A PORTABLE SCINTILLATION COUNTER

RADIO & TELEVISION NEWS

APRIL
1955
35 CENTS
In U. S. and Canada

World's Leading Electronics Magazine

IN THIS ISSUE

ERASING TROUBLES IN MAGNETIC RECORDERS

REDUCING LOUDSPEAKER DISTORTION

MAKE READY FOR TRANSISTORS

REFERENCE-SHIFT MODULATOR

BASIC UNIT FOR 420 MC.

A TRANSISTORIZED PORTABLE RECEIVER

AN ELECTRONIC COMBINATION LOCK

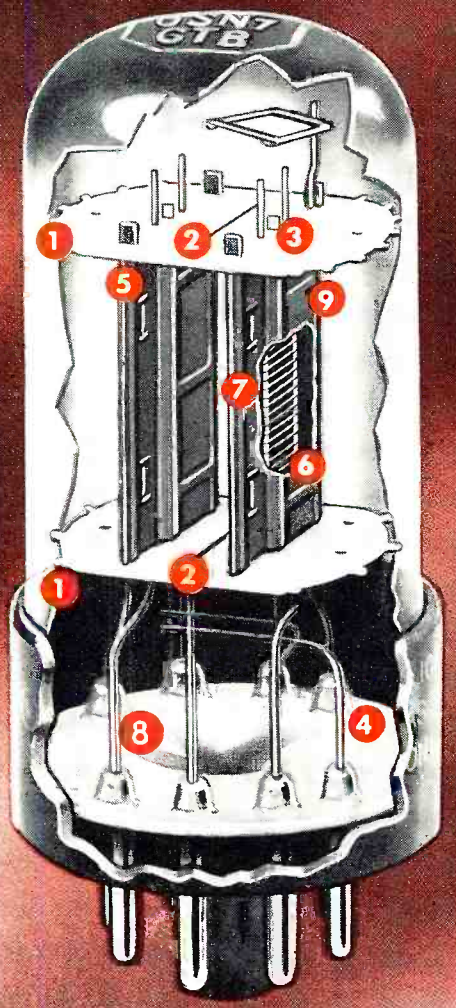
DOUBLE TROUBLES IN TV

LETTER BLOW
(See Page 87)

Premium Quality Tubes

FOR TV SERVICE

RAYTHEON



Raytheon Premium Quality Tube Types include: 5U4GA, 5U4GB, 6AX4GT, 6SN7GTA, 6SN7GTB, 12CU6, 25CU6.

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3. Cathode pinched above top mica for tighter mica cathode fit — lower microphonic level.
4. Short strong leads support mount at several points.
5. All plate tabs pinched or welded above top mica and below bottom mica to strengthen mount.
6. Improved grid design for sharper cut off.
7. High conductivity grid winding wire to eliminate grid emission.
8. Short leads — direct to pins.
9. Strict control of plate diameters (Geometry) for uniform characteristics.
10. Shorter over all length to improve rigidity.

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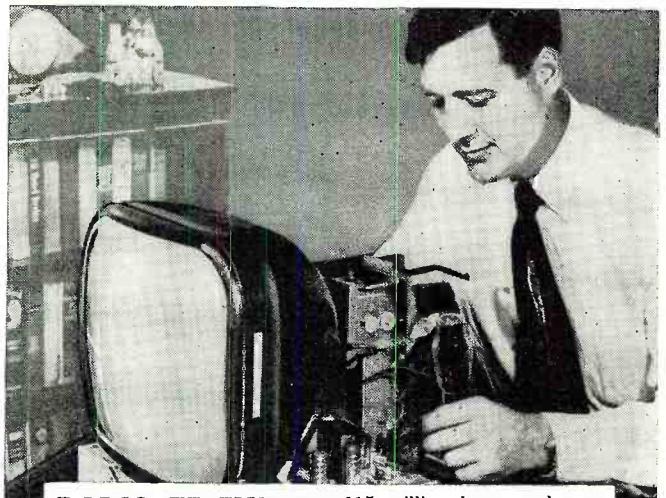
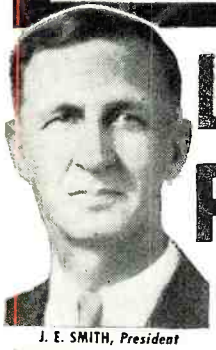


RADIO-TELEVISION SERVICING 115 million home and auto Radios plus 25 million Television homes (with total growing rapidly) mean increasing opportunities for qualified servicemen. Many NRI students make $10, $15 a week extra fixing sets in spare time while training. Many NRI graduates start their own full-time business or take good jobs with dealers.

Let Me Show How You Can Qualify for RADIO-TELEVISION AT HOME in Spare Time



J. E. SMITH, *President*
NATIONAL RADIO INSTITUTE,
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I Trained These Men

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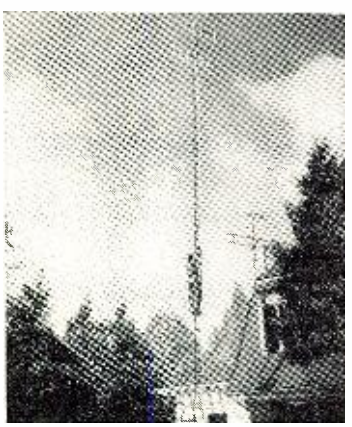

COVER PHOTO: A carefully installed antenna tower should be able to withstand winds of almost hurricane force. A few precautions taken at the time the tower is erected will pay off handsomely in the years to come. (Ektachrome by Jay Seymour)

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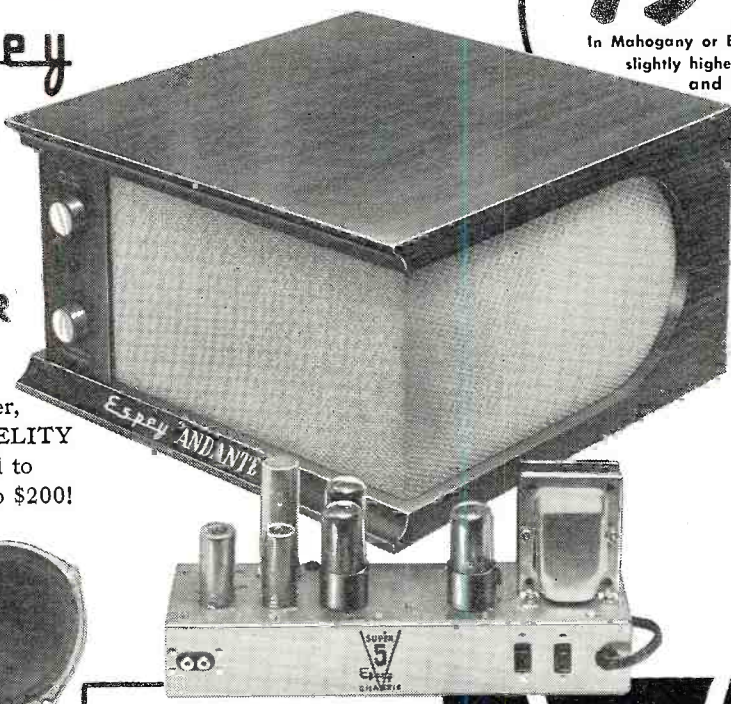

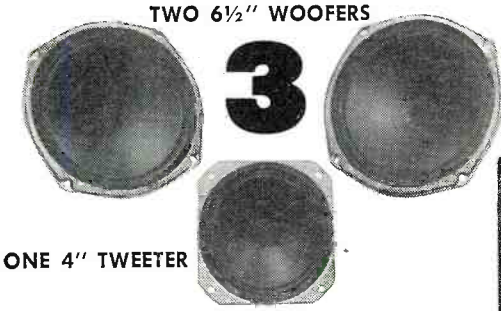

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This is 100% learn-by-doing, practical training. We supply *all* components, *all* tubes, *including* a 17-inch picture tube, and comprehensive manuals covering a thorough program of practice. You learn how experts diagnose TV defects quickly. You see how various defects affect receiver performance—picture and sound; learn causes of defects, accurately, easily, and how to fix them. You do more than just build circuits. You get practice recognizing, isolating, and fixing innumerable troubles.

You get actual experience aligning TV receivers, diagnosing the causes of complaints from scope patterns, eliminating interference, using germanium crystals to rectify the TV picture signal, obtaining maximum brightness and definition by properly adjusting the ion trap and centering magnets, etc. There isn't room on this or even several pages of this magazine to list all the servicing experience you get.

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For the RECORD

BY THE EDITOR

THE SHAPE OF THINGS TO COME

FROM the rapid strides being made in the fields of printed wiring, printed circuits, and automation, it is apparent that television sets and other items of electronic equipment of the near future will bear little if any resemblance to units now being produced. Even conventional components such as resistors and capacitors are undergoing radical redesign, and the techniques used to combine these and other components into a completed circuit result in an assembly which is a far cry from the maze of components visible in an underchassis glance at most of the equipment now being produced.

Service technicians are vitally concerned with the revolution in components and construction techniques now going on since they are going to be called on to service this new equipment. And, irrespective of our advancing technology, servicing will be required, at least on the more complicated pieces of equipment for a long time to come.

