Thine Eyes," and others of similar persuasion. The chorus and orchestra sound out, beautifully balanced, together. The arrangements are tasteful and tuneful and, as always, *Capitol* affords Fred ultra-quiet record surfaces.

HI-FI DRUMS
Buddy Rich, Chuck Flores, Louis Bellson, Dave Black, Alvin Stoller, Stan Levey, Irv Cottler with Woody Herman, Duke Ellington, Billy May and Jazz All Stars Orchestra. Capitol T926. Price $3.98.

This recording is destined to become a classic for drummin' enthusiasts. And no wonder! With some of the best jazz drummers in the world playing their specialties backed up by some of the jazz world's greatest bands, the sounds on this disc are exciting, to put it mildly. This is the art of drumming, expounded in distinctive rides by the experts and running the gamut of every style. There isn't space for detailed analysis here . . . it's the type of disc you must listen to anyway. Suffice to say that as a cross section of "skinland," this succeeds in showing that "exhibition" drumming didn't die with the big bands. The sound is really sensational. The drums are taut, sharp and clean, their every transient pulse undistorted. The side drums snarl vibrantly, the cymbals swish and scintillate, the pedal drums and tom-toms thud and throb with great power. The bands join in with smokin' hot brass and sizzling sax. Wrap all together in wide frequency and dynamic range and big spacious acoustics and here is the sound of jazz percussion . . . vibrantly alive!

Next month, more new discs and, if available, additional details on the progress of the new stereo disc "industry." —30—

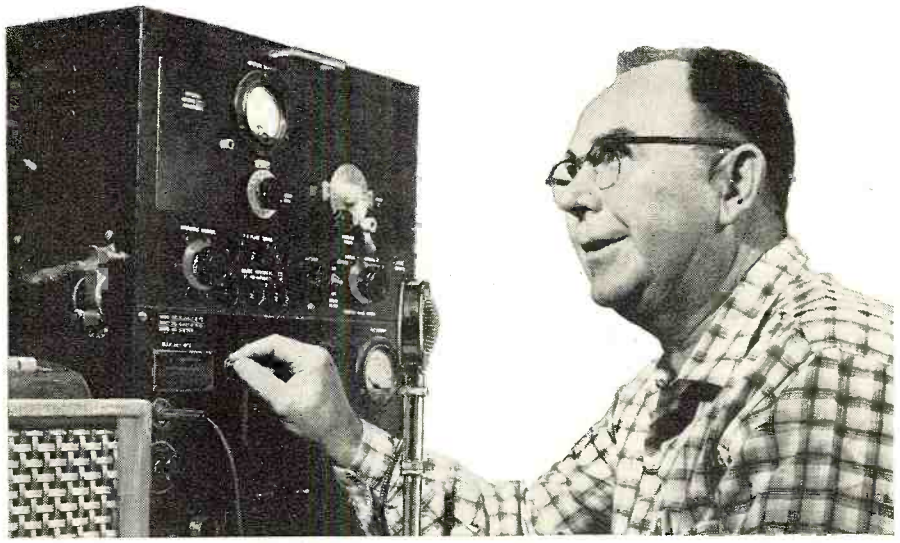
"OLD TIMERS' NITE"

THE Delaware Valley Radio Association has scheduled its annual stag party for Saturday, April 19th at the Stacy-Trent Hotel, West State St. at Willow in downtown Trenton, N. J.

Reservations for the affair must be made by April 15th at a tariff of $6.00 per ticket. The ante will be upped to $7.00 at the door.

Ed G. Raser, W2ZI, is general chairman of the 1958 "Old Timers' Nite" and reservations should be sent to him (with remittance) at 315 Beechwood Ave., Trenton, N. J. All (male) hams, no matter what grade, are cordially invited.

—30—



Jim Harrington is shown here at one of the transmitters he transported by boat to Cameron, La., last June when for 3 days he provided the only communications after the devastation of Hurricane Audrey which took more than five hundred lives.

1957 Ham of the Year

James E. Harrington, K5BQT, wins G-E's Edison Radio Amateur Award for disaster aid during Hurricane Audrey.

A LOUISIANA radio amateur who provided the only communications from a hurricane-devastated town for three days has received *General Electric's* annual Edison Radio Amateur Award for 1957.

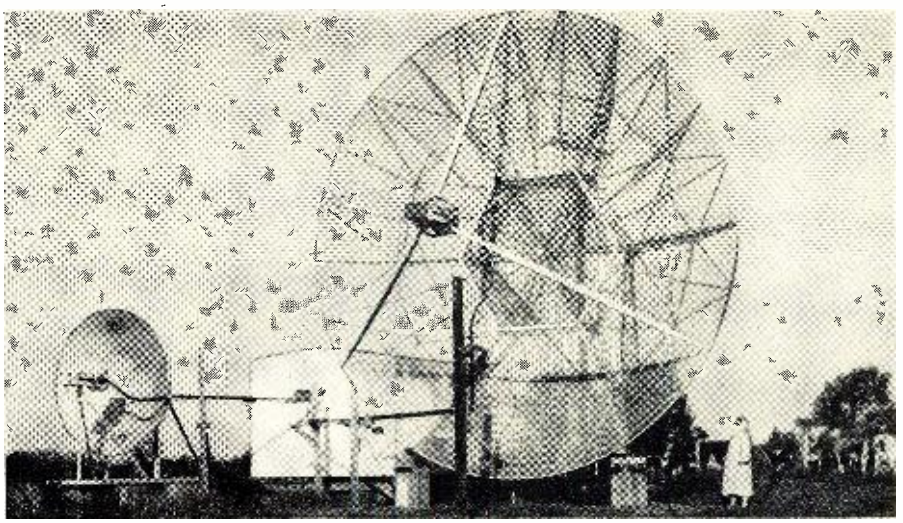
He is James E. Harrington, 45, of Lake Charles, La., who operates amateur radio station K5BQT. He received a trophy and $500 at a banquet where the principal speaker was Lt. Gen. Francis H. Griswold, vice-commander of the Strategic Air Command. Gen. Griswold, a ham himself, talked on the public services provided by the nation's 150,000 licensed amateur radio operators.

After Hurricane Audrey hit the coastal town of Cameron last June 26, Harrington—then alternate civil defense radio officer in Lake Charles—gathered equipment and a crew of two ham assistants and traveled by boat 40 miles southward through the swollen Calcasieu River. At Cameron, Harrington and the two operators—Capt. N. H. Mabrey, W5VTU, and Sgt. M. J. McDermott, K5CTQ, of the Lake Charles Air Force Base—waded waist-deep through mucky flood waters with radio transmitters and receivers, a heavy generator, a supply of gasoline, and a 3-day supply of food and water.

They set up a radio station in the Cameron court house and in three days and two nights handled 1500 messages. These told rescue agencies of the desperate need for water, food, and medical supplies. They reported the arrival of rescue boats and scheduled return trips so the hundreds of refugees would be met at debarkation points with ambulances, clothing, medicine, and food.

Judges for this sixth annual award were Comm. Rosel Hyde, FCC; E. Roland Harriman, American National Red Cross; and G. L. Dosland, president, ARRL. —30—

Mission of mercy is re-enacted by Harrington in this photo. Jim loaded equipment and supplies on the fishing boat "Sea Castle" and sailed 40 miles to set up a station at Cameron, La.



If you look carefully just to the right of the large dish antenna, you will be able to see Mrs. Orton Newton of Pharsalia, N. Y., who is helping Bell Telephone Laboratories conduct some over-the-horizon radio studies from her farm.

Farm Housewife Helps Over-Horizon Radio Study

Operates three microwave transmitters in an experimental 171-mile scatter radio link.

BETWEEN the morning milking and the evening chores, life on the farm takes a scientific turn for Mrs. Orton Newton of Pharsalia, N. Y. Orah Newton, a homey, 59-year-old housewife, holds a restricted radiotelephone operator permit and operates three radio transmitters almost daily. She still manages to tend house for her son and husband and lend a hand with 50 head of dairy cattle. A former school teacher, Mrs. Newton got into the "science business" three years ago when research men at *Bell Telephone Labs.* determined to learn more of what happened in over-the-horizon transmission.

Near grazing cows and tall corn, the radio researchers erected a 28-foot antenna, a 10-foot antenna, and a radio building on a hilltop. Life hasn't been quite the same for the Newton family ever since.

Each day, Dr. W. Kummer of the *Laboratories* telephones Mrs. Newton and designates which transmitters are to be operated, and at what time. Adjoining Mrs. Newton's telephone is a special dial, exactly like that on a telephone. By dialing combinations of numbers, she activates the proper transmitters, beaming microwave radio signals to be received by a 60-foot antenna at the *Laboratories'* research center at Holmdel, 171 miles away.

To permit lengthy testing, the transmitters were installed on the Newton farm hilltop about 1800 feet above sea level. The hill was chosen because it is on direct line with *Bell Laboratories* centers at Holmdel and Murray Hill, N. J., is an adequate distance from Holmdel, and provides a clear sending path to the area.

In the usual line-of-sight radio transmission, signals travel in a straight line between transmitter and receiver; a distance limited to about 30 miles. In beyond-the-horizon propagation, the transmitting antenna sends signals into the atmosphere and the receiving antenna picks up the weak scattered energy. —30—

Mrs. Newton looks over an automatic recording device for the three microwave radio transmitters that she controls.

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The best-looking, best-performing FM-AM tuner kit your money can buy! Carefully designed for quick, easy construction—a tuner you'll enjoy assembling and be proud to own, both for its amazing musical performance and outstanding beauty. Covers the full AM broadcast band and 88 to 108 mc FM. On FM, *sensitivity is a remarkable 2.5 microvolts for 20 db of quieting;* hum and noise, −60 db; IF bandwidth, 200 kc at 50% down on curve; response, ± 0.5 db, 20-20,000 cps. On AM, *sensitivity is 3 microvolts for 10 db signal-to-noise ratio;* IF bandwidth, 8 kc at 50% down on curve; response, 20-8000 cps. Outstanding features include: Inertia Flywheel Tuning for effortless, accurate tuning; Automatic Frequency Control (plus AFC disabling) to "lock-in" FM stations; printed circuit board (with most of the kit wiring already done for you) assures time-saving, error-free assembly; pre-aligned RF and IF coils; tuned RF stage on FM; drift-compensated oscillator; neon glow tuning pointer; cathode follower output; two output jacks—one for recorder, one for amplifier; rotatable built-in ferrite antenna for AM. Includes beautiful French-gray case with chrome-finished tapered feet, 4 x 13 x 8″. Ideal for use with 18, 20 or 30 watt KNIGHT-KIT amplifiers. Ready for easy assembly. Shpg. wt., 12 lbs.

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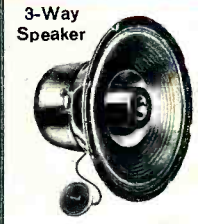

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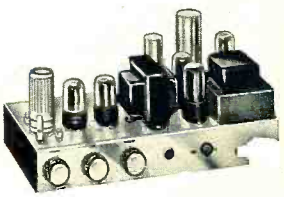

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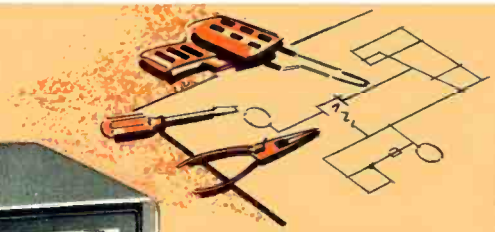

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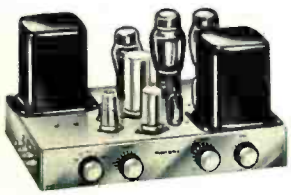
Y-759. Metal Cover for above; black finish. 5 lbs. Net..... **$4.25**



knight-kit 20-Watt Hi-Fi Amplifier Kit

Y-750

$35.75

$3.57 down

True hi-fi for less! Complete with full set of controls and built-in preamplifier. Response, ± 1 db, 20-20,000 cps; distortion 1% at 20 watts. Inputs for magnetic phono, microphone, crystal phono or recorder, and tuner. Compensation positions for 78 and LP records. Separate bass and treble controls. Output impedances, 4, 8, 16 and 500 ohms. Chrome-plated chassis. 7 x 13 x 8¾". Ready for easy assembly. Shpg. wt., 20 lbs.

Model Y-750. Net only.. **$35.75**

Y-758. Metal Cover..... **$4.15**

knight-kit 2-Way Hi-Fi Speaker System Kit

Model Y-789

$49.95

Only $4.99 down

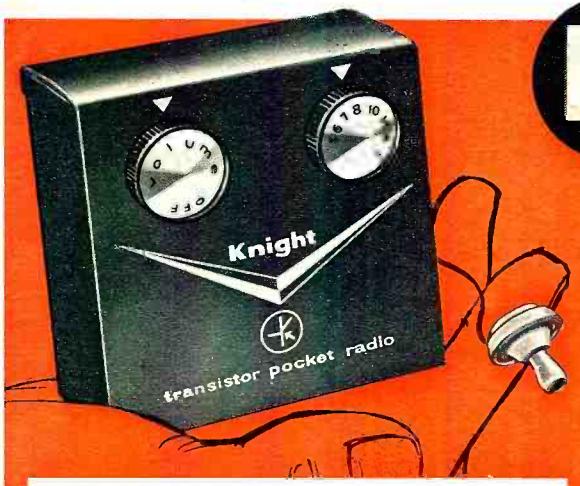
- Easy to Assemble—Pre-Finished Enclosure
- High Fidelity Response, 45 to 14,000 cps
- 12" Woofer and Horn-Type Tweeter
- A Wonderful Money-Saving Speaker Value

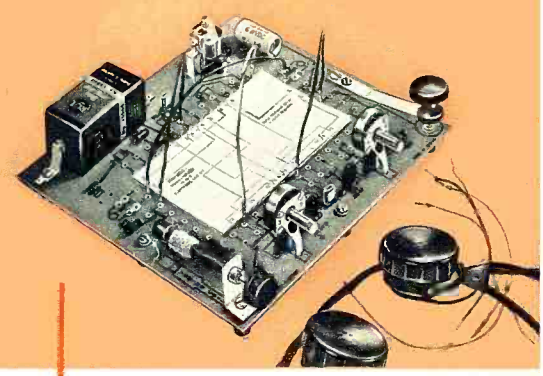
BIG SAVINGS—assemble your own quality KNIGHT-KIT 2-way speaker system—it's quick and easy! The cabinet is *pre-finished* in full-grained, high luster blonde or mahogany—you just assemble 7 pieces, mount the speaker components and enjoy rich, thrilling hi-fi sound—at incomparably low cost. Special Jensen-engineered baffle features "ducted port" construction to bring out the full beauty of bass notes, perfectly matching the Jensen woofer and compression tweeter; genuine L-pad control is rear-mounted to permit adjustment of tweeter for best tonal balance. Impedance, 16 ohms. The assembled unit delivers a frequency response of 45 to 14,000 cps. Enclosure measures 26 x 19 x 14". Beautifully styled to blend in any room. Kit includes Jensen 12" woofer, Jensen compression-type tweeter, pre-finished wood parts (with grille cloth installed), acoustic material, glue, hardware and step-by-step instructions. Absolutely no furniture finishing required. *Specify blonde or mahogany finish when ordering.* Shpg. wt., 33 lbs.

Model Y-789. 2-Way Speaker System Kit.
Net only..... **$49.95**

knight-kit HI-FI IS AVAILABLE ON EASY TERMS TO FIT YOUR BUDGET

Fascinating ALLIED knight-kits FOR EXPERIMENTERS AND HOBBYISTS





knight-kit 2-Transistor Pocket Radio Receiver Kit

Model Y-262 $14.65

- Loud, Clear Local Reception
- Newest Printed Circuit Board
- Built-In Loop Antenna
- Complete Kit—Nothing Else To Buy

It's fun to build this pocket-size two-transistor radio—and you'll enjoy its crystal-clear local broadcast-band reception wherever you go! Fits in your pocket, or with its button-down flap, can be worn from your belt. Completely self-contained with built-in ferrite loopstick antenna—no external antenna needed. Extremely efficient reflex type 2-transistor circuit actually does the work of 3 transistors! Printed circuit board reduces building time to about one hour. Has air-dielectric variable capacitor for easy, accurate station tuning. Operates for months and months on long-life alkaline battery supplied. Sensitive miniature earpiece provides crystal-clear tone. Handsome tan carrying case, plastic-impregnated, is styled to resemble leather; only 4x3¾x1¾". Kit includes all parts, transistors, earpiece, battery and case. Shpg. wt., 1½ lbs.

Model Y-262. Net only $14.65

knight-kit "Trans-Midge" Transistor Receiver Kit

Model Y-767 $2.45

Tiny, cigarette-pack-size one-transistor radio kit—fascinating to build—so low-priced. This novel miniature receiver will provide endless listening pleasure the moment assembly is completed. Covers the local AM broadcast band with exceptional sensitivity and selectivity. Special features include: Efficient, slug-tuned coil for excellent station separation; external knob for easy station tuning; low-drain transistor operating for months from single penlight cell supplied; hinged-back, red plastic case. Kit includes all parts, transistor, battery, compact case and easy-to-follow instructions for quick assembly. (External antenna and headphones required.) Shpg. wt., 8 oz.

Model Y-767. Net only $2.45
J-149. 4000 Ohm Headphones. 1 lb. .. $2.15
C-100. Antenna Kit. 1½ lbs. $1.03

knight-kit 10-Circuit Transistor Lab Kit

Model Y-299 $15.75

Sensational experimenters' transistor kit—an electronic marvel! Perfect for experimenter, student or hobbyist. Assemble basic parts once, then complete project after project (10 in all), by simply plugging leads into proper jacks on printed circuit board—no wiring changes needed. You learn how transistors operate by "plugging in" to make any one of the following circuits; AM radio for strong headphone reception; 2-stage audio amplifier; wireless broadcaster; code practice oscillator; electronic timer; electronic switch; electronic flasher; photoelectronic relay; voice-operated relay; capacity-operated relay. Includes all parts, 2 transistors, battery, headphones, circuit leads, relay, photocell, special guide cards for each project, explanation of each circuit. 3 lbs.

Model Y-299. Net only $15.75

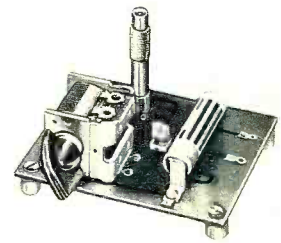
knight-kit 5-Transistor Superhet Personal Portable Radio Kit

Model Y-766 $29.95

- Styled to Equal the Finest
- Push-Pull Audio Drives 3½" Speaker
- Printed Circuit for Easy Building
- 200 Hour Battery Playing Life

Beautiful, easy-to-build transistorized personal portable with every ultra-modern design feature: 5 Texas Instrument Co. transistors; latest printed circuit chassis for easy, error-free assembly; bigger-than-average 3½" speaker; class B push-pull audio output; built-in high-gain ferrite loopstick antenna; plus phone jack output for private listening. Provides sensitive reception of the AM broadcast band with exceptional tone quality. Ultra-smart high-impact ivory plastic case has handsome gold trim with ebony accents; includes pull-out handle; only 7½x3⅜x1¾". With all parts, transistors, 9 volt transistor radio battery, carrying case and instructions anyone can easily follow. Shpg. wt., 2 lbs.

Model Y-766. Net only $29.95



1-Transistor Radio Kit

$3.95 Offers excellent AM local broadcast headphone reception. Printed circuit board for easy assembly. Operates from single penlight cell for months. Complete with all parts, transistor and penlight cell. (Antenna and headphones required.) Shpg. wt., 1 lb.

Model Y-765. Net only $3.95

"10-In-One" Electronic Lab Kit

$12.65 Famous experimenters' kit. Builds any of 10 fascinating projects, including broadcast receiver, wireless phono oscillator, code practice oscillator, signal tracer, relays, etc. Shpg. wt., 5 lbs.

Model Y-265. Net only $12.65

"6-In-One" Electronic Lab Kit

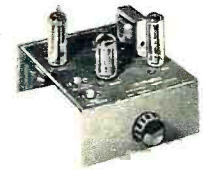
$8.45 A favorite with beginners. After basic wiring is completed, you make circuit changes without soldering. Builds any of six favorite projects, including radio, wireless broadcaster, etc. Shpg. wt., 3 lbs.

Model Y-770. Net only $8.45

Crystal Set Hobby Kit

$2.15 Entertaining, educational. Delivers clear headphone reception of local broadcast stations. With all parts, ready for easy assembly. (Antenna and headphones required.) Shpg. wt., 1 lb.

Model Y-261. Net only $2.15



Wireless Broadcaster Kit

$9.50 Play music or make announcements through your radio set—no connection to set required! Loads of fun—easy to build. Works up to 50 feet from set. Shpg. wt., 3 lbs.

Model Y-705. Net only $9.50

ORDER FROM ALLIED RADIO 100 N. WESTERN AVE. · CHICAGO 80, ILL

FUN TO BUILD . . . INSTRUCTIVE . . . LATEST CIRCUITS FOR TOP PERFORMANCE

WIDEST CHOICE OF QUALITY HOBBYIST KITS

Interruption of light beam triggers relay, which in turn sounds chime or bell, turns on lights, etc.

knight-kit Photoelectronic Relay Kit

Model Y-702 $13.50

Advanced-design, ultra-sensitive photoelectronic relay—build it yourself and save! Dozens of uses: for automatic control of lights, door announcer, burglar alarm, counting devices, etc. Provides dependable operation up to 250 feet with white light, up to 125 feet with "unseen" light (red filter) from Light Source Kit listed below. Selectable operation, with "trip" for burglar alarm to provide continuous ringing of alarm; and "auto" if relay is to operate each time beam is broken (for chimes, counting devices, turning on lights at darkness). Has SPST relay operated from thyratron; 6.3 v. terminals provide power for accessories. For 105-120 v. 50-60 cy. AC use. 6 lbs.

Model Y-702. Relay Kit. Net only . . **$13.50**

Model Y-703. Light Source Kit. With bulb and red filter. Shpg. wt., 3½ lbs. Net . **$6.75**

knight-kit "Ocean Hopper" All-Wave Radio Kit

Model Y-740 $11.95

This top-performing regenerative receiver puts a world of listening pleasure at your finger-tips. Tuning range (using coils listed below) is virtually world-wide; covers 155 kc to 35 mc, including every type of radio transmission: AM broadcast, marine, aircraft, distress channels, direction-finding, Amateur, frequency standard, foreign broadcast, and police. With bandspread tuning. For use with headphones or 3-4 ohm PM speaker. Kit is supplied with standard broadcast band coil and all tubes and parts. (Less extra coils, headphones, speaker and cabinet.) Shpg. wt., 5 lbs.

Model Y-740. Net only **$11.95**

Y-746. Cabinet for above. 1½ lbs. Net **$2.90**

Extra coils available: Long Wave Coil (155-470 kc), Net 79c. Short Wave (1.65—4.1 mc; 2.9—7.3 mc; 7—17.5 mc and 15.5—35 mc), Each 65c.

knight-kit "Space-Spanner" Bandswitching World-Wide Radio Kit

Model Y-243 $15.95

- Broadcast or Short Wave Reception
- Sensitive Regenerative Circuit
- Convenient Bandspread Tuning
- Built-In Loudspeaker

Imagine the thrill of hearing overseas broadcasts on a precision receiver you've built yourself—and then, at the flip of a switch, being able to tune to your favorite local broadcast station! Bandswitch selects exciting short wave, including foreign broadcasts, amateur calls, aircraft, police and marine radio on the 6.5 to 17 mc range, as well as standard 540-1700 kc broadcasts. Features highly sensitive regenerative circuit. Includes built-in 4" PM speaker and beam-power tube for strong volume and clear tone. Headphone connectors are available for private listening; switch cuts out speaker. Controls: Bandspread, Main Tuning, Antenna Trimmer, Bandswitch, Regeneration, Volume. 7x10x6". Easy to build from step-by-step instruction manual. For 110-120 v., 50-60 cy. AC or DC. (Less cabinet.) Shpg. wt., 5 lbs.

Model Y-243. Net only **$15.95**

Y-247. Cabinet for above. Shpg. wt. 2 lbs. Net . **$2.90**

"Ranger II" Superhet Receiver Kit

$17.25

Popular Broadcast band receiver built and enjoyed by thousands. Features built-in antenna, automatic volume control, ball-bearing tuning condenser, PM dynamic speaker. Handsome plastic cabinet. Easy to assemble. AC or DC operation. Shpg. wt., 8 lbs.

Model Y-735. Net only **$17.25**

knight-kit 2-Way Intercom System Kit

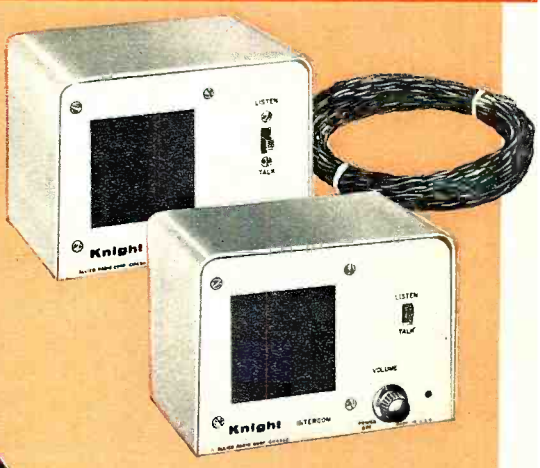
Model Y-295 $14.75

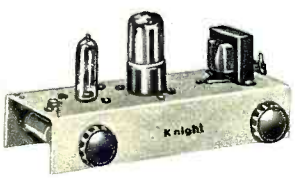
- Low Cost—Easy to Assemble
- High Gain—Clear Tone
- Handsome Metal Cabinets
- Includes 50-Foot Cable

Easy to build at lowest cost—ideal for home, office, shop or school. Consists of Master unit and Remote unit. Remote unit may be left "open" for answering calls from a distance, for "baby sitting", etc. Remote also may be set for "private" operation—cannot be "listened-in" on, but it can be called and can originate calls. Master unit includes high-gain 2-stage amplifier, combination volume control and on-off switch, plus pilot light. Each unit has 4" PM dynamic speaker. System responds to even a whisper. Handsome Antique white cabinets, each 4¾x6½x4⅜". With all parts, tubes and 50-ft. cable (up to 200-ft. may be added). For 110-120 v., AC or DC. 8 lbs.

Model Y-295. Master and one Remote. Net only . . **$14.75**

Y-296. Extra Remote Station Kit. 3 lbs. **$3.75**





Phono Amplifier Kit

$9.45

Build it yourself—and save! Ideal for use in a portable phonograph—just add record player and 3-4 ohm speaker. 1½ watts output. Inverse feedback circuit. Easy to assemble. Shpg. wt., 3 lbs.

Model Y-790. Net only **$9.45**

Electronic Photoflash Kit

$28.50

Ideal for color or black and white photography. 1/700th-of-a-second flash; 50 watt/second output. Synchronizes with any camera with X or O shutter. (Less battery.) Shpg. wt., 4 lbs.

Model Y-244. Net only **$28.50**

Code Practice Oscillator Kit

$3.95

Ideal for beginners learning the code. Transistorized circuit. Operates for months from single penlight cell supplied. Clear, crisp 500 cycle tone. Jacks for headphones; screw terminals for key. 1 lb.

Model Y-239. Net only **$3.95**

Phono Oscillator Kit

$5.85

"Broadcasts" recorded music through any standard radio set up to 50 feet away. No direct connection to set required. Easy to build—fun to use. Shpg. wt., 2 lbs.

Model Y-760. Net only **$5.85**

FINEST ELECTRONIC EQUIPMENT IN EASY-TO-BUILD MONEY-SAVING KIT FORM

Better By Far— ALLIED knight-kit QUALITY TEST INSTRUMENTS

knight-kit Low-Cost Tube Tester Kit

Model Y-143 $29.75

- With 16 Filament Voltages
- 600 Latest Tube Types Listed
- Easy-to-Read 4½" Meter
- Tests Series-String TV Tubes

Expertly designed for complete, up-to-date coverage of tube types. Tests *series-string TV tubes;* tests 4, 5, 6 and 7 pin large, regular and miniature types, octals, loctals, 9-pin miniatures and pilot lamps. Tests for open, short, leakage, heater continuity and performance (by amount of cathode emission). Big 4½" square meter has clear "GOOD-?-REPLACE" scale. With line-voltage indicator and line-adjust control. Choice of 16 filament voltages from 0.63 to 117 volts to check virtually all receiving tubes; blank socket for future type tubes. Universal-type selector switches permit selection of any combination of pin connections. Single-unit, pre-assembled 10-lever function switch simplifies and speeds assembly. Up-to-date illuminated roll chart lists over 600 tube types. Counter model case, 5 x 14 x 10". Easy to build. 14 lbs.

Model Y-143. Net only **$29.75**
Y-142. Portable Case model. 15 lbs. Net **$34.75**
Y-141. Picture Tube Adapter. 1 lb. Net ..... **$ 4.25**

knight-kit RF Signal Generator Kit

Model Y-145 $19.75

Build this wide-range, extremely stable RF signal generator—save two-thirds the cost of a comparable wired instrument! Large, semi-circular dial is clearly calibrated; range is covered in 5 separate bands for close accuracy in setting individual frequencies. Ideal for aligning RF and IF stages in radio and TV sets and for troubleshooting audio equipment. Delivers output on fundamentals from 160 kc all the way out to 112 mc; useful harmonics to 224 mc. Has built-in 400-cycle sine-wave audio oscillator for modulating RF; audio is also available externally. Features high-stability Colpitts circuit. Convenient jack for external modulation. Maximum audio output 10 volts; RF output over 0.1 volt on all ranges. Step and continuous-type attenuator controls. Supplied with precision-wound coils that require no adjustment. 7 x 10 x 5". Shpg. wt., 11 lbs.

Model Y-145. Net only **$19.75**

knight-kit 1000 Ohms/Volt VOM Kit

Model Y-128 $16.95

Exceptional accuracy and versatility at amazing low cost. Ideal for service shop, lab or Amateur use. Large 4½", 400 microamp meter with separate scales for AC and DC voltage and current, decibels and resistance. *Uses 1% precision resistors;* has 3-position function switch and 12-position range switch. *38 ranges* include: AC, DC and output volts, 0-1-5-10-50-500-5000 (1000 ohms/volt sensitivity); Resistance, 0-1000-100,000 ohms and 0-1 meg (center scale readings of 60, 150 and 1500 ohms); Current, AC or DC, 0-1-10-100 ma and 0-1 amp; Decibels, −20 to +69 in 6 ranges. Precision resistors are used as shunts and multipliers to assure exceptional accuracy of measurements. With all parts, battery, test leads and black bakelite case with convenient carrying handle, 6¾ x 5¼ x 3¾". A great value in an easy-to-build quality instrument. Shpg. wt., 2½ lbs.

Model Y-128. Net only **$16.95**

knight-kit Vacuum Tube Voltmeter Kit

Model Y-125 $24.95

- 200 μa Movement, 4½" Meter
- Includes AC, Peak-to-Peak
- Balanced-Bridge, Push-Pull Circuit
- 1% Film-Type Resistors

Top buy in an extremely stable, highly accurate VTVM. Easy to assemble—entire chassis is printed circuit board. Perfect for radio-TV service work, lab and Amateur use. Features low-leakage type switches; 1% film-type precision resistors; balanced-bridge, push-pull circuit (switch to any range without readjusting zero set); zero center scale and direct-reading db scale; polarity reversing switch. Ranges: Input Resistance, 11 megs; DC and AC rms, 0-1.5-5-15-50-150-500-1500; AC Peak-to-Peak, 0-4-14-40-140-1400-4000; Response, 30 cycles to 3 mc; Ohms, 0-1000-10K-100K and 0-1-10-100-1000 megs; db, −10 to +5. Includes all parts, tubes, battery, test leads and portable case, 7¾ x 5¼ x 4-3/16". Easy to assemble. Shpg. wt., 6 lbs.

Model Y-125. Net only **$24.95**
Y-126. Hi Voltage Probe; extends DC to 50,000 v. ..... **$ 4.75**
Y-127. Hi-Frequency Probe; extends AC to 250 mc. ..... **$ 3.45**

6V-12V Battery Eliminator Kit

$32.95 High current rating; continuously variable filtered output; delivers 15 amps at 6 volts, 10 amps at 12 volts. May be used as battery charger. Two meters provide simultaneous current and voltage readings. Shpg. wt., 18 lbs.

Model Y-129. Net only **$32.95**

Transistor Checker Kit

$8.50 Checks gain ratio of all types of transistors; checks germanium and silicon diodes; checks for continuity and shorts. A valuable instrument at very low cost. Easy to assemble. Shpg. wt., 2½ lbs.

Model Y-149. Net only **$8.50**

Flyback Checker Kit

$19.50 Checks condition of all types of horizontal output transformers and deflection yokes, as well as TV linearity and width coils. 4½" meter; widest range in its field. Shpg. wt., 6 lbs.

Model Y-118. Net only **$19.50**

Sweep Generator Kit

$43.75 Extreme linearity on a par with costly lab instruments; fundamentals to 250 mc; output flat within 1 db; electronic blanking. Easy, money-saving assembly. Shpg. wt., 16 lbs.

Model Y-123. Net only **$43.75**

Capacitor Checker Kit

$12.50 Tests capacitors while in the circuit! Has widest range—20 mmf to 2000 mfd. Exclusive circuit for cancelling lead capacity. "Magic Eye" indicator. Save 60% over factory-wired units. 5 lbs.

Model Y-119. Net only **$12.50**

ORDER FROM ALLIED RADIO 100 N. WESTERN AVE. • CHICAGO 80, ILL.

ADVANCED-DESIGN INSTRUMENTS FOR SERVICE, INDUSTRIAL AND RESEARCH USE IN EASIEST-TO-BUILD, MONEY-SAVING KIT FORM

knight-kit 20,000 Ohms/Volt VOM Kit

Model Y-140 $29.50

Outstanding quality and performance at money-saving low price. Features 1% precision multipliers; 4½" meter accurate within 2% of full scale deflection; 50 microamp sensitivity for 20,000 ohms/volt input resistance on DC; front panel "Zero adjust"; single switch to select function and range. 32 ranges: AC, DC and output volts, 0-2.5-10-50-250-1000-5000; Resistance, 0-2000-200,000 ohms and 0-20 meg.; DC ma, 0-0.1-10-100; DC amps, 0-1-10; Decibels, −30 to +63 in six ranges. Moisture-resistant film-type resistors for extreme accuracy. Carefully engineered circuit design achieves high sensitivity and extremely versatile application. Kit includes all parts, battery, test leads and black bakelite case with highly legible white markings; size 6¾ x 5¼ x 3¾". Easy to assemble. Shpg. wt., 5 lbs.