The changes which are closest to us and in some cases upon us at present are the extensive use of so-called "printed wiring" and automatic assembly techniques. It should be brought out that the term "printed wiring" is somewhat of a misnomer, since the techniques employed in general do not come under the term "printing" as most of us think of it. However, until someone comes up with something better, it appears that this nomenclature will stay with us. Also, there is a tendency to use the terms "printed wiring" and "printed circuits" interchangeably. The first term should be applied to those techniques where the interconnecting conductors only are printed; the second term is used where certain circuit components, such as capacitors and resistors, are printed, as well as the wiring.

At least six printed wiring techniques are under investigation at the present time. Each has its advocates and it appears that perhaps more than one will win out in the end since each has its peculiar advantages and disadvantages. The six being most actively investigated are etched, embossed, stamped, pressed powder, plated, and painted wiring. Biggest advantages of printed wiring techniques are savings in labor and improved uniformity.

Several companies already incorporate printed wiring in their radio and TV receiver production, and field reports appear to indicate greatly increased reliability as a result. Needless to say, labor savings are appreciable, and the uniformity of the end product is greatly improved. Servicing and circuits does not appear to pose any insurmountable problems. Techniques have already been described ("Servicing Printed Wiring in TV Receivers," Dec. '54) for repairing circuits of this general type, and more such information will be published as their use becomes more widespread. Transistor circuitry will also come in for its share of editorial treatment.

The principles outlined in "Project Tinkertoy," announced by the National Bureau of Standards some time ago, are under active investigation by at least three companies and one company is manufacturing military equipment using these techniques. Basic principles consist of "printing" components such as resistors and capacitors on small ceramic wafers and then assembling the desired number and variety of wafers into a "module" which makes up a simple stage of the equipment such as a complete i.f. or audio stage. All operations are almost completely automatic and noncritical materials are used. A 100% electrical inspection of individual wafers and completed modules is possible, eliminating the reject problem in completed equipment. One company has adapted a television receiver to so-called "modular design," using 17 modules. Total cost of these modules to the TV receiver manufacturer does not exceed the present cost of the individual components and assembly time is reduced enormously. Servicing is simplified to the point of removing a complete module which may be defective and installing a new one. Reliability is also greatly improved.

Another startling thought is the possibility that a printed circuit transistor may be developed in the near future. Such a development, along with one or a combination of the techniques described, could completely revolutionize electronic construction techniques. It is even conceivable that on smaller equipment, such as table model radios, the line cord will be eliminated and a built-in battery, easily replaced, used to provide power for several years of normal operation. This technique might even be applied to "picture on the wall" television sets, which will be with us shortly if present indications are not misleading.

We will keep our readers informed of these new developments as rapidly as information becomes available so that you too will have an exceptionally good idea of "the shape of things to come" . . . . . O.R.

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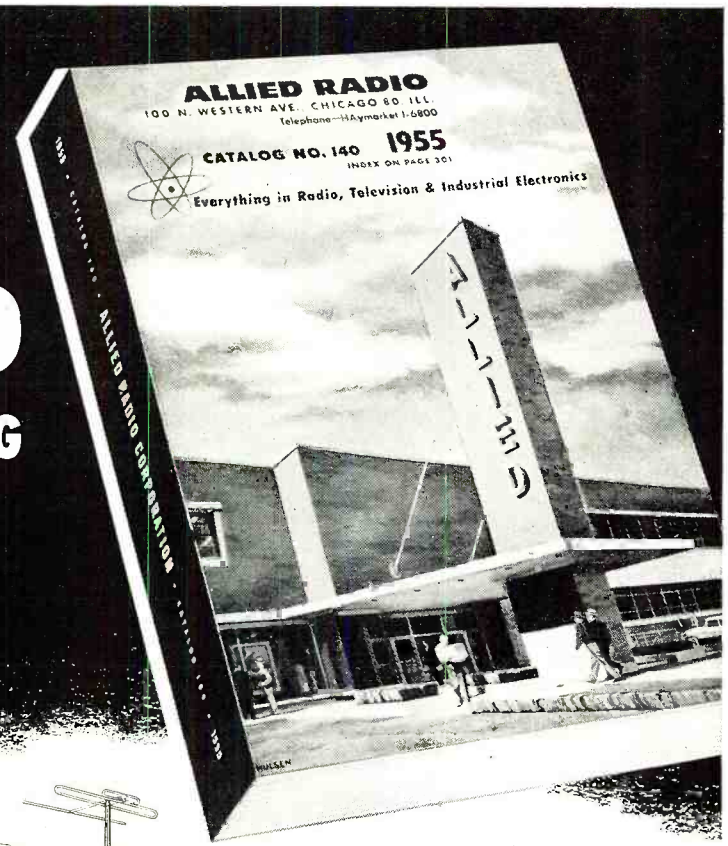

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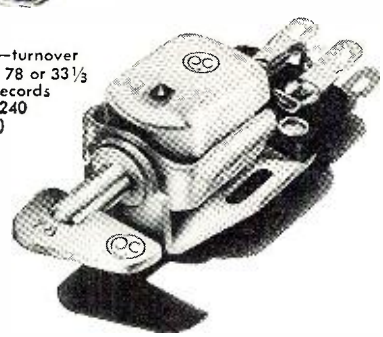

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Wider Frequency Response

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These characteristics have real meaning to those who understand that maximum performance depends upon components which meet professional standards. If you want the best that high fidelity can offer, ask your dealer to demonstrate the 220, 240 and 260 Pickering cartridges . . .

The Most Nearly Perfect Phono Pickups Ever Produced

PICKERING ***and company incorporated • Oceanside, L.I., New York***

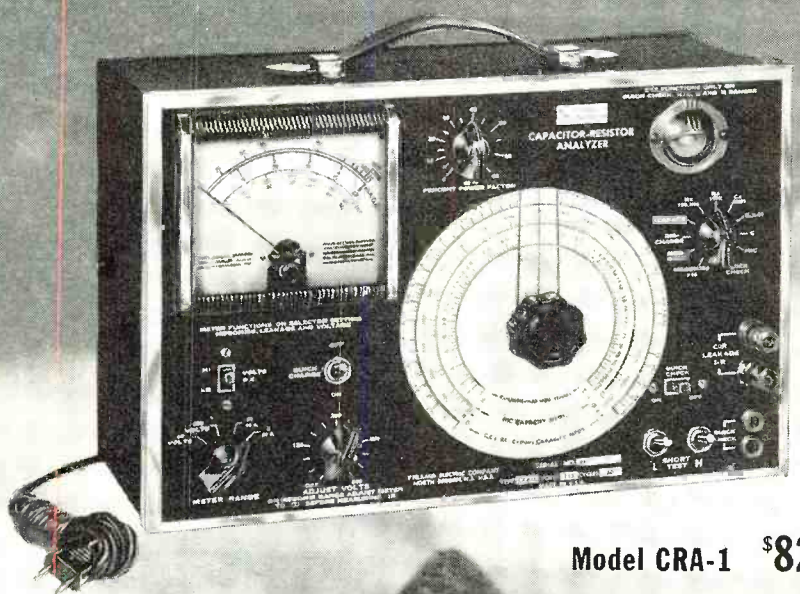
PICKERING COMPONENTS ARE PROFESSIONAL QUALITY

"For those who can hear the difference"

. . . Demonstrated and sold by Leading Radio Parts Distributors everywhere. For the one nearest you and for detailed literature; write Dept. C-7

NEW Capacitor Resistor-Analyzer AND Quick Capacitor Checker

another Pyramid first



Model CRA-1 **$82.95**

user net price

This fine double duty instrument provides you not only with the complete setup for checking and analyzing all types of capacitors and resistors, but also the "Quick Check" feature enables you to test capacitors while they are wired in a set.

With the Pyramid analyzer there is no need to remove capacitors from the circuit to determine if they are open, shorted or intermittent.

This new development that saves time in servicing and production testing serves the function that required two instruments previously, actually costs less than the older type analyzer plus a separate "quick" capacitor checker.

PYRAMID ELECTRIC CO.
1445 Hudson Blvd., North Bergen, N.J.

2 in 1

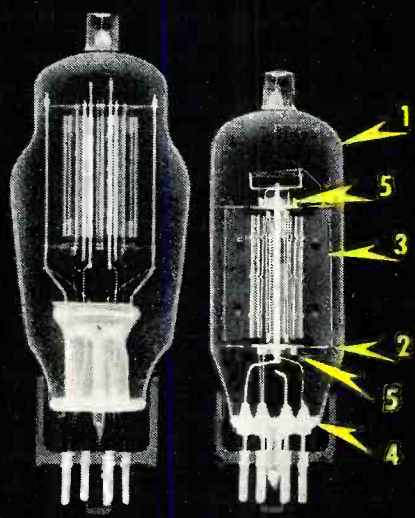
BURTON BROWNE ADVERTISING

PYRAMID

Ready to install! 6 NEW G E

You can put top quality in more TV sockets,

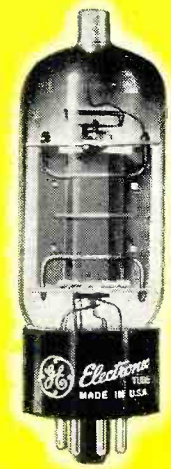
X-RAYS PROVE STRONGER TUBE CONSTRUCTION



OLD 6BG6-G NEW 6BG6-GA

1. New bulb is straight-side, much smaller and sturdier.
2. Bottom mica, as well as top, now contacts the glass all around, for greater rigidity.
3. Redesigned, more shock-resistant structure.
4. Button-stem base gives shorter and better-separated leads; improves heat conduction.
5. New beam shields mask off stray electron bombardment from micas and bulb.