Model Y-140. Net only..... **$29.50**

knight-kit High-Gain Signal Tracer Kit

Model Y-135 $26.50

A remarkable value in an easy-to-build instrument which permits visual and aural signal tracing of RF, IF, video and audio circuits. Has *highest gain in its price class.* Traces signal from antenna to speaker. Reproduces signal at plate or grid connection of any stage. Identifies and isolates "dead" stages. Features: usable gain of *91,000;* "magic eye" with calibrated attenuators for signal presence indication and stage-by-stage gain measurements; built-in 4" PM speaker; combination 2-position probe, one for RF (6 mmf. input), the other for audio. Provides noise test; built-in watt-meter calibrated from 25 to *1000 watts;* provision for external scope or VTVM. Binding posts provide output transformer and speaker substitution test, plus external 280 volts B+. With all parts, tubes and probe. 7x10x5". 12 lbs.

Model Y-135. Net only..... **$26.50**

knight-kit 5" Wide-Band Oscilloscope Kit

Model Y-144 $69.00

Only $6.90 down

- 5 mc Width for Color TV
- Horizontal Sweep to 600 kc
- 25 mv/inch Sensitivity
- Z-Axis Input
- Printed Circuit Construction

Equals or betters the performance of commercially wired scopes costing far more. Two printed circuit boards and laced wiring harness assure wiring accuracy and cut assembly time. Ideal for lab use, color TV servicing and high frequency applications. Wide sweep range—*15 to 600,000 cps.* Vertical response, ± 3 db, 5 cps to 5 mc; only 1 db down at 3.58 mc color burst. High vertical sensitivity of .025 rms v/inch. Input capacity, 20 mmf. Outstanding features: cathode follower inputs; 2nd anode provides 1400 volts high-intensity trace; push-pull amplifiers; positive and negative locking; frequency-compensated attenuator; Z-axis input; one volt P-P calibrating voltage; astigmatism control; retrace blanking circuit; DC positioning control. Includes CRT. 14½ x 9½ x 16". 40 lbs.

Model Y-144. Net only..... **$69.00**
Y-148. Demodulator Probe. Net..... **$ 3.45**
Y-147. Low Capacity Probe. 12 mmf. Net.... **$ 3.45**

Voltage Calibrator Kit

$12.75

Permits use of any scope as precision peak-to-peak AC voltmeter. Puts a true square-wave voltage on scope screen. Selects any voltage between .01 and 100 volts; feeds external signal direct to scope for instant comparison. Shpg. wt., 5 lbs.

Model Y-136. Net only..... **$12.75**

knight-kit 5" General-Purpose Scope Kit

Model Y-146 $42.00

Only $4.20 down

- Phantastron Linear Sweep
- 25 mv/inch Sensitivity
- Printed Circuit Board
- Retrace Blanking Circuit

Feature for feature the world's best oscilloscope kit value. A standout in its class with all these fine features: *Printed Circuit* wiring board and laced harness for quick, error-free assembly. *Phantastron Sweep Circuit* for high linearity of sweep from 15 to 150,000 cps. *25 Millivolts Per Inch Sensitivity*—3 times that of similarly priced scope kits. *Calibration Voltage*—1 volt peak-to-peak square wave, fully regulated. *Vertical Amplifier*—frequency response ± 3 db, 3 cps to 1.5 mc (± 6 db to 2.5 mc). Includes: Directly coupled positioning controls; retrace blanking circuit; frequency-compensated vertical input attenuator; positive and negative internal sync; high 2nd-anode voltage for high-intensity trace; input capacity, 45 mmf. Kit includes CRT. 9½ x 13¾ x 17¾". 26 lbs.

Model Y-146. Net only..... **$42.00**

Resistance Substitution Box

$5.95

Easily determines resistor values required in a circuit. Makes available 36 standard 1-watt resistance values in 2 ranges between 15 ohms and 10 megohms, with 10% accuracy. Slide switch selects range; 18-position switch for value selection. Shpg. wt., 2 lbs.

Model Y-139. Net only..... **$ 5.95**

Capacitance Substitution Box

$5.95

Makes it easy to find capacitor values needed in a circuit. Provides 18 standard values from .0001 mfd to .22 mfd, ± 20%. All values are 600 volt, except .15 and .22, which are 400 volt. 18-position selector switch. Shpg. wt., 2 lbs.

Model Y-138. Net only..... **$ 5.95**

Audio Generator Kit

$31.50

Excellent design; range, 20 cps to 1 mc; less than .25% distortion; 600 ohm output. Ideal for hi-fi testing; offers the flat response of a lab standard. Shpg. wt., 16 lbs.

Model Y-137. Net only..... **$31.50**

R/C Tester Kit

$19.50

Measures capacitance and resistance. Balanced-bridge circuit; indicates power factor; tests capacitors at rated voltage. Large, easy-to-read dial and "magic eye." Shpg. wt., 10 lbs.

Model Y-124. Net only..... **$19.50**

EASY TERMS AVAILABLE

Take advantage of the most liberal Easy Pay plan in electronics. On Knight-Kit orders totaling $45 or more—just 10% down, small monthly payments thereafter. Low carrying charges—no "red tape."

knight-kits FOR THE RADIO AMATEUR

knight-kit All-Band Amateur Receiver Kit

Model Y-726

$104.50

Only $10.45 down

- Tunes 540 kc to 31 mc
- Built-In Q-Multiplier
- Constant Running HF Oscillator
- Worthy of the Advanced Ham Operator
- Printed Circuit Bandswitch
- Printed Circuit Board
- 1.5 μv Sensitivity

A sensational communications receiver value with all the selectivity, sensitivity and features of high-priced commercial units. Uses printed circuitry throughout, including the exclusive new KNIGHT-KIT printed circuit bandswitch, for remarkably easy assembly. Covers 540 kc to 31 mc in 4 ranges; calibrated, electrical bandspread on 80-10 meter Ham bands; slug-tuned Hi-Q coils; continuous, VR tube-regulated B+ applied to HF oscillator lets you switch from standby to receive with no drift; built-in Q-multiplier peaks desired signal or nulls interference; delayed AVC; provision for crystal calibrator (below). Sensitivity, 1.5 microvolts for 10 db signal-to-noise ratio. Selectivity: variable from 300 cps to 4.5 kc at 6 db down. Exalted BFO injection. Controls: Main tuning, bandspread, band selector, Q-multiplier selectivity, Q-multiplier tune, null-off-peak, BFO pitch, RF gain, AF gain, BFO-MVC-AVC-ANL, off-stby-rec-cal, antenna trimmer, and phone jack. Cold-rolled 1/16" steel chassis. Handsome metal cabinet, 10 x 10 x 16½". (Less phones, 8-ohm loudspeaker and S-meter.) 23 lbs.

Model Y-726. Amateur Receiver Kit. Net..... **$104.50**

Y-727. S-Meter Kit for above. 1 lb. Net..... **$9.50**

knight-kit 50-Watt CW Transmitter Kit

Model Y-255

$38.95

Only $3.89 down

- Ideal for the Novice
- Pi Antenna Coupler
- Bandswitching—80 to 10 Meters

There's exceptional value in this very popular bandswitching transmitter kit. Compact and versatile, it's the perfect low-power rig for the beginning novice as well as the seasoned veteran. Has bandswitching coverage of 80, 40, 20, 15 and 10 meters. Rated at 50 watts—actually operates at up to 60 watts on 80 and 40 meters. Oscillator is efficient 6AG7; final is reliable 807. Crisp, clean, cathode keying of oscillator and final. Built-in pi coupler permits use with random length antennas. Has highly effective TVI suppression. Other features not usually found in transmitter kits at this low price include: Ceramic-insulated final tank capacitor; pre-assembled switches; pre-wound parasitic chokes; ceramic coil forms; coax connector; crystal and VFO socket on front panel; power take-off jack for accessory equipment. Meter reads either plate or grid current of final. Takes crystal or VFO without circuit changes. Cabinet interior and chassis are copper-finished. Size, 8½ x 10½ x 8¼". With tubes and all parts for easy assembly. (Less crystal and key.) Shpg. wt., 19 lbs.

Model Y-255. 50-Watt Transmitter Kit. Net only..... **$38.95**

knight-kit Self-Powered VFO Kit

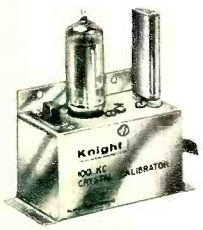
Model Y-725

$28.50

Only $2.85 down

Complete with built-in power supply! Careful design and voltage regulation assure high stability. Excellent oscillator keying characteristics for fast break-in without clicks or chirps. Full TVI suppression. Has plenty of bandspread; separate calibrated scales for 80, 40, 20, 15, 11 and 10 meters; vernier drive mechanism. 2-chassis construction keeps heat from frequency determining circuits. Output cable plugs into crystal socket of transmitter. Output: 40v on 80, 20v on 40. With Spot-Off-Transmit switch for spot frequency tuning. Extra switch contacts for operating relays and other equipment. Attractive metal cabinet, 8¾ x 6 x 6". Ready for easy assembly. Shpg. wt., 8 lbs.

Model Y-725. VFO Kit. Net only..... **$28.50**



knight-kit 100 Kc Crystal Calibrator Kit

Model Y-256

$10.50

Crystal frequency standard at very low cost. Gives marker every 100 kc up to 32 mc. A "must" for marking band edges. Mounting flanges for installation in or back of receiver cabinet. Size only 1½x 1½x3". Requires 6.3 v. at 0.15 amp and 150-300 v. DC at 3-6 ma. Trimmer for zero-beating with WWV; On-Off switch. Complete with tube, crystal, all parts and easy-to-follow instructions. Shpg. wt., 1 lb.

Model Y-256. 100 Kc Crystal Calibrator Kit. Net only..... **$10.50**

knight-kit Amateur RF "Z" Bridge Kit

Model Y-253

$5.85

Measures standing wave ratio (SWR) and impedance of antenna systems; ideal for adjusting antenna systems for optimum results. Measures impedances from 20 to 400 ohms up to 100 mc; SWR to 150 mc. Any VOM may be used for null indicator. With coax input and output connectors. Meters both input and bridge voltage. Calibrated dial gives direct impedance reading; includes 1% precision resistor for precise calibration adjustment. With all parts and handy plasticized SWR chart (less meter). 2½ x 3 x 4½". Shpg. wt., 1½ lbs.

Model Y-253. "Z" Bridge Kit. Net only..... **$5.85**

ORDER BLANK ALLIED RADIO 100 N. WESTERN AVE., CHICAGO 80, ILL.

ALLIED RADIO, Dept. RE, 100 N. Western Ave., Chicago 80, Ill.

Ship me the following KNIGHT-KITS:

Quantity	Description	Model No.	Price

$.....enclosed. (For parcel post, include postage—express is shipped collect).

☐ My Down Payment in the amount of $..... is enclosed. Send Time Payment form.

Name.....

Address.....

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

ALL PRICES NET F. O. B. CHICAGO

Our 37th Year

FREE 1958 404-PAGE ALLIED CATALOG

See the 1958 ALLIED 404-Page Catalog for complete listings of more than 50 KNIGHT-KITS, covering Hi-Fi, Hobby, Test Instrument and Amateur Kits. The 1958 ALLIED Catalog is your complete Buying Guide to the world's largest stocks of everything in Electronics.

☐ Send FREE 404-Page 1958 ALLIED Catalog.

Stereo Head and Preamp

(*Continued from page 54*)

have adjusted the head's azimuth alignment previously.

Stereophonic Set-up

This completes the preliminary adjustment of your stereophonic reproducer. Now all you need are two medium-power power amplifiers and two loudspeaker systems. For best results, the power amplifiers and speakers should be identical. This can easily prove to be expensive, which is why the author is currently completing the construction of an extremely simple and inexpensive high-quality dual-channel power amplifier.

However, the high cost of two power amplifiers and speaker systems need not discourage you, for there is a simple interim solution. That is the use of headphones for binaural listening and the use of your current single-channel hi-fi system for listening to one channel of stereophonic tapes.

The *Brush* Model 205 "A-1" crystal headphones have excellent frequency response and sell for around $14.00. Replace the headphone's cord with two single-headphone cords and a three-pin phone plug and you have an excellent, inexpensive binaural monitor.

Connect the stereophonic preamp to two power amplifiers and speakers, or headphones, and turn the preamp's gain control full on. Adjust the hum balance control for minimum.

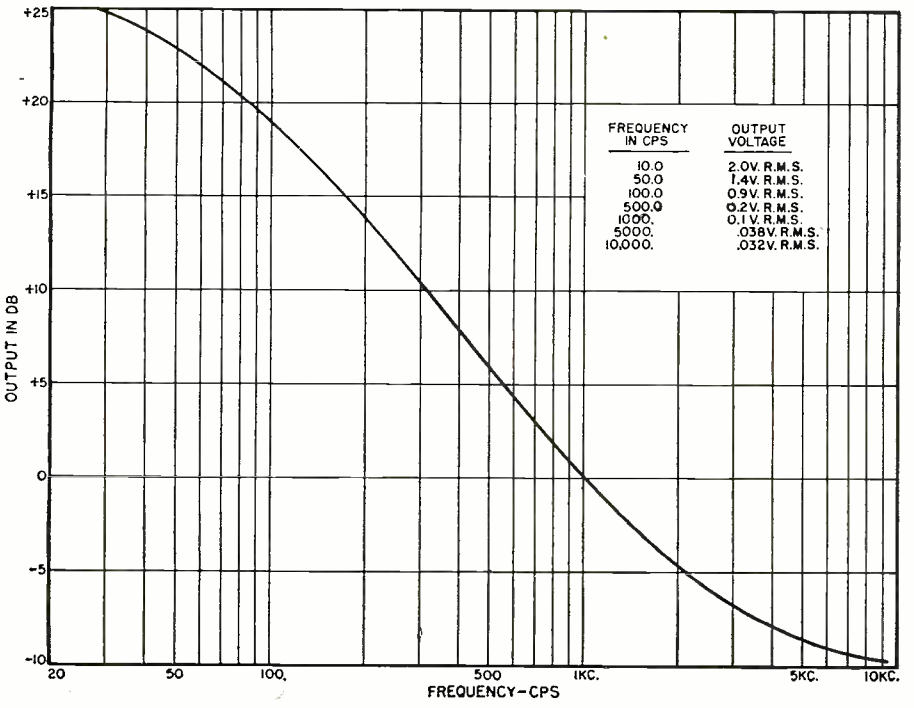
If you are using loudspeakers, place the speakers in two adjacent corners in the listening room, keeping the speakers as flat against the wall as possible. At one time it was suggested that the speakers be angled toward the center of the room, but much better results are obtained with the speakers flat against the wall. A little experimentation will quickly determine the best position for your loudspeakers.

Now comes the most essential item . . . stereo tape. Load your "new" stereo tape player with a stereophonic tape and set the balance control in the center. If the sound appears too loud from either side, adjust the balance control until the sound is evenly distributed between the two channels.

If your tape lacks high-frequency response, either the "TLD" head's azimuth alignment has not been properly set or the preamp is not set to the NARTB playback curve. Check these two adjustments. If the sound has too much hum, either the hum balancing control has not been adjusted or the head itself is picking up hum from the recorder's motors. If the hum stops when the motors are turned off, the motors are causing your trouble. To correct this, you should install Mumetal shielding about the head. To determine the proper location of the shielding, connect a small piece of Mumetal to the preamplifier's case with a short piece of wire and experiment with this shielding until you find a location that yields minimum hum. Then mount a piece of Mumetal in this position permanently. The "TLD" head has built-in magnetic shielding, so you should not normally experience hum pickup problems.

There you have it! You have constructed a piece of equipment that will yield endless hours of enjoyment. The sound is truly fabulous. In no time at all you'll be spoiled and almost refuse to listen to single-channel sound again. It's that good. The sound has a depth, clarity, and spatial presence that cannot be duplicated by any single-channel system. —30—

Fig. 6. Graph below shows the standard NARTB playback curve for tape recorders.

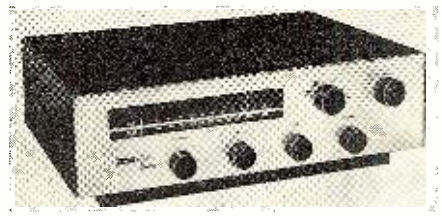


Hi-Fi-Audio Product Review

FM TUNER-AMP-PREAMP

Harman-Kardon, Incorporated, 520 Main St., Westbury, N. Y. has recently introduced its new "Guide Line" of hi-fi components which have been priced in the "economy" class.

The line consists of an FM tuner, an amplifier, and a three-in-one unit which incorporates an FM tuner, pre-amp, and amplifier on a single chassis.



This latter unit, known as "The Sonata", Model FA-10, provides 10 watts output with a peak power of 16 watts. Output impedances of 8 and 16 ohms are provided. Frequency response is 15 to 30,000 cps at 2 watts and 45 to 20,000 cps at 10 watts. The chassis carries a total of six controls (function, loudness-on-off, FM tuning, treble, bass, and contour). There are three loudness contour positions.

For complete information on the Model FA-10 or the other two units in the new line, write the manufacturer direct.

STRAIGHT FM TUNER

De Wald Radio, a division of *United Scientific Laboratories, Inc.,* 35-15 37th Avenue, Long Island City 1, N. Y. is now offering a straight FM tuner as the Model N-804.

The instrument features "Micro-matic" beam tuning, separate tape and multiplex outlets, a.f.c., increased sensitivity, and good over-all performance. The unit is housed in a cage of telephone black with a gold face plate.

Write the company direct for full specs and price.

IMPORTED TURNTABLE

Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. is now importing a professional type turntable with hysteresis-synchronous motor, the PK-225.

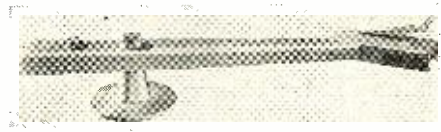
The new unit has wow and flutter of less than .2%; a 4-pound, 12-inch turntable with extra-heavy flywheel rim; rumble and noise 50 db below average recorded level; integrated speed control for 33⅓, 78, and 45 rpm; and two heavy duty idlers.

The turntable rides on a single ball thrust bearing floating on a thin film of oil. It has a free-floating, shock-mounted motor, rubber cushion shock-mounts, and automatic idler disengagement. The turntable is designed for 60-cycle operation at from 105 to 130 volts. It comes with a cork and rubber mat, a 45 rpm adapter, and a strobe disc. Write the U. S. distributor for full details and price.

"MICRO-BALANCED" TONE ARM

The Gray Manufacturing Company, Arbor St., Hartford, Conn. is now offering a new "Micro-Balanced" dual viscous damped tone arm, the Model 212.

Featuring sealed viscous damping on both vertical and horizontal pivots for better tracking and lower resonance; complete static balance for



maximum tracking stability; ability to handle all records up to 12" in diameter; adjustable stylus force from 0 to 15 grams, the new unit can be used with all popular cartridges. The cartridge slide plugs in for easy removal of the cartridge and slide assembly.

A four-color booklet outlining the advantages of this tone arm is available from the manufacturer on request.

ORGAN-PHONO UNIT

Thomas Organ Company, 8345 Hayvenhurst Avenue, Sepulveda, California is now marketing its "Overture" model organ with a hi-fi phono system housed in the same cabinet.

The two instruments may be played together or separately. An advanced amateur can play along with his favorite records or a novice can learn to play the organ using the specially prepared lesson-plan LP records offered by the firm.

The organ features a full 49-note keyboard of four octaves, F to F. A 13-note, 16-foot pitch radial arc pedal bass with a range of C to C produces rich, undistorted bass notes. The organ has five voices: diapason, reed, flute, string, and horn which are completely independent of each other and continuously variable. A headset out-

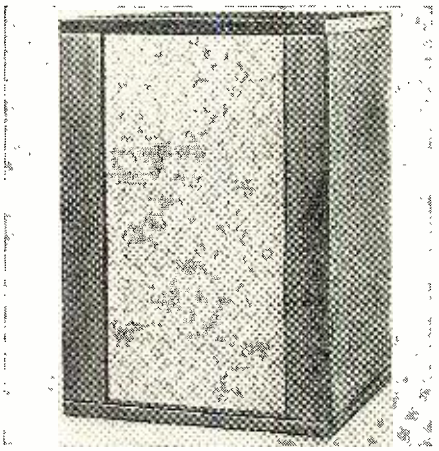
let permits "private practice" or private listening, if desired.

The phono turntable is an automatic four-speed changer equipped with a ceramic turnover cartridge. The company will supply full specifications on request.

KLIPSCH "MODEL H" SPEAKER

Klipsch and Associates of Hope, Ark. has recently introduced its first non-horn, non-corner design, the "Model H".

This speaker, being small, is deliberately limited to about 100 cps at the bass end to retain clarity and freedom from distortion in the all-important



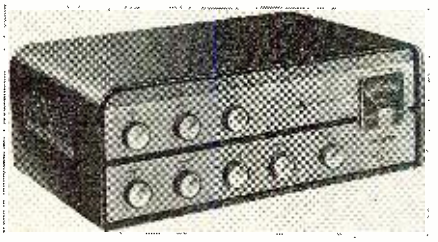
middle and upper range. It is applicable wherever a small speaker may be used and is compatible with other speakers in the company's line. It may also be used for the second or third channel of a stereo system. Over-all dimensions of the Model H-8, for instance, are only 11″ x 12″ x 16″.

Details on how to obtain 3-channel stereo from a 2-track source, together with data on the "Model H" are included on a single-page spec sheet which is available from the manufacturer without charge.

35-WATT P.A. AMPLIFIER

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill. is now marketing a new 35-watt p.a. amplifier as the Model KN-3035 deluxe unit.

Designed to handle the most critical professional requirements in medium-duty public address applications, the KN-3035 includes ample input,



output, and control facilities; delivers substantial power output; and offers many features which contribute to its versatility. It is *UL* approved and is guaranteed for one year.

The amplifier has a vu meter, six inputs (each with its own volume control), bass, treble, master volume, and on-off controls as well as a microphone/magnetic switch which cuts out

one of the microphone inputs when a magnetic phono pickup is being used.

Speaker taps for 4, 8, 16, 250, and 500 ohms as well as for 70.7 volt lines are provided. Frequency response is ± 2db from 20 to 20,000 cps. Distortion is 2% at 35 watts.

WALL-PLATE AUDIO CONTROLS

Vidaire Electronics Mfg. Corp. of Baldwin, N. Y. is now offering a complete line of L-pads, T-pads, faders, and switches mounted on wall or panel plates.

Five finishes are being offered so that the units will fit the decor of any home; brass satin, chrome satin, polished chrome, ivory wrinkle, and brown wrinkle with decorative knobs to match.

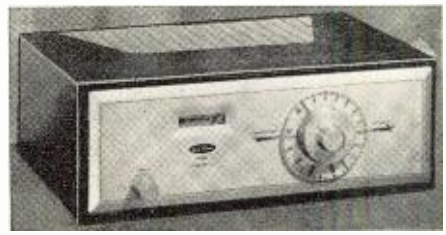
The plates are designed to fit the standard electric wall boxes for installation in new construction or finished homes or may be installed on the front panel of the hi-fi cabinet.

The L-pads and T-pads are constant impedance controls to vary the level of any speaker with impedances of 8 or 16 ohms.

NEW MODEL FM TUNER

H. H. Scott, 111 Powdermill Road, Maynard, Mass. is now offering a new version of its 311 FM tuner as the 311-C.

Sensitivity is now 2 microvolts for 20 db of quieting and achieved through use of the firm's silver-plated front end. The circuit incorporates



the company's wide-band design which increases selectivity and reduces co-channel and adjacent interference.

The tuner has a planetary drive tuning mechanism with edge-lighted lucite dial for both quick and vernier tuning. It also has a signal strength meter for precise tuning.

A complete technical bulletin on the 311-C is available on request from Department P of the company.

"ECHO CHAMBER"

Hi-Fi Headquarters of 150 E. 46th St., New York, N. Y. is handling the distribution of a new professional, portable echo chamber which was developed by Dr. W. Kuhl of the *Rundfunktechnisches Institut* of Nuremberg, Germany.

Designated as the EMT 140, the chamber measures 8 feet, 2½ inches by 1 foot, 11 inches, by 4 feet, 3 inches and uses a 115-volt power supply. Input level is 1.55 volts and output level is 1.55 volts. Reverberation time is between 1.2 and 6 seconds. The device offers a range of between 30 and 12,000 cps, gives distortion free output, gradual decay of reverberation, and is adaptable for special effects, symphonic program material, or jazz.

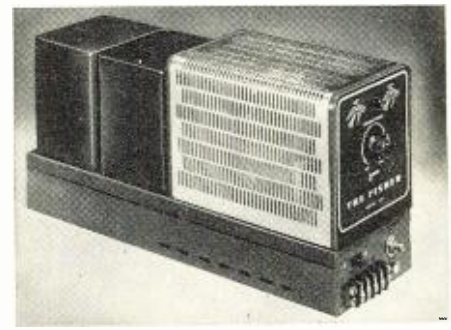
The U. S. distributor will supply full details and prices on the echo chamber upon request.

NEW FISHER AMPLIFIER

Fisher Radio Corporation, 21-21 44th Drive, Long Island City 1, N. Y. has added a 30-watt amplifier to its line of hi-fi equipment and designated the new unit as the "100".

Designed to supply 30 watts in continuous sine-wave operation, with constant response over the entire range of hearing, the amplifier offers a reserve peak power of 70 watts and is capable of driving even the lowest efficiency speaker system.

Over-all stability is provided by controlled frequency response above



and below the audible range. Harmonic distortion is less than 1% at 30 watts, IM distortion is less than 1% at 30 watts peak, and hum and noise are inaudible.

The "100" features a push-pull amplifier stage with three feedback loops that assure low internal impedance, extremely low distortion, and over-all balance. The company's exclusive "Z-Matic" variable damping factor control has more than adequate range to cover all known speakers. An impedance matching switch permits use of the amplifier with 4, 8, and 16 ohm speaker systems.

NEW POCKET RECORDER

Mohawk Business Machines Corporation, 944 Halsey St., Brooklyn 33, N. Y. has just released a transistorized version of its "Midgetape" as the #300.

Having essentially the same size and appearance as the original battery operated pocket-size recorder, the #300 is operated by four transistors instead of tubes. In addition to increasing the efficiency and battery life, transistorization provides extra space for a tiny, self-contained loudspeaker —available as optional equipment— which permits high volume playback.

Other features of the recorder include a battery life indicator, cartridge loaded tape, instant warm-up, governor-controlled motor for con-

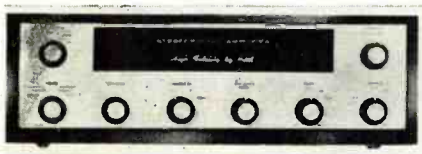
stant recording speed during battery life, and a visual elapsed-recording-time indicator.

Department AR of the company will supply complete specs and prices.

STEREO PREAMP-AMP

Pilot Radio Corporation of Long Island City 1, N. Y. has added a stereo preamp-control amplifier, the Model SM-244, to its line of audio components.

The new unit is a complete stereo system with self-contained bi-channel preamp. It consists of two power am-



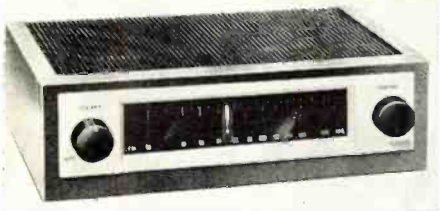
plifiers rated at 14 watts each at less than 1% distortion. It is housed in a brushed brass and burgundy metal enclosure and features bass and treble controls, loudness and volume controls. Inputs are provided for stereo FM-AM broadcasts, stereo tape, stereo discs, microphones, and auxiliary. There is a separate output for making stereo tape recordings.

The Model SM-244 may be used for monaural work as well as stereo. Dimensions are 4 13/16" x 14 11/16" x 12¼".

EICO FM TUNER

Electronic Instrument Company, Inc., 33-00 Northern Blvd., Long Island City 1, N. Y. has added an FM tuner to its *EICO* line of equipment in kit and wired form.

Designated as the HFT 90 FM tuner, the front end of the new unit is pre-wired and pre-aligned to provide drift-free performance. Center-of-



channel tuning is provided by a precision "eyetronic" neon indicator while the sensitivity of the circuit provides good reception even in fringe areas.

Other features of the new circuit include flywheel tuning, a.g.c., stabilized low-limiting threshold for weak signal reception, broadband ratio detector for improved capture ratio and easier tuning, full-wave rectifier and heavy filtering, and low distortion.

The tuner measures 3⅝" x 12" x 8¼". A cover is available optionally at small additional charge. Write the company direct for prices on both the kit and wired versions of this tuner.

NEW TURNTABLES

Collins Radio Company of Cedar Rapids, Iowa is now offering two new turntables in its broadcast product line.

Both the TT-200 with a 12" turn-

table and the TT-400 with a 16" turntable are available with either a four-pole or synchronous motor.

Built of heavy cast aluminum, the non-magnetic turntable features a three-speed gear shift selector; a

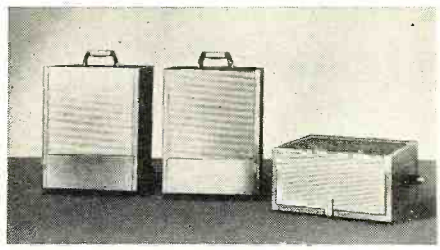
double-ball thrust bearing which decreases wow and rumble; and an indentation for 7" 45 rpm records with no spindle adapter required.

The synchronous models have a reverse switch for cueing. The turntables are finished in a blue gray wrinkle to match the coloring of the other products in the firm's broadcast line.

BELL'S STEREO SYSTEM

Bell Sound Systems, a division of *Thompson Products, Inc.,* 555 Marion Road, Columbus 7, Ohio has added a portable stereo system to its line of high-fidelity equipment as the Model T-2075.

The tape transport provides convenient half-track monaural recording and playback as well as stereo record and playback in either the in-line



or offset head arrangements. A stereo selector switch provides this feature. Recording characteristics conform to the NARTB standard. Frequency response for both record and playback is claimed to be 20 to 10,000 cps ± 2 db with useful response to 20,000 cps.

The matching amplifier-speaker systems are designed to be used with a radio tuner and record player as well as with the tape machine. Each system is equipped with a fully rated 10 watt push-pull amplifier having a frequency response of 20 to 20,000 cps ± 1 db. Each unit has three input positions and four controls.

AUDIO CATALOGUES

UNIVERSITY SPEAKER SYSTEMS

University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N. Y. has just released a 4-page brochure covering its complete line of high-fidelity speaker systems and factory assembled enclosures.

The brochure illustrates how the most advanced acoustic design principles can be combined with good cab-

inet styling to enhance home decor. Each model is shown in an actual room setting. Both design and styling features and acoustical design details are covered in the publication. Available finishes and prices of each speaker system are also included.

HARMAN-KARDON CATALOGUES

Harman-Kardon, Inc., 520 Main St., Westbury, N. Y. is offering two new catalogues without charge to interested persons.

The first is a two-color folder which illustrates the company's complete custom, standard, and deluxe lines of tuners, amplifiers, and tuner-amplifier combinations. The second sheet includes information on the new "Guide Line" series of economy audio gear.

Complete specifications and illustrations are included. Copies of either or both of these catalogue sheets are available from Dept. L of the company.

MASCO PRODUCTS

Mark Simpson Manufacturing Co., Inc., 32-28 49th St., Long Island City 3, N. Y. has issued a 12-page catalogue covering its line of sound and intercom equipment.

Pictured and described are portable amplifier systems, mobile sound units, amplifiers and booster amplifiers, high-power p.a. systems, mixers and preamps, converters, and sound system accessories.

PEERLESS AUDIO TRANSFORMERS

A new 12-page catalogue describing its full line of tranformers is now available from *Peerless Electrical Products*, 6920 McKinley Ave., Los Angeles 1, Calif.

Designed for use by professional and hobbyist designers and builders of hi-fi, broadcast, and recording equipment, the new catalogue provides specifications, performance curves, application data, and prices on transformers for all audio applications.

"SPLIT/KITS"

Transvision, Inc. of New Rochelle, N. Y. has issued a 20-page general catalogue which lists, among other things, its line of hi-fi kits, cabinets, records, and test equipment.

The catalogue pictures and describes an intercom system, preamps, amplifiers in various power ratings, record changers, AM-FM tuners, speakers systems, equipment and speaker enclosures, etc.

HARTLEY FOLDERS

Hartley Products Co., 521 East 162nd St., New York 51, N. Y. has available new illustrated folders giving detailed information on the new polymerized and tri-polymer cones as used in the 217 full-range speaker and the *Hartley-Luth* "Holton" speaker system.

Details and illustrations of the entire line of cabinets, as well as some new designs are also included in the folders. —30—

SHIPPED ON APPROVAL

NO MONEY WITH ORDER

NO C.O.D.

Model TD-55 — TUBE TESTER . . . Total Price $26.95 — Terms: $6.95 after 10 day trial, then $5.00 per month for 4 months.

Superior's New Model TD-55

EMISSION TYPE TUBE TESTER

For the Experimenter or Part-time Serviceman, who has delayed purchasing a higher priced Tube Tester.
For the Professional Serviceman, who needs an extra Tube Tester for outside calls.
For the busy TV Service Organization, which needs extra Tube Testers for its field men.

Speedy, yet efficient operation is accomplished by: 1. Simplification of all switching and controls. 2. Elimination of old style sockets used for testing obsolete tubes (26, 27, 57, 59, etc.) and providing sockets and circuits for efficiently testing the new Noval and Sub-Minar types.

You can't insert a tube in wrong socket
It is impossible to insert the tube in the wrong socket when using the new Model TD-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

"Free-point" element switching system
The Model TD-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum.

Checks for shorts and leakages between all elements
The Model TD-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

Elemental switches are numbered in strict accordance with R.M.A. Specifications.
The 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

Complete with carrying case..... **$26.95 NET**

Model TW-11 — TUBE TESTER . . . Total Price $47.50 — Terms: $11.50 after 10 day trial, then $6.00 per month for 6 months.

Superior's New Model TW-11

STANDARD PROFESSIONAL TUBE TESTER

- Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, 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. **All elements are numbered according to pin-number in the RMA base numbering system.**
- Model TW-11 does not use 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. Printed in large, easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE

SEPARATE SCALE FOR LOW-CURRENT TUBES Previously, on 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 scale. The extra scale used here greatly simplifies testing of low-current types.

Housed in hand-rubbed oak cabinet... **$47.50 NET**

Model TV-12 — TRANSCONDUCTANCE TUBE TESTER . . . Total Price $72.50 — Terms: $22.50 after 10 day trial, then $10.00 per month for 5 months.

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

★ **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.

EXTRA FEATURE:
Model TV-12 Also Tests 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.

Housed in hand-rubbed oak cabinet... **$72.50 NET**

Model TV-40 — PICTURE TUBE TESTER . . . Total Price $15.85 — Terms: $3.85 after 10 day trial, then $4.00 per month for 3 months.

Superior's New Model TV-40

PICTURE TUBE TESTER

NOT A GADGET—NOT A MAKE-SHIFT ADAPTER, BUT A WIRED PICTURE TUBE TESTER WITH A METER FOR MEASURING DEGREE OF EMISSION—AT ONLY $15.85

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Test for open elements.

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

Only..... **$15.85 NET**

USE APPROVAL FORM ON NEXT PAGE

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.

NO INTEREST OR FINANCE CHARGES ADDED!

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

TRY FOR 10 DAYS

before you buy!

then if satisfactory pay in easy, interest free, monthly payments. See coupon below.

Superior's New Model 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER

Compare it to any peak-to-peak V. T. V. M. made by any other manufacturer at any price!

- Model 77 completely wired and calibrated with all accessories (including even portable carrying case) sells for only $42.50.
- Model 77 employs a sensitive six inch meter. Extra large meter scale enables us to print all calibrations in large easy-to-read type.
- Model 77 uses new improved SICO printed circuitry.
- Model 77 employs a 12AU7 as D.C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability.
- Model 77 uses a selenium-rectified power supply resulting in less heat and thus reducing possibility of damage or value changes of delicate components.
- Model 77 meter is virtually burn-out proof. The sensitive 400 microampere meter is isolated from the measuring circuit by a balanced push-pull amplifier.
- Model 77 uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

AS A DC VOLTMETER: The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

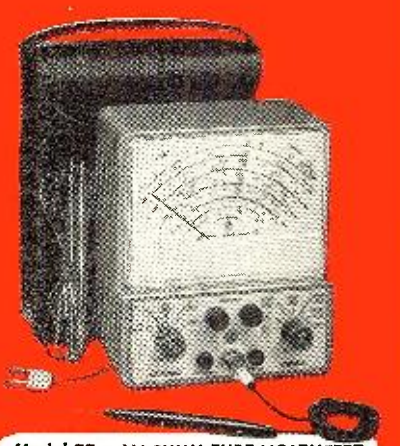
AS AN AC VOLTMETER: Measures RMS values if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading, intermittents are easily found, isolated and repaired.

SPECIFICATIONS

• **DC VOLTS** — 0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance. • **AC VOLTS (RMS)** — 0 to 3/15/75/150/300/750/1,500 volts. • **AC VOLTS** (Peak to Peak) — 0 to 8/40/200/400/800/2,000 volts. • **ELECTRONIC OHMMETER** — 0 to 1,000 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 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, probe and leads. Operates on 110-120 volt 60 cycle. Only ..... **$42.50** NET



Model 77 — VACUUM TUBE VOLTMETER . . . Total Price $42.50 — Terms: $12.50 after 10 day trial, then $6.00 per month for 5 months.

Superior's New Model 76

ALL PURPOSE BRIDGE

IT'S A CONDENSER BRIDGE IT'S A RESISTANCE BRIDGE IT'S A SIGNAL TRACER IT'S A TV ANTENNA TESTER

Specifications

CAPACITY BRIDGE SECTION
4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

RESISTANCE BRIDGE SECTION
2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

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.

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? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads ..... **$26.95** NET

Model 76 — ALL PURPOSE BRIDGE . . . Total Price $26.95 — Terms: $6.95 after 10 day trial, then $5.00 per month for 4 months.

Superior's New Model TV-50

GENOMETER

7 Signal Generators in One!

- R.F. Signal Generator for A.M.
- R.F. Signal Generator for F.M.
- Audio Frequency Generator
- Bar Generator
- Cross Hatch Generator
- Color Dot Pattern Generator
- Marker Generator

R.F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics
VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.
BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.
CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.
MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

Complete with shielded leads . . . **$47.50** NET

Model TV-50 — GENOMETER . . . Total Price $47.50 — Terms: $11.50 after 10 day trial, then $6.00 per month for 6 months.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-453, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligation.

Name .....

Address .....

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

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

- ☐ Model TD-55 .....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 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 TV-40 .....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model 77.....Total Price $42.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.
- ☐ Model 76.....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TV-50.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

Checker for Intermittent Tube Shorts

By **GEORGE W. COTTER**
Receiving Tube Dept.,
General Electric Co.

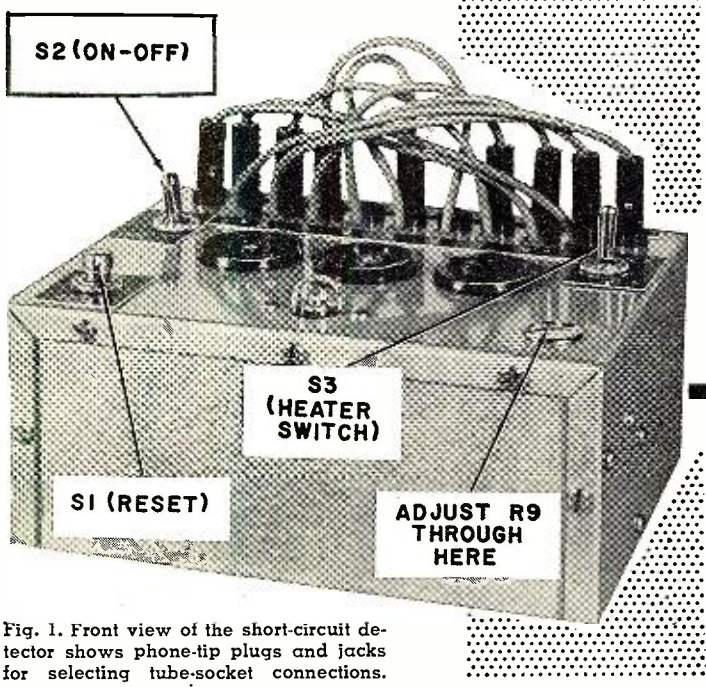


Fig. 1. Front view of the short-circuit detector shows phone-tip plugs and jacks for selecting tube-socket connections.

Fig. 2. Tube tapper made from #8 bottle cork, mounted on a short fiber rod.

Useful data about intermittent tube shorts turned up by tests; also, a special tube-short detector.

INTERMITTENT short circuits in vacuum tubes can be a source of erratic noise in electronic equipment of any kind but especially in mobile transmitters and receivers. Extensive laboratory and field tests prove that the seriousness of this short-circuit problem depends on the resistance and time duration of the shorts and also the amplitude of the shock that is being transmitted to the equipment.

It has been found that, with the receiving equipment on which tests were performed, only short circuits of less than 50,000 ohms resistance and greater than one millisecond in time duration resulted in objectionable, erratic noises. In the tests, the equipment was installed in a vehicle, which was driven at high speeds over extremely rough roads. A maximum shock of 5 G's (five times the force of gravity) was transmitted to the mixer stage of the receiving equipment in question under these conditions. Surprisingly enough, pressing the station-selector push-buttons on the receiver resulted in a shock of 15 G's, or three times as great! This provides an interesting clue to the possible shocks to which intermittent tubes may be subjected in presumably stationary equipment.

Since even the tubes installed in guided missiles are seldom subjected to shocks greater than 25 G's, 50 G's was established as the maximum shock likely to be encountered. Tests were then conducted with a special instrument, a type of accelerometer, to determine the amplitude of the shocks that could be administered to electronic tubes with the tools that are commonly found on the work bench. Such implements as a pair of long-nose pliers, a 12-inch screwdriver, a 6-inch Spintite wrench, an ordinary wooden pencil, and a specially made cork-tipped tapper were swung against the tube in a stroke of two to three inches.

Even with so short a stroke, the 12-inch screwdriver delivered a shock whose amplitude was measured at 1000 G's, far greater than that necessary for testing. The same may be said of the shocks delivered by the long-nose pliers and the Spintite wrench, each of which measured 650 G's. Tapping with the wooden pencil produced a 100-G shock, also more than is needed. Surely there is a moral here for those technicians who think it necessary to assault a tube to the breaking point while testing! The cork-tipped tapper, shown in Fig. 2, delivered the desired 50-G shock (75 G's maximum) with a 2-inch stroke. The tapper is made by gluing a No. 8 cork to one end of a 6-inch length of fiber rod having a diameter of ⅛ in. It makes a handy addition to any service technician's tool box.

It has already been noted that only those intermittent short circuits having a resistance of less than 50,000 ohms and a time duration of one millisecond or more produce objectionable noises. A useful short-circuit tester must be capable of detecting this small magnitude of short circuit, otherwise it will be of little value in tracing these erratic noises.

Short-Circuit Detectors

Many short detectors used in conventional tube testers employ a neon lamp and a negative d.c. voltage. A typical circuit is shown in Fig. 3. No current is drawn through the lamp until a short occurs. The tube elements are checked one by one as the switch is rotated. The sensitivity of this detector depends upon the firing voltage of the neon lamp and the applied d.c. voltage. When using an NE-45 neon lamp and d.c. voltage of 90 volts, a short of 50,000 ohms and one millisecond duration can be detected. This detector is the non-tripping type, so that the operator must observe the momentary flicker of the neon lamp when the short occurs.

An investigation of tube testers indicates many are not sufficiently sensitive to detect shorts of the magnitude discussed, while others are far too sensitive and detect leakage which does not cause erratic noises in the equipment. A suitable "triggering" type short-circuit detector, in which the indicator lamp remains lighted following even a single momentary short within the tube being tested, can be constructed from components usually

found in the service shop. This circuit, shown in Fig. 4, overcomes a principal disadvantage of the tube-tester short detector in Fig. 3, with which the operator must observe the momentary flicker of the neon glow lamp when a short occurs.

Operation of this circuit is quite simple. A 2D21 miniature thyratron control tube, connected across a 150-volt regulated d.c. source, triggers the NE-45 neon glow lamp which serves as the short indicator. The 2D21 normally is biased to beyond its plate current cut-off point by the voltage divider network which includes fixed resistors R_{10} and R_{11} plus the 5000-ohm bias adjustment potentiometer, R_9. Elements of the tube under test are connected between 33,000-ohm resistors (R_1 to R_7) in another voltage-divider network at the left side of the diagram. When a short occurs between adjacent tube elements, one of the 33,000-ohm resistors is shorted out, thus reducing the bias on the 2D21. This tube will then draw plate current through the neon lamp until the normally closed push-button switch is pressed. This extinguishes the neon lamp and resets the short tester until another intermittent short occurs.

Construction Details

A 3 x 5 x 7-inch "Minibox" (*Bud* CU-2108) was found to be a convenient chassis on which to build the short-circuit detector. The parts layout is not critical, but the locations shown in the top and bottom views, Figs. 1 and 5, respectively, are recommended. Mount a row of insulated phone-tip jacks along the rear edge of the top deck. The 33,000-ohm resistors in the voltage-divider network are assembled directly to the phone jacks.

The power-supply components were mounted in one corner. A small partition made from sheet aluminum serves as a mounting bracket for the 2D21 and 0A2 tube sockets. Sockets for testing only 7- and 9-pin miniatures plus octal-based tubes were included, since most present-day electronic equipment likely to come into the service shop uses only these tube types. A 12.6-volt center-tapped filament transformer provides voltage for both 6.3 and 12.6-volt tube heaters through a selector switch. A tube-tester type filament transformer and multi-point tap, multi-position selector switch can be substituted if tubes having other heater voltages are to be tested.

Leads running from the phone-tip plugs to the socket for octal-based tubes should be flexible, insulated, test-lead wire. Correspondingly numbered lugs on the 7- and 9-pin miniature tube sockets are then connected to the octal socket. Flexible lead number nine should be connected directly to that numbered lug on the 9-pin socket. Although leads and phone-tip plugs will of course be connected to all socket pins, for the sake of clarity only four have been shown in Fig. 4. All under-chassis wiring is done with insulated hook-up wire.

Using the Short Checker

The short checker should be tested and calibrated before it is put to use. After a wiring check, apply a.c. power. A pink glow should be noticed within the elements of the 0A2 voltage regulator tube. If the glow is not present, reduce the value of R_{12} until a glow in the 0A2 occurs.

Obtain a 51,000-ohm (or 47,000-ohm) and a 62,000-ohm resistor. Adjust calibration potentiometer R_9 so that the NE-45 neon lamp, PL_1, lights when the 51,000-ohm resistor is connected across one of the 33,000-ohm resistors in the checker, but does not light when the 62,000-ohm resistor is placed across a 33,000-ohm resistor. The checker is now ready for operation.

First consult the basing diagram for the tube to be tested and insert the numbered tip plugs into the jacks marked for the proper tube elements.

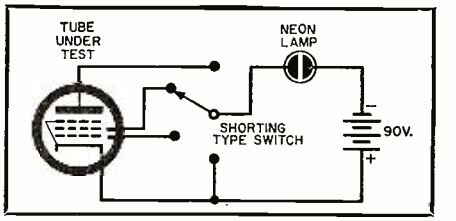


Fig. 3. Conventional short-detecting circuit used in typical tube testers.

Throw the heater-voltage switch to the correct position and insert the tube in the proper socket. Tap the tube and note whether the neon lamp lights. If it does, press the reset button, remove the tip plug from the *H* jack and tap the tube. If a short still is indicated, remove the *C* lead, press the reset button, and again tap the tube. Keep repeating this step while successively removing tip plugs until the short indicator no longer lights. This will determine the pair of elements between which the short circuit occurs. —30—

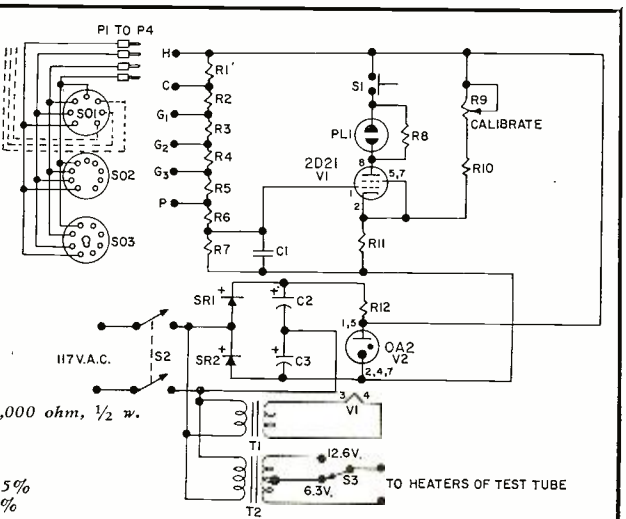


Fig. 4. Schematic diagram of the short-circuit detector, described in the text, which gives positive indication of momentary shorts.

R1, R2, R3, R4, R5, R6, R7—33,000 ohm, ½ w. res ± 5%
R8—470,000 ohm, ½ w. res.
R9—5000 ohm, 1 w. pot
R10—22,000 ohm, 1 w. res. ± 5%
R11—4700 ohm, 1 w. res. ± 5%
R12—7000 ohm, 5 w. res.
C1—.02 µfd., 200 v. capacitor
C2, C3—20 µfd., 150 v. elec. capacitor
S1—Push-button switch, normally closed
S2—D.p.d.t. switch
S3—S.p.d.t. switch
T1—Fil trans. 6.3 v. @ 1 amp
T2—Fil. trans. 12.6 v. center-tapped @ 1 amp.

SO1, SO2, SO3—Tube sockets (see text)
P1, P2, P3, P4, etc.—Phone tip plugs
SR1, SR2—65 ma., 130 v. selenium rectifier (Federal No. 1263A or equiv.)
PL1—NE-45 neon bulb
V1—2D21 thyratron control tube
V2—0A2/150 voltage regulator tube

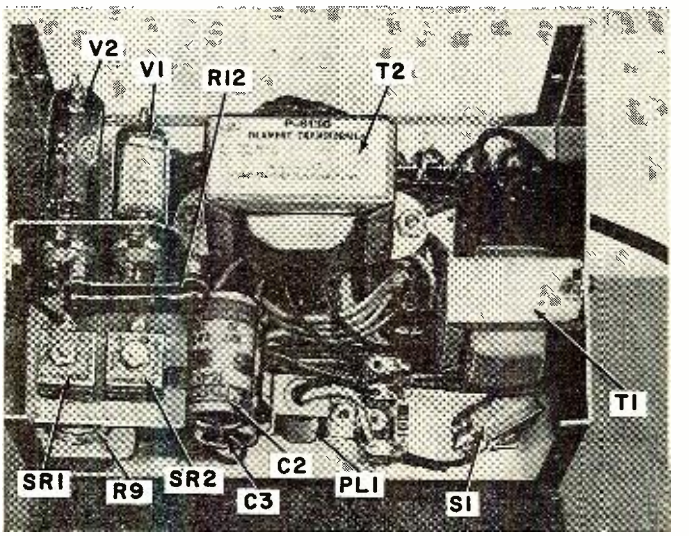


Fig. 5. Bottom view of the short-circuit detector. While layout is not at all critical, some constructors may wish to follow this plan.

New Tube Tester Data

Recent listings with which owners of Triplett tube checkers can keep roll charts up to date.

TRIPLETT MODEL 3423

TUBE TYPE	A	B	CDEFG	UP	DOWN	READS
6AM5/EL91	6.3	37	51753	3	124	1690
6BM8	6.3	47	53762	4	235	3900
6BM8 Test 2	6.3	23	61093	4	158	1625
6BW8	6.3	14	56892	4	567	3380
6BW8 Test 2	6.3	51	20016	4	25	Good
		Pin 7 also shows short				
6BW8 Test 3	6.3	51	20036	4	25	Good
		Pin 7 also shows short				
6CK4	6.3	56	53052	2	378	3250
		Pin 1 also shows short				
6CU8	6.3	25	58093	4	158	2050
6CU8 Test 2	6.3	16	57322	4	567	4050
		Pin 1 also shows short				
6CY7	6.3	26	67064	4	578	845
		Pins 2 and 3 also show short				
6CY7 Test 2	6.3	58	53013	4	359	3500
		Pins 2 and 3 also show short				
6DE7	6.3	52	67063	4	578	1300
		Pins 2 and 3 also show short				
6DE7 Test 2	6.3	57	52013	4	259	2925
		Pin 3 also shows short				
6DL7	6.3	*	64355	2	478	
		(*Eye closes - 78, opens - 0)				
6DL7 Test 2	6.3	*	64655	2	478	
		(*Eye closes - 50, opens - 0)				
6DQ5	6.3	50	514Y2	2	1367	6725
		Pins 4, 5, and 8 also show short				
6DS5	6.3	29	51652	3	124	3770
		Pin 7 also shows short				
8CX8	7.5	20	62033	4	125	2990
8CX8 Test 2	7.5	20	60896	4	567	Good
8CY7	7.5	26	67064	4	578	850
		Pins 2 and 3 also show short				
8CY7 Test 2	7.5	64	53012	4	359	3500
		Pin 2 also shows short				
9CL8	9.45	17	51022	4	135	3900
9CL8 Test 2	9.45	15	59762	4	589	3900
9EF6	9.45	43	55433	2	578	3250
10DE7	9.45	56	67063	4	578	1300
		Pins 2 and 3 also show short				
10DE7 Test 2	9.45	56	52013	4	259	4225
		Pin 3 also shows short				
12DE8	12.6	32	31864	4	159	320
12DE8 Test 2	12.6	46	20036	4	25	Good
12DK7	12.6	20	31373	4	125	3250
		Pin 8 also shows short				
12DK7 Test 2	12.6	89	20066	4	25	
		Good reads 25 Pins 1 and 8 also show short				
12DK7 Test 3	12.6	90	20096	4	25	
		Good reads 30 Pins 1 and 8 also show short				
12DW5	12.6	58	53193	4	357	3250
		Pin 6 also shows short				
12EM6	12.6	24	31363	4	125	3250
12EM6 Test 2	12.6	92	20096	4	25	
		Good reads 25				
12EN6	12.6	48	55432	2	578	5200
12EL6	12.6	9	31024	3	147	390
12EL6 Test 2	12.6	95	20056	3	47	
		Good reads 60				
12EL6 Test 3	12.6	95	20066	3	47	
		Good reads 60				
13DE7	12.6	55	67063	4	578	1300
		Pins 2 and 3 also show short				
13DE7 Test 2	12.6	55	52013	4	259	4225
		Pin 3 also shows short				
18AK5	19.6	20	51653	3	1247	3750
18AQ5	19.6	41	51653	3	124	2260
		Pins 1 and 7 also show short				
18J6	19.6	21	65023	3	457	3250
18J6 Test 2	19.6	21	66012	3	467	3250
EL84/6BQ5	6.3	18	52972	4	235	7300
		Pin 1 also shows short				
407A	19.6	16	53042	5	1239	3575
407A Test 2	19.6	15	57062	5	1789	3575
408A	19.6	19	51653	3	124	3250
		Pin 7 also shows short				
5641	6.3	16	30026	3	56	Good
		Pins 2, 4, and 8 also show short				
6883	12.6	66	553Y3	2	14567	2340
6887	6.3	50	20026	3	45	Good
6887 Test 2	6.3	50	20076	3	14	Good
6888	6.3	20	60686	2	3457	Good
6919	6.3	16	30026	3	45	Good
6919 Test 2	6.3	17	30076	3	14	Good

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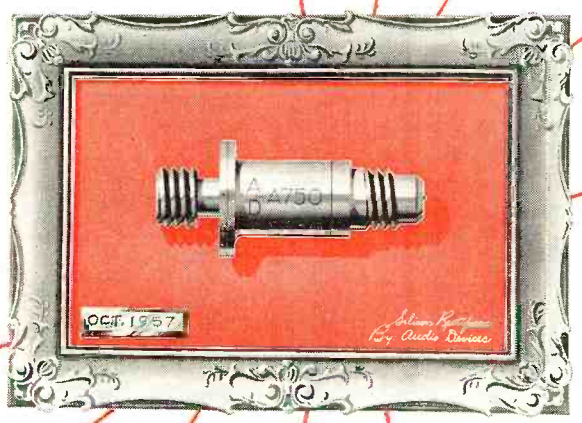
Full-wave Bridge

A-200
Repair Kit

THE *Masterpieces...*

A-750 Repair Kit



Five Pack

A complete universal line of Silicon Rectifier Repair Kits...to replace all Selenium Rectifiers in existing Radio / Television / and Electronic Devices

We invite you to see this universal screw-in/plug-in type Rectifier at your nearest distributor or write us direct for further information.

Inquire Dept. R/TV-4/58

AUDIO DEVICES, INC. Rectifier Division

620 EAST DYER ROAD · SANTA ANA · CALIFORNIA

RADIO-TV *Units Puzzle*

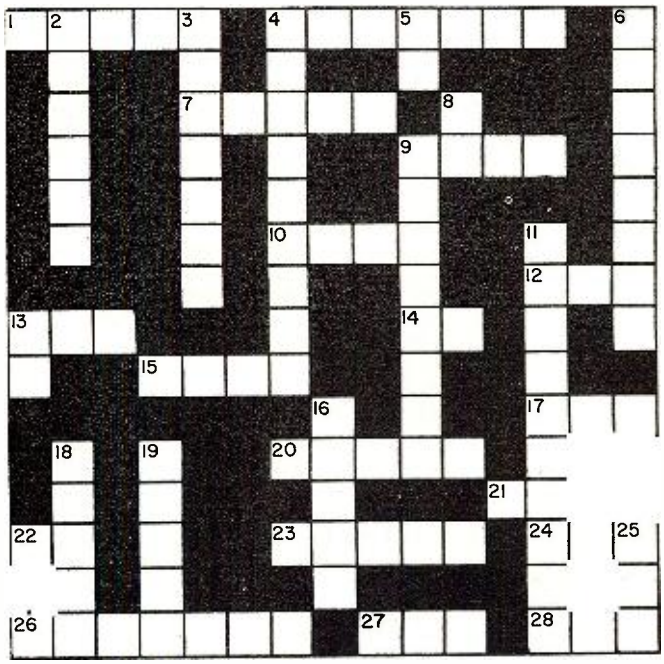
By JOHN A. COMSTOCK

HOW well are you acquainted with the innumerable units of measure found in the radio-TV-electronics field? To determine the scope of your units knowledge, work this interesting cross-units puzzle. If you are familiar with all of the units listed, your rating is truly *excellent!*

(*Solution on page* 171.)

ACROSS
1. The unit of capacitance.
4. The unit of magnetic flux.
7. The unit of measure for frequency.
9. This is the most commonly used unit of power consumption.
10. A unit which was named after its discoverer, and often used to indicate an amount of potential difference.
12. The unit of conductance.
13. A unit of electromotive force equal to one-thousand volts multiplied by one-ampere of current. (Abbr.)
14. The unit for measuring power or rate of work equal to 550-footpounds per second. (Abbr.)
15. The ——— candle is the unit of measure for light intensity.
17. The unit of magnetic reluctance.
20. The unit of inductance.
21. A unit of inductance equivalent to 1/1000 of a henry. (Abbr.)
22. A unit used to express the audio frequency power level in decibels above a reference level of 1-milliwatt.
23. Unit of wavelength equivalent to 39.37-inches.
24. Unit of resistance, reactance, and impedance.
26. A unit of magnetic intensity equivalent to the field strength at a distance of one centimeter.
27. Associated with tape recorders, the speed of the tape past the recording head per unit time. (Abbr.)
28. Associated with turntables and motors, speed of rotation. (Abbr.)

DOWN
2. Unit of current flow.
3. A unit of power ratio equal to 1/10th bel.
4. One-millionth of the basic unit of potential.
5. A unit used to express power consumption per hour. (Abbr.)
6. A unit equal to 1/10th of a millimicron commonly used to express the wavelength of light radiation.
8. The product of one-volt and one-ampere. (Abbr.)
9. Used to express power consumption with regard to time.
11. A unit equal to 3600-coulombs of electricity transferred by a current of one-ampere in one-hour.
13. One-thousand units of frequency. (Abbr.)
16. An electro-acoustic unit of power ratio.
18. Unit of work or energy equal to one-watt-second.
19. The unit of magnetic induction.
24. This unit is commonly used to express radio-frequency field strength. (Abbr.)



Within the Industry

(*Continued from page* 26)

created a new post of national jobber sales manager and named **STANLEY NEUFELD** for the job.

* * *

GEORGE M. ARISMAN, JR. has been appointed president and general manager of the *Mallory Battery Company,* a division of *P. R. Mallory & Co., Inc.*

He has been controller of the organization since 1955 and has been associated with the parent firm since October 1954. In his new capacity Mr. Arisman will be in complete charge of all plants and laboratories of the battery firm including those in North Tarrytown, N. Y.; Elmsford, N. Y.; Dubuque, Iowa; Memphis, Tenn.; and Cleveland, Ohio. Headquarters are in Cleveland.

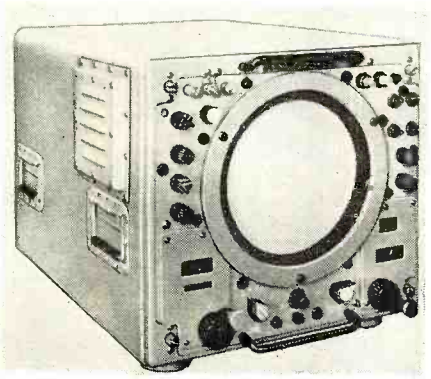
* * *

EDWARD J. QUIRK has just been appointed plant manager of the Lowell semiconductor plant of *CBS-Hytron.*

As the former works manager of *Clevite Transistor Products,* Mr. Quirk was responsible for organizing and directing from the outset the complete manufacturing and engineering operation for transistors and crystal diodes. Prior to this he was a senior product engineer at *Western Electric Company,* specializing in semiconductor products.

Mr. Quirk received his BS degree in physics at Georgetown University and took advanced electronics work at Harvard and M.I.T. —30—

Shown here is a transistorized radar indicator developed by Westinghouse for the U. S. Navy. The unit, a repeater for search radars, is currently being tried out aboard the U.S.S. Norfolk. The indicator has a built-in power supply and contains 57 transistors, 3 vacuum tubes (exclusive of the cathode-ray tube), and 7 magnetic amplifiers. It has a volume less than half that of the usual vacuum tube indicator, a total weight of only 180 lbs, and a power consumption less than one-quarter of that used by conventional indicators. Extensive use of printed circuit boards with plug-in connectors is expected to ease maintenance of the gear.



Miss-Distance Indicator Improves Navy Target Scores

Precision electronic device tells gunners how close missiles come to targets.

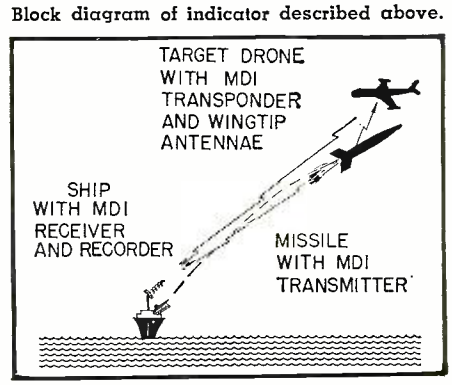
A PRECISION electronic device that tells anti-aircraft gunners how close their missiles come to the target has been perfected by scientists at the Naval Ordnance Laboratory, Silver Spring, Maryland.

Used both to develop better anti-aircraft weapons and to train missilry and gunnery crews, the newly disclosed "miss-distance indicator" makes it possible to determine the distance, in feet, by which a missile failed to hit its target. The MDI automatically records its findings on sensitized paper for immediate analysis. The system works with rockets, supersonic missiles, or conventional shells.

The MDI is composed of 3 basic radio components: a simple transmitter in the missile, a shipboard receiver-recorder, and an aircraft transponder which receives a radio signal from the missile transmitter on one frequency and retransmits it to the shipboard receiver on a different frequency.

When a missile is fired, its transmitter emits a steady, v.h.f. radio signal. As it approaches the target, the transponder within the target picks up the signal, changes its frequency, and sends the new signal to the shipboard receiver. At the same time the signal being sent out by the transmitter in the missile is picked up by the receiver. The receiver at that time is simultaneously intercepting two signals on different frequencies. Determination of the distance by which the missile missed the target is arrived at by means of an electronic measurement of the frequency difference between the two signals. The device is intended only for training since no enemy plane would oblige missile crews by mounting a suitable transponder. —30—

Block diagram of indicator described above.



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Send for your Free Copy today!

This is a brand new edition of the book which has launched thousands of men on good-paying careers in radio-TV-electronics.

It brings you completely up to date—answers important questions on newest career developments in electronics, including Radar, Guided Missiles, Servomechanisms, Computers, as well as Aeronautical Electronics, Broadcasting (AM, FM, TV), Military, Navy and CAA Electronics, Communications and Electronics Manufacturing.

This book, "Your Future in the New World of Electronics," also shows you how CREI Home Study leads the way to greater earnings in the booming electronics world.

However, CREI does not promise you a "snap." With accredited technical school curricula such as CREI offers, you must study to convert your ambition into technical knowledge which you can sell in the fabulous field of Electronics.

Since its founding in 1927, CREI has provided thousands of professional electronics men with technical educations. During World War II, CREI trained thousands for the Armed Services. Leading firms recommend CREI training for their own personnel. Among them: United Air Lines, Canadian Broadcasting Corporation, Trans-Canada Airlines, Douglas Aircraft Co., The Martin Co., Columbia Broadcasting System, All-American Cables and Radio, Inc., Gates Radio Co., Canadair, Ltd., Federal Electric Corp., and U. S. Information Agency (Voice of America).

CREI courses are prepared by recognized experts, in a practical, easily understood manner, and constantly revised to meet the new electronic challenges of our time. You get the benefit of time-tested study assignments under the personal supervision of a CREI staff instructor. Your studies are accomplished on your own time, during hours selected by you, and controlled by your own will power. This complete training is the reason that graduates find their CREI diplomas keys-to-success in even the most advanced of electronic applications. CREI alumni hold top positions in America's leading firms.

At your service is the CREI Placement Bureau, which helps to find positions for advanced students, and graduates, although CREI does not guarantee jobs. Now is the time of decision for you. Luck will not propel you forward unless it finds you trained. Contacts won't budge you an inch unless you have the skill to back them up. The answer is: Technical Training . . . and willingness to learn. Together they will bring you increased earnings in the new Age of Electronics. Fill out the postcard below *completely* and mail it now. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest —your future—is up to you!

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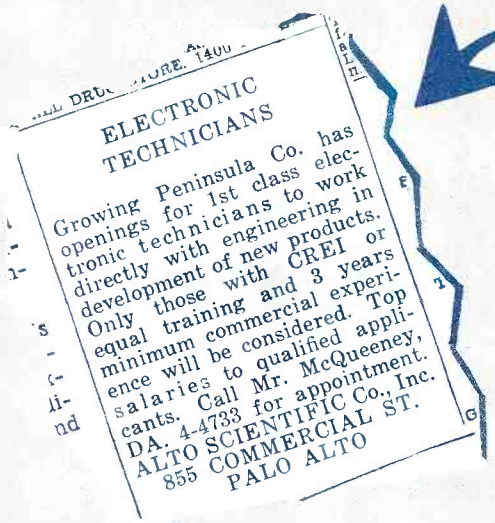

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Growing Peninsula Co. has openings for 1st class electronic technicians to work directly with engineering in development of new products. Only those with CREI or equal training and 3 years minimum commercial experience will be considered. Top salaries to qualified applicants. Call Mr. McQueeney, DA. 4-4733 for appointment.
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Here you see an actual help wanted ad from the San Francisco Examiner, one of many which specify "CREI or equal" training. This shows that industry approves CREI training, even insists on it.

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(R.N. Apr. 58)

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- ☐ Aeronautical Electronic Engineering Technology

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What would a $10 or $20 a week raise mean to you? Only one $10-a-week raise will repay your investment in CREI training, and leave you a substantial profit the very first year! Your increases in pay thereafter are all pure profit, and you'll be prepared for many more promotions and pay raises in the future years of your life!

WHAT YOU DO NOW—today, tomorrow, next week—will decide your success in the electronics field. Every day counts because the *well-trained* technicians are the ones who get the "plums" when promotions are handed out. How can you be sure to step ahead of competition, to earn more money, to get the position that carries more responsibility—and the pay that goes with it? The answer is contained in a CREI booklet called "Your Future in the New World of Electronics."

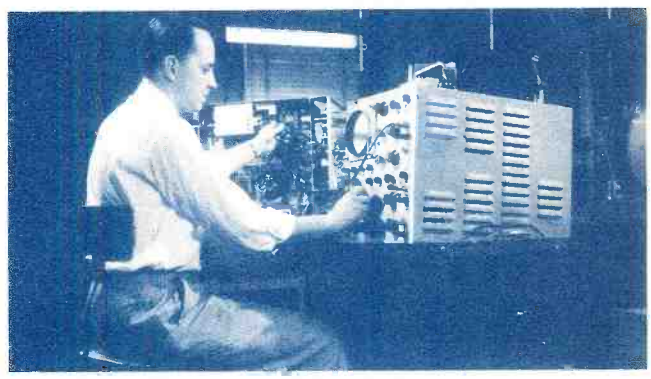
ERA OF ELECTRONICS

This is the era of guided missiles, automation, astronautics, instrumentation. This is the era of defense orders and a manufacturing industry which last year alone sold billions of dollars worth of electronic equipment, which will top ten billion dollars (without military) this year. This is the era of electronic development, research, design, production, testing, inspection, manufacture, broadcasting, telecasting and servicing. This is the era of electronic careers—well-paid, interesting, and secure.