NEW SERVICE-DESIGNED 6BG6-GA

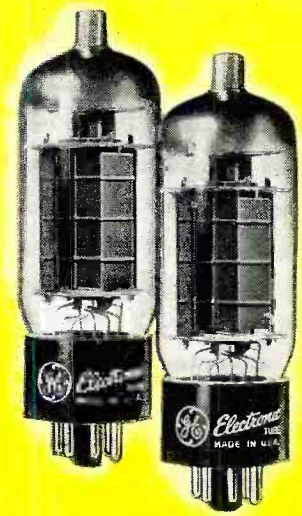


● X-ray pictures at left explain why the new tube is stronger throughout, also more compact. (Note that new straight-side bulb is "necked down" at bottom to take the same diameter base as prototype, so the same ring-clamps can be used when installing.)

Tube performance is much improved. Internal structure and micas have been redesigned to cut down inter-electrode leakage, reducing the chance of horizontal TV-picture shrinkage. The new beam shields, which mask off stray electron bombardment, further increase operating stability.

And *every* 6BG6-GA is high-voltage seasoned—is pulse-treated at absolute max voltage ratings, among other checks!

NEW SERVICE-DESIGNED 6CD6-GA AND 25CD6-GB



● Prototypes gave arc-over trouble, causing horizontal TV-picture streaking. In the new sweep tubes, brand-new mica design corrects this fault.

Also, plate area has been increased for greater dissipation. Ratings are higher:

	PROTOTYPES	6CD6-GA and 25CD6-GB
Plate positive-pulse voltage	6600 v	7000 v
Plate dissipation	15 w	20 w

New tubes are high-voltage seasoned. *Every* 6CD6-GA and 25CD6-GB gets an arc-over test at absolute max ratings!

More compact and sturdier than prototypes, with same base diameter. All of the new construction features shown in the X-ray picture of the 6BG6-GA, apply also to Types 6CD6-GA and 25CD6-GB.

GE Electronic TUBES

NOW 14 G-E SERVICE-DESIGNED TUBES . . . SPECIALLY DEVELOPED, BUILT, AND TESTED TO OUT-PERFORM AND OUTLAST THE TYPES THEY REPLACE!

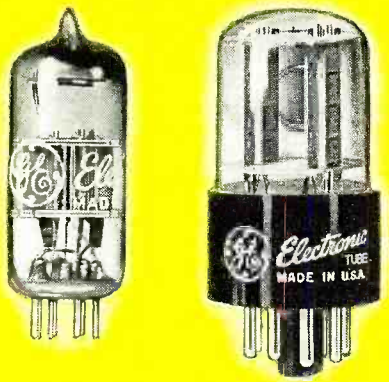
NEW 1B3-GT
NEW 5U4-GA
NEW 5Y3-GT
NEW 6AV5-GA
NEW 6AX4-GT
NEW 6BG6-GA
NEW 6BQ6-GA
NEW 6BX7-GT
NEW 6CD6-GA
NEW 6J6
NEW 6SN7-GTB
NEW 12SN7-GTA
NEW 25BQ6-GA
NEW 25CD6-GB

SEE YOUR G-E DISTRIBUTOR FOR NATIONALLY-ADVERTISED G-E SERVICE-DESIGNED TUBES!

SERVICE-DESIGNED TUBES

build more customer goodwill, than ever before!

NEW SERVICE-DESIGNED 6J6 6SN7-GTB



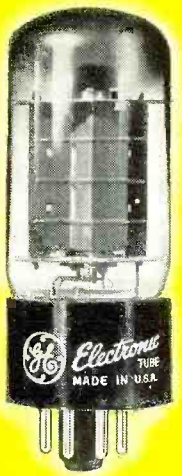
● 6J6 . . . Whisper-quiet! Microphonics are cut 'way down! The prototype, used in many head-end TV circuits, was subject to microphonic disturbance when jarred or shaken. This caused picture jitter . . . in some sets, audio noise.

Redesigned tube elements and structure now give servicemen a whole new deal on this much-used type. With Service-Designed 6J6's, technicians can satisfy their most critical customers.

● 6SN7-GTB . . . Shows that G-E design improvement is a never-ending process! A brand-new model of the popular 6SN7-GTA, with all the latter's superior performance . . . plus a 600-ma heater with "series-string" warm-up time.

Completely interchangeable with the 6SN7-GTA. Also, because of its "series-string" heater, a tube that's universally adaptable for servicing old or new sets.

NEW SERVICE-DESIGNED 6AV5-GA



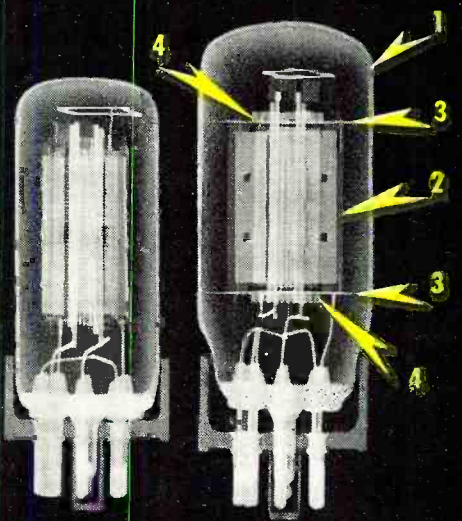
● The prototype 6AV5-GT had a tendency to run hot, which shortened tube life. X-ray pictures at right show important improvements in G.E.'s new 6AV5-GA that add up to more hours of service.

The new tube operates safely at high temperatures, withstands high pulse plate voltages, and is sturdy in construction. All these advantages are integral in the 6AV5-GA's new design.

Also—like other Service-Designed Tubes—the 6AV5-GA is high-voltage seasoned. *Every tube* is pulse-tested at absolute max voltage ratings.

Your can count on 6AV5-GA dependability and long life! Install this tube to improve still further your standing with your customers!

X-RAYS SHOW WHY TUBE LIFE IS INCREASED



OLD 6AV5-GT NEW 6AV5-GA

1. New bulb is much larger, radiates more heat. Tube runs cooler and gives longer service.
2. Redesigned plate has larger area, reducing internal operating temperature of tube.
3. Redesigned micas cut down on high-voltage arcing.
4. New beam shields mask off stray electron bombardment from micas and bulb. Help stabilize tube performance.

● G-E SERVICE-DESIGNED TUBES cost no more than others . . . yet give far superior service. Fully interchangeable with prototypes, they perform better, and tube life is longer. You *gain* when you install them, because they enhance your reputation as a TV service technician.

You *save* in fewer customer call-backs—in reduced tube inventory needs, due to the fact that G-E SERVICE-DESIGNED TUBES give top performance in all television chassis, regardless of the make.

Now 14 types are available, covering a wide range of sockets. G-E SERVICE-DESIGNED TUBES—a popular success from the start—are nationally advertised. TV owners know about them, ask for them. *Profit* by selling and installing these proved high-quality tubes, obtainable only from your G-E tube distributor! *Tube Department, General Electric Company, Schenectady 5, New York.*

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GENERAL ELECTRIC

161-1A2

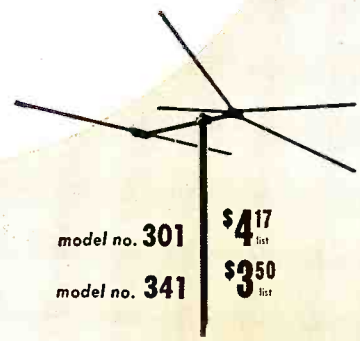
CHANNEL MASTER

steers you to the greatest conical values ever offered!

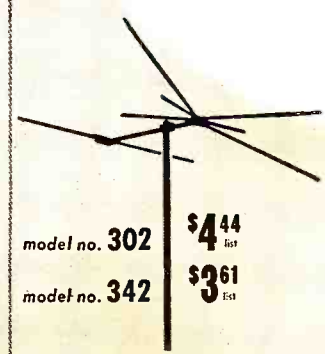
the New "MAVERICK"

Never before such a complete line of conicals at such fabulous LOW PRICES!