PRACTICAL COURSES

Your work is under the supervision of a regular staff instructor who knows and teaches what industry needs. Training is accomplished on your own time, during hours chosen by you.

KEY TO SUCCESS—As a graduate you'll find your CREI diploma the key to success in the entire field of electronics. At your service is the CREI Placement Bureau which helps to find positions for advanced students and graduates. No short cuts are promised; no jobs are guaranteed—but requests for CREI-trained personnel come in regularly.



COLLEGE DEGREE NOT ESSENTIAL—This is *professional* training, not for beginners, but you don't have to be a college graduate to benefit from CREI's famed courses. You *do* have to be willing to study at home. You can do it while holding down a full-time job. Thousands have. If you have had *some* electronics experience, CREI has a course for you.

CREI's professional guidance is recognized all over the world. Since 1927 CREI has trained practical electronic engineers and engineering technicians; you find them in radio and television stations; you find them in electronics planning and manufacture; you find them everywhere and, generally, near the top. Leading firms recommend CREI training for their own personnel (among them are United Air Lines, Canadian Broadcasting Corp., Douglas Aircraft Co., The Martin Co., and All-America Cable & Radio, Inc.).

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Write today for this FREE BOOKLET. Tuition is reasonable, terms are easy, information is free. If you have the equivalent of a high school education, and are good at mathematics, and have *some* electronic experience, fill out the postage-paid reply card completely, and mail today to Capitol Radio Engineering Institute, 3224–16th St., N.W., Washington 10, D. C.

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All-Lateral Stereo Disc Demonstrated

Second channel frequency modulated on 25 kc. carrier.

AS WE GO TO PRESS it appears that the *Westrex* 45-45 stereo disc system is to become the official industry standard for stereo recording and playback. However this does not mean that the door is forever closed to future developments leading to other methods of putting stereo on a phono disc.

One such interesting development was the recent demonstration of the Minter stereo disc compatible recording system by *Components Corp.*, Denville, N. J. and *Electro-Sonic Labs.*, Long Island City, N. Y.

The stereophonic properties of these discs is obtained from a supersonic, frequency modulated carrier recorded laterally in the groove together with the ordinary lateral microgroove recording. They are played back with a conventional monaural cartridge, in which the single stylus operates laterally only, as is customary in ordinary monaural recordings.

The second channel is recorded by frequency modulating a 25 kc. supersonic carrier. This carrier, recorded along with the first channel, is swung from 20 kc. to 30 kc. for a ±5 kc. deviation. In order to recover this channel the playback cartridge must have good response up to at least 30 kc. Several presently available cartridges meet this requirement. Although a ½-mil playback stylus is preferred, an ordinary 1-mil stylus may be used. Also required is a 3-tube detector-preamp in place of a second conventional preamp that would otherwise have to be used.

The Minter system is said to be completely compatible. The playback cartridge can reproduce monaural discs as well as the stereo discs. In addition, when the stereo disc is played back on a monaural system, the *combined* output of *both* channels will be heard. This is possible since the two original channels are added together to produce one stereo channel recorded on the disc. The original channels are also subtracted to form the second stereo channel that is used to modulate the 25 kc. carrier recorded on the disc. Playback circuits combine these sum and difference channels in such a way as to recover the two original stereo channels. These, then, may be applied to two amplifiers and speakers for playback.

—30—

Are You in a Rut?

(*Continued from page 62*)

gotten so keen that it is tending to eliminate the man who does not have the "drive" necessary to stimulate new business.

Some dealers use an "idea insurance" plan by preserving every new idea they run across in an "idea file." Such files contain an assortment of material which may include newspaper and magazine ads that carry ideas, sales and promotional letters that have come in, and hand-written or typed notes that cover ideas the dealer has observed from time to time.

Another plan used successfully by many dealers is that of maintaining a series of seasonal files. For instance, during the pre-Christmas holiday season a dealer may observe a plan in use that holds good business-building possibilities during this period. It may be too late for him to use it that year, so he makes a note of it and files it in the "Fall Idea" file for consideration the next year. This plan is especially good in pre-planning promotions that will cushion the normal spring and summer drop in business. These slumps usually catch most service dealers unawares. When their businesses hit the skids it is too late to cushion the drop.

Another plan used successfully by many dealers is to go directly to customers for business-building ideas. One dealer, who has relied on this plan for many years said, "It's always good business to keep in close touch with one's customers. That's my excuse for calling on them whenever I am out in search of ideas. Actually, I am searching for a need which my shop can fill . . . a new idea to get more business from each particular customer as well as other customers."

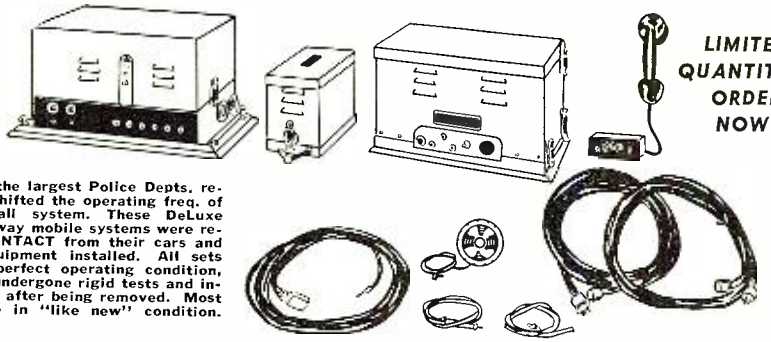
His method of going direct to his customers for ideas assures him that, even if his investment of time has not developed a workable idea at the end of the day, he has made it pay off in the good-will he built up among his customers. Seldom does he have to spend an entire day, however, before he finds an idea that will pay off in new business.

Service dealers also have a wealth of "idea material" available from the tube manufacturing companies. All of them have excellent material in the form of complete, professionally prepared campaigns. The ad mats, postal cards, and other direct mail material can be obtained imprinted with the dealer's name, all ready for addressing and mailing. They are also valuable for the ideas that can be woven into special campaigns.

We are living in a fast-moving age. Set owners are bombarded with so many offers and ideas that they are apt to forget quickly. The service dealer who keeps his "idea factory" busy will help them to remember—him. —30—

LIQUIDATING MOBILE RADIO EQUIPMENT AT TREMENDOUS SAVINGS!

Manufactured by the famous LINK RADIO CORP.



LIMITED QUANTITY— ORDER NOW!

One of the largest Police Depts. recently shifted the operating freq. of their call system. These DeLuxe Link 2-way mobile systems were removed INTACT from their cars and new equipment installed. All sets are in perfect operating condition, having undergone rigid tests and inspection after being removed. Most sets are in "like new" condition.

FM MOBILE EQUIPT.—TYPE FMTR
FOR 6 VOLT OPERATION

Complete asembly designed for mobile 2-way communication on the 30-44 megacycle very-high frequency band. Consists of Radio Transmitter Type 35-UFM, Power Supply Type VPA-3A, Radio Receiver Type 11-UF, and accesories (less antenna assembly) for accomplishing an operating 2-way mobile communication system. Designed normally to derive all its primary energy from 6-volt, 3-cell lead storage battery. **Radio Transmitter Type 35-UFM** is a 35-watt (nominal output) freq.-modulated unit designed especially for mobile use. It utilizes the phase-shift method of obtaining the desired freq. deviation. This permits direct crystal control of the carrier freq. and a simple circuit design with no critical tuning adjustments. It is designed for a maximum freq. deviation of ± 15 kc in its operating range of 30 to 44 megacycles. A carrier power considerably in excess of the rated wattage is available under normal operating conditions in mobile service. The transmitter is entirely self-contained and utilizes a dynamotor to convert the 6-volt input to high voltage for plate supply of the tubes. 7 tubes are included on the chassis, 6 of which are of the low drain receiving type. Tubes are: 7C7, 7A8, 7A8, 7C7, 7C7, 7C5, 807. **Radio Receiver Type 11-UF** is an 11-tube, crystal-controlled, single-freq., freq.-modulation superheterodyne receiver designed particularly for the reception of freq.-modulated signals of the type generated by Mobile-Radio Transmitter Type 35-UFM and fixed station transmitters. The receiver utilizes 11 tubes in a multiple-superheterodyne circuit. Tubes are: 7AG7, 7AG7, 7AG7, 7AG7, 7S7, 7C7, 7AG7, 7A6, 7F7, 7B5, 7A6. **Receiver Power Supply Type VPA-3A** is a synchronous vibrator "B" supply designed for use with the 11-UF receiver. It incorporates the most efficient and long-lived vibrator and circuit available, and affords a very reliable and economical method of obtaining "B" voltages. **Complete system (as described above) with instruction manual.. $99.50**
Crystals & Antenna for above avail.—price on request, PMC Kits & 12-volt Conversion Kits avail. from manufacturer.

FM RADIO EQUIPMENT TYPE 2210
6-VOLT OPERATION

Designed for 2-way communication in mobile radio systems operating in the 152-162 mc very-high-freq. band. In most cases it will be used in mobile units and derive its power from the 6-volt vehicular electrical system. Write for detailed description. Complete with all accessories & instruction manual, ready for operation. Used, checked out..... **$129.50**
Crystals, 12-volt Conversion Kit & Antennas avail.—prices on request.

FM RADIO EQUIPMENT TYPE 2365
6-VOLT OPERATION

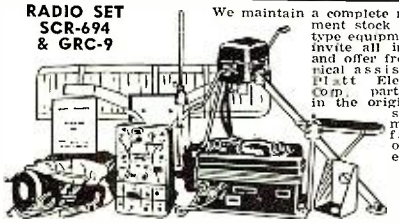
Designed for 2-way communication in mobile radio systems operating in the 25-50 mc very-high-freq. band. In most cases it will be used in mobile units and derive its power from the 6-volt vehicular electrical system. Write for detailed description. Complete with all accessories & instruction manual, ready for operation. Used, checked out..... **$99.50**
Crystals, 12-volt Conversion Kit & Antennas avail.—prices on request.

7 TUBE FM TRANSMITTER

- 6 Volt Dynamotor Power Supply.
- Instructions for connecting and for converting to 10 or 6 meters.

A 7C7 is used in a resistance coupled crystal controlled oscillator circuit. The output freq. is between 30 & 40 MC. The crystal freq. is between 937.5 KC and 1250 KC. Two 7A8's are used as balanced modulators. Two 7C7's are used as freq. quadruplers, and a 7C5 as a freq. doubler. An 807 is used as a power amplifier. Also included is a schematic diagram of the transmitter, a hook-up diagram and instructions for converting to 6 or 10 meters. Transmitter housed in louvred grey enamel case 8"x8"x16" W. Link Radio Mobile FM Transmitter Model 35-UMF as described. Reg. $325.00 ..... **$39.95**

RADIO SET SCR-694 & GRC-9



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Like new
$19.95

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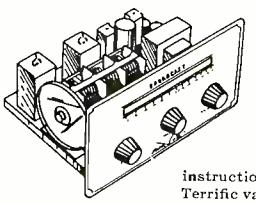
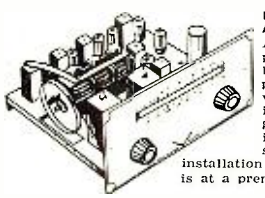
60 Cycle Lighting Transformers

Completely insulated & rubber housed for all weather conditions. Made by Jefferson Electric Co. Power distributing transformer over run lighting, 500VA type F1, rating 4000/120 V, 60 cycles. SPECIAL, Brand New ... **$39.95**

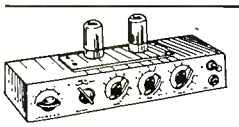
THE "APPROVED" NAME IN KITS manufactured by APPROVED



Model V-5 Binaural Twin AM TUNER. 5 tube AM Tuner Kit. Complete with 5 standard brand tubes and all parts, incl. 28-page book with pictorial, mechanical and schematic diagrams in step-by-step instruction.
Terrific value..... **$32.50**



Model V-12 Imperial AM-FM TUNER. 12 tube AM-FM Tuner Kit. Complete with 12 standard brand tubes and all parts, incl. 48-page book with pictorial, mechanical and schematic diagrams and step-by-step instructions. Compact size mades it ideal for installation where space is at a premium..... **$43.50**

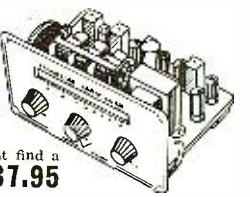


Model A-800 PRE-AMPLIFIER, with built-in 6 position equalizer for GE & Pickering Cartridges. Complete with tubes & all parts, incl. 24-page instruction book..... **$20.95**

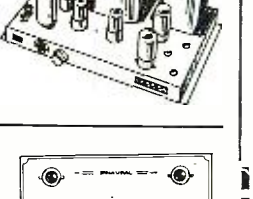
Model A-620 Universal POWER SUPPLY. 117 volt 60 cycles, choke filter system. Completely wired and tested. Ideal power supply for Model V-12 AM-FM Tuner..... **$14.50**

HI-FI KITS

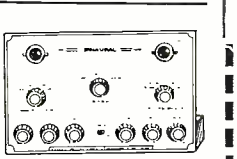
Free descriptive literature avail. on these HI-FI Kits. (All prices incl. 10% Federal Excise Tax.)



Model V-9 Binaural Twin FM TUNER. 9 tube FM Tuner Kit. Complete with 9 standard brand tubes and all parts, incl. 28-page book with pictorial, mechanical and schematic diagrams in step-by-step instruction. You will not find a better kit value..... **$37.95**



Model A-890 20 Watt Williamson Type AMPLIFIER KIT. Complete with all tubes & parts, incl. 24-page instruction book, step-by-step pictorial & schematic diagrams. Incl. AC power supply. The finest amplifier of its kind in the HI-FI audio & audio-visual equipt. fields..... **$52.50**



Model A-880 Binaural TWIN CHANNEL AMPLIFIER KIT, channel 1 & 2. Complete with tubes & all parts, incl. 28-page instruction book with step-by-step pictorial & schematic diagrams. Incl. AC Power Supply..... **$43.95**

BC-221 Frequency Meter

Real Value! QUANTITY IS LIMITED —so first come, first served. They are just like new, with original calibration charts. Range 125-20,000 KC with crystal check points in all ranges. Complete with crystal and tubes..... **$139.50**
MODULATED TYPE **$169.50**
MODULATED TYPE with AC Power Supply **189.50**
These Frequency Meters are factory treated, checked for frequency alignment and GUARANTEED.

PORTABLE TELEPHONE SIGNAL CORPS TYPE TP-9

A portable telephone set designed to provide communication over greater distances than those obtained with ordinary local battery sets. This is made possible by the use of vacuum-tube amplifiers in both the transmitting and receiving circuits. Power is supplied by batteries mounted inside the instrument. Provision is made so that the telephone may also be used without the amplifiers as a local battery set. When using the amplifiers, transmission may be effected in only one direction at a time. Complete with additional set of spare tubes. BRAND NEW... **$59.95**

GENERAL PURPOSE RECTIFIER

Designed to convert electric power from standard power lines for the purpose of operating the telegraph printer unit and providing a 500-watt source for the telegraph printer motors. Power input: The primary source of power required to operate the rectifier is a 95 to 125 volt 50-60 cycle power line, or a 190 to 250 volt 50-60 cycle power line. The input with full load alternating-current and direct-current on is approx. 600 watts. Power Output: (1) Direct Current—up to 400 milliamperes at 115 v. (2) Alternating Current—up to 4.35 amperes at 115 v. Weight 39 lbs.
Like New **$59.95**

BC-456 MODULATOR

Size: 8" w., 10" l., 6½" h. (mounting centers 7½"x 9"). Tube compliment: VR-150, 12J5 speech amplifier, 162 modulator. Uses: Grid modulator for transmitters up to 150 watts, or can plate modulate small rigs up to 35 watts. Also can be used as a paging amplifier, audio amplifier (by changing to output transformer) etc. Contains valuable parts as transformers, tubes, relay, resistors and by pass condensers. Voltage requirements: 12.6 v.—2.5 amps filament. 150 v. (for screen & speech amplifier). 300-400 v. plate voltage. Each..... **$1.95**

SPECIAL!

20 LBS. of ASSORTED RADIO PARTS
A terrific buy at only
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Kit of 20 assorted RESISTORS, ranging from 10 to 100 watts, standard makes..... **$1.39**
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Order the above listed kits now while quantity lasts.

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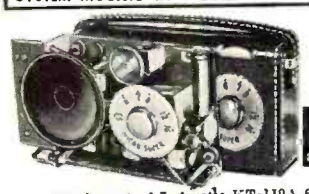
SY-87—Complete System ..... Net **27.50**



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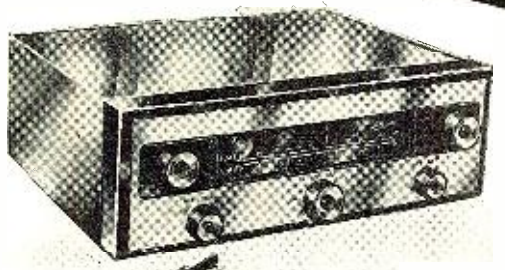

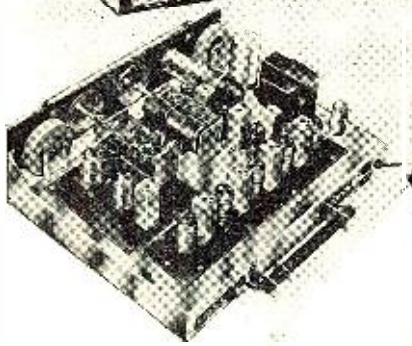

KT-500 IN KIT FORM **74.50**

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- **Dual Cathode Follower Output**
- **Armstrong Circuit with FM/AFC and AFC Defeat**

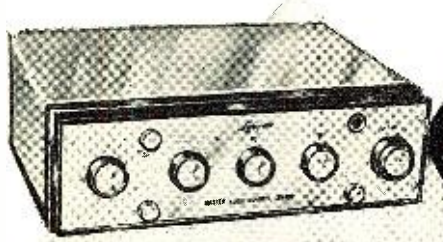
More than a year of research, planning and engineering went into the making of the Lafayette Stereo Tuner. Its unique flexibility permits the reception of binaural broadcasting (simultaneous transmission on both FM and AM), the independent operation of both the FM and AM sections at the same time, and the ordinary reception of either FM or AM. The AM and FM sections are separately tuned, each with a separate 3-gang tuning condenser, separate flywheel tuning and separate volume control for proper balancing when used for binaural programs. Simplified accurate knife-edge tuning is provided by magic eye which operates independently on FM and AM. Automatic frequency control "locks in" FM signal permanently. Aside from its unique flexibility, this is, above all else, a quality high-fidelity tuner incorporating features found exclusively in the highest priced tuners.

FM specifications include grounded-grid triode low noise front end with triode mixer, double-tuned dual limiters with Foster-Seeley discriminator, less than 1% harmonic distortion, frequency response 20-20,000 cps ± ½ db, full 200 kc bandwidth and sensitivity of 2 microvolts for 30 db quieting with full limiting at one microvolt. AM specifications include 3 stages of AVC, 10 kc whistle filter, built-in ferrite loop antenna, less than 1% harmonic distortion, sensitivity of 5 microvolts, 8 kc bandwidth and frequency response 20-5000 cps ± 3 db.

The 5 controls of the KT-500 are FM Volume, AM Volume, FM Tuning, AM Tuning and 5-position Function Selector Switch. Tastefully styled with gold-brass escutcheon having dark maroon background plus matching maroon knobs with gold inserts. The Lafayette Stereo Tuner was designed with the builder in mind. Two separate printed circuit boards make construction and wiring simple, even for such a complex unit. Complete kit includes all parts and metal cover, a step-by-step instruction manual, schematic and pictorial diagrams. Size is 13¾" W x 10⅜" D x 4½" H. Shpg. wt., 18 lbs.

The new Lafayette Model KT-500 Stereo FM-AM Tuner is a companion piece to the Models KT-300 Audio Control Center Kit and KT-400 70-watt Basic Amplifier Kit and the "Triumvirate" of these 3 units form the heart of a top quality stereo hi-fi system.

KT-500.....Net **74.50**



KT-300 IN KIT FORM **39.50**

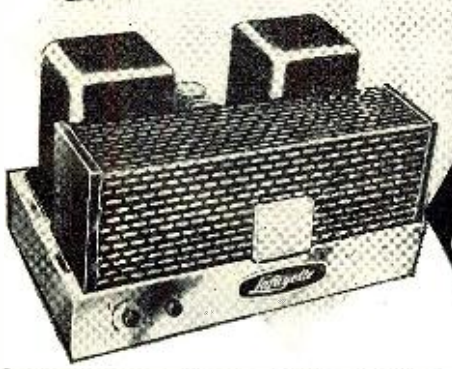
LAFAYETTE MASTER AUDIO CONTROL CENTER with BINAURAL CHANNEL AND DUAL VOLUME CONTROL.

- **Self-Powered**
- **DC On All Filaments**
- **24 Positions of Equalization**
- **Tape Head Input, High Impedance**
- **Dual Cathode Follower Output Stages**

This is not only the finest hi-fi preamp characterized by unmatched features, but it has been functionally designed to keep pace with the conversion of your present hi-fi system to binaural (Stereophonic) sound. Incorporates an extra channel and dual volume control for binaural reproduction. Features include DC on all tube filaments, negative feedback in every stage, dual cathode follower output stages and latest printed circuit construction. Less than 0.09% IM distortion and less than 0.07 harmonic distortion at 1V. Hum and noise level better than 80 db below 3V. Uniformly flat frequency response over entire audible spectrum. 7 inputs for every type of phono, tuner or tape. Tasteful styling, brilliantly executed. Size 12¾ x 9⅛ x 3¾". Shpg. wt., 10½ lbs.

KT-300—Lafayette Master Audio Control Kit Complete with cage and detailed assembly instructions. ..... Net **39.50**

LT-30—Same as above completely wired and tested with cage and instruction manual. Net **59.50**



KT-400 IN KIT FORM **69.50**

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- **Conservatively Rated At 70 Watts**
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KT-400—Lafayette 70 watt Deluxe Basic Amplifier Kit complete with cage and detailed assembly instructions. .....Net **69.50**

LA-70—Same as above completely wired and tested with cage and instruction manual. Net **94.50**

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Sound on Tape

By BERT WHYTE

THINGS are kind of quiet in the world of tape at the moment. Probably this is because everyone is sort of sitting back and waiting to see how the stereo disc ball is going to bounce. Not that there seems to be any evidence of retrenchment, or anything like that. I think in fact that, if anything, many companies are marking time now because there are expansion plans in the offing and they want to wait and get the advantages of better timing in connection with any stereo disc announcements. As I wrote some months ago, co-existence of stereo tape and stereo disc is very probable, rather than a dog-and-cat fight. There seems to be a growing sentiment in the stereo tape industry that such will be the case. Wise heads, however, are also of the opinion that if the stereo tape market is to remain the "deluxe" stereo market, then steps must be undertaken to ensure that the stereo product the tape customer buys is truly a high quality "deluxe" product.

One of the most interesting developments along these lines, is the increased awareness of the signal-to-noise-ratio problem, or in plain English . . . the ubiquitous and annoying tape hiss. This whole business of tape hiss is kind of up in the air. If I report to you that on such and such a tape the "hiss level was unobtrusive," this can really have a variety of meanings. One, obviously, is that the tape hiss isn't gone, but merely "unobtrusive." Now is it unobtrusive because I have psychologically conditioned myself to reject it? It is also true that if a tape is played back in a given room at a level of say 65 or 70 db . . . at that level the tape hiss may not be discernible at all. But if the auditor is listening to his tape at a 90-95 db level, then the hiss may be intolerable. It is apparent that several things need doing about tape hiss. The most obvious answer is to try and eliminate it from the tape altogether through improved production techniques. The other thing is that a standard reference level of playback be established so that judging the amount of hiss that may be present on a tape would not be quite so empirical a task.

In connection with the elimination of hiss, you may be interested to know that a number of people in the industry are attacking the problem by building a special recording and playback amplifier for their tape machines or are modifying existing amplifiers. It is too involved to go into the inner workings of these, but roughly it involves more expensive and low noise component parts, a change in bias voltage and its control and regulation, and other trickery. That enterprising small company, *Vanguard,* is reported to have a new low-noise amplifier now in service, several others are in the process of building the new ultra-quiet units, and one of the majors is reportedly dickering with an independent supplier for very special low-noise amplifiers to replace the present electronics in all its stereo equipment . . . meaning something on the order of 25 units! This is not meant to malign the electronics as supplied with most stereo recorders. They do a good enough job, but if something better is wanted, inevitably this means more money, and quite logically the stereo machine manufacturers don't want to pass on to all their customers the extra costs involved in building the fancy amplifiers. It probably will remain a custom affair for some time to come, but at least there is work in progress to combat the tape hiss problem. As time goes on I'll keep you posted on developments in this area.

GERSHWIN
CONCERTO IN F
Eugene List, pianist with Eastman Rochester Orchestra conducted by Howard Hanson. Mercury MDS5-9. Price $12.95.

You might expect that the music of Gershwin would be ideal for stereo, and certainly on the evidence of this sensational tape, this would seem to be true. All the color and the "syncopated rhythms" and the clever Gershwin orchestrations take on new interest when stereo weaves its magic. On this tape we have an ideal combination of artists to tackle the tricky "Concerto in F." Eugene List is a young American pianist, who you may remember played for President Truman during the last war. He has come a long way since then, having concertized with leading orchestras all over the world these past years. Always a keen student of American and modern music, he was the logical choice to team up with this country's foremost conductor of American music, Dr. Howard Hanson. The performance that has resulted from this association may be considered as near definitive.

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List has caught the spirit of Gershwin as few other pianists have before him and with Dr. Hanson's knowing and communicative accompaniment, the concerto sparkles with life and vigor. The stereo sound is such a fabulously superior thing that one feels as if the concerto is being played for the first time. From the robust exclamations of the opening tympani figure and cymbal clash, one instinctively feels that something memorable in your experience with recorded sound is going to unfold. And it's all there . . . the sharp, transient cleanness of the piano, the smooth sweep of the strings, the brazen cry of the brass, the busy murmurings of the woodwind, the authoritative power of the percussion.

Directionality here was ideal with the piano a hair left of center in the ghost center channel. The effect of depth was considerable and was enhanced more so by the very forward sound and projection of the music and the balance against the right amount of hall reverberation. All in all, a stunning tape and if you are even remotely interested in Gershwin, a "must" on your listening list.

HAYDN

TOY SYMPHONY

Solisti di Zagreb conducted by Antonio Janigro. Vanguard VRD-2. Price $8.95.

This is one of the most perfectly delightful stereo tapes yet produced. Haydn's almost whimsical little score is an ideal stereo vehicle with its use of toy cuckoo, nightingale, sleighbells, snares, etc. The Solisti steps lightly out of their all-string roles, long enough to give us a very neat, nicely paced performance, kept properly light and played that way. The various "toy" instruments stand out clearly in the bright light of stereo and their positioning is no matter of guesswork. The directional features of this little work are not overdone which is as it should be.

Recorded fairly close, yet good spacious hall reverb has been employed to maintain presence. The tape is notable for its lack of distortions, and I'm happy to report that even at good room-filling levels, tape hiss is minimal. This could become, in the future, the "young child's stereo primer." (And maybe for some not-so-young children too, eh!)

JAZZ AT STEREOVILLE (VOL. 2)

Concert Hall Society EX50. Price $11.95.

This is the second volume to appear of the highly successful Jazz at Stereoville combo, reviewed here some months ago. The same high powered personnel is on this tape and they play four new numbers with equal zest and gusto. They are, "I Got A Right To Sing The Blues," "Walkin' My Baby Back Home," "When Your Lover Has Gone," and "I Knew You When." As with the first tape each side of the band "fights" the other and in stereo there is no mistaking where the various personnel is deployed. All is as clean and undistorted as before and I can recommend this volume to you with equal enthusiasm.

SNOWFALL

The Hal Otis Orchestra. Sonotape SWB7033. Price $6.95.

One of a group of new pop stuff turned out by *Sonotape* and, of its type, very good. This is a fair sized band and they give out with four numbers on which the arrangements were rather obviously slanted to stereo pickup. The numbers are "Snowfall," "Our Waltz," "Dance of the Spanish Onion," "Stella by Starlight," and "On the Alamo." This is set up dance style so that the slow "dreamy" stuff (*i.e.* "Our Waltz") alternates with some of the stuff with more ginger ("On the Alamo"). The sound is very good with all elements clean and crisp, with excellent instrumental separation, good directionality, and a reasonable amount of center "fill." Nothing earth-shaking here, but pleasant in its own way.

That cleans up this month's batch of tapes but things should be picking up soon so that I hope to have a juicy assortment next month to coax those hi-fi dollars out of your jeans. All for now—see you in May! —30—

"BONUS" FOR JAZZ BUFFS

REEVES Soundcraft Corporation has come up with a unique merchandising idea which will appeal especially to Dixieland Jazz fans.

The company recorded an actual jamfest of one of the greatest "All-Star" combos and is making this recording available as a bonus with the purchase of any 7" reel of "Soundcraft" tape.

The deal works like this. For the price of a 7" reel of tape, plus 75 cents to cover postage and handling, the customer can have "Dixieland Jamfest in Stereo" specially recorded for him on the reel of tape he buys. It can be recorded either stereophonically or monaurally, according to the customer's wishes.

Since this collector's item is not for sale, jazz buffs who want this 20-minute recording of everything from blues to Dixieland marches will want to take advantage of this offer.

The tape features Coleman Hawkins, Sol Yaged, "Red" Allen, J. C. Higginbotham, Lou Stein, Milt Hinton, and Cozy Cole.

The company's franchised dealers have full details on this offer. —30—

STEREO TAPE CATALOGUE

A COMPLETE listing of all available stereo tapes, including titles, artists, selections, catalogue numbers, and prices is now available as the "Complete Catalogue of Stereo Music."

Published by Mooney-Rowan Publications of Severna Park, Maryland, the new catalogue describes each tape fully and represents the output of 47 companies, from the majors to the smallest independents.

The catalogue will be issued quarterly and is available from tape dealers or by subscription for $2.00 a year.

The issue released on February 1st carried a listing of more than 750 stereo tapes and runs to over 100 pages. It features a four-color cover. —30—

The Weakest Link

(*Continued from page 47*)

and tapes that were sheer pleasure, even on audio equipment of very modest character, making one unaware of distortion, imbalance, noise, and even of the presence of an electromechanical intermediary. Such experiences are proof that the audio art has reached sufficient development to provide outstanding reproduction of music in the home—the kind of reproduced music you can listen to for the same length of time that you might spend enjoyably in a concert hall.

It is the thesis of this article, however, that program sources of first quality still represent too small a portion of the total. This is not to be misconstrued as a clamor for perfection, which simply is not to be had. While present audio technology entitles one to expect a reasonable facsimile of the original sound, without obvious distortion or imbalance, it must be granted that one cannot expect every disc or tape or FM program to live up to the same high standard, for this implies perfection. Nevertheless, allowing for normal human and mechanical slips, it appears that the sources of high-fidelity material are too frequently falling short of the art's present potential.

The last statement takes cognizance of the fact that progress brings change not only in satisfaction of our standards, but also in the standards themselves. What was enjoyable reproduction yesterday may become "low-fidelity" today. Yet, allowing for the fact that our ears have come to expect better and better reproduced sound, it may still be contended that program material, no matter what the source, is below high-fidelity standards more often than it should be.

What might the audiophile do about this? (It is assumed that the reader agrees with the writer, which of course may not be the case; many persons are happy with what they have, while others are wracked by the pursuit of perfection.) It seems that he can lose nothing and perhaps gain much by expressing his opinion to the FM station, the disc recording company, the tape recording company, or the disc and tape retailer. But in fairness both to himself and the source of the program material, he should take the trouble to make clear not only the faults that he finds but also the virtues. Only in this way can the sources of program material concentrate on minimizing the faults and maximizing the virtues. The manufacturer and broadcaster both know that the road to profit lies in giving the customer what he wants (at least what the majority wants) and they would be happy to eliminate guesswork for first-hand information as to what the customer likes as well as dislikes.

—30—

Audio Operated Switch

(*Continued from page 61*)

an audio input signal of 5 volts. With the values shown in Fig. 1 for R_7, C_3, and R_8, the relay remained closed for 10 seconds after there was no audio signal applied to the input. As long as there was speech or music to the amplifier input, with pauses no greater than 10 seconds, the relay remained closed and, of course, the recorder mechanism kept running.

The 10 second timing was the time interval the author desired for his device. The constructor may increase or decrease this delay time. Increasing the values of R_7, R_8, or C_3 will increase the time delay. Decreasing the value of any of these components will decrease the delay time. R_7 or R_8 could be made variable controls so that the delay could be easily varied, if desired. Also, the sensitivity of the relay can be varied by means of an adjusting screw so it will operate with more or less current flow through its coil.

It will be found that the *RC* time-constant must be modified when such a circuit is at the input of a transistor amplifier *versus* the case of using a network of this type at the input of a tube. With a tube, the capacitor discharges through the resistor, R_7 in this discussion, but there is no d.c. path by way of the tube grid. With a transistor circuit, the capacitor discharges through the resistor and also into the transistor circuit.

Some Applications

Although the unit described in this article was intended primarily for tape transport operation, it may be employed to start and stop any electrical equipment or motor driven device. When using it with a complete audio system, the constructor may automatically start his recorder mechanism when recording material is picked up by the microphone. When listening to programs from a radio tuner or television audio signals, the microphone of the audio system may be placed near his favorite listening position and, with an "on-off" switch on the microphone, it is only necessary to throw the mike switch "on" and speak, whistle, or clap the hands into the microphone to start recording any desired portion of the program. With this same arrangement, a record player may be started and automatically stopped after the record has been played. When using a record changer, it may be stacked with records and each record played at will by speaking, whistling, or clapping into the mike and at the end of each record the changer would automatically stop. Each following record can then be played when desired by this procedure and the changer will stop after each selection. The builder will no doubt think of many other applications for the device and can vary the timing of the device to suit his individual requirements. —30—

BC-645 XMTR RECEIVER

15 Tubes 435 To 500 MC

Can be modified for 2-way communication, voice or code, on ham band 420-450 mc. citizens radio 460-470 mc, fixed and mobile 450-460 mc. television experimental 470-500 mc. 15 tubes (tubes alone worth more than sale price!): 4—7F7, 4—7H7, 2—7E6, 2—6F6, 2—955 and 1—WE316A. Now covers 460 to 490 mc. Brand new BC-645 with tubes, less power supply in factory carton. Shipping weight 25 lbs. **$29.50**

PE-101C DYNAMOTOR for BC-645, has 12-24V input (easy to convert for 6V Battery operation) ..... only **$7.95**

UHF ANTENNA ASSEMBLY, for BC-645 ..... **$2.45**

Complete set of 10 Plugs for BC-645 ..... **$5.50**

CONTROL BOX for above **$2.25**

SHOCK MOUNT for above **1.25**

CONVERSION BOOKLET. Instructions for most useful surplus rigs **$2.50**

SCR-274 COMMAND EQUIPMENT

ALL COMPLETE WITH TUBES

Type	Description	Excellent Used	Brand NEW
BC-453	Receiver 190-550 KC.	$14.95	$18.95
BC-454	Receiver 3-6 Mc.	9.95	12.95
BC-455	Receiver 6-9 Mc.	9.95	13.50
BC-456	Modulator	3.45	4.95
BC-450	3-Receiver Control Box.	1.49	1.95
BC-451	Transmitter Control Box	1.25	1.49
BC-696	Xmtr 3-4 Mc (like new)	6.95	8.88

BC-457 TRANSMITTER—4-5.3 Mc. complete with all tubes and crystal. BRAND NEW.. **$7.88**

BC-458 TRANSMITTER—5.3 to 7 Mc. Complete with all tubes and crystal. BRAND NEW **$7.88**

BC-459 TRANSMITTER—7-9.1 Mc. complete with all tubes and crystal. BRAND NEW **$11.95**

ARC-5/T-19 TRANSMITTER—3 to 4 Mc. BRAND NEW complete with all tubes & crystal **$8.88**

110 Volt AC Power Supply Kit, for all 274-N and ARC-5 Receivers. Complete with metal case, instructions **$7.95**
Factory wired, tested, ready to operate.... $11.50

SPLINED TUNING KNOB for 274-N and ARC-5 RECEIVERS. Fits BC-453, BC-454 and others. Only **49c**

LORAN APN-4

FINE QUALITY NAVIGATIONAL EQUIPMENT

Determine exact geographic position of your boat or plane. Indicator and receiver complete with all tubes and crystal.
INDICATOR ID-6B/APN-4, and **RECEIVER** R-9B/APN-4, BRAND NEW..only **$48.49**

Complete Kit of Accessories for Above: PE-206 Inverter, Set of Plugs, Visor for Indicator, Operation Manual, ALL BRAND NEW **$49.50**

SPECIAL APN-9A LORAN Receiver less tubes, NEW (demilitarized) ..... Indicator, **$24.50**

SCR-522 2-METER RIG!

Terrific buy! VHF Transmitter-receiver, 100-156 Mc, 4 channels, Xtal-controlled. Amplitude modulated voice. They're going fast! Excellent condition.
SCR-522 Transmitter-Receiver, complete with all 18 tubes, top rack and metal case.
COMBINATION ..... Special **$33.33**

Receiver only, with all tubes $19.50
Transmitter Only, with all tubes $22.25
Accessories for above available.

DYNAMOTOR VALUES!

Type	Input	Output	Excellent Used	BRAND NEW
DA-19-A	28V 11A	400V .400A	$4.99	$6.95
DM-28	28V	224V .07A	2.95	4.95
DM-32A	28V 1.1A	250V .05A	2.95	5.95
DM-33A	28V 5A	575V .16A		
	28V 7A	340V .25A	1.95	3.95
DM-34D	12V 2A	220V .080A	4.25	5.50
DM-37	25.5V 9.2A	625V .225A	5.95	8.95
DM-40	14V 3.4A	172V .138A	1.75	3.45
DM-53A	28V 1.4A	220V .080A	3.95	5.95
DM-64A	12V 5.1A	275V .150A		7.95
PE-73C	28V 20A	1000V .350A	8.50	11.50
PE-86	28V 1.25A	250V .050A	2.95	5.24
PE-186	28V 11A	400V .400A		6.95

BD-77C DYNAMOTOR, input: 14 V DC @ 39 A. output: 1000V DC @ .35 A. With Filter. Like New! Special **$22.50**

FL-5 FILTER **79c**

WESTINGHOUSE 2½" ROUND PANEL METER —10 to +4 Db. BRAND NEW **$2.95**

BC-442 ANTENNA RELAY

Wonderful Value! Consists of ¾ amp 2" RF Ammeter (antenna current indicator), 0-10 scale. Transmitter-Receiver Switching relay, in aluminum case with associated components. BRAND NEW..... **$2.49**

AN/APN-9 LORAN SYSTEM

TERRIFIC BUY!
Value $1200
OUR PRICE
$169.50

Used in ships and aircraft. Determines position by radio signals from known xmitters. Accurate to within 1% of distance. Complete with tubes and crystal. Exc. used.

NEW VALUES—JUST ARRIVED!

BC-348 SUPERHET RECEIVER. Locally controlled 8-tube 6-band receiver for aircraft, communications type, for voice, tone and CW. 200 to 500 Kc and 1.5 to 18 Mc. For operation on 24 V DC with self-contained dynamotor. Complete with tubes.
Exc. used **$89.75**

AN/ARN-7 AIRCRAFT NAVIGATIONAL INSTRUMENT. Superhet radio receiver. Range 100 Kc to 1750 Kc in 4 bands. Exc. used **$87.25**

AN/ARN-6 RADIO COMPASS EQUIPMENT. Frequency 100 to 1750 Kc in 4 bands. 24 V DC operation.
Exc. used **$188.50**
BRAND NEW **$225.00**

BC-733 VHF 10-TUBE AIRCRAFT RECEIVER. 6-channel xtal control. Freq. 108.3 to 110.3 Mc. Dual filter range. Easily converted for tracking Sputniks!
Exc. used **$12.95**
Dynamotor for above—Brand New $5.95

AN/APR-4 RECEIVER only. 38 to 4000 Mc in 5 tuning unit ranges. High precision laboratory instrument used to monitor or indicate frequency of any signals within its range. Includes wide and narrow band IF strip selected from panel. Outputs provided for attachments to pulse analyzer, panadapter, etc. Input 115 V 60 cy.
BRAND NEW **$69.50**
Tuning Units for above—each ... $39.50

BC-788 RECEIVER TRANSMITTER ALTIMETER. Complete with all tubes. Exc. used **$49.50**

AN/ARN-5A AIRCRAFT RECEIVER. 11 tube superhet, 3-crystal control UHF for static-free reception.
Exc. used with tubes **$24.95**

I-152 AM INDICATOR **$29.50**

DYNAMIC HANDMIKE, with "Press-to-talk" Switch, cord and plug—BRAND NEW, only **$2.95**

DYNAMIC HANDMIKE, aircraft, made by Telephonics Corp. Press-to-talk switch. BRAND NEW.. **$4.95**

DYNAMIC HEADPHONES, 600-ohm impedance, with large earphone cushions, cord and phone plug. BRAND NEW, special **$3.95**

BC-605 INTERPHONE AMPLIFIER

Easily converted to AC intercom set—ideal for home, office or factory. **BRAND NEW, with original schematic** **$4.95**
AC Conversion Instructions ..... **.65**

Hi-Fi DYNAMIC HEADSET with Cushions
Freq. Range: 40-14000 CPS. No Distortion.
BRAND NEW **$7.95**

IMPEDANCE MATCHING Plug-in Transformer, 2000 to 600 ohms. Brand New **97c**

MICROPHONES

Model	Description	Excellent Used	BRAND NEW
T-17	Carbon Hand Mike.	$5.45	$8.95
T-30	Carbon Throat Mike.	.39	.79
T-45	Army and Navy Lip Mike.		1.33
T-24	Carbon Mike		5.95
TS-9	Handset		4.95
RS-38	Navy Type	2.79	4.95

HEADPHONES

Model	Description	Excellent Used	BRAND NEW
HS-23	High Impedance	$2.25	$5.45
HS-33	Low Impedance	2.79	4.95
HS-30	Low Imp. (featherwt.)	1.49	2.25
H-16/U	High Imp. (2 units)	3.75	7.95
CD-307A	Cords, with PL55 plug and JK26 Jack		.99

SCHEMATIC DIAGRAMS For any equipment on this page, each .. **65c**

Please include 25% Deposit with order—Balance C.O.D. 50c Handling Charge on all orders under $5.00. All shipments F.O.B. Our Warehouse, N.Y.C.

G & G Radio Supply Co.
Telephone: CO 7-4605
51 Vesey St., New York 7, N. Y.

ARC-5/R28 RECEIVER

2-meter Superhet, 100 to 156 Mc in 4 crystal channels. Complete with 10 Tubes.
BRAND NEW **$22.45**
110 V AC Power Supply Kit for above **$9.75**

ARC-5/T-23 TRANSMITTER

100-150 Mc Includes 2—832A, 2—1625 Tubes. BRAND NEW **$19.95**
SPECIAL OFFER! Limited quantity ARC-5/T23 xmitters. BRAND NEW, less tubes $7.95
Excellent Used, less tubes $5.95

ARC-5 MARINE RECEIVER-TRANSMITTER

Navy Type Comm. Receiver 1.5 to 3 Mc BRAND NEW with 6 tubes **$16.95**

Navy Type Comm. Transmitter 2.1-3 Mc BRAND NEW with 4 tubes and Xtal **$12.45**

BC-603 FM RECEIVER, 10-channel push button tuning or continuous tuning. 20-28 Mc. Complete with speaker, tubes, squelch, 12-V Power Supply. Exc. **$14.95**

BC-683 same as above except 27 to 38.9 Mc. **$24.95**

RADIO RECEIVER NAVY TYPE RAY-3

Model AN-PRGN is for 14V DC operation.
These receivers are supplied complete with built-in dynamotor, 11 tubes. Weston output meter on front panel, as well as coax antenna and output connection, phono jack, on-off switch.
WHILE THEY LAST ..... Our Price **$13.95**

HI-LO IMPEDANCE MATCHING TRANSFORMER
For headphones. 600 ohms to 8000 ohms. Standard phone plug and jack, in metal case. Instructions included. **BRAND NEW** **97c**

BENDIX DIRECTION FINDER

For commercial navigation on boats and planes. Complete installation comprises:
MN-26-C Receiver, used, with 12 tubes **$16.50**
MN-26-C With 12 Tubes, BRAND NEW **$24.95**
MN-20-E Rotatable Loop **4.25**
MN-52 Azimuth Control Box **2.95**
All necessary accessories for above in stock.

ARB NAVY RECEIVER-TRANSMITTER

Receiver 4 band 195-9050 Kc. Transmitter 3000-9050 Kc and 2300-4200 Kc. 28 V Dynamotor. ALL BRAND NEW, complete **$88.50**

NAVY "HANDY-TALKY" TRANSCEIVER

Two way communication by voice or MCW up to 30 miles. Xtal controlled transmitter 140.58 Mc. Superregen. Receiver. Telescopic Antenna. Press-to-Talk Switch. Overall 15⅛"x2⅝" diam. Our low price, less batteries ..... each **$22.50**

BC1206-C BEACON RECEIVER

195 to 420 Kc. made by Setchel-Carlson. Works on 24-28 volts DC. 135 Kc. IF. Complete with 5 tubes. Size 4" x 4" x 6". Wt. 4 lbs.
BRAND NEW **$8.88**
Brand New, less tubes $5.95
USED, with tubes.. 5.95 USED, less tubes ... 2.95

BC-659 TRANSMITTER & RECEIVER

27 to 38.9 Mc F.M. Two preselected channels crystal controlled. 5 to 10 watts. Complete with speaker, tubes. Excellent Used **$11.95**
POWER SUPPLY for above, 117 V 60 Cycles AC. Excellent used **$16.95**
Vibrator Supply for 6-12-24 Volts **9.95**

BC-221 FREQUENCY METER

Special Buy! Complete with operating manual. LIKE NEW ..... only **$99.50**
BC-221 Modulated **$129.50**

BC-221 FREQUENCY METER CASE

Aluminum Case for BC-221 or TS-164 Freq. Meters. Shock Mounted. BRAND NEW **$3.99**
(add 50c for packing)
Original 1000 Kc Crystal for BC-221. BRAND NEW **$8.45**

LM FREQUENCY METER

Crystal calibrated modulated. Heterodyne. 125 Kc to 20,000 Kc. With Calibration book.
Exec. Cond. **$49.50**
Less Calibration Book **$29.50**

GOLD PLATED SPECIAL!
TS-1/ARR-1 TEST OSCILLATOR
Portable, complete with two 955 tubes, cavity and antenna. BRAND NEW, in metal housing 9¾" x 6¾" x 7" high. OUR LOW PRICE, each **$3.95**

BRAND NEW SPECIAL PURPOSE TUBES

In Original Individual Packing

Type	Each	Type	Each	Type	Each
2C42	$4.95	304TL	8.95	837	1.15
2C46	3.50	CRP-730A	3.45	1625	.26
5D21	4.50	813	6.95	1626	.16
RK-34	.39	815	2.99	2X2	.39
RK65	7.25	826	.44	6A7	.35
2J724B	.35	829B	7.50	6AG5	.33
VR105	.79	832A	5.95	6J6	.33
VR150	.79				

NEW! Cathode Ray Tubes NEW!

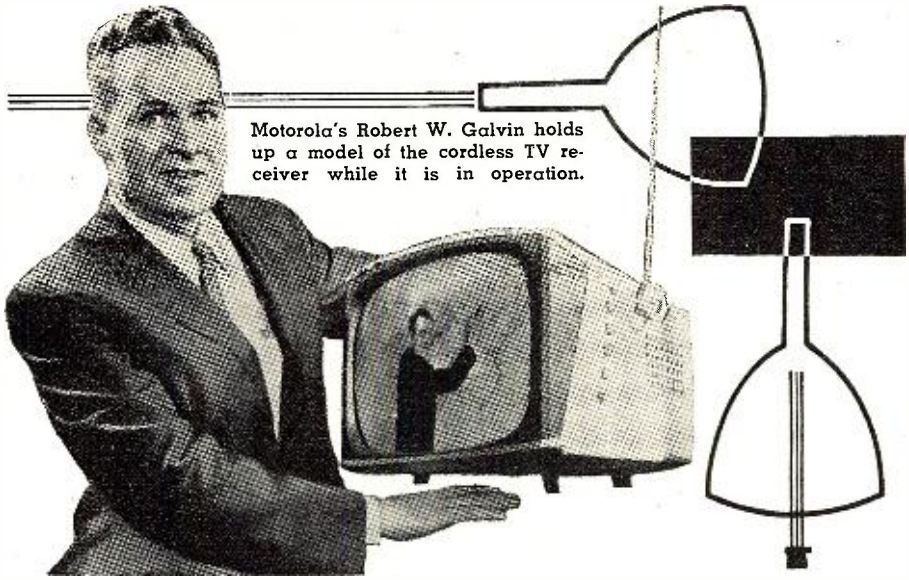
3CP1	$1.18	5BP4	$2.22
3FP7	1.18	5CP1	2.45
5BP1	2.22	5FP7	1.44
		9LP7	1.88

WILLARD 6-VOLT MIDGET STORAGE BATTERY
3 Amp. Hour. **BRAND NEW.** 3⅝" x 1-13/16" x 2⅜". Uses Standard Electrolyte ..... Only **$2.69**

2 VOLT BATTERY "PACKAGE"

1—2V. 20 Amp. Hr. Willard Storage Battery $2.79
1—2V. 7 prong Synchronous Plug-in Vibrator 1.49
1—Quart Bottle Electrolyte (for 2 cells) 1.45
ALL BRAND NEW! Combination Price.... **$5.45**

An All-Transistor TV Set



Motorola's Robert W. Galvin holds up a model of the cordless TV receiver while it is in operation.

This fully portable receiver can operate away from normal power sources on its integral batteries.

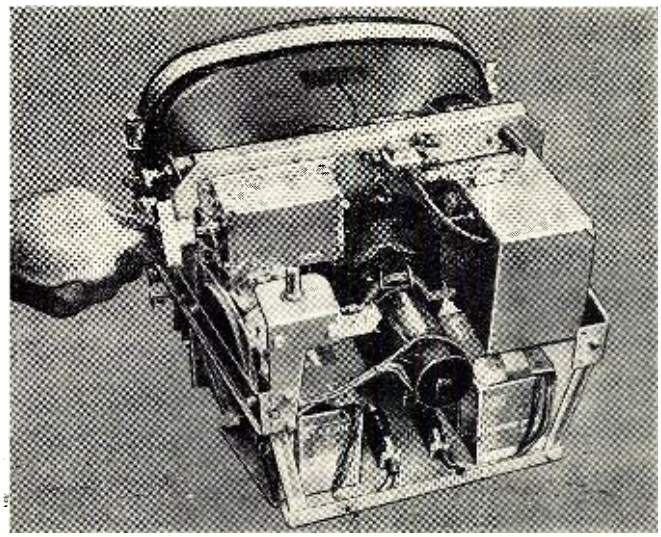
FULLY transistorized and battery-operated, a new *Motorola* TV receiver is capable of playing wherever the signal is, without having to be plugged into an a.c. outlet.

The truly portable receiver is powered by rechargeable 12-volt nickel-cadmium batteries. Weighing about 30 lbs. altogether, it is comparable to the lightest of tube-operated portable TV sets. Using 31 transistors, many of them developed by *Motorola* engineers, the compact unit consumes less than 11 watts, as compared to power-consumption ratings of over 100 watts for even the most efficient of present-day sets. The manufacturer reports that a full six hours of playing time can be obtained, starting out with fully charged batteries.

To completely recharge the batteries, eight hours are required. However, the set may be used normally during the recharge period. Either recharge or normal playing can be achieved through a 12-volt automotive system or a 117-volt a.c. source. With the long-life batteries, *Motorola* claims that the cost for operating the set averages out to less than half a cent an hour.

General availability of the set depends on cost and availability of the transistors used in its design. Although present cost would be prohibitive, it is believed that a set of this kind could be sold at a realistic price in possibly two years.

The greatest immediate value in designing the set—over 8000 hours in engineering manpower were required—was the information developed concerning the problems of transistor design and the techniques used in solving them. —30—



The chassis of the transistorized, battery-operated, fully portable TV receiver. As can be seen, the picture tube is the only tube it uses. The two relatively small nickel-cadmium batteries are shown at the rear. 31 transistors replace the usual vacuum tubes.

Mac's Service Shop

(*Continued from page 68*)

that is what the American auto manufacturers thought about the small-car market until the European manufacturers changed their thinking. Say, not to change the subject, but I recently came across some information on transistors that I think might interest you. At least it was interesting to me. We have accumulated quite a bit of experience and technical information on transistors; but I still find it hard to come up with a snappy answer when someone asks me things like: How long does a transistor last? How rugged are they? Why are they exceptionally adapted to use in portable receivers? A speech delivered a while ago by Mr. H. B. Fancher, general manager of the *General Electric* Semiconductor Products Department, at Cleveland gave some dan-dan-dandy answers to these questions."

"Say on," Mac encouraged.

"Take the matter of dependability. Mr. Fancher says regular commercial vacuum tubes have an expected 80% survival after 1000 hours of operation. Highly stabilized 5-star tubes have an expectancy of 95% survival in 1000 hours. Transistors, though, have a demonstrated life of 98% survival at 10,000 hours! Some transistors have been on life test more than 26,000 hours with no change of characteristics. That's equal to being in continuous operation eight hours a day for nine years."

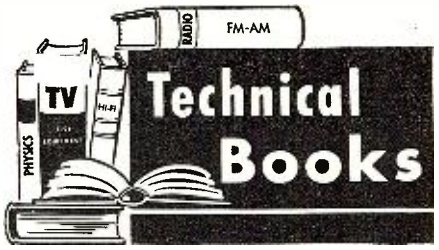
"That proves that under favorable conditions transistors are long-lived; but can they take it when things are not so favorable?"

"*G-E* fired several groups of transistors from a mortar. They still worked after that, even though this subjected them to shocks of 15,000 g's."

"So, I guess we don't have to worry if we drop one."

"Right; but the thing that really intrigues me is his explanation of why transistors are so important to equipment that cannot be powered from the a.c. lines. He says power taken from these lines costs roughly one penny per kilowatt hour. At that rate, the extra power more or less wasted by heating tube filaments is of little consequence. However, if you get this same kilowatt hour from flashlight cells, it will cost you ten dollars just so you can carry your equipment in your pocket or your hand. That's quite a price to pay."

"That certainly does drive home the economy of transistors in portable equipment," Mac agreed; "and it explains why it is anticipated that 80% of all portable radios produced in 1958 will be transistorized; but if we don't get to work we're not going to have any pennies to buy those kilowatt hours; so reach for your solder-gun, Pardner!" —30—



"TELEVISION TUBE LOCATION GUIDE" compiled by Sams Staff. Published by *Howard W. Sams & Co., Inc.,* Indianapolis. 204 pages. Price $2.00. Spiral bound (Vol. 7.)

This is the seventh volume in this publisher's series of guides which show the layout of television receivers, the types of tubes used, and the function of each tube. Of particular help to technicians is the "Tube Failure Check Chart" which accompanies each diagram and indicates which tubes are most likely to cause the trouble.

This volume gives complete coverage of 160 chassis used in approximately 500 model television receivers made during 1956 and 1957. Three color sets are included. As is this publisher's custom, a cumulative index lists all models covered in the previous volumes as well as those included in this particular guide.

* * *

"SURPLUS COMMUNICATION EQUIPMENT AND ITS USE IN CIVIL DEFENSE ORGANIZATIONS" prepared and published by FCDA. Available free from Communications System Office of FCDA, Battle Creek, Mich. 48 pages. Paper bound.

This manual offers guidance in selection of excess or surplus military communication equipment for civil defense use. It includes a brief description of the radio receivers, transmitters, and allied equipment suitable for use in Civil Defense communications setups.

Some of the equipment listed may require slight or moderate mechanical and/or electrical modifications for Civil Defense use. No attempt is made in this publication to outline such technical details, hence it cannot be considered a conversion guide as such.

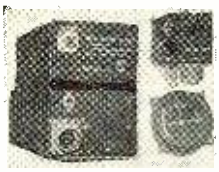
* * *

"THE ULTRA HIGH FREQUENCY PERFORMANCE OF RECEIVING TUBES" by W. E. Benham & I. A. Harris. Published by *McGraw-Hill Book Company,* New York, 169 pages. Price $6.50.

This book, written by two British engineers, has been prepared for the engineer and advanced student. It is a theoretical discussion of the behaviour of standard radio receiving tubes at the ultra-high frequencies. The text describes how such tubes (chiefly triodes) perform or are expected to perform as low-noise amplifiers, as oscillators and, to a lesser extent, as mixers.

A thorough understanding of mathematics at a college engineering level is prerequisite to a grasp of the ma-

"EXPLORER" SATELLITE RECEIVER



Receive Radio Signals being transmitted by the U.S. Satellite—on approx. 108 MC. This Receiver is AM and Crystal Control on Six preset frequencies in the 108.3 to 110.3 MC range. Provides audio and band pass filter output of 90 and 150 cycles for aircraft instrument landing for which it was originally used. Complete with Ten Tubes: 1/12AH7, 2/12SG7, 2/12SR7, 1/12SQ7, 3/717, 1/12A6, Crystals and Schematic. Voltage required: 12 or 24 VDC & 220 VDC 80 MA. Size: 13⅜" x 5" x 7". Also can be converted to FM Receiver 80 to 108 MC. Price—Used—Less Tubes & Crystals **$4.95**

NEW—Complete with Tubes and Crystals..... 12.95
Control Box—N: $2.00. Cross Point Indicators—U: 2.00
Plugs for Receiver, Indicator, or Control Box—Ea.: 1.00

100 WATT TRANSMITTER $24.95

Voice CW—Freq. 200—500 KC., 1500—12500 KC by use of plug in Tuning Units. Uses 1/10y & 4/VT-4C Tubes. Size: 23" L x 21" H x 8" W. Complete with Tubes, less tuning units—

BC-191 Transmitter—12 Volt: Used $24.95—New $34.95
BC-375 Transmitter—24 Volt: Used $29.95

TUNING UNITS For BC-375 & BC-191:

	NEW	USED
TU-5 —1.5 MC to 3 MC	$5.95	$4.95
TU-6 —3 to 4.5 MC		3.95
TU-7 —4.5 to 6.2 MC	3.95	2.95
TU-8 —6.2 to 7.7 MC	3.95	2.95
TU-9 —7.7 to 10 MC	3.95	2.95
TU-10—10 to 12.5 MC	3.95	2.95
BC-306 Antenna Tuner	3.95	2.95
CABLES PL-64-61 or PL-59 Each End	Ea.:	2.75

ANTENNA MATCHER—Variable Inductance Tuner with calibrated veneer lock Dial, 100 Watt Capacity. Size: 7½" x 3½"—Used.....$ 9.95
UNIT with 0-8 RF Meter and Panel—Used.....$12.95

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HANDSET with Retractable Cord—Butterfly Sw., PL-68 & PL-55 Plugs H-22/U.....New: $4.95
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FREE $1.50 Value Rubber covered HANDSET HANGER — FREE of charge with purchase of any Handset!

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T-17 MICROPHONE.....New: $8.95.....Used: 3.95
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BC-1158 TRANSMITTER

Pictured at left—Easily converted to 6 Meters. Frequency coverage 53.3 to 95 MC, 50 Watt RF Doubler Amplifier & Modulation sections complete with 4/815 & 10/12SN7 Tubes. For conversion, see CQ Magazine, January, '57.

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BC-929 RADAR OSCILLOSCOPE—Makes a low cost station monitor. Has horizontal, focus, sweep, & intensity controls. Tubes: 1/3BP4, 2/6H6, 2/6SN7, 1/6G6, 1/6X5, 1/2X2, & Antenna Change Motor. Voltage required: 115 V 400 cycle & 24 VDC. For conversion, see QST, August, '57.

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$11.95 DM-35 DYNAMOTOR $14.95

USED, CHECKED — 12 Volt input; output 625 VDC @ 225 MA. — NEW

12 VDC DYNAMOTORS:

	NEW:	USED:
220 VDC—80 MA—DM-34	$4.95	$2.95
540 VDC—450 MA—DA-12	14.95	11.95
425 VDC—163 MA—WE-377	12.95	9.95
225 VDC—100 MA—D-402	8.95	5.95
230 VDC— 90 MA—PE-133	4.95	...
150 VDC—100 MA—DM-310X	...	2.95
250 VDC— 60 MA—DM-32-12V	4.95	...
250 VDC— 50 MA—DM-25	4.95	2.95
500 VDC— 50 MA—USA/0515	4.95	3.95
24 VDC—1.5 A—USA/0515	4.95	3.95
300 VDC—150 MA—CTR-124	5.95	4.95
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625 VDC—255 MA—DM-35	14.95	11.95

6 VDC DYNAMOTORS:

640 VDC—260 MA—Reconditioned by G.E.....$12.95
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Send us your Specifications and requirements for other type Dynamotors—Inverters—Generators!

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BC-906D—Absorption Type, using the dip of a 2" 0-500 DC Microammeter for frequency indication. Battery operated, with Chart and Manual—USED: $7.95
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115 Volt 60 cycle Receiver for Airport monitoring. Frequency Range: 200-500 KC Five Tube, fixed tuned TRF Circuit by use of four Plug-in coils. Unit fits standard 19" Rack Panel, 3½" deep. Complete with Tubes: 2/6SK7, 6SJ7, 6V6. & 5Y3GT and Four Plug-in Coils to cover the Freq. Range. Also Instruction Book. New.

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TYPE No.:	VOLTAGE:	USED WITH:	NEW:	USED:
PE-110	115 V—60 cyc.	BC-669	$49.50	
PE-117	6 or 12 VDC	BC-659	12.95	$ 9.95
PE-97	6 or 12 VDC	BC-620	12.95	9.95
RA-20	115 V—60 cyc.	BC-342/312	14.95	12.95
PS-274	115 V—60 cyc.	Rec.274/ARC-5	18.95	
PS-3050	115 V—60 cyc.	BC-603/683	17.95	
PS-1206	115 V—60 cyc.	BC-1206	18.95	

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1080 VCT/190 MA—6.3/1.2; 6.3/3.6; 5V/4.....$4.95
600 VCT/100 MA—6.3/5A; 5/3A 3.95
240 VCT/35 MA—24/.9A; 6.3/.6; 6.3/.3..... 1.75
1500 VCT/260 MA—6.3/3A; 6.3/5A; 5V/4.5A.... 7.95
700 VCT/150 MA—6.3/4.5A; 5V/3A 3.95
1890 VCT/12.6 MA—Tapped 2.5V/2A 3.95
1100 VCT/80 MA—7.5 VCT/3.25A 3.95
560 VCT/70 MA—6.3V/2.1A; 5V/3A 2.95
16 Volt 35 Amp....$14.95; 9 Volt CT 35 Amp.... 5.95
5V/2 Amp 3 Windings: 5V/6A..... 2.95

TRANSFORMERS FOR SURPLUS EQUIPMENT:

1200 VCT/200 MA—12.5/2A; 12.5/2A; 5V/3A—H-108 .....$8.95
500 VCT/50 MA—24V/1A; 6.3V/1A—H-109 ..... 4.95
500 VCT/80 MA—24V/2A: 5V/3A—H-110 ..... 4.95
12.6/2 Amp.....$1.95; 24V/1 Amp..... 1.95
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CHOKE 12.5 HY/100 MA..... 1.95
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CHOKE 8 HY/150 MA 200 ohm Open Frame..... 1.25
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RD-7/APA-23 RECORDER

Electro - Mechanical Device, intended to record radar search receiver Freq. & Time signals. Requires two minutes for sweep across recording paper. Automatic or manual operation. Operates on 80/115 V. 60-1200 cycle & 28 VDC. New..... **$29.95**

EE - 8 FIELD TELEPHONE $14.95

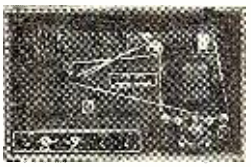
Ideal for private telephone system for two or more phones, up to 17 miles. Hand ringer, generator with handset, carrying case. Uses 2 flashlight batt. Used, Checked.

WIRE—Weatherprooof Twisted Pair: 500 ft. $4.75—135 ft. $1.00—2500 ft. $19.95. Per Foot at 1½¢.
COMBAT WIRE—Rubber covered W-130..$.01 per Ft.

SCHEMATICS and MANUALS

Surplus Conversion Manual #1 or 2.....$2.50
Surplus Conversion Manual—Command Sets..... 1.50
TECHNICAL MANUALS—BC-603/604, BC-659, BC-745, BC-223, BC-312, Mark II.....Each: 3.00
SCHEMATICS—BC-348, BC-224, BC-375, BC-603, BC-229/429. BC-230/430, Mark II...Each: 1.00

TG-34A KEYER



Automatic unit for reproducing audible code practice signals previously recorded in ink on paper tapes—Complete with speaker and phone jack for plugging into headset. Variable speed motor control to 25 WPM. Keying oscillator for use with hand key—Complete portable unit with Tubes and Manual.....New: **$24.95**

PANORAMIC ADAPTER: $34.95

NAVY MODEL RDP—115/230 Volt 60 cycle; for viewing of Radio Signals on 3" C R Tube 5 MC above and below the receiver frequency simultaneously; 30 MC input, 10 MC max. sweepwidth. Size: 18" L x 10" H x 17" W. Used—Complete with tubes.

RADAR OSCILLOSCOPE

Control Indicator with 25 Tubes, consisting of: 12/6SN7, 5/6SL7, 7/6V6, & 1/5CP1. All Controls on front panel, such as horizontal, vertical, sweep, intensity, centering, input and output circuits, etc. Voltage required: 2400 VDC 300 VDC & 6.3 V. Size: 24" L. x 20" D. x 10½" H. Complete with tubes and circuit diagram .....NEW: **$14.95**

SCR - 522 REC. - TRANS. $29.95

100—156 MC Crystal Control, 4 channel AM Voice, Preset Freq., 18 Tubes. Complete with Tubes, Schematic, and Conversion to 2 Meters. Used.

RECEIVER Chassis Only, Less Shifters—	TRANSMITTER Chassis Only, Less Shifters—
With Tubes.....$14.95	With Tubes.....$18.95
Less Tubes..... 7.95	Less Tubes..... 7.95

POLICE • CD • FIRE • CAP Communication Equipment 20 TO 50 — 150 TO 172 MC

30 - 50 MC FM RECEIVER

NEW: $29.95
USED: $24.95

Converted Gov't. Surplus, 15 MC Spread. Specify Freq. Spread. Receiver illustrated at left, described below, prices at right. FM Receiver, continuous tuning & 10 preset channels, speaker, squelch, 10 tubes.

BC-603: 20—27.9 MC—Used $14.95.....New $19.95
BC-683: 27.9 to 38.9 MC.....Used 24.95
12 V Dynamotor f/above Rec.: Used $2.95—New 6.95
115 V 60 cycle Power Supply f/above Rec....New 17.95

BC-604 FM TRANS. 20-27.9 MC U: $14.95; N. 19.95
BC-924 FM TRANS. 27-38.9 MC U: $14.95; N: 19.95
BC-620 FM TRANS.-REC.—20—27.9 MC....U: 14.95
BC-659 FM TRANS.-REC.—27—38.9 MC....U: 14.95
POW. SUP. 6 or 12 VDC f/BC-620-659 U: $9.95—N: 12.95

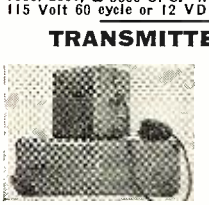
30-40 MC FM RECEIVER $34.95

Link Model FM R11UF—Crystal Control preset. Ten Tubes: 2/6H6, 1/6V6, 2/6AC7, 2/6SJ7, 1/6K6, 1/6C8, 2/6K8. Size: 13" L x 7½" H x 8½" W. New, complete with Tubes. Voltage required 6 VDC & 220 VDC 80 MA.

I-208 FM SIGNAL GENERATOR $59.50

I-208 FM SIGNAL GENERATOR—Standard of Voltage Frequency and Frequency Deviation for the test alignment, calibration, sensitivity measurements of FM Receivers. Frequency Range 1.9 to 4.5 MC & 19 to 45 MC. Frequency Deviation can be adjusted 0 to 5 KC for 1.9 to 4.5 MC and 0 to 50 KC each side for the 19 to 45 MC Band. Stability .03 percent through use of crystal calibrator. Power output .333 to 7.03 Kilowatts. Voltage output .10 to .84. Modulation Freq.: 150-400, 1000, 2500, & 5000 CPS. With Output Meter & Speaker: 115 Volt 60 cycle or 12 VDC input—Used.