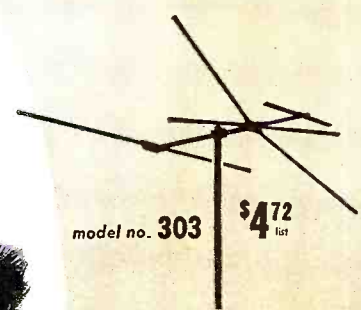
Low-priced conicals? Here is the LOWEST-PRICED, fullest conical line you've ever seen—a complete series of 22 different models. Checked out and approved by the Channel Master laboratory, every "MAVERICK" antenna provides outstanding Broad Band reception wherever conical antennas find application. Available both "Super-sembled" and non-assembled, the "MAVERICKS" are, without doubt, today's most sensational ante na buy



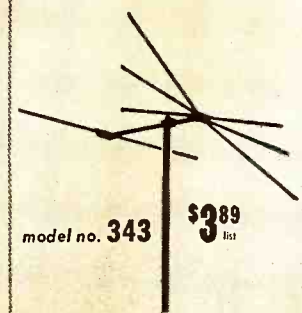
model no. 301 $4.17 list
model no. 341 $3.50 list



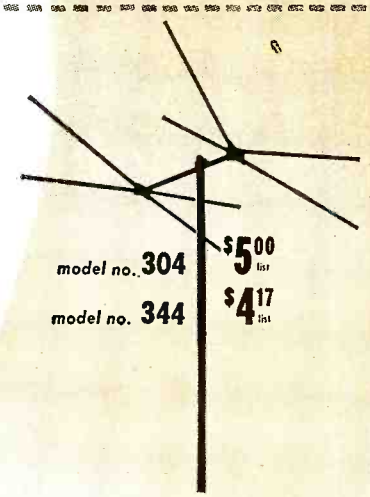
model no. 302 $4.44 list
model no. 342 $3.61 list



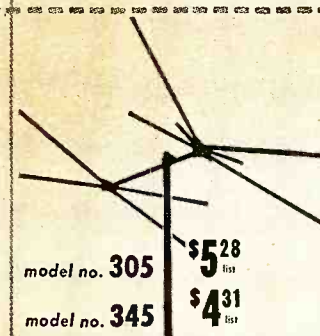
model no. 303 $4.72 list



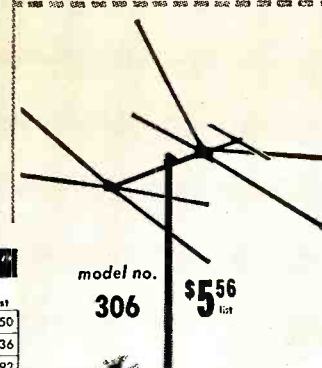
model no. 343 $3.89 list



model no. 304 $5.00 list
model no. 344 $4.17 list



model no. 305 $5.28 list
model no. 345 $4.31 list



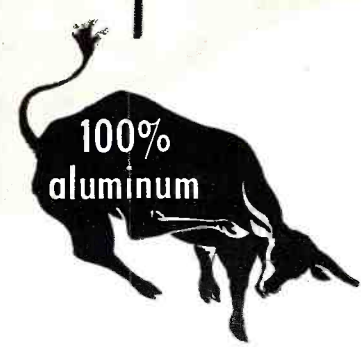
model no. 306 $5.56 list

"MAVERICK 300"

model no.	desc.	pack'd	list
301	1-Bay	6	$4.17
301-2	2-Bay	3	8.75
301-8	2-Bay	1	9.31
302	1-Bay	6	4.44
302-2	2-Bay	3	9.31
302-8	2-Bay	1	9.86
303	1-Bay	6	4.72
303-2	2-Bay	3	9.86
303-8	2-Bay	1	10.42
304	1-Bay	6	5.00
304-2	2-Bay	3	10.42
304-8	2-Bay	1	10.97
305	1-Bay	6	5.28
305-2	2-Bay	3	10.97
305-8	2-Bay	1	11.53
306	1-Bay	6	5.56
306-2	2-Bay	3	11.53
306-8	2-Bay	1	12.08
301-3	Conn. Rods		.56

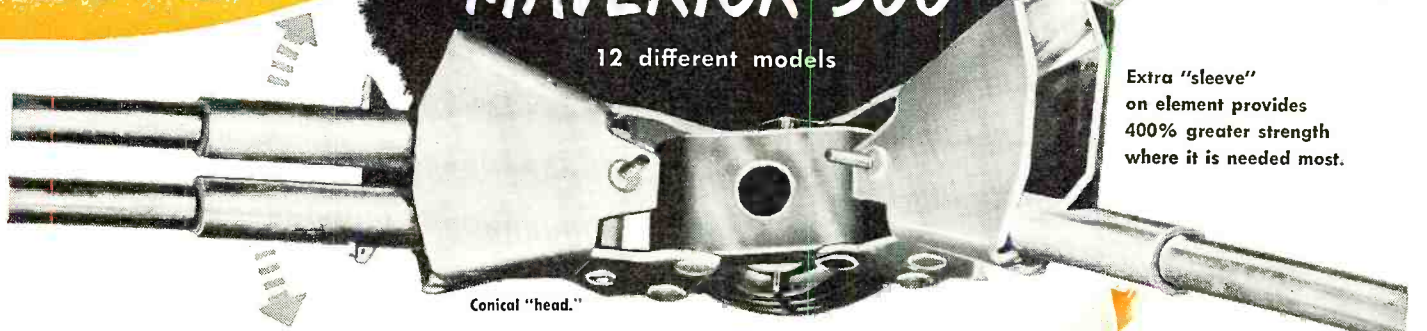
"MAVERICK 340"

model no.	desc.	pack'd	list
341	1-Bay	6	$3.50
341-2	2-Bay	3	7.36
341-8	2-Bay	1	7.92
342	1-Bay	6	3.61
342-2	2-Bay	3	7.64
342-8	2-Bay	1	8.19
343	1-Bay	6	3.89
343-2	2-Bay	3	8.19
343-8	2-Bay	1	8.75
344	1-Bay	6	4.17
344-2	2-Bay	3	8.75
344-8	2-Bay	1	9.31
345	1-Bay	6	4.31
345-2	2-Bay	3	9.03
345-8	2-Bay	1	9.58
341-3	Conn. Rods		.56



"MAVERICK 300"

12 different models

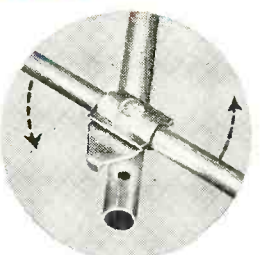


Extra "sleeve" on element provides 400% greater strength where it is needed most.

Conical "head."

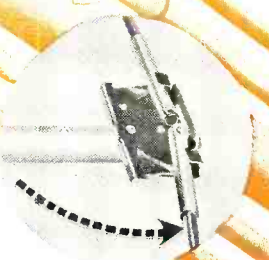
The **first** and **only** full line of conical antennas completely "Super-sembled"

No hardware, no tools, no tightening— pops open, ready for the mast!



Director bracket.

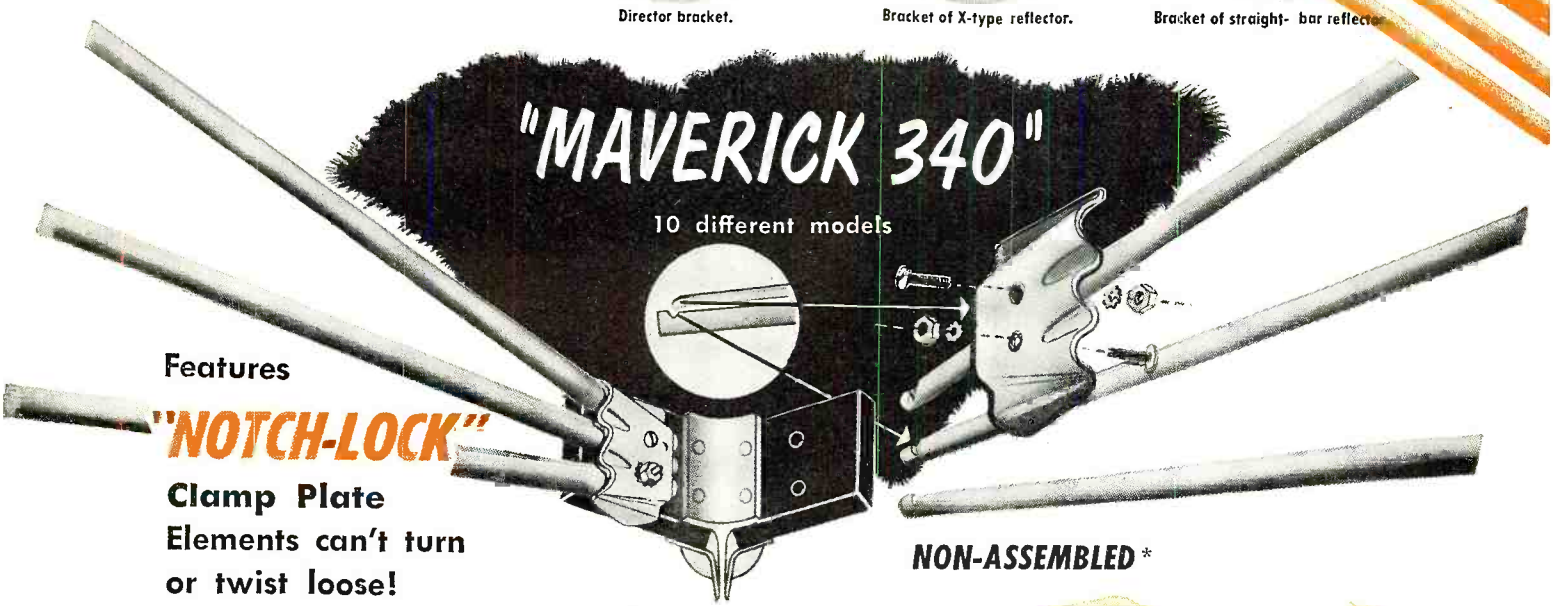
Bracket of X-type reflector.