TRANSMITTER-RECEIVER



150 - 172 MC FM

Fixed Frequency Crystal Control; less Crystal. Both units on a common chassis. Transmitter 30 Watt—Separate 6 VDC Power Supply—Complete with Cables, Control Unit, Microphone, & Antenna. Used—Checked. Raytheon #21TRIIA....$59.50

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terial presented by the authors, but for design engineers and those concerned with equipment operating in the u.h.f. bands, this text should prove invaluable. — —

* * *

"TRANSISTOR PHYSICS AND CIRCUITS" by Robert L. Riddle & Marlin P. Ristenbatt. Published by *Prentice-Hall, Inc.*, New York. 418 pages. Price $10.00.

The transistor art has moved so fast and so far in such a short time that it often seems impossible to keep abreast of the new developments from the laboratories and factories.

This is a brand new approach to the subject, presented in such a way that the person relatively unfamiliar with these components can grasp the principles and practices involved in their application.

The text is divided into two main sections, the first dealing with the physical operation of transistors and the second devoted to an explanation of the units themselves. Any person with a good background in algebra and trigonometry will have no trouble with the text. —30—

CALENDAR of EVENTS

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			2	3	4	5
						12
						19
						26

APRIL 10, 11, 12
Tenth Southwestern IRE Conference and Electronics Show. St. Anthony Hotel and Municipal Auditorium, San Antonio, Tex. Conference theme is IGY. Papers, technical sessions, and exhibits. Program for ladies. Contact SWIRECO at Box 55, San Antonio 6, Tex. for other details.

APRIL 14-17
Radio Component Show. Grosvenor House and Park Lane House, London, Eng. Sponsored by Radio and Electronic Component Manufacturers' Federation of Britain.

APRIL 16-25
Instruments, Electronics, and Automation Exhibition, Olympia, London. High-level scientific conference with speakers from many countries will run concurrently. Over 55,000 persons are expected this year.

APRIL 18, 19
Twelfth Annual Spring Technical Conference on Television and Transistors. Engineering Society of Cincinnati Bldg., 1349 E. McMillan St., Cincinnati, Ohio. Sponsored by the Cincinnati Section of IRE. For reservations, write C. F. Winder, Baldwin Piano Co., 1801 Gilbert, Cincinnati 25, Ohio.

APRIL 21-25
83rd SMPTE Convention. Ambassador Hotel, Los Angeles. Technical sessions and exhibits. Herbert E. Farmer, Cinema Dept., USC, chairman of program. Other details from Society of Motion Picture and Television Engineers, 55 W. 42nd St., New York 36, N. Y.

APRIL 24-26
URSI USA National Committee-IRE Spring Meeting. Willard Hotel, Washington, D. C.

FM Station Sends Three Programs At One Time

Conn. station broadcasts 2-channel stereo at same time with a third program.

SUCCESS in broadcasting three programs simultaneously was reported recently to the FCC by FM station WGHF, Brookfield, Conn. The station has also broadcast 2-channel stereo programs while simultaneously broadcasting an entirely different program. WGHF is the first station in the country to be commercially licensed under subsidiary communications authorization to transmit three programs at once. The station has been using the multiplex system of broadcasting to do so.

In practice, two supersonic subcarriers are used to handle the two extra channels sent out by the station. The subcarriers are at 41 kc. and 67 kc. The bandwidths used with these subcarriers is not as great as that used in the main channel, but improvements are being made in this direction at present.

Stereo sound has been broadcast before by the use of two radio stations, such as one AM and one FM, and by experimental FM stations. WGHF is a *regularly licensed* station which has been broadcasting stereo under special trial authorization. The station plans to inaugurate FM stereo broadcasts on a regular schedule as soon as multiplex adapters become generally available to the public.

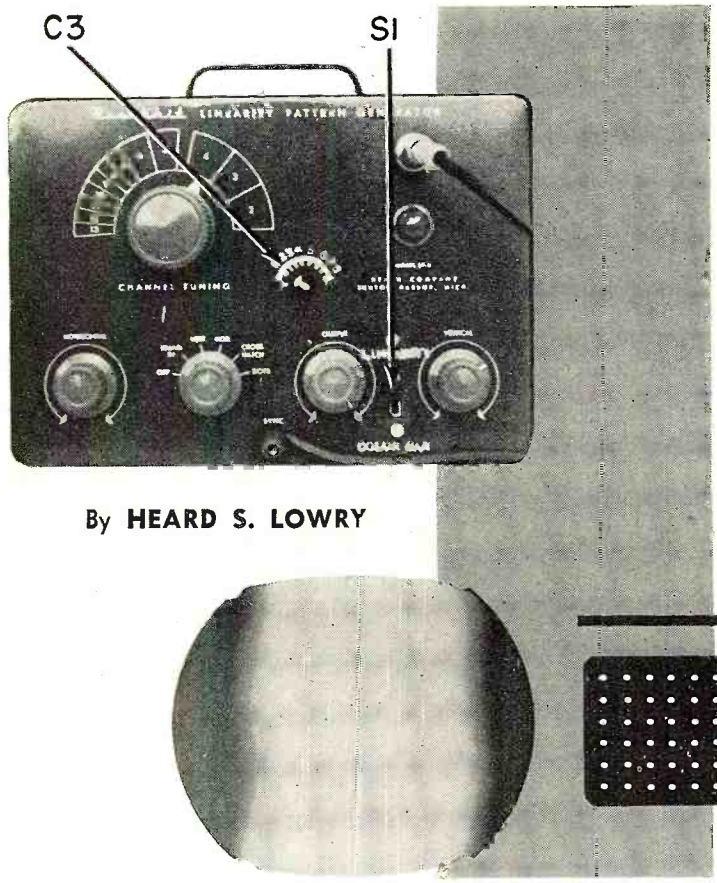
Several manufacturers are interested in making the adapters, which may retail for less than $100 and will make ordinary FM receivers capable of receiving the stereo sound.

The system that is used is fully compatible in that there is no inference to the main channel program when programs are being sent out on one or both of the subcarrier channels.

The station has employed two different methods of broadcasting the stereophonic sound, both using 3-channel transmitter equipment. The first method was to use the station's main channel for an entirely different program, while the two subchannels were used for stereo. Then the station began to use one of the subchannels for a commercial background music service. The main channel and the other subchannel were then used for the stereo broadcasts.

Pointing to the rapidly growing sales of stereo tapes and home equipment, the station foresees a heavy demand for hi-fi stereophonic broadcasting. —30—

Get Color Bars from Your Linearity Generator



By **HEARD S. LOWRY**

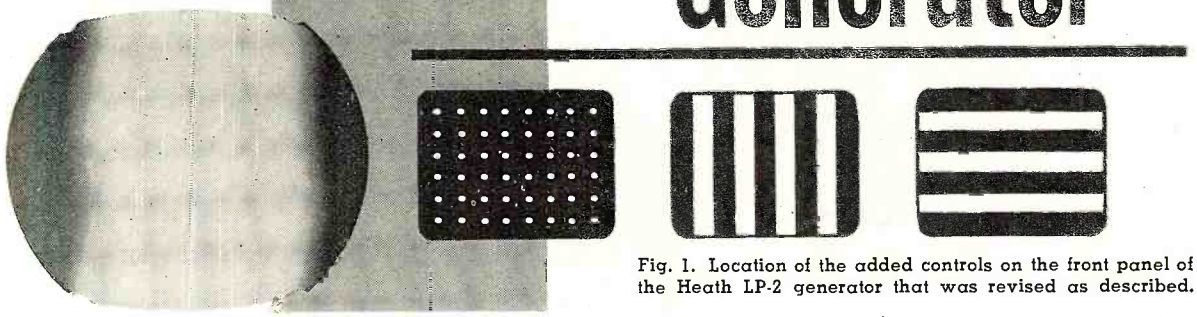


Fig. 1. Location of the added controls on the front panel of the Heath LP-2 generator that was revised as described.

A simple switched network added to most pattern generators will yield a rainbow-pattern output.

AS LONG as there is color service work to be done, the need for some sort of color-bar generator is obvious. The repair technician needs a signal that is within his control for testing purposes.

The idea that a color-bar generator circuit could be added to a linearity pattern generator occurred because the latter clearly has the needed circuit elements for the former already provided. A power supply, an r.f. oscillator, and a means of modulating that oscillator already existed. Accordingly it was decided that the pattern generator on hand, the *Heath* LP-2, would be investigated with this conversion in mind. It was also decided that the following tentative conditions would be laid down: no additional tubes should be needed for the modification, no extra power should be drawn, and whatever components were to be added should fit into the available space without crowding. Also, the added facility should be convenient to use, stable, and not interfere with normal function as a linearity generator.

The relative simplicity of the modification stems from the fact that a rainbow (or color-difference or linear-phase-sweep) signal can be obtained simply by modulating an r.f. signal with another sine-wave signal whose frequency is offset somewhat from that of the color subcarrier. To produce what has come to be accepted as the standard rainbow pattern (oranges and reds on the left, blending into blues in the center of the raster and greens at the right) the r.f. signal would have to be modulated by a frequency of 3.563811 mc. This is the frequency of the color subcarrier minus the frequency of a single line.

Before modification is attempted, the schematic of the linearity pattern generator to be used for the adaptation should be investigated so that a plan of attack might be worked out. The r.f. generator will be there, in any case. To develop the desired modulating signal, we could adapt the horizontal-bar oscillator, the vertical-bar oscillator, or the modulator.

The original circuit of the LP-2 is shown in Fig. 2. In this circuit, the left half of V_4, a 12AT7, is used as a video amplifier (for the modulating signal) and as the modulator. To remove existing circuitry from this stage and to connect the color subcarrier oscillator in its stead, a 4-pole, 2-position switch was required. Actually, a *Mallory* type 6243 lever-action switch was used as S_1. This particular switch actually has 3 positions, one of which was not used. Instead, the

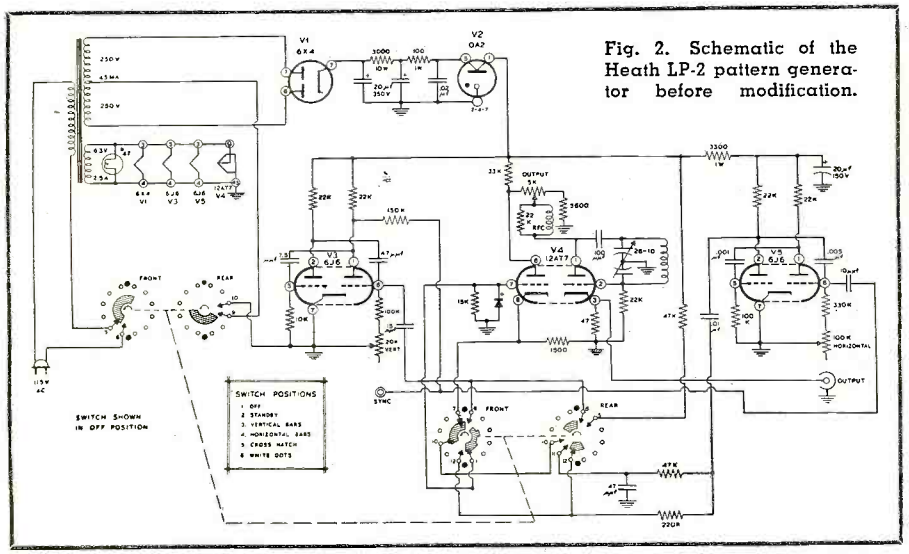


Fig. 2. Schematic of the Heath LP-2 pattern generator before modification.

opening for the switch cut into the front panel (see Fig. 1) was made only long enough to permit the switch to operate in two positions. If the occasion should arise to add another function to this instrument, the slot could be lengthened.

The added circuitry comprises simply an oscillator of the desired frequency and a network to match it to the r.f. carrier oscillator. The schematic of that portion of the circuit which has been modified is shown in Fig. 3. Components that are part of the original circuit are identified as to value. Added components have been enclosed in the broken-line box and identified to correspond with the parts list.

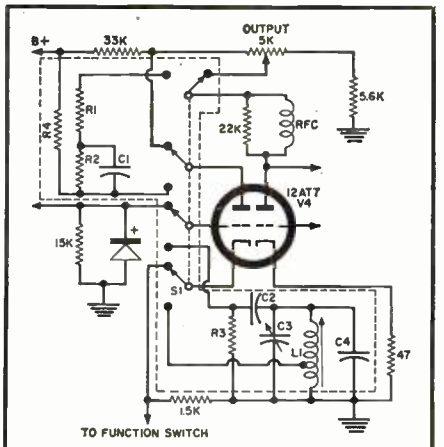
The Hartley oscillator used to generate signal in the vicinity of 3.58 mc. involves a coil (L_1) that may be built up easily on a slug-tuned powdered-iron-core coil form. A ⅜-inch form is used. It may be taken from a surplus coil if one is available, but the variable form itself can be procured separately. Total inductance of the coil is about 13.5 microhenrys, but the need for critical accuracy is eliminated by the fact that we have a variable inductor. Using No. 24 enamelled wire, the author's coil had 49 turns altogether, with the cathode tap being 15 turns up from ground.

Shunted across the coil is a variable capacitor of the midget type (C_3) so that it would not take up too much space on the panel of the instrument. The addition of C_4 in parallel adds to the stability of the oscillator.

It was decided that, rather than providing a fixed rainbow pattern, the instrument should permit some flexibility. The added oscillator was therefore calibrated so that it could be externally adjusted by means of C_3 to produce one or many standard rainbows or else a reversed rainbow. This meant that it would have to be tunable to be slightly above the color subcarrier frequency of 3.58 mc. (to the extent of the frequency of a single line of scan) and quite a bit below (several scan lines) this frequency. (For further information on rainbow patterns and their applications, see "How to Test and Adjust Chroma Circuits," by Robert G. Middleton, January 1958.)

To calibrate the instrument as desired, rotate C_3 until it is fully open. Then the capacitor is backed off by a small amount—approximately 10% of full capacity. In this position, the oscillator should be resonating at the frequency of the color subcarrier itself, 3.58 mc. The variable inductor is now used to bring it to that frequency with the capacitor remaining in the position just noted. To do this, we connect the generator to the antenna input of an operating receiver and adjust the "Channel Tuning" control so that the generator is working on the frequency to which the receiver is tuned. The instrument's original function switch is thrown into the "Vert." position. The added switch, S_1, is thrown into the "Color Bar" position. The inductor is now adjusted until a solid field of light green is seen on the picture-tube screen. (*Although light green was obtained in the case of the author, it is only important to adjust for a solid field. The particular color may vary from receiver to receiver.—Editor.*)

This provides us with a coarse adjustment of oscillator frequency. To refine it, capacitor C_3 is now opened all the way again. The oscillator should now be slightly above 3.58 mc., to the extent that a complete rainbow pattern in reverse is displayed (greens on the left, followed by blues, and then reds). If this condition does not exist, only a slight and final readjustment of the variable inductor should produce the reverse rainbow



R1—1000 ohm, ½ w. res.
R2—10,000 ohm, ½ w. res.
R3—47,000 ohm, ½ w. res.
R4—4700 ohm, ½ w. res.
C1—10 μμfd., 600 v. ceramic capacitor
C2, C4—150 μμfd., 600 v. mica capacitor
C3—4-20 μμfd. midget variable capacitor
L1—13.5 hy. coil. 49 t. #24 en. wire, wound on ⅜" slug-tuned powdered-iron-core form. Tap 15 t. from gnd. end
S1—4-pole, 2-pos. lever-action switch (see text)

Fig. 3. Portion of the original circuit that was revised, with only added components keyed to the parts list.

now. After this has been done, C_3 becomes the adjustment by which we can control the chroma pattern to produce anything from a single reverse rainbow, through one and up to ten rainbows in the accepted direction. Mounted on the front panel (Fig. 1), C_3 may be calibrated.

Figs. 4 and 5 indicate the disposition of the important added components. Although this arrangement does not necessarily hold true for pattern generators of all makes, there is sufficient similarity from one to another so that layout can be adjusted to other units without undue difficulty. The rainbow oscillator described is the key circuit in any case. —30—

Fig. 4. Inside under-chassis view of the modified generator, showing location of new coil L_1 and added selector switch S_1.

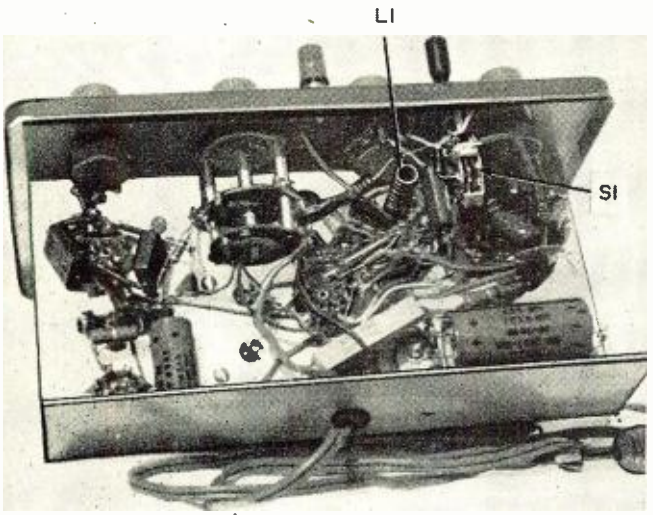
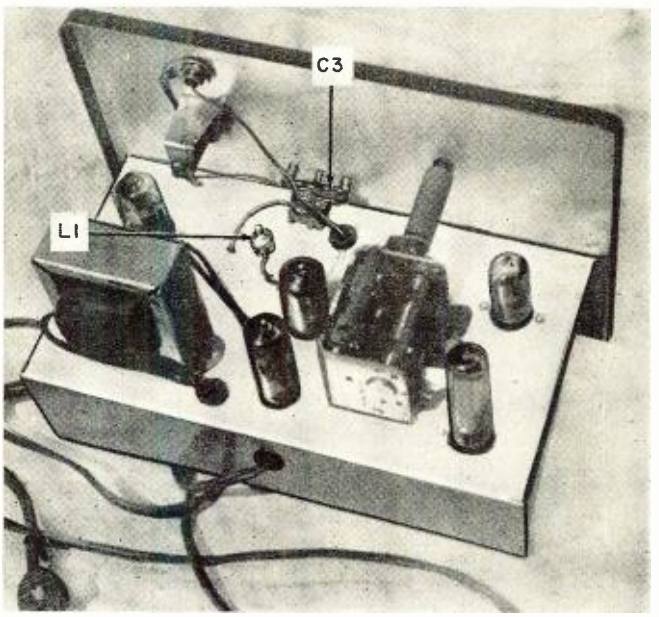
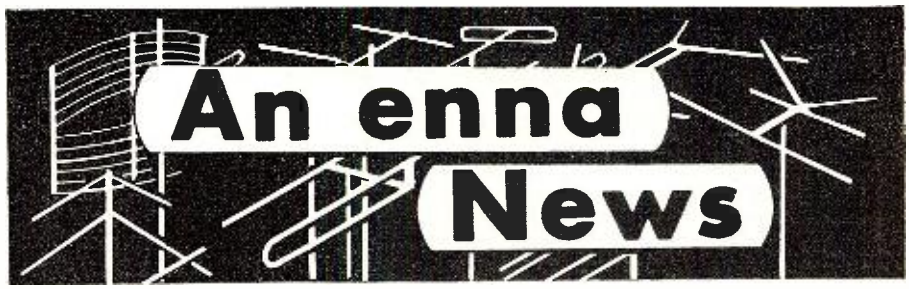


Fig. 5. Inside top-chassis view, showing adjusting slug of the added coil and the panel-mounted rainbow control, C_3.





COMMUNICATIONS TOWER DATA

Rohn Manufacturing Company, 116 Limestone, Bellevue, Peoria, Ill. is currently offering a complete new communications tower catalogue which is available without charge on request.

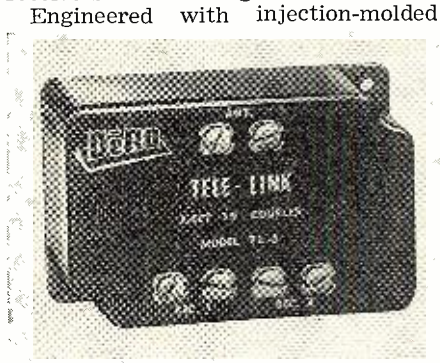
The new publication features full information on the firm's line of heavy duty communications and amateur towers. Produced to include specifications and engineering data not only as to the towers themselves but also in matters of design, installation, and suitability, this catalogue should be of interest to all hams and communications men.

The company's representatives have copies of the catalogue available or readers may write direct to Dept. RTN of the manufacturer for a copy by mail.

TWO-SET COUPLER

DeRO Electronics, 134 Nassau Road, Roosevelt, N. Y., is now in production on a new two-set coupler which permits the operation of two TV or FM receivers from a single antenna.

Engineered with injection-molded



plastics, the TL-2 features exclusive corner-tab design that allows for mounting in any convenient location. The circuit features a piggy-back coil mount that terminates input and output impedances right on the connecting terminals—300-ohm solderless screw terminals for all connections.

Write the manufacturer direct for complete specifications and ordering data.

7-ELEMENT HAM ANTENNA

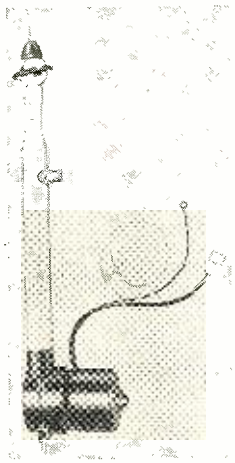
Telrex Laboratories of Asbury Park, N. J., is now offering a new and improved version of its "Tri-Band" antenna to the amateur fraternity.

Designated as the Model TB-7E, this new array features the company's exclusive full-size fanned "Tri-Band" 10, 15, and 20 meter dipole, resonated and matched for single-line 52-ohm feed with 3-element 10-meter section, 2-element 15-meter section, and 2-element 20-meter section.

The company will supply full specifications, price, and shipping data on this new antenna on request.

RETRACTABLE AUTO ANTENNA

The Tenna Mfg. Co., 7580 Garfield Blvd., Cleveland 25, Ohio is now marketing an electrically operated, disappearing type auto radio antenna, the Model TM-1 "Tennamatic."



This universal mounting, motor-driven antenna utilizes a patented thrust-limiting clutch which prevents motor burnout, the major cause of failure in this type of antenna.

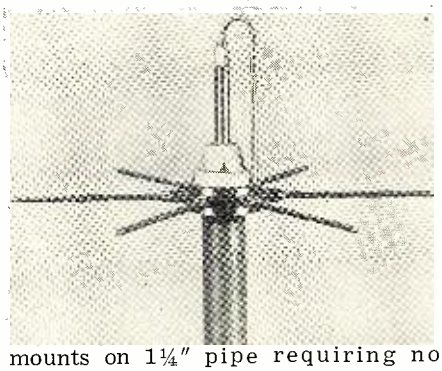
The telescoping mast extends or retracts in a minimum of 10 seconds. The unit's 15-pound thrust assures free action even in zero weather. The motor operates on 12 volts d.c. and draws a maximum of 10 amps. Its housing is treated with special waterproofing compound.

The model TM-1 is designed for front mounting, TM-2 for rear mount while TM-3 is a conversion kit which permits the TM-1 to be rear-mounted.

FOLDED RADIATOR

Herb Kreckman Co. of Cresco, Pa. has added a new model to its "Kreco" line of communication antennas, the Model FGP-155.

The new unit is a folded-radiator type ground plane and is factory cut to any frequency from 108 to 174 mc. It is constructed entirely of corrosion resistant brass (solid, no tubing) and



mounts on 1¼" pipe requiring no clamps or adapters.

RG-8/U feedline is recommended, requiring a PL-259 to attach to the antenna. The feedline is routed through

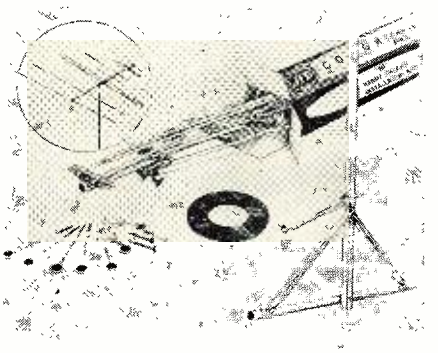
the pipe mast. This same unit is also available equipped with a reflector, thus obtaining a cardioid radiation pattern.

Catalogue 458 describing this new antenna in detail is available without charge from the manufacturer.

JFD "COLORTENNA" KITS

JFD Electronics Corp., 6101 Sixteenth Ave., Brooklyn 4, N. Y. is now making available its "Fireball," "Junior-Helix," and "Super-Helix" Colortennas in the form of complete installation kits.

Packaged in bold 3-color cartons, each factory assembled antenna is shipped complete with Tri-Mount aluminum mast, 50 feet of twin-lead, three 3½" and one 7½" wood screw-eye stand-offs, two mast stand-offs, and three self-sealing drive-in nails.



A hammer and 15 minutes' time are all that are required for making the installation.

TELESCOPING TOWERS

Alpar Mfg. Corp., 2910 Spring St., Redwood City, Calif. is now offering a new series of telescoping aluminum towers and work structures covering a variety of application requirements.

Specially designed extruded aluminum uprights and cross and diagonal bracing provide structures which are about one-fourth the weight of steel at equivalent heights. These precision extrusions also provide low-friction track surfaces for the 2" diameter tempered nylon wheels upon which the telescoping sections roll. Side surfaces on the extruded tracks prevent pull-out or binding of the nylon rollers used with the structures.

Both cranked and motor-operated models are available. Structures and towers which extend to heights up to 200 feet are included in the line. The manufacturer will supply full details on request.

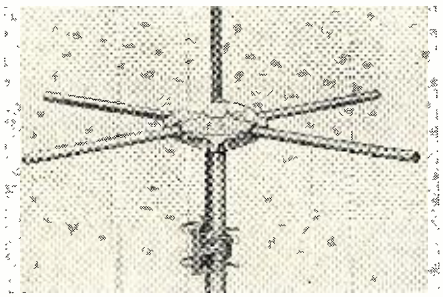
HEATED ANTENNA

Scala Radio Company, 2814 19th Street, San Francisco, Calif. has just introduced a new ground-plane antenna which has a 24-volt heating system for complete weatherproofing and safe year-round operation under the most severe icing and weather conditions.

The Model GPC-150 has been continuously field tested atop Mt. Spokane, Wash. for the past two winters and despite 4" to 5" of radial ice on the guy wires, the antenna remained

free from ice and operated normally through both winters.

Heaters are located in all radial elements as well as the driven element. The 24-volt system can be operated from either a 117- or 230-volt a.c. line. Thermostatically controlled heaters operate only during freezing temperatures.

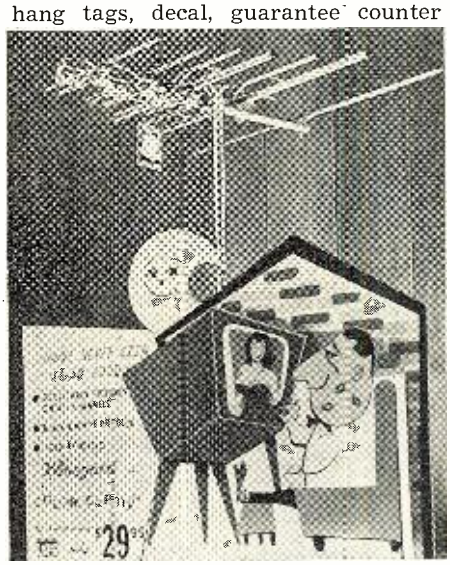


Frequency range is 40 to 170 mc. The unit is shipped complete with all necessary hardware, including U-bolt mounting clamps and brackets. Write the company direct for additional details.

TV ANTENNA DISPLAYS

Winegard Company of Burlington, Iowa recently introduced two dealer floor displays to promote its "Twilight" and "Color'ceptor" models.

The "Twilight" sales booster includes the little "house," five colorful hang tags, decal, guarantee counter card, window signs, and newspaper ad mats. The other display consists of a third-size scaled model of the antenna, two window signs, counter card, decal, check-up sheets, and ad mats.



For information on obtaining either or both of these promotion pieces, write the manufacturer direct.

"MONARCH" COMMUNICATION YAGIS

Telrex Laboratories of Asbury Park, N. J. has announced the development of new, larger "Monarch" yagis.

The top of the line in this new amateur and commercial line is a medium-spaced 14 mc., 6-element array with a 45-foot long x 3-inch o.d. boom, coupled with a center section comprising a 12-foot by .250 wall by 3½" o.d. with sectionally tapered swaged elements providing minimum bulk and

minimum wind drag design. Also supplied are stainless steel hardware and extra heavy-duty, heavily cadmium plated universal gusset mounting. This array produces a gain of 13 db plus a front-to-back ratio of 30 db, and a horizontal beamwidth of 49°.

In addition, to round out the "Monarch" series, the company is offering a 7-element, 21 mc. array; an 8-element, 28 mc. array; and a 13-element, 50 mc. array.

DIRECTIONAL COUPLER

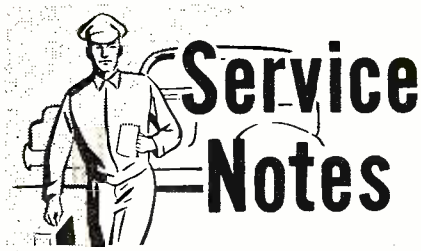
E. F. Johnson Company of Waseca, Minn. has developed a directional

coupler and indicator which provides a continuous reading of either incident or reflected power.

The coupler may be permanently installed in 52-ohm coaxial line and will readily handle maximum legal power as specified by the FCC for amateur service. The indicator consists of a 0 to 100 microammeter calibrated directly in s.w.r. and relative power. Standard tip jacks will permit the use of a commercial multimeter as an indicating instrument, if desired. Reference sheets showing curves are supplied with each coupler for popular multimeter basic ranges.

Additional information on this unit is contained in the company's Catalogue #957 which will be supplied without charge on request —30—

President John L. Burns (center) of RCA looks on as D. Y. Smith (right) and W. W. Watts, company vice-presidents, point out the internal structure of the company's two billionth tube, a traveling-wave type used in radar and missile control systems. The tube is to become a part of a new Navy defense system. RCA is the nation's first electronics company to manufacture the fabulous number of 2 billion tubes.



VIDEO WASHOUT, HOFFMAN

During troubleshooting of a "Mark 10" portable, chassis 326, it may be discovered that the combined video-amplifier/sync separator tube, a 6AW8A, is defective. After replacement, it may develop that the picture washes out when either the brightness control or the contrast control is advanced to a high setting. Because the symptom was not in evidence before failure of the original 6AW8A, technicians may be misled into suspecting some defect in the circuit apart from the tube itself.

If you run into this situation, don't waste time running down a false clue. The new tube itself may be causing all your woes. The manufacturer of the set notes that many 6AW8A's, although they may not be defective, may nevertheless fail to meet the particular requirements of this receiver's circuit. Before attempting other troubleshooting, try several tubes, selecting different runs from different manufacturers, if possible.

RADIO HEARD ON PHONO, RCA

"Break-through" of the radio when combination models 9-US-5H or 9-US-5KE are used in the phonograph position can be eliminated by a relatively simple wiring change, which may be performed with reference to Fig. 1.

This change takes R_5 (47,000 ohms) out of the circuit between the i.f. transformer and the radio-phono

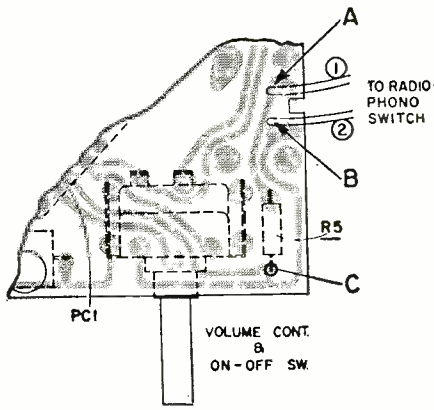


Fig. 1

switch and places it in the circuit between the radio-phono switch and the high side of the volume control. With this revised connection, the switch will connect the i.f. transformer directly to ground during phono operation, shorting out radio signals, and yet retain the original circuit for radio operation. To make the change, proceed as follows:

Disconnect R_5 from C. Disconnect lead *1* from A. Disconnect lead *2* from B. Connect R_5 to B. Connect lead *1* to C. Connect lead *2* to A.

SEARCH TUNING DEFECT

On some *Motorola* automotive radios, specifically the *International Harvester* 86MI Truck Radio, the situation may be encountered in which the search mechanism hangs up at either end of the tuning range or at both ends, failing to reverse itself. The difficulty occurs because the reversing switch that operates the search motor is not tripped completely.

This situation is corrected without much difficulty, but first there is a precautionary note to take into account: when the automatic mechanism has failed to work in the manner just described, the manual tuning mechanism will be blocked as a result.

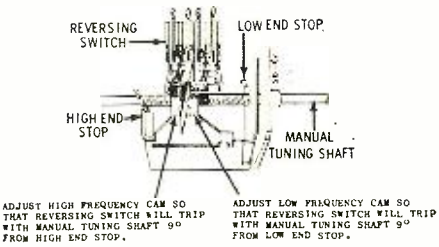


Fig. 2

Therefore, do *not* attempt to force manual tuning at this time, as damage may result. To clear the mechanism and make manual tuning adjustment possible, first turn off the radio briefly, then turn it on again and proceed as follows:

If reversal fails to occur at the high-frequency end, manually trip the reversing switch (see Fig. 2) working from the rear of the chassis. With the manual tuning knob, turn the radio to the high-end stop, then back off the knob about 9° from this stop, as indicated in Fig. 2. Then adjust the high-frequency adjusting cam to trip the switch at this point.

If reversal fails to occur at the low-frequency end, manually trip the switch and tune to the low-frequency extreme. Back off the knob about 9° from this low-end stop and adjust the low-frequency cam to trip the switch at this point.

HUM AND BUZZ, MAGNAVOX

Some chassis in the 21-01BB, 21-02, etc. series were produced with the high side of resistor R_{307} connected to 270 volts. With this wiring, sync buzz may be fed back from the sync splitter to the audio amplifier under certain conditions. If this symptom is encountered, simply disconnect the high side of R_{307} from the present 270-volt point and re-connect this resistor to the junction of R_{215} and R_{216}.

If 120-cycle hum occurs, this is generally due to a change in value of R_{502}, which should be 680 ohms. If this resistor checks off value, replace it with one that is within tolerance rating as specified on the parts list. —30—

"NAME THE ROTOR"

In a joint promotion of its new and improved *CDR* Type 15/16 TV antenna rotator, *Cornell-Dubilier Electric Corporation* of South Plainfield, N. J., and its subsidiary, *The Radiart Corporation* of Indianapolis, has a nationwide "name" contest underway.

Involving no purchases, the contest is open to all radio, TV, and electronic technicians residing in the United States. Official entry blanks are available at all distributors handling either line.

Top prize for the best name submitted is a 1958 *Plymouth* station wagon. The contest closes at midnight, April 30, 1958.

* * *

"PHOTOFACT" SELLING PACKAGE

A life-size floor display in full color is being used by distributors to introduce the *Howard W. Sams & Co's.* new "Photofact" selling package for service technicians.

The new program offers an all-steel, single-drawer free with each 60 sets

of "Photofact" folders. The display features a male cut-out who calls attention to salient features.

Further information on this promotion can be obtained by writing the general sales manager of the firm, Joe E. Marin, in care of the company at 2203 E. 46th St., Indianapolis 5, Ind.

* * *

MUELLER "50TH" SOUVENIR

Mueller Electric Company, 1583H E. 31st St., Cleveland 14, Ohio, is celebrating its 50th anniversary year with a gracious gesture to its friends and customers over the years.

Upon request, the company will send a gold-plated alligator clip as a souvenir of its Golden Anniversary. The clip might be termed symbolic of "membership" in the electrical or electronic industries and will be found useful as a tie clip, general purpose desk and

paper clip, or just as a handy gadget to have in the pocket.

* * *

SPEAKER PACKAGING

Oxford Components, Inc., 556 W. Monroe St., Chicago, Ill., is now packaging its complete line of rear seat hi-

fi kits in eye-catching, multi-color counter displays.

According to the company, the new packages will "sell themselves" because in addition to bright colors and modern design, they make inventory checking simple with large size lettering for model number and other pertinent information.

Further information on both the speakers and the counter displays is available from the company on request. Please send inquiries to the attention of Tom Brown, the distributor sales manager.

* * *

"SERVICE-SAVER" DISPENSERS

JFD Electronics Corporation, 6101 Sixteenth Ave., Brooklyn 4, N. Y., has converted all cartoning of its numerous television accessories to its new "Service-Saver" dispenser.

The new shipper-merchandiser-dispenser will carry five of the units, each individually housed in a newly styled, 3-color box. Equipped with a tab on the top and easel back, the dispenser can be hung from a shelf or wall or stood on a counter or window shelf for maximum display value.

* * *

"PROMOTION-OF-THE-MONTH"

Sylvania Electric Products Inc. has observed the first anniversary of its "Promotion-of-the-Month" with the announcement that the unique merchandising plan will be improved and expanded during 1958 by the radio and television division of the firm.

This year's plans call for a new promotion on the first day of each month, with all ideas field-tested before use and the finished promotion backed by national advertising and material for local dealer tie-ins. The Division has promised to deliver each promotion to distributors at least 30 days before

the opening date, giving dealers plenty of time to become acquainted with the particulars.

Although the 1957 promotions were confined to the television line, this year's promotions have been expanded to include high-fidelity instruments and home radios.

* * *

MOTION DISPLAY

A three-dimensional, four-color, battery-operated motion display of a tube being plugged into and out of a socket

is being made available to its franchised distributors by *Amperex Electronic Corporation,* Hicksville, Long Island, N. Y.

Besides its striking visual appeal, the display will also attract by the unique click sound made when the tube contacts the socket. The slogan "Retube with *Amperex*" is prominent on the display, which is constructed of sturdy board and uses but one standard flashlight battery.

For further details on this sales aid, write direct to the manufacturer at the above address.

* * *

ATR COUNTER DISPLAY

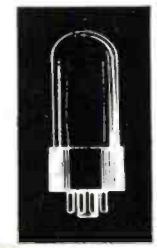
American Television & Radio Co., 300 E. Fourth St., St. Paul 1, Minn., has released another of its products in a new and lively counter display.

The latest of the "silent salesmen" offerings features the firm's electronic tube protector. The package takes up little room on the counter yet presents

a flip-up top which carries a pertinent sales message.

Complete descriptive literature on the product and its new packaging for fast turnover are available from the factory. —30—

1958 Tube Inventory for Service Shops



By **MURRAY BARLOWE**
Barlowe Television

Do you have trouble determining how many of which tube types to stock?

WITH the continuing stream of new tube types —this year's list is about 18% longer than last year's—keeping a working inventory becomes increasingly difficult. We find it necessary to set up a perpetual check system, in which this "minimum-quantity" list is compared to actual stock every morning. As soon as a type falls below its minimum-quantity figure, it is re-ordered. The quantity figure is, of course, relative, depending on volume of business, but should hold proportionately.

Since the list is geared to the independent shop in a metropolitan v.h.f. area, the minor addition of u.h.f. r.f. types should be made where needed. Since the relative importance of industrial electronic (*) and color TV (**) service may vary widely, the tubes involved have been specially marked.

A number of tube types that still showed some activity last year began gathering dust on the shelves this year. Accordingly, they were dropped from the listings as deadwood. These include the 1A7GT, 1H5GT, 6SBY7, 6F5, 6N7, and 80. The significance of this reduction is more than counterbalanced by the fact that over 40 types that were not included last year have been added! In addition, recommended quantities have changed. —30—

Type	Quan	Type	Quan	Type	Quan	Type	Quan	Type	Quan	Type	Quan
*0A2	2	5J6	3	6BC8	2	6DQ6	5	7F8	2	12V6GT	3
*0B2	2	*5R4GYA	5	**6BD4A	1	6DT6	1	7G7	1	12X4	2
0Z4	5	5T8	2	6BD6	3	6E5	1	7H7	1	17AV5	1
*1AX2	3	5U4GB	10	6BE6	5	6H6	1	7N7	2	17AX4	1
1B3	5	5U8	2	6BF5	2	6J5	3	7Q7	1	17DQ6	1
1R5	2	5V4G	3	6BF6	2	6J6	6	7X7	1	19AU4	2
1S4	2	5X8	2	6BG6	6	6K6GT	6	7Y4	1	19BG6	2
1S5	2	5Y3GT	4	6BH6	1	6L6	1	12AL5	1	19T8	1
1T4	2	6AB4	4	6BH8	1	6M3	1	12AQ5	1	25AX4	1
1U4	2	6AC7	4	6BJ6	1	6S4	4	12AT6	3	25BK5	2
1U5	2	6AG5	5	**6BK4	2	6S8GT	1	12AT7	6	25BQ6	4
1V2	2	6AG7	3	6BK5	1	6SA7	3	12AU6	2	25CD6	1
1X2B	5	6AH4	2	6BK7A	3	6SC7	2	12AU7	10	25CU6	1
*2D21	2	6AH6	3	6BL7	3	6SF5	1	12AV6	3	25DN6	2
**3A2	2	6AK5	2	6BN6	3	6SG7	1	12AV7	5	25L6	4
**3A3	2	6AK6	1	**6BN8	1	6SJ7	2	12AX4	3	25W4	4
3AL5	2	6AL5	5	6BQ6	10	6SK7	3	12AX7	3	25Z5	1
3AU6	4	6AL7GT	2	6BQ7A	10	6SL7	3	12AY7	2	25Z6	2
3AV6	1	6AM8	2	6BR8	2	6SN7	10	12AZ7	1	35A5	2
**3B2	2	6AN8	4	6BV8	1	6SQ7	3	12B4	3	35B5	3
3BC5	4	6AQ5	4	6BX7	2	6SR7	1	12BA6	3	35C5	3
3BE6	2	6AQ6	2	6BY5	2	6T8	3	12BA7	1	35L6	4
3BN6	2	6AQ7GT	2	6BY6	1	6U8	6	12BD6	2	35W4	5
3BU8	1	6AR5	1	6BZ6	2	6V3	2	12BE6	4	35Y4	1
3BY6	2	6AS5	3	6BZ7	6	6V6GT	6	12BF6	3	35Z5	4
3BZ6	2	6AS6	2	6C4	2	6W4	10	12BH7	5	50A5	1
3CB6	4	*6AS7G	1	**6CB5	2	6W6GT	4	12BK5	2	50B5	2
3CF6	2	6AT6	5	6CB6	10	6X4	4	12BN6	1	50C5	2
3CS6	2	6AU4	4	6CD6	4	6X5	2	12BQ6	3	50L6	5
3DT6	2	6AU5	3	6CF6	2	6X8	3	12BY7	4	117Z3	1
3Q4	1	6AU6	10	6CG7	6	6Y6	1	12BZ7	2	117Z6	1
3Q5GT	1	6AV5	3	6CG8	1	7A7	1	12CA5	1	5642	2
3S4	2	6AV6	4	6CH8	2	7AF7	1	12CU5	3		
4BQ7A	4	6AV8	2	6CJ5	2	7AG7	1	12DQ6	3		
4BZ7	2	6AW8	4	6CL6	3	7AH7	1	12L6	2		
5AM8	2	6AX4	4	6CM6	1	7AU7	5	12SA7	2		
5AN8	4	6AX5	2	6CM7	2	7B4	1	12SG7	1		
5AQ5	2	6AX8	1	6CN7	1	7B5	1	12SH7	1	*Industrial electronic	
5AT8	2	6AZ8	1	6CR6	1	7B6	1	12SJ7	1	**Color	
5AV8	2	6BA6	4	6CS6	2	7B7	1	12SK7	3		
5BK7A	3	6BA8	2	6CS7	2	7C5	2	12SL7	1		
5BR8	1	6BC5	10	6DE6	1	7E5	1	12SN7	4		
5CG8	1	**6BC7	2	**6DQ5	1	7F7	1	12SQ7	3		

Transistor Keyer

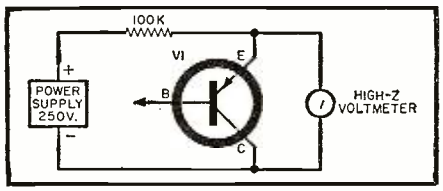
(*Continued from page 39*)

transistor. Care should be taken to limit the maximum possible current so that the dissipation of the transistor is not exceeded. If possible, several transistors should be checked and the one with the highest breakdown voltage should be used. (See Fig. 2.)

No doubt everybody knows by now that a heat sink is necessary if the transistor is to be soldered into the circuit with short leads. A tricky point when using a socket with a transistor is that the transistor *must not* be in the socket when doing the soldering. This is brought up since a common practice with miniature tubes is to use a tube to hold the socket pins straight when soldering.

After hooking up the transistor keyer to your transmitter a check should be made of the keying characteristics both of the transmitter up to and including the keyed stage, and then of the transmitter as a whole. This is because if the later stages have excessive bias, drive, or parasitics, they may reintroduce clicks which would defeat the purpose of this unit. -30-

Fig. 2. Transistor Zener voltage test.



LOW-FREQUENCY RECEIVER

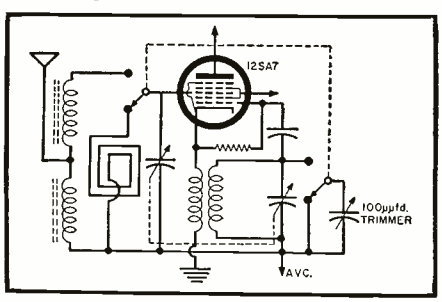
By DALE LEUTHOLD

MANY private plane owners wish to receive the local low-frequency weather station in their homes. An a.c.-d.c. five tube receiver can be easily converted for this purpose.

Two "Vari-Loopsticks" side by side in series-aiding resonate around 332 kc. with the tuning capacitor plates closed. For lower frequencies, it may be necessary to add a trimmer across the "Loopsticks." A 100 μμfd. trimmer across the oscillator section of the tuning capacitor lowers the oscillator frequency.

Since only one station is desired, the receiver may be peaked at that frequency without regard for tracking. An antenna wire six feet long should provide ample volume. A d.p.d.t. switch permits regular broadcast reception. -30-

Simple circuit for aviation enthusiasts wishing to tune l.f. weather stations.



What's New in Radio

NEW V.T.V.M.

Superior Instruments Co., 2435 White Plains Road, New York 67, N. Y. has just introduced a new vacuum-tube voltmeter which combines unusual sensitivity with ease of operation.

The Model "77" is equipped with a large, easy-to-read 6″ meter which provides accurate readings at a glance. Complete with all accessories including test leads, probe, portable case, and full instructions, the unit can be used as a sensitive d.c. voltmeter, an r.m.s. and peak-to-peak a.c. voltmeter, and electronic ohmmeter. It can also be used for db measurement and is equipped for zero center discriminator alignment.

Further details on this moderately priced service instrument will be supplied by the company on request.

NEW "HANDI-CHEST" MODELS

Campro Products, Inc., 3131 Alliance Road, Canton, Ohio is now offering a new line of "Jiffy Handi-Chest" cabinets designed for the orderly storage of small parts.

Of interest to hobbyists as well as professional technicians, the frames of the chests are molded of super-tough

high-impact plastic in modern colors of tangerine, beige, or turquoise. The chests set on inch-high tapered risers to prevent scratches or mars.

The five models range in capacity from four drawers to 16 drawers. All of the drawers are 1¼″ deep, are crystal clear for quick identification of contents, and have dividers supplied with them to make three compartments in each drawer, if desired.

ISOLATION TRANSFORMER

A new isolation transformer specifically designed to isolate a.c.-d.c. portable TV receivers (hot chassis) from the 117-volt line is now being produced by *Chicago Standard Transformer Corporation*, 3501 W. Addison St., Chicago 18, Ill.

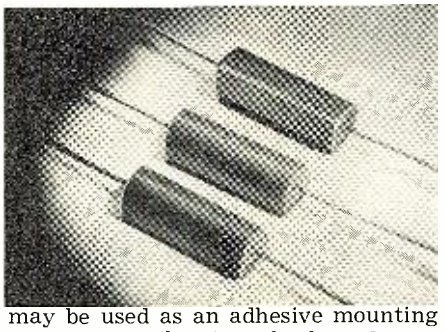
Designated as *Stancor* part number P-6371, the transformer will handle up to 175 watts and is supplied in a one-piece drawn steel case. It has an electrostatic shield and is equipped with a six-foot line cord.

The company will supply full details upon written request.

"FLATTED" RESISTORS

Clarostat Mfg. Co., Inc. of Dover N. H. has developed a deposited-carbon precision resistor which has a flatted area to meet the requirements of certain assembly jobs.

The flatted area serves as an index surface for automation, permitting orientation of marking and leads. It



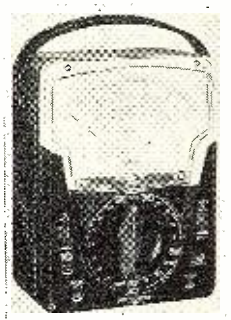
may be used as an adhesive mounting for unusual vibration, shock, and power requirements, doing away with mounting brackets with their associated weight and space needs. Marking area is extended to three sides and readily seen and, of course, the component will not roll.

At the present time the company is offering these ½-watt "Fixtohm" units in a resistance range of 10 ohms to 2.5 megohms ± 1%.

Write the manufacturer for full details and complete specifications.

TWO NEW TRIPLETT V.O.M.'S

Triplett Electrical Instrument Company of Bluffton, Ohio has added two new v.o.m.'s to its service and industrial line, bringing to eleven the number of such instruments available for a wide range of applications.



The Models 630-PL and 630-APL feature easier reading and provide a clear unbreakable shadowless front for instant accurate vision of the new longer, wider spread scales.

Other features of the new models include: 5 to 500,000 cps response on a.c.; continuous resistance readings from .1 ohm to 100 megohms; polarity reversing switch; single king-sized switch to select both circuit and range, minimizing wrong settings and burnouts.

Further information and full specifications on these two new models will be supplied by the manufacturer on request.

GARAGE DOOR CONTROL

Barber-Colman Company, Rockford, Ill. is now offering a new garage door controlling device which is being marketed under the name of the "Barcol Doorman."

The unit opens, closes, and locks garage doors electronically; operates garage lights and driveway lights; will handle multiple controls either in cars or in the house; provides instant reversing of the door from the dashboard or any control button; includes a safety clutch if any obstacle interferes with the door operation; and operates from a low voltage source.

Operating frequencies are adjusted so that no two installations in adjacent areas are the same, thus eliminating faulty or illegal operation. A four-page brochure on the "Doorman" will be supplied by the company on request.

NEW "REJUVATUBE"

Central Electronics, Inc., 1247 W. Belmont Ave., Chicago 13, Ill. is now marketing a new model of its CRT rejuvenator as the Model RE-2 "Rejuvatube".

The newest model features a rugged, heavy duty steel carrying case; illuminated meter; new TV interlock power cords; and a new "cube socket" selector and cable as a "one piece" assembly.

The new "cube socket" and switch assembly enables the testing and rejuvenation of each gun of a color tube; 110-degree short tubes with miniature or medium bases; and conventional black-and-white tubes. A new circuit and an additional direct reading scale on the meter allows the technician to check "gas content" of all popular picture tubes.

A four-page brochure on this new instrument is available from Dept. RN of the company.

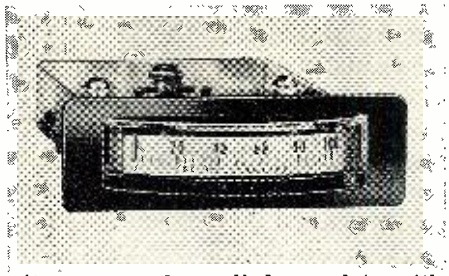
EDGEWISE PANEL METERS

Simpson Electric Company, 5200 W. Kinzie St., Chicago 44, Ill. is marketing a new panel meter which has been specifically designed to save space.

Available in two styles, the new panel instruments provide all the visibility of a conventional 2½" meter while using only half the panel space. Using the company's self-shielded core

magnet meter movement, the new "Edgewise" meters are accurate to plus or minus 2% of full scale deflection in d.c. ranges.

Weighing only 5 ounces, the new meters are mounted in dustproof lu-



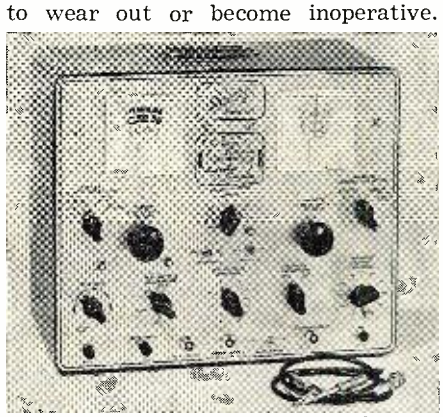
cite cases and supplied complete with bezel, escutcheon plate, and two speed nuts for quick, easy mounting.

Currently the new meters are being stocked in fifteen ranges and types. Contact your local electronic distributor or the company direct for further information.

TV SWEEP AND MARKER

The Hickok Electrical Instrument Co., 10524 Dupont Ave., Cleveland 8, Ohio is now offering a new single unit v.h.f.-u.h.f. sweep-marker-alignment generator which has been specifically engineered to provide all the necessary features and ranges required for visual alignment of modern TV receivers.

The Model 615 features an all-electronic sweep with no moving parts to wear out or become inoperative.



Amplitude modulation said to be less than .1 db per mc. results in true and undistorted curves when viewed on a scope. Marker frequency is within .5% at any setting, with excellent attenuation. Knife-edge non-parallax pointers practically eliminate reading errors.

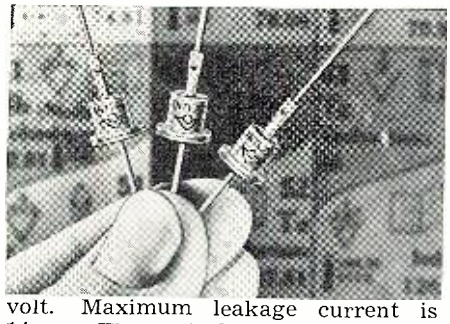
Complete electrical and performance specifications on the Model 615 are available on request.

SILICON PIGTAIL DIODES

International Rectifier Corporation, 1521 E. Grand Ave., El Segundo, Calif. is now offering a new series of high-current silicon pigtail diodes featuring excellent forward and reverse characteristics, resulting in high rectification efficiency.

This series, composed of JETEC types 1N536 through 1N540, is rated at 750 ma. at 50 degrees C and 250 ma. at 150 degrees C ambient, with

peak inverse voltage ratings of 50, 100, 200, 300, and 400 volts respectively. The maximum full load average voltage drop of these diodes is .5



volt. Maximum leakage current is 14 ma. The typical diode characteristics are well within these specified maximum values.

The company will supply additional details on this new line, on request.

SUBMINIATURE ELECTROLYTICS

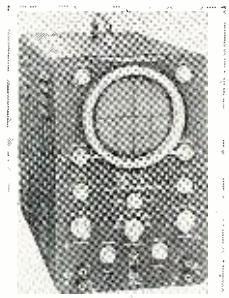
Cornell-Dubilier Electric Corp. of South Plainfield, N. J. is now offering its Type EC aluminum-foil electrolytic capacitors which have been specifically designed for transistor and "low-B" tube applications where compactness is important.

The smallest case size is .187" in diameter and ½" long, the largest only .375" x 1½". The new capacitors are available in ratings from 3 to 75 volts and in capacities from 1 to 250 μfd., depending on voltage ratings. Operating temperature range is −20 to +65 degrees C.

Bulletin 524A, containing complete information, is available from the manufacturer without charge.

5" SCOPE KIT

Paco Electronics Company, Inc., 70-31 84th St., Glendale 27, New York is now offering a 5" cathode-ray oscilloscope in kit form as the Model S-50.



Designed for use in radio and TV servicing, hi-fi custom building and service, electronic hobbies, amateur radio, and school lab work, the new circuit features push-pull vertical and horizontal amplifiers, printed-circuit amplifier design, and a 1 mc. high-sensitivity vertical amplifier. In addition, the scope provides a built-in, 1-volt peak-to-peak self-calibrator, a two-color easy reading panel, and a louvered steel cabinet.

The Model S-50 measures 13⅜" x 8¾" x 17¼" over-all. A set of probes comes with the scope.

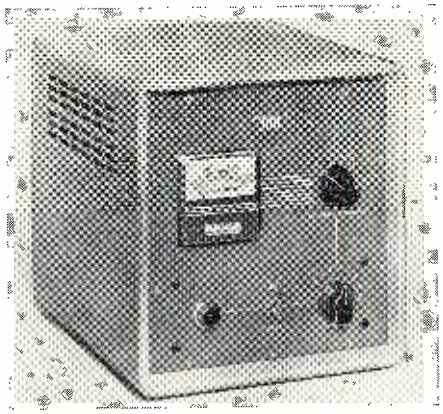
LINEAR AMPLIFIER

Transitron, Inc., 186 Granite St., Manchester, N. H. has put a compact, fully shielded linear amplifier on the market as its "Vantron 300".

Capable of high power operation on c.w., AM, and SSB, it is especially

suited for SSB operation. It features a minimum number of tuning adjustments, requires little driving power, and has a heavy-duty power supply.

Only readily replaced tubes are used. There are no plug-in coils and the unit's continuously tuned plate

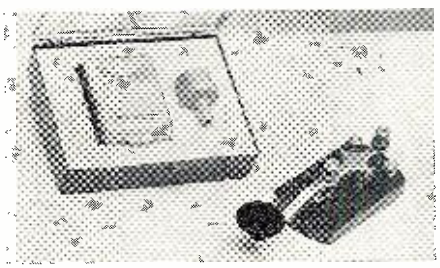


circuit is designed to match 50 to 100 ohm antennas. The circuit is housed in a compact cabinet which measures only 8¼" x 8¼" x 10½".

TRANSISTOR CODE OSCILLATOR

Valandy Electronics Corp., 15 W. 44th St., New York 36, N. Y. is now offering an all-transistor subminiature code oscillator designed to be used anywhere at any time.

The entire device weighs only 2 ounces and is as small as a pack of matches. It is powered by a 10-cent



battery which lasts for 6 months. It is furnished complete, ready to operate, with super-powered dynamic earphone, regulation key with adjustments, battery, and copy of the Morse code. It is gift packaged and sold on a money back guarantee.

NEW PHOTOTRANSISTOR

General Transistor Corp. of Jamaica, N. Y. has announced the availability of a new-style *p-n-p* phototransistor, the Type 2N469. It is an improved version of the company's type 2N318, being smaller and having greater optical sensitivity.

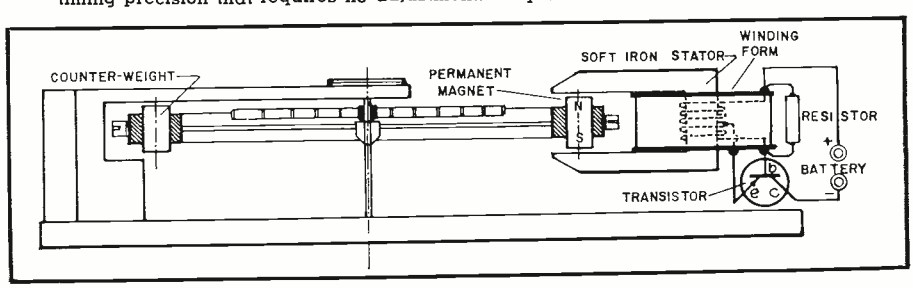
The new device has wide application in a variety of industrial and military circuits where light is utilized to activate electronic equipment. It is especially adaptable to punched card and tape readouts in computer systems. —30—

TV Set Scope

(*Continued from page 67*)

a couple of feet of "antenna" close to the horizontal output of the set. The grid or cathode of the CRT is usually the most accessible place to connect the output of the converter, as this usually means only baring a small part of the wire leading to it and making a connection. However, as the output of the 12AT7 will be on the order of 10 volts or less you may wish to make the connection at the grid of the video amplifier stage in order to achieve a brighter trace. Once the connections are made, the TV set and the converter may be turned on and the "Position" control adjusted until a vertical trace appears near the center of the screen. Don't be too surprised if the trace should turn out to be black, however, as this could mean that you are driving the cathode of the CRT when you should be applying the signal to the grid, or possibly that the polarity of the horizontal drive pulses at the 12AU7 grid are reversed. Moving the horizontal pickup antenna to a different location may remedy the difficulty, or possibly you may care to make a direct connection to the output of the horizontal blocking oscillator in the set. Again, you can juggle the output of the 12AT7

A novel method of magnetically driving a conventional oscillating balance wheel and hairspring assembly by means of a self-switching transistor circuit has been described in a recent French patent. The transistor replaces expensive and critical precious metal contacts. The method is suitable for use in clocks and watches. The balance wheel is modified by mounting a small magnet on its rim. As the magnet enters the soft iron stator, energy is imparted to the balance because of magnetic attraction. The transistor is now non-conducting. As the magnet begins to leave the stator, a signal is generated that triggers the transistor into full conduction. Current flowing though part of the winding then produces a magnetic field which repels the magnet out of the stator and thereby imparts additional energy to the balance. By this means, one stator with one magnetic circuit serves both the control and motor functions and provides an inherent timing precision that requires no adjustment. Only 8 microwatts of power are used.



between grid and cathode of the CRT, as well as the video amplifier stage, or add another amplifying and inverting stage to the output of the converter. Although this may sound rather confusing, it shouldn't cause any real difficulty. The ambiguity stems from the fact that there are so many different kinds of TV sets in existence.

Once you have your vertical line standing still on the face of the set it will be opportune to feed an audio signal into the converter and see what results you have for your labors. The consequences should be, of course, nicely rounded sine waves filling an appreciable portion of the screen, as shown in accompanying photos. Although, as mentioned before, the sweep rate will be essentially 60 cycles, the response of the circuit may be as high as one megacycle. Beats are produced at 15,750 cycles, and multiples thereof, which makes it possible to observe individual waveforms in this area, although distortion may occur.

Linearity will depend first upon the adjustment of the TV set sweep circuits and, although it is not necessary to operate the set with a station tuned in, the best linearity will probably be obtained when receiving synchronizing pulses from a transmitter. A second factor determining linearity is the accuracy of the saw-tooth generated by the 12AU7 in the converter and the biasing voltages applied to the 12AT7 clipper tube. Deflection sensitivity of the circuit is also somewhat dependent upon the bias on the two grids of the 12AT7 and, to a considerable measure, on the amplitude of the saw-tooth voltage applied to the input grid. An audio input signal of between 5 and 10 volts should be adequate for deflection nearly across the entire screen.

Many possibilities seem inherent in the principle used and inasmuch as the converter is basically a form of electronic switch it is a simple matter to simultaneously observe two or more signals by merely adding a 12AT7 clipper for each channel desired. A common source for the saw-tooth voltages required could be used if it were of sufficiently low impedance, but otherwise one half of a 12AU7 may be used for isolation purposes. However, the outputs of two or more of the 12AT7 clippers may apparently be paralleled without appreciable interaction and, of course, the position controls allow each trace to be located where desired on the screen.

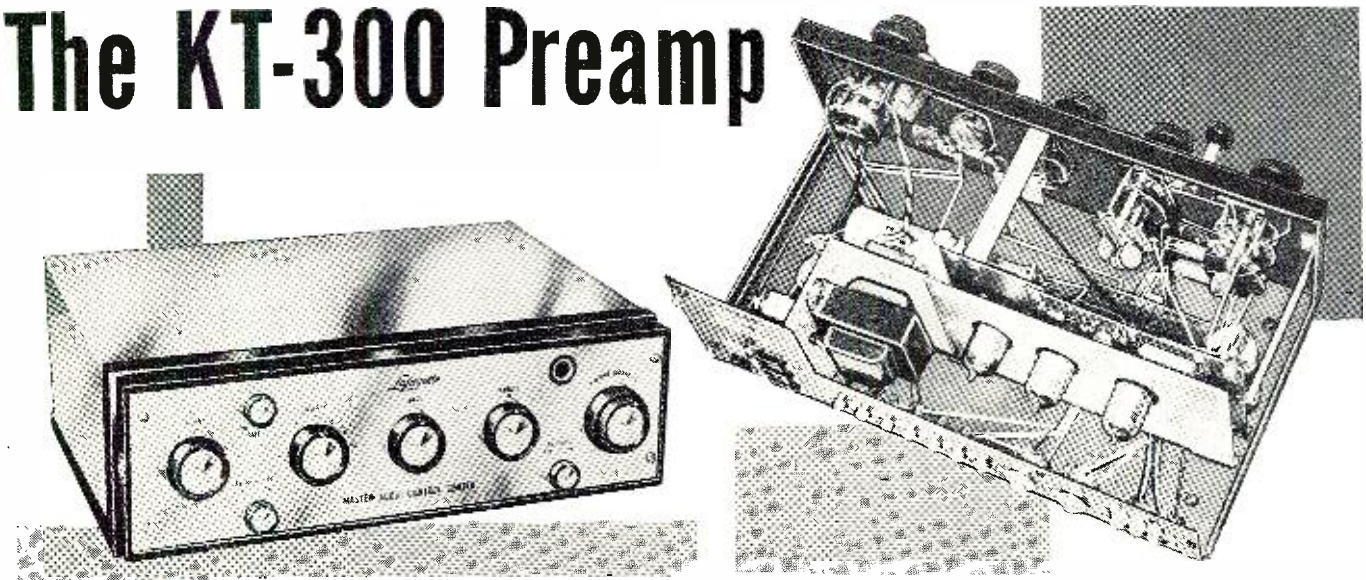
Many modifications of the circuit illustrated will probably occur to the reader, and it might be noted that the signal obtained from the converter may be fed directly into the video equipment of a television station or closed circuit distribution system for simultaneous viewing on a number of receivers.

REFERENCES

1. *O'Kelley, H. E. & Todd, W. H.: "Magnetically Deflected 21-Inch Oscilloscope," Electronics, July 1957*
2. *May, J. C.: "Variable Pulse Length Generator," Electronics, January 1950*

—30—

The KT-300 Preamp



Two views of the KT-300 hi-fi preamplifier originally designed by Victor Brociner and now being marketed in kit form by Lafayette Radio.

A master control unit that combines good electronic and mechanical design for top-quality performance.

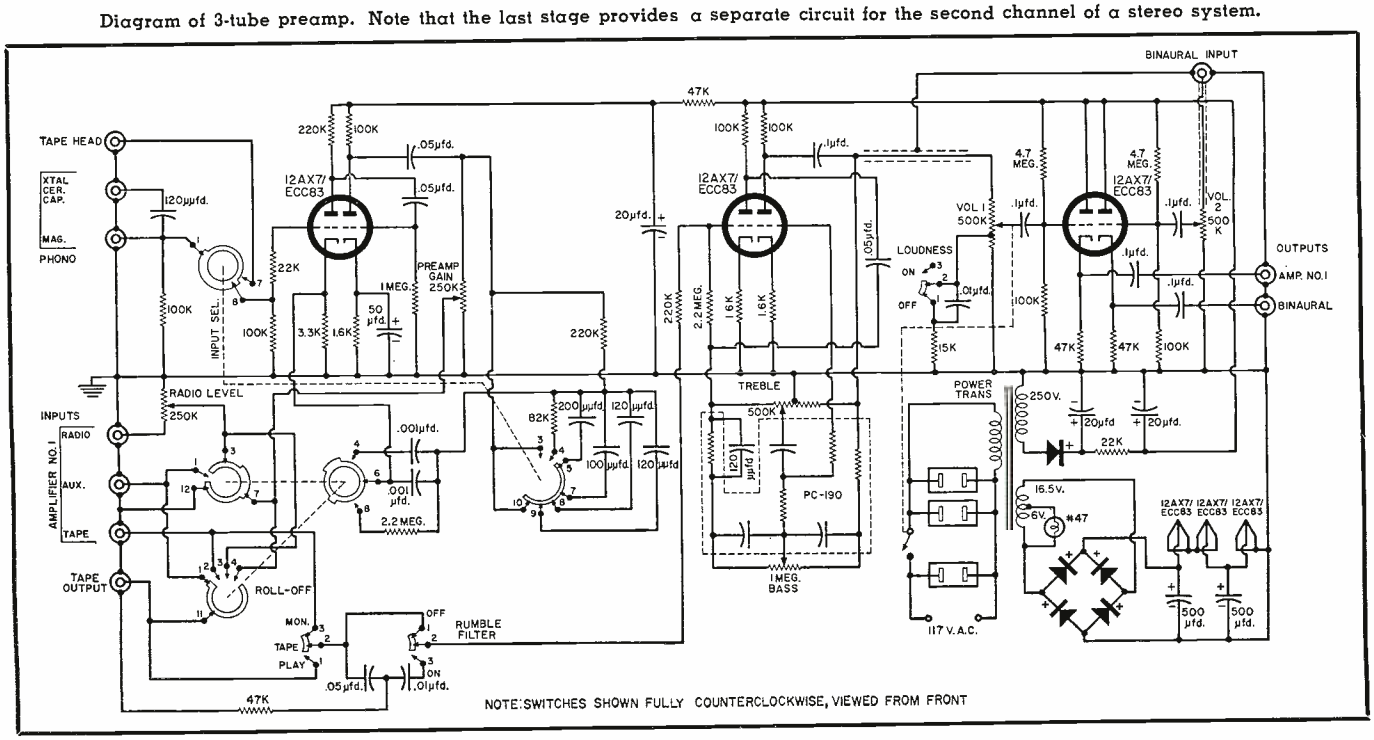
FROM outward appearance one would not recognize this unit as a kit and, when all of the behind-the-scenes facts are compiled, it becomes obvious that it wasn't originally designed for such a purpose. Victor Brociner, well known to most audiophiles, is given credit for the over-all design; in fact, mechanically all metal parts seem to be made from his original tools and dies. One particular trademark of his is the use of the ⅝" metal flange between the chassis proper and the dial plate. If one wants to panel-mount the preamp in a cabinet, the flange is simply removed making such assembly rather easy.