Bracket of straight- bar reflector

"MAVERICK 340"

10 different models



Features

"NOTCH-LOCK"

Clamp Plate

Elements can't turn or twist loose!

This exclusive feature, until now, has been available only in much higher-priced models.

NON-ASSEMBLED*

*This **quality** line carries the lowest price-tags ever seen on conical antennas!*

- Installs in a matter of minutes.
- Most popular conical arrangements.
- Finest materials; durable, rugged construction.

*** Extra Preassembly Feature!**

On all models with straight-bar reflectors, the reflector element is completely *preassembled* for snap-open installation.

CHANNEL MASTER CORP.

ELLENVILLE, N. Y.

WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

Write for complete technical literature

AMAZING PHILCO SUPER-ALUMINIZED

SUPER ALUMINIZED SCREEN

PRECISION FOCUS ELECTRON GUN

PRE-SELECTED FOR HIGHEST PERFORMANCE

PHILCO StarBright 20/20 Look for this mark . . . it's your guarantee of Philco Quality!

These top features assure Philco StarBright dealers of top sales . . . top profits in picture tube replacements. They mean sharpness, clarity, detail and over-all performance that give "You are There" realism.

Right in your neighborhood there are hundreds of TV set owners who want the new, fresh, vital picture that only a Philco StarBright 20/20 can provide. Now is the time to sell them . . . and the Philco StarBright 20/20 can be installed in practically any make TV.

Your customers want a quality picture—they know Philco—famous for quality the world over. Put the two together and you've started sales and profits rolling your way. Call your Philco Distributor today for complete details on this money making program.

PHILCO TUBES IMPROVE THE PERFORMANCE OF ANY TV OR RADIO RECEIVER

Star Bright 20/20

PICTURE TUBE

Backed by Powerful Profit Producing Promotion

Eye-catching, colorful store and direct mail pieces bring home the advantages of Philco StarBright 20/20—fast—for quick consumer action. Put this material to work for you.

NEW 1955 PHILCO

SHARE and PROFIT

OPPORTUNITY!

Service Dealers everywhere are going to make more money with Philco this year. Bonus dollars and profits are yours with *no* additional effort through one of Philco's greatest promotions. Call your Philco Distributor at once for complete details.

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Spot Radio News

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

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

BROADCASTING AND THE COMMUNICATIONS ACT, needled for years by investigating committees, but never seriously affected by the probes, received its most serious jolt, a few weeks ago, when Senator Warren G. Magnuson, chairman of the tough Senate Interstate and Foreign Commerce Committee, released the scorching Plotkin memo, which broadly indicted not only industry, but government agencies for a lack of initiative and progressive thinking. The report declared quite bluntly that neither the broadcast operator nor the manufacturer appeared to be willing to promote the high bands, and many of the key telecasters had stymied action on modifications of the act; moves which have made it impossible to keep pace with economic and scientific changes, and other provocative problems.

The Senator found the report so impressive that he ordered copies sent to the Commission and the Department of Justice for immediate action. The FCC was asked to set up a continuing investigation of the recommendations proffered, issue interim reports at 60-day intervals and then submit a final paper within six months. The author of the 1934 act, former Senator Clarence C. Dill, who incidentally was co-author of the 1927 measure which created the old Federal Radio Commission, was called in on the scene to study the blistering essay of Plotkin, and offer his suggestions on any legislative changes that would be appropriate now.

The rampaging broadside, prepared by Harry M. Plotkin, a former FCC legal light, scored the networks for their dominating control. *NBC* and *CBS* were accused of holding the reins; a situation which has been of concern to the Congress and the Commission for nearly a score of years.

Commenting on the problems of exclusivity and network affiliation, Plotkin said that the public has a legitimate interest in the manner by which affiliations are granted. In the first place, he added, a network tie is a . . . "most valuable asset for all television stations and is the difference between success and failure for many stations."

Reviewing the u.h.f. situation, Plotkin said that the high-band stations have had . . . "great difficulty in securing network service and unless they are able to secure such service on a fairly extensive scale, successful u.h.f. operation is very difficult, and there is a good prospect that a large part of the radio spectrum will go unused."

Analyzing the duplication of programs, a touchy subject among networks, the former government attorney said that the networks should be . . . "required to publish and file with the Commission the standards they purport to follow in determining what is excessive duplication in the awarding of affiliations." Plotkin felt that the FCC should approve, disapprove, or modify the standards. In his opinion any station complying with the published standards would be entitled to an affiliation on a non-discriminatory basis, as far as compensation and other terms of the affiliation are concerned. He believed, too, that a procedure should be set up enabling other than affiliates in a network to carry programs that were not being used by the network stations.

Discussing intermixture of high- and low-band stations, and equalizing of such stations in an area, Plotkin said that the . . . "Commission should undertake to enumerate those markets in the United States with fewer than four facilities of relatively equal desirability, whose availability are important for network operation. . . . At the present time, a u.h.f. facility in an intermixed market would obviously not be included as one of the four. But, if and when conversion should reach a high enough point (85 or 90 per-cent), u.h.f. stations in such communities could then be included."

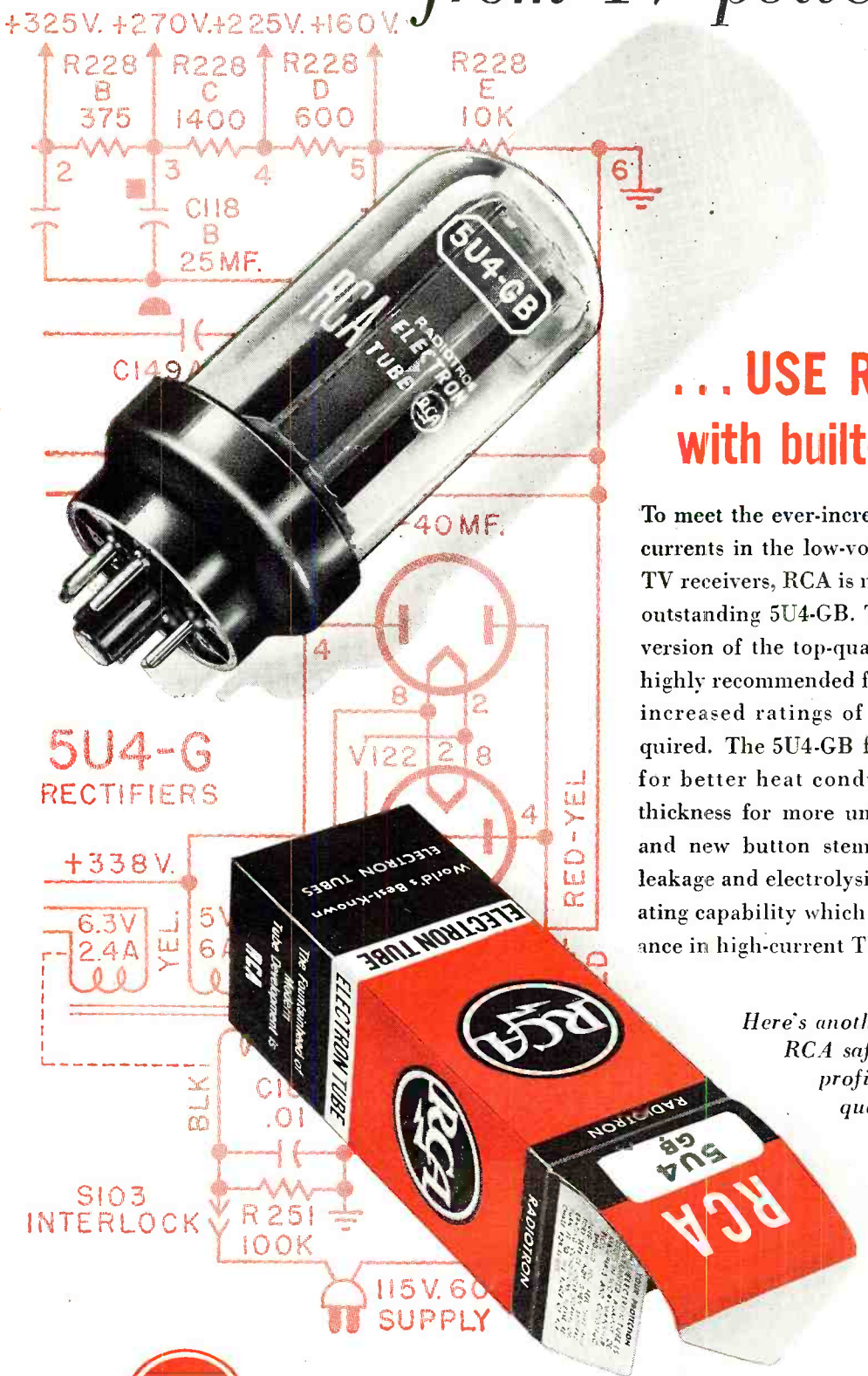
In a roaring dissent on the Plotkin statement, *CBS'* prexy, Frank Stanton, said that his company believes that many of the proposals, insofar as they concern network television, are ". . . mistaken, impractical and unwise." Adoption of such proposals, he said, would gravely cripple the networks and the public's investment of . . . $13.5 billion in receivers would be substantially depreciated."

Continuing his biting criticism of the memo, Stanton said that the proposals betray a . . . "complete lack of understanding of the complex business of television networking."

The failure to test theories against facts, he added, "has resulted in unrealistic and extreme proposals."

According to the network president,

For dependable output from TV power supplies



. . . USE RCA TUBES with built-in quality!

To meet the ever-increasing demand for higher currents in the low-voltage supplies of modern TV receivers, RCA is making available the new, outstanding 5U4-GB. This tube is a heavy-duty version of the top-quality RCA 5U4-G which is highly recommended for applications where the increased ratings of the 5U4-GB are not required. The 5U4-GB features more plate area for better heat conduction, increased plate thickness for more uniform heat dissipation—and new button stem construction to reduce leakage and electrolysis. Result—a reserve operating capability which assures you top performance in high-current TV power supplies.

Here's another example of how RCA safeguards your servicing profits by "building-in" extra quality where you need it!

RADIO CORPORATION of AMERICA
ELECTRON TUBES **HARRISON, N.J.**

Your First Choice for TV circuits . . . dependable RCA Tubes.

the report attempts . . . "to resuscitate concepts and approaches, which during the last decade have been specifically and uniformly repudiated by the Congress and the FCC."

"Television networking," the broadcast head stressed, "is precisely the kind of business where blind and unrealistic tampering with some of the parts can destroy the whole . . . It is, therefore, of the utmost importance that those, who would consider restrictions on network broadcast operations, should be fully informed as to the workings of the industry and come to understand how it has been able to provide the American public with the best radio and television service in the world."

Urging that they be heard, if the proposals are to be considered by the Senate Committee or the Commission, Stanton said that he asks this right not only for his company, but for the public, whose stake is even larger. Noting that there are a number of ways in which the public's investment can be depreciated, the network official said that . . . "in the recommendations of the Plotkin memorandum, one such road is clearly blueprinted."

AT AN UNUSUAL TV TUBE DEMONSTRATION, under the jurisdiction of the Navy, a multi-color radar was shown, under actual operating conditions at the National Airport, in Washington.

The showing marked the first time that it has been possible for different types of radar information, namely, stationary and moving or friendly and enemy, to be displayed simultaneously in more than one color on a single radar indicator.

The heart of the new device is a single electron-gun color picture tube, the "Chromatron," which was invented by Dr. Ernest O. Lawrence. The tube, although redesigned for the radar unit, was said to be similar basically to the color picture designed for TV.

Previously, it was said, radar operators have had to rely on a single color for the interpretation of all data on the screen. Now, with the help of more than one color appearing simultaneously on the same radar screen, it becomes possible to distinguish between incoming signals faster, with greater facility and for a longer period of time, without too much concentration.

The tactical applications of color radar, it was noted, are under further development by several branches of the armed forces.

ON THE EAST SLOPE of the Front Range of the Rocky Mountains, near Colorado Springs, Colorado, lies Cheyenne Mountain, a towering sheet of rock, that government experts, from the Bureau of Standards, found to be ideal for the evaluation of v.h.f. and u.h.f. propagation for assorted services; particularly for air-ground communications.

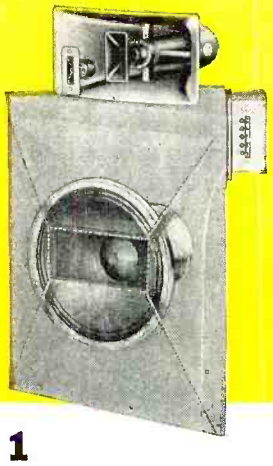
(*Continued on page* 98)

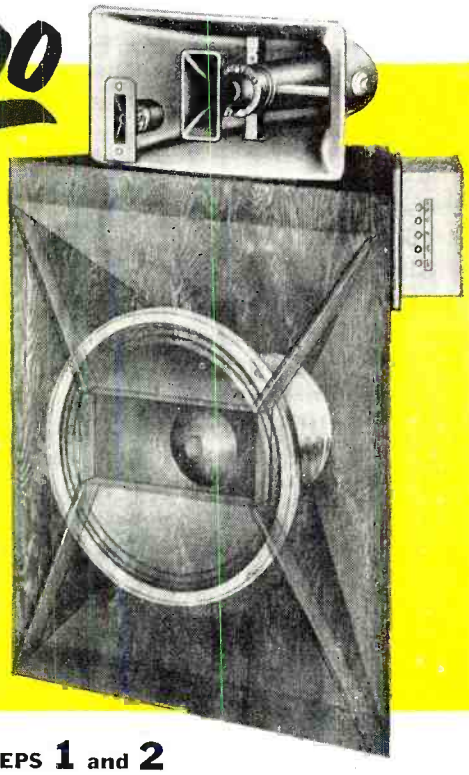
the finest in High Fidelity!

Complete 4-way Speaker System

FOR LESS THAN $300.00

*See Model 105-106 below





STEP 1

Model 105 Package of Georgian Driver Components

This gives the music lover the driving components to start a Georgian 4-way system. Can readily be used for converting existing Klipsch type speaker systems to a Georgian 4-way. Includes E-V 15WK LF Driver, 848HF Coaxial Mid-Range Unit, T35 VHF Driver, X336 Crossover Network, AT37 Level Controls and 8574 Cable Harness. Also includes complete instructions for constructing "K" bass section and outer furniture housing for Georgian.

List, $342.00. **Audiophile Net, $205.20**

STEP 2

Model 106 Klipsch "K" Type Basic Low-Frequency Driver Horn

Add this corner folded horn with back deflecting board and corner spacer for bass section to augment bass reproduction. Designed for E-V 15WK 15" low-frequency driver unit. Painted with flat matte black prime coat, in order not to show through grille cloth. Can be painted by user in other colors, but will not take furniture finish. Size: 38½" high x 32¼" wide x 22¾" deep.

List, $150.00. **Audiophile Net, $90.00**

*STEPS 1 and 2

Model 105-106 Complete 4-way Reproducer Kit—Ready to Assemble and Operate

Consists of all parts of the Georgian system except the outer decorative housing. Includes Model 105 Driver Components and Model 106 "K" type corner folded horn. Ideal for building in. Also used as utility high fidelity monitoring speaker system for commercial purposes and for sound reinforcement in auditoriums. Plans supplied for home construction of outer decorative furniture housing. Can be assembled easily, quickly with ordinary tools. No cutting or fitting required.

List, $492.00. **Audiophile Net, $295.20**

Now Get GEORGIAN 4-Way Performance...Economically...Step-By-Step

Now for the first time by easy stages, the quality-minded, budget-limited hi-fi enthusiast can own and enjoy the thrilling 4-way performance of the magnificent E-V GEORGIAN loudspeaker system! Think of it! For only $295.20 Audiophile Net, you have the complete GEORGIAN 4-WAY SYSTEM, less the outer decorative cabinet which you can add at any time!

STEP 3

Model 107 Georgian Outer Decorative Furniture Housing Only—in lustrous hand-rubbed finish

Mahogany. List, $333.00. **Audiophile Net, $199.80**
Blonde. List, $366.33. **Audiophile Net, $219.80**

Model 109 Georgian Cabinet Combination Consists of Models 106 and 107.

Mahogany. List, $483.00. **Audiophile Net, $289.80**
Blonde. List, $516.33. **Audiophile Net, $309.80**

THE MAGNIFICENT *Georgian*

Write for Bulletin No. 199

Electro-Voice

ELECTRO-VOICE, INC. • BUCHANAN, MICHIGAN

Licensed under Klipsch Patents No. 2310243 and No. 2373692

CRYSTAL PACKAGE SALE!

Genuine Govt. Surplus Crystals! Same day shipment! Assorted frequencies!

WARRANTY! All crystals in Special Packages Number 1, 2, 3 and 4 are GENUINE government surplus crystals manufactured by NATIONALLY-KNOWN companies such as Bliley, Piazza, Monitor, John Meck, Cecor, Telicon, etc. U. S. CRYSTALS, INC. GUARANTEES YOUR SATISFACTION OR YOUR MONEY BACK IN FULL!

SPECIAL PACKAGE DEAL NO. 1

100 CRYSTALS!

SPECIAL PACKAGE DEAL NO. 1 CONSISTS OF:

80.....FT-243 10.....FT-171 10.....DC-34-35

MIXED FREQUENCIES! At least 20 HAM BAND frequencies! For operation on 160, 80, 40, 20, 10, 6 and 2 meters on either FUNDAMENTAL or HARMONIC frequencies.

SHIPPING TERMS: Same day shipment! Shipping wt.: 5¾ lbs. Check postal zone and ADD SUFFICIENT POSTAGE to cover cost of mailing.

SPECIAL PACKAGE DEAL NO. 1 $9.95 Regular value $69.00!