So much for the mechanical design. Electrically, this preamp combines practically all of the necessary functions to make it a true audio control center. In addition to bass, treble, and loudness controls; rumble filter; seven separate input channels; and all the necessary equalization positions, there is one additional feature worthy of mention. The last stage is a low-impedance cathode-follower circuit for use with a second channel of a stereo system. It may be used as an isolation stage between a tape playback preamp and a power amplifier for stereo reproduction. With this additional stage, the preamp is designed for full stereo operation. The convenience of the last stage is that it contains a volume control thereby permitting volume adjustments directly from the preamp. The over-all gain of the stage is less than 1.

Since it is almost impossible to judge, with any degree of accuracy, the quality of a preamp by listening tests, one should compare actual laboratory performance data. With this thought in mind, the following is a complete technical analysis as obtained in our laboratory:

Sensitivity: Tape head, .0042 v.; magnetic phono, .0025 v.; ceramic

Diagram of 3-tube preamp. Note that the last stage provides a separate circuit for the second channel of a stereo system.



phono, .048 v.; aux., tuner, and tape, .2 v. These figures are for 1 volt output with volume control at maximum.

Hum and Noise: Tape head, −43 db; magnetic phono, −41 db; ceramic phono, −54 db; aux., tuner, and tape, −76 db. These figures were obtained with the input open but, under shorted conditions, the figures are not changed materially. The figures are with reference to 1 volt and with the volume control adjusted as follows: low-gain circuits, .5 volt input, 1 volt output; high-gain circuits, .01 volt input and 1 volt output.

Frequency Response: ±2.1 db from 20 to 20,000 cps; loudness control, effective range 12.8 db at 20 cps; rumble filter, −17.2 db at 20 cps; −3 db at 100 cps.

Equalization: ±3.3 db on the RIAA selector position.

Tone Controls: Bass control, 18.3 db attenuation, 17 db boost at 20 cps; treble control, 17 db attenuation, 10.3 db boost at 20,000 cps.

IM Distortion: .26% for mike, aux., and tuner circuits. .29% for magnetic phono input.

A reverse equalization network was used for the phono position and volume control adjusted as follows: phono input, 1 volt output, .01 volt input. Other circuits, 1 volt output and 1 volt input. All figures were obtained with frequencies of 60 and 6000 cycles, 4:1 ratio.

Harmonic Distortion: Tuner input, 1% at 20 cps; .08% at 1000 cps; and .16% at 20,000 cps. These figures were taken with the volume control adjusted for 2 volts output with .5 volt input.

Referring back to the data on the loudness control, it will be obvious that it is designed to affect solely the low-frequency end of the audio spectrum. No attempt was made to vary the high end. This is not abnormal since the variation at the high end is extremely slight and unnoticeable with volume variations to the average ear.

With regard to the low-frequency equalization control, the 800 and RIAA positions are identical while the high-frequency equalization control produces the same response on the RIAA and AES positions. Here again, this certainly is not unusual since the theoretical variations between these positions are so small that the average person could not detect the difference with normal program material.

For those who are interested in a completely wired and tested unit, the control center is available in this form as the Model LT-30 from *Lafayette Radio*.

All of the characteristics discussed, when carefully analyzed, bear out the fact that this audio control center is worthy of being classified as a high-fidelity component. In all fairness, we are not implying that it is equal to the best preamp available today, but considering the cost, which is comparatively low, it is a good value. —30—

Service Industry News

SERVICE associations: have you sent in your requests for questionnaires that will enable us to bring to the attention of our readers the story of what your group is doing? While we are pleased with the response to our invitation, it would grieve us to think that so much as a single association was omitted due to someone's momentary oversight. If you've put off filling out the coupon reproduced here, better act now while it's on your mind and before you have another chance to forget. If you're hesitating because you think someone else may have filled one in on behalf of your association, go ahead anyhow; let us worry about the duplication problem. All it takes is one minute and a postal card. For more details about our project, see page 8 of our January issue.

The highly successful Mid-West Electronic Forum, sponsored and promoted by the Television Service Association of Michigan, served to demonstrate the power of the independent service industry to do things for itself when a majority of the dealers in an area work enthusiastically together in a formal trade association.

Originally formed as a service contractors' association in the early days of TV, TSA has kept in step with industry changes by constantly adjusting its organizational pattern and programs to fit the immediate needs of the service industry. It has always been aggressive and militant in working with local law-enforcement and other agencies to improve the quality and character of electronic service in the greater Detroit area.

The accomplishments of TSA during the past year were clearly outlined by the association president, Karl Heinzman, in his annual report to members. In it he said:

"Early in the year of 1957 we were engaged in a campaign to put the brakes on captive service and to alert independent service men across the country to trends we felt were detrimental to independent service men. I would like to say that our action was highly successful but, as of now, we have only scratched the surface. In Detroit, Telectro was established to offer the manufacturer and distributor the service they said they could not get from the individual independent service dealer and several manufacturers have availed themselves of that service. However, that same service has been offered to the manufacturer whose entry into captive service in the latter part of 1956 stirred such a storm of protest. To this date no attempt has been made by that manufacturer to use the services of the independent group. Theirs is still captive service.

"It must be assumed that 1957 saw only skirmishes in the effort made by the small independent service business men to preserve their businesses. Vigorous, vigilant action must be the byword and we must continue to support those who have done so much to show their support of our program.

"In 1957 we saw, too, the visible mushroom of the long since past kinescope explosion and the depressing picture it presents. The story of the new and the rebuilt picture tube is one that must encompass everyone in the industry including the manufacturer and the distributor, the service dealer, and the consumer. Certainly it is time to take a long look ahead at it.

"No one knows how many so-called 'new' tubes (rebuilt) have been sold to the consumer at the list prices established by the manufacturers of factory new tubes. On the other hand, there is the kind of competition the ethical service dealer faces from those who sell 'new licensed by' at a ridiculous price, and find it well nigh impossible to explain to a customer the difference in price and quality of the *genuine* new tube that he is offering.

"We grant that there are first class rebuilts on the market and consumers

Service Editor
RADIO & TV NEWS
1 Park Avenue
New York 16, New York

We want to tell you more about our association. Please send us your questionnaire.

Name of Association.....

Mailing Address .....

.....

Name of President or Corresponding Sec'y.....

have benefitted by their use—when they have been sold as such, and the customer given the price advantage of such a tube.

"Our concern, too, must touch upon the possible safety of a rebuilt picture tube that has been 'reprocessed' perhaps several times, during which the face plate has been ground each time to remove scratches and each time resulting in a thinner face plate below desirable safety standards. We wonder, too, about the molecular structure of such a tube after several annealing processes and whether it can continue to withstand the tremendous pressures involved. These technical questions must be left to the glass experts.

"On the economic and ethical side of this picture, however, these are the questions that our customers ask us and for which we would like to have the answers: Is a rebuilt picture tube as good as a new tube? If so, why the wide price differential? And if such differences exist as to warrant the wide price differential, let someone take the lead and proclaim that this is a brand new, factory-fresh tube of the very best quality.

"It is our belief that in this land of discounts and price consciousness, the vast majority of people are still interested in quality and only want tangible assurance that the products and services they buy are 'first class.'

"We look to '58 to give us a yardstick that we can use to present to our customers the high measure of quality we want to be selling."

Telectro, Inc., mentioned by Mr. Heinzman in his message, refers to a service corporation set up by members of the Television Service Association to provide warranty service on a broad scale for set manufacturers and distributors. Any service dealer member of TSA may participate in the Telectro service activity by becoming a member of the service corporation.

The advantage that Telectro offers to the set manufacturer is that, although the manufacturer deals with only one company in an area to handle warranty work on his sets, service is always immediately available to his customers from a TSA member shop in the customer's immediate area. Service provided by Telectro members is not only faster than that normally available from factory depots, but is said to be more competent and efficient.

Discussions are underway among the numerous associations in the Middle West to rotate the annual Mid-West Electronic Forum among the major cities in that area.

Customer Price Education

Electronic Technicians' Association of Toledo recently inaugurated a program to acquaint the set-owning public with what they should be prepared to pay for honest, competent service on TV sets. Key feature of their program is a printed schedule of service rates which is left with set owners when sets are taken to a shop for repairs.

In announcing this program, Carl Stallfus, president of ETAT, said:

"In my experience as a service dealer, the vast majority of customers are willing to pay for value received. But, with no basis to judge, how is a customer to know if he has received his money's worth? This gives rise to doubt about the honesty and integrity of the service industry as a whole, not just the individual service man.

"With the cooperation of several members, we were able to arrive at a list of charges that form a 'Consumer Guide to Television Service Fees.' This card lists thirty-seven major service operations which cover 95 per-cent of all repairs. This card can be left with the customer when his set is picked up or presented with the statement of charges.

"This system provides a method whereby the customer can check his itemized statement against established service fees. Service charges billed in this manner can be supported by the Better Business Bureau. In addition to better customer relations, it will offer the service dealer an opportunity to show a profit on his investment."

Program Recommended

W. J. Inman, immediate past president of the Texas Electronic Association, recently outlined a comprehensive program of activities for state and local service associations to follow to improve the business and professional climate of the independent electronic service industry. Mr. Inman said in presenting his program:

"Today's business conditions are a challenge to us all, for the measure of a good business man is the one who keeps abreast of the times and rides *with* the tides of business.

"That man who is not willing to plow back into his industry a part of his time, energy, and substance, is not deserving of a better industry. To appeal to the strictly mercenary among us, you can get answers to some of your own problems by participating in association meetings and swapping ideas with your competitors. This is proven every day. I would like to submit a program for your serious consideration which can be carried out by our local and state associations:

1. Organize and follow through on an intensive training program on business management, especially for shop owners but open to technicians.

2. Organize and follow through on an intensive training program for the technicians in all member shops.

3. Organize and follow through on a program of cooperation with all available educational facilities, both public and trade school, so that students can have some practical experience along with their school work.

4. Organize and follow through on a program of public-relations advertising, as nearly state-wide as is practical.

5. Copy the licensing law of some city or state where it is now working beneficially, obtain state-wide support

for it so that it can be run through the next session of the legislature and enacted into law. This will act to weed out the 'cotton choppers' who are masking as technicians and increase the stature of those remaining in the business."

Advanced TV Instruction

A complete correspondence course in black-and-white TV servicing is being offered to independent radio and TV service technicians by *Sylvania Electric Products Inc.* Available through the purchase of receiving and picture tubes, the 12-lesson course is designed to keep the independent abreast of new developments in TV. Each lesson has an examination sheet attached. Exam papers will receive individual attention and will be returned corrected. -30-

WEST COAST HAMFESTS SET

THE Oregon Amateur Radio Association has picked May 3rd and 4th as the dates and Salem, Oregon the place for its 1958 convention.

The hosts this year will be W7SAA. Registrations and reservations may be made at Convention Headquarters, Marion Hotel, P. O. Box 142, Salem, Ore. Pre-registration fee is $6.00 for hams and $3.00 for non-hams. An interesting and varied program is planned.

* * *

THE 24th Annual Glacier Park Hamfest will take place July 19-20 at the APGAR Camp Grounds in scenic Glacier National Park.

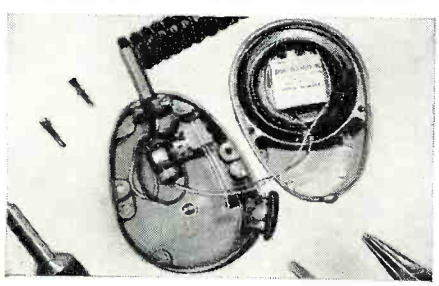
The committee in charge is providing ample advance notice so that all U. S. hams can schedule their vacations and make their plans to include this event.

A full program has been planned for hams, XYL's, XL's, and the harmonics—in addition to the regular attractions offered by the park.

An impressive roster of speakers, fine prizes, a renewal of the famous auction, a super party, transmitter hunts, mobile inspections, etc. are just a few of the items being planned.

Complete details on the program can be obtained from Lavon Gamett, Box 367, Great Falls, Mont. or information on reservations, etc. is available from Frank Anderson, W7GCS, president or Harold "Pappy" Colvin, K7AXD, publicity chairman of the event. -30-

Carbon microphones can be converted to transistorized, controlled magnetic microphones in just a few minutes with new kit manufactured by Shure Brothers, Inc. of Evanston, Ill. Wires originally leading to carbon cartridge are soldered to transistorized amplifier, while leads from amplifier are soldered to new cartridge. Transistorized microphone features greater durability and better frequency response than the carbon unit.



Manufacturers' Literature

HEATHKITS FOR 1958

Heath Company of Benton Harbor, Mich. has issued a colorful 58-page catalogue which lists all of the kits currently in the firm's 1958 line.

Available kits include test equipment, ham gear, audio units, broadcast and short-wave receivers, probes, and specialized checkers of various types. Each unit is pictured, its salient features listed, specifications and schematic provided, and a brief description of performance given.

Copies of this new catalogue are available on request to the company.

SERVICE TEST GEAR

Moss Electronic Distributing Co. Inc., 3849 Tenth Ave., New York 34, N. Y. has issued a four-page flyer describing a complete line of service test gear.

Among the *Superior* units pictured and described are a "Genometer," a utility tester for checking electric appliances and auto circuits, a "super meter," a multi-purpose unit which combines a capacitor and resistance bridge with a signal tracer and TV antenna tester, and two tube testers.

Special features, pictures, and prices are given on each item.

ALLIED FLYER

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill. has issued Supplement 172 which lists hundreds of money-saving buys and new electronic products.

Included in the catalogue are all types of audio equipment, records, radio kits, test instruments and test instrument kits, antennas and antenna kits, amateur equipment of all types, tools, tubes, recorded stereo tapes and tape accessories.

Copies of this new supplement are available without charge upon application to the company direct.

HICKOK TEST GEAR

The Hickok Electrical Instrument Company, 10524 Dupont Ave., Cleveland 8, Ohio is now offering copies of its new 8-page composite test equipment catalogue, Form SM-31.

The publication lists 24 pieces of new test gear including two new color generators and the new "Cardmatic" automatic tube tester. Each instrument is pictured, described in detail, and its special features outlined. Equipment for both the service shop and the laboratory is included.

COPPER FOIL DATA

The Copper Foil Department of *The American Brass Company,* Waterbury, Conn. has issued an 8-page illustrated booklet suggesting commercial applications for its line of *Anaconda* "Electro-Sheet" copper foil.

The electrical applications for this product, including electrostatic shielding, printed circuitry, etc. are all covered in some detail in this catalogue.

Publication D-8-R will be supplied without charge upon written request to the company.

B&K INSTRUMENT FOLDER

B&K Manufacturing Co., 3726 N. Southport Ave., Chicago 13, Ill. has issued a colorful 4-page bulletin on its scanners, tube checkers, and specialized instruments for both industrial and service shop use.

Bulletin No. AP10 provides complete information on the firm's "Dyna-Scan" Models 1050 and 1000, "Dyna-Quik" Models 500, 650, and 675 tube testers; Model 400 CRT rejuvenator-tester; Model 750 test equipment calibrator; Model 150 transistor tester; and the Model 100 shorted-turns indicator.

Copies of this publication are available without charge.

CONVERSION FACTOR CHART

Precision Equipment Co., 4411E Ravenswood Ave., Chicago 40, Ill. has published a reference table for engineers and other executives in wall chart form which it is offering without charge as a service to the industry.

Included are common conversions such as inches to centimeters or watts to horsepower as well as many conversions that are difficult to locate in reference manuals.

SUPREME'S "MASTER INDEX"

Supreme Publications, 1760 Balsam Road, Highland Park, Ill. has announced publication of a new "Master Index" which lists television and radio material covered in all of its service manuals to date.

The index makes it easy to find the volume and pages where particular service material is located. Although the Index is priced at 25 cents a copy, readers of this magazine may obtain a copy for a 5 cent mailing cost charge.

Write the publisher direct, enclosing the five-cent payment.

ARGONNE COMPONENTS

Argonne Electronics Mfg. Corp., 165-11 South Road, Jamaica 33, New York is now offering copies of its new 12-page catalogue and price list which covers an extensive line of imported and American-made miniaturized components as well as specialty and audio items.

Catalogue ARC-7 lists a wide variety

of transistor transformers; miniature tuning capacitors; transistor antenna, r.f., oscillator, and i.f. coils; miniature electrolytics; subminiature volume controls; multi-testers; phono cartridges and styli; miniature earphones; viscous-damped and other phonograph arms and pickups; as well as a variety of microphones, musical instrument pickups, etc.

TV COIL REPLACEMENTS

J. W. Miller Company, 5917 S. Main Street, Los Angeles 3, Calif. is now offering copies of its new "TV Technician's Coil Replacement Guide No. 158" which has been specifically designed to speed the operations of service technicians.

The 72-page publication carries more than 2000 different chassis and nearly 11,000 TV model numbers, cross-references all of the set manufacturer's coil numbers with the *Miller* replacement number, and provides compact but pertinent data on a number of other components of interest to the service fraternity.

Those who service television receivers are invited to write the manufacturer direct for a copy of this new publication.

NEW MERIT CATALOGUE

Merit Coil & Transformer Corporation, 4427 N. Clark St., Chicago 40, Ill. has just issued a comprehensive 60-page catalogue which lists more than 900 items in the firm's line of transformers, coils, and chokes.

Prepared at an editorial cost of $45,000, the new publication contains six sections devoted to horizontal output flybacks; power transformers; chokes; i.f. transformers and coils; yokes, audio transformers, and r.f. transformers; and coils and chokes. Each section features a table of exact replacements by manufacturer's part number, *Merit* part number, and suggested list price and each item is illustrated for easy identification alongside a simplified schematic drawing and exact specifications and applications.

Copies of Catalogue No. 5811 are currently being mailed to distributors. Inquiries on how to obtain a copy should be addressed to the company which will advise on local availability or mail a copy direct.

MOTEL TV BULLETINS

Blonder-Tongue Laboratories, Inc., 9-25 Alling St., Newark 2, N. J. has issued two new "Masterline" TV system bulletins designed to promote the sale of master TV systems to motels, tourist courts, trailer courts, and other multiple-unit installations.

Form MP-97 covers advantages, system layouts, TV outlet connections, and a listing of some of the firm's most outstanding installations. It is designed for dealer and installer use in contacting motel owners and managers.

The other bulletin, Form SF-97,

shows a complete system layout which may be used in 90% of the more than 60,000 motels in the United States. Either or both of these publications may be obtained from the company's distributors or from the manufacturer direct.

PRECISION CAPACITORS

Film Capacitors, Inc., 3400 Park Ave., New York 56, N. Y. has issued a six-page product catalogue covering its complete line of Polystyrene, polyethylene, Teflon, and Mylar dielectric capacitors and a line of high-voltage packaged power supplies.

The catalogue provides electrical characteristic data and physical specifications on all types. Related part numbers and list prices are also included.

MASTER TV PARTS GUIDE

Thordarson-Meissner has undertaken the compilation of a 244-page loose-leaf permanent edition "Master TV Components Replacement Guide-Book" as a service to television technicians. Available to service dealers and technicians through the company's distributors, the new publication contains a parts list, model index, and chassis index.

Each copy of the book will be registered in the name of the service dealer or technician. Pages will be replaced everytime there is a major change or addition in the replacement information relating to any one of the hundred or more TV set manufacturers covered.

Practicing technicians interested in obtaining this guide should contact their nearest *T-M* distributor.

INSULATING MATERIALS

The *Insulation Manufacturers Corporation*, 565 W. Washington Blvd., Chicago 6, Ill. has issued a new edition of its catalogue covering electrical insulating materials for repair and maintenance shop use.

The 32-page publication contains descriptions, photos, prices, and ordering data on an extensive line of tapes and twines, sleevings, tubings, slot insulation, etc. Free copies of Catalogue #23 are available from the Advertising Department of the company.

ANDERSON COMPONENTS

Anderson Controls, Inc., 2777 Mannheim Road, Des Plaines, Ill. has just published a new catalogue which covers its line of solenoids, coils, and electronic components.

This multi-colored catalogue carries illustrations, technical information, charts, and graphs on the components. The publication is free. —30—

LISTEN TO THE AMERICAN MOONLETS

By DONALD H. SCHUSTER, K6MEV

THE "Explorer" and the satellites to follow are broadcasting signals on a frequency of 108 megacycles. Amplitude modulation (AM) is being used primarily, with some frequency modulation (FM) and multiplexing.

An FM tuner with a good r.f. stage and a diode detector would be nice to try to pick up the moonlets, but the AM conversion of FM discriminators is the stickler. The bright idea occurred to the author to modify the stabilizing voltage part of a ratio detector, since this voltage serves for a.g.c. action. Simply change the stabilizing voltage time constant and RC-couple this voltage to the audio amplifier.

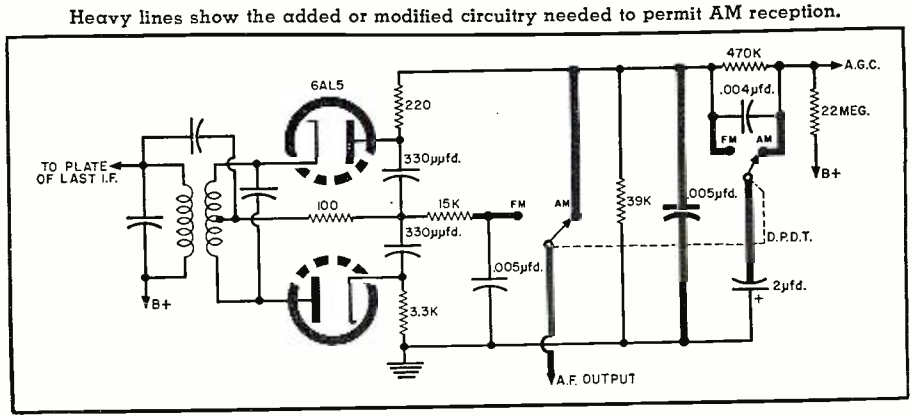
The accompanying diagram shows how this modification was accomplished in an RCA RK-135 AM-FM tuner. The two necessary additions were a d.p.d.t. switch and a 0.005 μfd. ripple capacitor. The d.p.d.t. switch was mounted near the 6AL5 detector tube to minimize capacity changes. One section of this switch connects the audio output lead to the normal de-emphasis circuit for FM and to the diodes stabilizing voltage for AM. The other switch section connects the 2.0 μfd. a.g.c. filter capacitor across the diodes stabilizing voltage for FM and across the other end of the a.g.c. filter resistor (470,000 ohms) for AM. The added 0.005 μfd. capacitor thus, for AM reception, acts only as an i.f. ripple filter and leaves the a.f. signal unaffected.

This is a very simple FM-AM conversion scheme. It took about two hours' time and, quite important, it left the i.f. alignment substantially unaffected. Thus the tuner still works normally on FM.

While at the time the author built his circuit no satellite signals were available for testing, it worked OK with an AM signal generator at 108 mc. Those who build the circuit now will be all set for future monitoring with a mere flip of a switch, as the figure below shows.

—30—

Heavy lines show the added or modified circuitry needed to permit AM reception.



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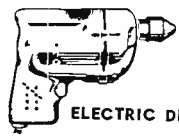
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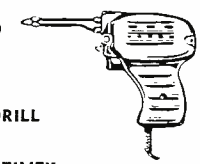
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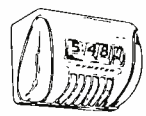
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AKRON 8, OHIO

The "D.C. Varivolter"

(*Continued from page 65*)

All constant-current sources have this characteristic when they are terminated in a filter capacitor, but, here again, transistor damage can be easily avoided, when you are using this instrument, simply by getting in the habit of setting the output control fully counterclockwise.

With vacuum-tube circuits: The upper range of the "Adjust Output" control is most useful for checking the general run of vacuum-tube circuits, although the low range is handy for working with experimental setups employing one or more of *Tung-Sol's* new tubes which use only 12 volts d.c. on the plates. Some such circuits draw a fairly heavy space-charge current, however, so be careful not to exceed the instrument's 50-milliampere limit.

Aside from the obvious advantage of being able to start at zero plate and screen voltage in experimental or questionable vacuum-tube circuits and working up while observing performance, the "Varivolter" is an extremely valuable instrument for checking frequency shift with plate and/or screen voltage variation in an oscillator (especially where stability under such conditions is important), for determining optimum screen potential for maximum output in a pentode voltage amplifier stage, for taking tube characteristic curves, for selecting tubes to be used in a circuit where they have to have balanced output at more than one plate and/or screen potential, and many other applications which will become evident when you have the "Varivolter" near at hand. Precise setting of the zero isn't necessary when high voltage output is being used.

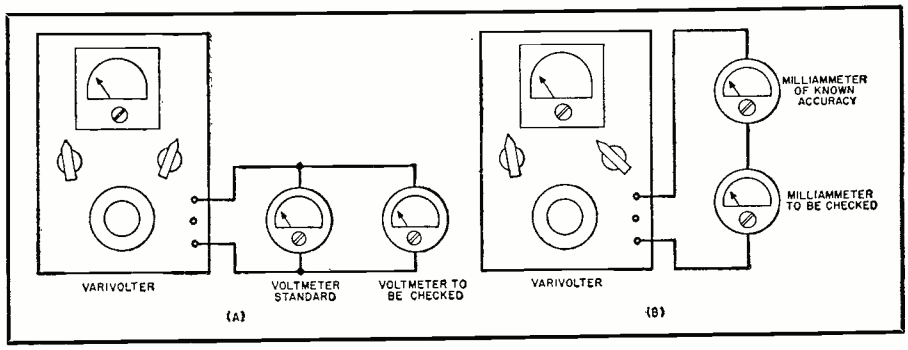
Checking the accuracy of d.c. voltmeters and multipliers: To check the accuracy of a d.c. voltmeter or the multipliers in your v.o.m. or v.t.v.m. merely connect the voltmeter to be checked and your standard voltmeter in parallel across the output terminals of the "Varivolter." See Fig. 2A. Starting at zero, or at any level you prefer, advance the "Adjust Output" control in steps of any desired increment and compare the readings on the two externally connected voltmeters. For a rough check on a questionable voltmeter, you can use the meter in the "Varivolter" as a standard. Most such meters available today have an accuracy of ±2%, and this is available in the "X1" position of the "Selector" switch. The "X5" and "X30" positions provide an accuracy of approximately ±3%.

Checking the accuracy of d.c. milliammeters and milliampere ranges: Set the "Adjust Output" control fully counterclockwise, set the "Selector" switch to "X1", and vary the "Adjust Zero" control for zero reading on the voltmeter. Then, connect the milliammeter of questionable accuracy and a milliammeter of known accuracy having the same full-scale current range, in series across the output terminals of the "Varivolter", as shown in Fig. 2B. Advance the "Adjust Output" control slowly while observing and comparing the readings on the two milliammeters.

The "Varivolter" may be used in this manner to check the accuracy of all milliammeters and the milliampere ranges of v.o.m.'s up to 50 milliamperes full scale. Thanks to the high internal resistance of the instrument at low voltage outputs, even a 1-milliampere meter may be checked safely and easily on the "Varivolter." Always use the "X1" position of the "Selector" switch when checking milliammeters.

Other applications to which the "Varivolter" is well adapted, to name but a few, include checking "bargain" or questionable resistors for performance under actual load conditions, checking the leakage of and reforming electrolytic capacitors up to 250 v.d.c. working (including miniature, low-voltage, transistor types), determining the ohms-per-volt rating of a d.c. voltmeter, checking I_{co} and I_{cbo} of transistors at the voltage level specified by the manufacturers, rejuvenating dry cells and batteries, finding the pull-in and drop-out voltage and current of sensitive relays, operating transistorized receivers for test purposes (to avoid running down a customer's battery or to serve as a substitute when a set comes in with a dead battery), checking and predicting the sensitivity and output of a transistorized receiver as the battery ages and the voltage across it decreases, etc., etc., indefinitely! —30—

Fig. 2. (A) Connections that are used for checking the accuracy of one voltmeter against another, standard unit. (B) Circuit connections that are employed for checking accuracy of one milliammeter against another by means of the "Varivolter."



Answer to Puzzle appearing on page 120.

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WANTED: Receiver R5/ARN-7, MN-62A Transceivers, RT18/ARC-1, AN/ARC-3, BC-788C, I-152C, Collins, Bendix equipment, Test Sets, Dynamotors, Inverters. We pay highest prices. Advise quantity, condition, price first letter. Aircraft Radio Industries, Inc., 70 East 45th St., N. Y. 17, telephone LExington 2-6254.

LABORATORY Quality Equipment and Military Surplus Electronics bought, sold. Engineering Associates, 432 Patterson Road, Dayton 9, Ohio.

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DISGUSTED Of "HI" HI-FI Prices? Unusual Discounts On Your High Fidelity Requirements. Write. Key Electronics, 120 Liberty St., New York 6, N. Y. EVergreen 4-6071.

PRICES? Try ours! Everything in Hi-Fi. Factory sealed components. Write right now. Audion, 64-62 Booth St., Rego Park 74, N. Y.

DISCOVER our "Six Unique Services" on Hi-Fi; Stereo. Complete line. Write The Silver Trumpet, 406R Walnut, Alexandria, Indiana.

TAPE & TAPE RECORDERS

TAPE Recorders, hi-fi components, tapes. Unusual Values. Free catalog. Dressner, 69-02 R, 174 St., Flushing 65, N. Y.

RECORDERS, HiFi, Tapes, Free Wholesale Catalog. Carston 215-R E. 88 St., N. Y. C. 28.

DISCOUNTS to 50%, recorders, tapes, hi-fi components, consoles, photograph equipment. Request specific prices only. Long Island Audio & Camera Exchange, 3 Bay 26th Street, Brooklyn 14-N, N. Y.

WHOLESALE Catalog 10¢. Recorders! Tapes! Typewriters! Radios! Towers, #155, Philadelphia 5.

HI-FI Recording Tape, Mylar 2400' $2.99, 6/$2.89. Acetate 1800' $1.89, 12/$1.79. 1200' 6/$1.29. Postage 20¢ per tape. Guaranteed. Catalogue. Broadcast Box 231R, Wallingford, Conn.

BUSINESS OPPORTUNITIES

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WANTED A-1 Sales Reps. For Real Hot Line Imported Miniature Electronic Components Just Being Introduced. Several Key Areas Still Open. Submit Full Particulars. Intercontinental Industries, Inc., 555 W. Adams St., Chicago 6, Ill.

CORRESPONDENCE COURSES

USED Correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Ala.

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ENGINEERING Degrees, EE Option Electronics earned by home study. Residence classes also available. Pacific International University (operating as a college of engineering only at present), 5719-C Santa Monica Boulevard, Hollywood 38, California.

MISCELLANEOUS

ENGRAVING: Panels, name-plates, Barber & Howard Co., East Ave., Westerly, R. I.

"HOME Brewed Wines, Beers." Complete Book $1.00. ABC Publications, Box 849, San Francisco 1-WP, California.

INDEX OF Advertisers

APRIL 1958

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

"University speakers were top performers on our *Hi-Fi Holiday** Concert Tour"

FRED WARING

"I had always dreamed of applying hi-fi techniques to our live concerts . . . but I hadn't thought it could be accomplished to my satisfaction. I presented the problem to University engineers prior to launching our most recent nation-wide tour. Result? University provided the most stirring sound I had ever heard in a concert hall, so dynamically effective that we named our show 'Hi-Fi Holiday.'

"'Hi-Fi Holiday' made sound history . . . it was sound success—and we plan to repeat the tour. University deserves a low bow for their contribution to the success of our show—a top performer most welcome to share the stage with The Pennsylvanians anytime."

**First such live stage presentation in musical and high fidelity history.*

AND HERE'S WHAT FRED WARING'S CHIEF ENGINEER HAS TO SAY . . .

"Fred Waring's 10-week 'Hi-Fi Holiday' needed loudspeakers which would withstand the abuse of a gruelling 200-500 miles per day in a trailer truck. The speakers had to be easy to set up in theaters, auditoriums and even large, hard-surfaced gymnasiums which, each night, would be physically and acoustically different, yet produce high fidelity sound that would make every seat 'front row center.'

"University loudspeakers were selected not only because of their reputation for quality and reliability, but also for their constancy of performance characteristics which is extremely important to the exacting achievement of aural 'balance' and 'perspective.'

"We were happy to find that these technical objectives could be accomplished using various speaker types and systems from University's standard high fidelity line. Not a single speaker failure occurred during the 20,000 mile cross-country tour."

Russ Turner

See your dealer for a demonstration of what University can do for you! For FREE LITERATURE on speakers and components, enclosures and kits, complete systems, write Desk S-2, University Loudspeakers, Inc., 80 So. Kensico Ave., White Plains, N. Y.

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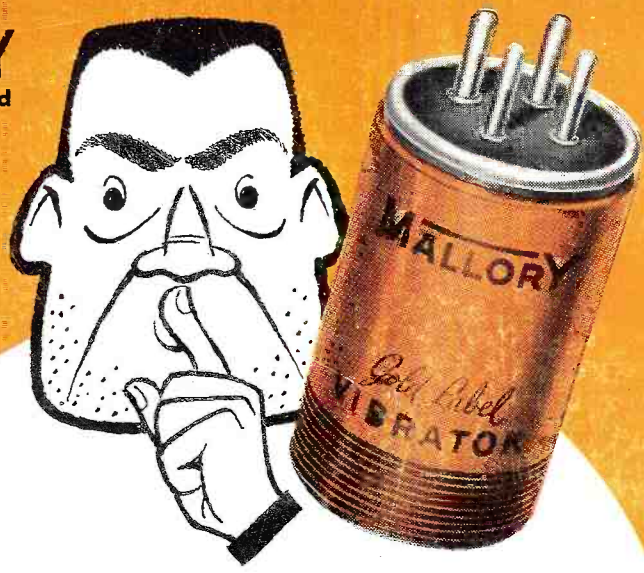

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FOR TOP PERFORMANCE

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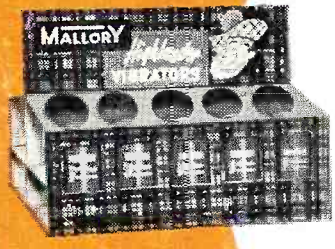

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