SPECIAL PACKAGE DEAL NO. 2

Guaranteed to oscillate! **Consists of 5 choice crystals:**

1—ZENITH MODEL DC-18-A 1,000 KC CRYSTAL: Built-in 12 V. automatic thermostatic controlled heating unit. 8-pin octal base. Regular value....$5.95

1—SR-5 BLILEY. 10,000 Kc. Reg. Value.$1.99
1—FT-243. 5,000 Kc. Reg. value..... 1.99
1—DC-15. 200 Kc. Reg. value..... 1.99
1—FT-241. 500 Kc. Reg. value..... 1.99

Total regular value $13.91.

SPECIAL PACKAGE DEAL NO. 2 **$8.95** *POSTPAID!* Satisfaction guaranteed!

SPECIAL PACKAGE DEAL NO. 3

36 FT-241 LOW FREQUENCY CRYSTALS!

FOR SINGLE SIDE BAND

Frequency range from 370.370 Kc. to 435.185 Kc. in steps of every 1.852 Kc. approximately. Channels: 0 to 35.

SPECIAL PACKAGE DEAL NO. 3 $3.95 *POSTPAID* Satisfaction guaranteed! Regular value $14.04

SPECIAL PACKAGE DEAL NO. 4

THE BIGGEST CRYSTAL BARGAIN EVER OFFERED! CONSISTS OF:

1 Special Package No. 1. Reg. value $9.95
1 Special Package No. 2. Reg. value 8.95
1 Special Package No. 3. Reg. value $3 95
Total value $22.85

SPECIAL PRICE FOR ALL 3 PACKAGES..... $19.95 *POSTPAID!* Satisfaction guaranteed!

INDIVIDUAL CRYSTALS!

Guaranteed to oscillate! **Your choice of frequencies! Same day shipment!**

ALL CRYSTALS TESTED FOR ACTIVITY! 1-DAY SERVICE FOR EVERYTHING IN STOCK!

NOVICE BAND

FT-243 FUNDAMENTAL FREQUENCIES

Lots of 10 or more. Ea. **99c**

Individually. Ea. $1.25

YOUR CHOICE OF FREQUENCIES!

80 METERS 3701, 3702, 3703 through 3748 in steps of 1 KC.

40 METERS 7176, 7177, 7178 through 7198 in steps of 1 KC.

DOUBLING TO 40 METERS: 3588, 3589, 3590 through 3599 in steps of 1 KC.

SINGLE SIDE BAND—FT-241-A

Low Frequency Crystals **79c**

Lots of 10 or more. Each.....
Lots of 5 or more. Each.....89c
Individually. Each.....99c

400	442	446	450	453	456	459	463	466	470	474	477
440	444	447	451	454	457	461	464	468	472	475	479
441	445	448	452	455	458	462	465	469	473	476	480

MISCELLANEOUS & SHIP BAND FREQUENCIES

81.95	KC. Octal tube type (Used in SCR-584 & SPM-1).....	$3.99
200	KC. FT-241 CR2/U	1.99
200	KC. Type DC-15 in octal tube base type holder	1.99
327.8	KC. No. D-168342. (Used in TS-102/AP)	9.95
500	KC. FT-241	1.99
1000	KC. Type DC-9, in octal tube base type holder.....	3.45
2000	KC. FT-243	1.99
2009	KC. DC-34	2.99
2110	KC. DC-34	2.99
2126	KC. DC-34	2.99
2142	KC. DC-34	2.99
2166	KC. DC-34	2.99
2174	KC. DC-34	2.99
2182	KC. DC-34	2.99
2182	KC. FT-243	2.99
2206	KC. DC-34	2.99
2500	KC. FT-243	1.99
2559	KC. DC-34	2.99
2567	KC. DC-34	2.99
2629	KC DC-34	2.99
2632	KC. FT-243	2.99
2637	KC. DC-34	2.99
2637	KC. FT-243	2.99
2638	KC. DC-34	2.99
2638	KC. FT-243	2.99
2670	KC. FT-243	2.99
2647	KC. FT-243	2.99
2670	KC. DC-34	2.99
2738	KC. type 1-C.....	2.99
2738	KC. FT-243	2.99
2738	KC. MC-7	2.99
2891	KC. DC-34	2.99
2907	KC. DC-34	2.99
2931	KC. DC-34	2.99
2973	KC. DC-34	2.99
2977	KC. DC-34	2.99
2983	KC. DC-34	2.99
3000	KC. FT-243	1.99
3021	KC. DC-34	2.99
3033	KC. DC-34	2.99
3043	KC. DC-34	2.99
3053	KC. DC-34	2.99
3055	KC. DC-34	2.99
3088	KC. FT-243	2.99
3093	KC. DC-34	2.99
3093	KC. FT-243	2.99
3098	KC. FT-243	2.99
3103	KC. FT-243	2.99
3123	KC. DC-34	2.99
3125	KC. DC-34	2.99
3188	KC. FT-243	2.99
3193	KC. DC-34	2.99
3193	KC. FT-243	2.99
3198	KC. FT-243	2.99
3203	KC. FT-243	2.99
3000	KC. FT-243	1.99
10.000	KC. Type SR-5 Bliley, in CR-1 holder	1.99

NUMBERS LISTED ARE FUNDAMENTAL FREQUENCIES IN KILOCYCLES

FT-243

Lots of 10 or more. Ea.....
Lots of 5 or more. Ea....79c
Individually. Ea. 99c **69c**

1110	2520	2905	3240	4695	5782.5	6340	7073.3	7520	7773.3	8016.7	8260	8508.3
1129	2525	2910	3290	4710	5800	6350	7075	7525	7775	8020	8266.7	8510
1150	2530	2915	3310	4735	5806.7	6362	7100	7530	7780	8025	8270	8516.7
1195	2535	2920	3320	4780	5820	6373.3	7106.6	7533.3	7783.3	8030	8273.3	8520
1525	2545	2925	3340	4785	5825	6375	7125	7540	7790	8033.3	8275	8525
1900	2550	2930	3410	4815	5840	6400	7140	7541.7	7791.7	8040	8280	8530
1915	2557	2935	3420	4820	5850	6405	7150	7550	7800	8041.7	8283.3	8533.3
1930	2560	2940	3455	4840	5852.5	6406 6	7160	7558.3	7806.6	8050	8290	8540
1940	2565	2945	3465	4845	5860	6425	7173.3	7560	7808.3	8058.3	8291.7	8541.7
1950	2570	2950	3500	4852.5	5873.5	6440	7175	7566.7	7810	8060	8300	8550
1965	2575	2955	3510	4880	5875	6450	7200	7570	7816.7	8066.7	8306.6	8558.3
2015	2580	2960	3525	4900	5880	6473.3	7206.6	7573.3	7820	8070	8308.3	8560
2017	2585	2965	3640	4930	5892.5	6475	7225	7575	7825	8073.3	8310	8566.7
2020	2590	2975	3655	4950	5900	6500	7240	7580	7830	8075	8316.7	8570
2025	2595	2980	3680	4980	5906.7	6506.6	7250	7583.3	7833.3	8080	8320	8573.3
2035	2650	2985	3700	4995	5907.5	6525	7273.3	7590	7840	8083.3	8325	8575
2040	2655	2990	3760	5030	5925	6540	7275	7591.7	7841.7	8090	8330	8580
2055	2660	2995	3800	5035	5940	6550	7300	7600	7850	8091.7	8333.3	8583.3
2060	2665	3005	3885	5090	5950	6573.3	7306.6	7606.6	7858.3	8100	8340	8590
2065	2675	3010	3940	5127.5	5955	6575	7308.3	7608.3	7860	8106.6	8341.7	8591.7
2090	2680	3015	3955	5165	5973.3	6600	7316.7	7610	7866.7	8108.3	8350	8600
2105	2685	3020	3980	5180	5975	6606.6	7325	7616.7	7870	8110	8358.3	8606.6
2125	2690	3025	3990	5205	5995	6625	7333.3	7620	7873.3	8116.7	8360	8608.3
2130	2695	3030	3995	5235	6000	6640	7340	7625	7875	8120	8366.7	8610
2135	2705	3035	4035	5245	6006.6	6650	7341.7	7630	7880	8125	8370	8616.7
2140	2710	3040	4045	5285	6025	6673.3	7350	7640	7883.3	8130	8375	8620
2195	2715	3045	4080	5295	6040	6675	7358.3	7641.7	7890	8133.3	8380	8625
2300	2720	3050	4095	5300	6042	6700	7366.7	7650	7891.7	8140	8383.3	8630
2305	2750	3055	4110	5305	6050	6706.6	7633.3	7658.3	7900	8141.7	8390	8633.3
2320	2755	3060	4135	5327.5	6073.3	6725	7373.3	7660	7906.6	8150	8391.7	8640
2350	2760	3065	4165	5335	6075	6740	7375	7666.7	7908.3	8158.3	8400	8641.7
2355	2765	3070	4175	5385	6100	6750	7383.3	7670	7910	8160	8406.6	8650
2360	2770	3075	4190	5397.5	6106.6	6773.3	7391.7	7673.3	7916.7	8163.4	8408.3	8658.3
2365	2775	3095	4215	5435	6125	6775	7400	7675	7920	8166.7	8410	8660
2370	2780	3100	4220	5437.5	6140	6800	7406	7680	7925	8170	8416.7	8666.7
2375	2785	3110	4255	5485	6142	6806.6	7406.6	7683.3	7930	8173.3	8420	8670
2390	2790	3130	4280	5500	6150	6815	7408.3	7690	7933.3	8175	8425	8673.3
2415	2795	3135	4295	5545	6173.3	6825	7416.7	7691.7	7940	8180	8430	8675
2430	2815	3140	4300	5582.5	6175	6840	7425	7700	7941.7	8183.3	8433.3	8680
2435	2825	3145	4330	5587.5	6185	6850	7433.3	7706.6	7950	8190	8440	8683.3
2440	2830	3150	4340	5645	6200	6873.3	7440	7708.3	7958.3	8191.7	8441.7	8690
2442	2835	3155	4395	5660	6206.6	6875	7441.7	7710	7960	8200	8450	8691.7
2450	2840	3160	4397.5	5675	6225	6900	7450	7716.7	7966.7	8206.6	8458.3	8700
2455	2845	3165	4445	5687.5	6235	6906.6	7458.3	7720	7970	8208.3	8460	8706.6
2460	2850	3170	4450	5700	6240	6925	7466.7	7725	7973.3	8210	8466.7	8708.3
2465	2855	3175	4490	5706.7	6250	6940	7473.3	7730	7975	8216.7	8470	8710
2470	2860	3200	4495	5725	6273.3	6950	7475	7733.3	7980	8220	8473.3	8716.7
2475	2865	3202	4530	5730	6273.5	6973.3	7483.3	7740	7983.3	8225	8475	8720
2480	2870	3205	4540	5740	6275	6975	7491.7	7741.7	7990	8230	8480	8725
2485	2875	3210	4580	5750	6300	7000	7500	7750	7991.7	8233.3	8483.3	8730
2490	2880	3220	4610	5760	6306.6	7006.6	7506.6	7758.3	8000	8240	8490	8733.3
2495	2885	3225	4620	5773.3	6315	7025	7508.3	7760	8006.6	8241.7	8491.7	8740
2505	2890	3230	4635	5775	6325	7040	7510	7766.7	8008.3	8250	8500	8741.7
2510	2895	3235	4680	5780	6335	7050	7516.7	7770	8010	8258.3	8506.6	8750
2515												

ZENITH MODEL DC-18-A 1,000 KC CRYSTAL

Built-in 12 V. automatic thermostatic controlled heating unit. 8-pin octal base. Ea. (Shipping wt. ½ lb.) **$5.95**

TERMS: All items subject to prior sale and change of price without notice. Minimum order: $2.50. ALL crystal orders MUST be accompanied by check, cash or M.O. WITH PAYMENT IN FULL. NO C.O.D. Postpaid shipments made in U. S. and possessions only. IN ORDERING INDIVIDUAL CRYSTALS, INCLUDE APPROX. 5c PER CRYSTAL FOR POSTAGE. Also indicate second choice frequencies wherever substitution may be made. Calif. buyers add sales tax.

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You can hold down a full-time job and still train AT HOME by the same successful methods I used to help hundreds of men—many with no more than grammar school training—master television!

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My School fully approved to train veterans under new Korean G.I. Bill. Write discharge date on coupon.

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Almost from the very start you can earn extra money while learning by repairing radio-TV sets for friends and neighbors. Many of my students earn up to $25 a week . . . pay for their entire training from spare time earnings . . . start their own profitable service business.

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(For men with previous radio & TV training) I train you at home for an exciting big pay job as the man behind the TV camera. Work with TV stars in the TV studios or "on location" at remote pick-ups! Available if you want it . . . one-week course of practical work on TV studio equipment at Pierce School of Radio & TV, our associate resident school in New York City.

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C-W Telephone Transmitter

RF Signal Generator

Super-Het Radio Receiver

Public Address System

Combination Voltmeter-Ammeter-Ohmmeter

ENOUGH EQUIPMENT TO SET UP YOUR OWN HOME LABORATORY

As part of your training, I give you all the equipment you need to prepare for BETTER PAY TV job. You build and keep a professional GIANT SCREEN TV RECEIVER complete with big picture tube (designed and engineered to take any size up to 21-inch) . . . also a Super-Het Radio Receiver, RF Signal Generator, Combination Voltmeter-Ammeter-Ohmmeter, C-W Telephone Transmitter, Public Address System, AC-DC Power Supply. Everything supplied, including all tubes.

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Qualifies you for Higher Pay! Given to all my students AT NO EXTRA COST after TV Theory and Practice is completed. Helps you qualify for the TOP JOBS in Radio-TV that demand an FCC License! Full training and preparation at home for your FCC License.

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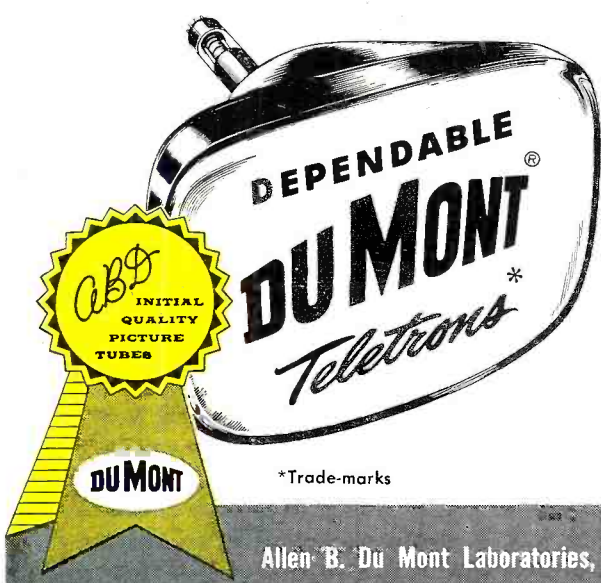

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Look for the Initial Quality Picture Tube tag packed with every Du Mont picture tube. Use it to show your customers that you have provided the finest quality components with your service.

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GOOD JOBS AWAIT THE TRAINED RADIO-TV TECHNICIAN

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

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

EARN WHILE YOU LEARN

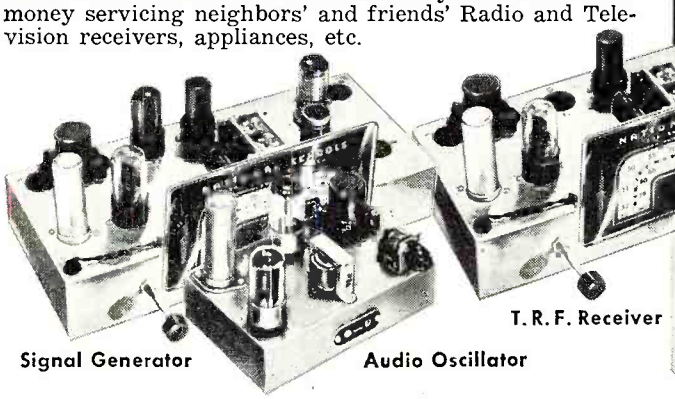
Many National students pay for all or part of their training with spare time earnings. We'll show you how you can do the same! Early in your training, you receive "Spare-time Work" Lessons which will enable you to earn extra money servicing neighbors' and friends' Radio and Television receivers, appliances,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

MASTER ALL PHASES!

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

We Bring National Schools To You!

Superheterodyne Receiver



T. R. F. Receiver

Signal Generator Audio Oscillator

LEARN BY DOING

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

FREE! RADIO-TV BOOK AND SAMPLE LESSON!

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

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

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VETERANS: Give Date of Discharge_____

Within the INDUSTRY

STEWART-WARNER ELECTRIC DIVISION has withdrawn from the manufacture and sale, within the United States, of home radio and television receivers and phonographs.

According to the company, the decision was influenced by the heavy load of electronic development and production work which has been undertaken for the U. S. government.

Hoffman Electronics Corp. of Los Angeles will assume the *Stewart-Warner* service warranties, parts inventories, and the majority of its television distributors.

* * *

MARION PETTEGREW has been named general manager of the parts division of *Sylvania Electric Products Inc.* in Warren, Pa. He will make his headquarters in Warren and be in charge of the division's four plants at Warren, York, Pennsylvania, Nelsonville, Ohio, and in Cleveland, Ohio.

He joined the company in June, 1953 as general manufacturing manager of the parts division. Until his new appointment he had been acting general manager of the division.

* * *

TRAV-LER RADIO CORPORATION has purchased all of the stock of **HALLICRAFTERS CANADA, LTD.** The plant will continue to distribute and manufacture the *Hallicrafters* line of TV, radio, and high-fidelity phonographs in addition to a line which will be marketed under the *Trav-Ler* tradename . . . **NORTHERN ENGINEERING LABS** has been established in Burlington, Wisconsin as an affiliate of **GENERAL CRYSTAL CO.** of the same city . . . Edward Berliant has acquired control of **INSTRUMENTS FOR SERVICE, INC.** of Baldwin, Long Island. The company manufactures a line of service test instruments . . . **TRANS-AMERICAN PRECISION INSTRUMENT CORP.** of Flushing, N. Y. has become a division of **STERLING PRECISION INSTRUMENT CORPORATION.** The general office and manufacturing plant address of the new division will remain unchanged . . . All stock of **VIDAIRE ELECTRONICS MANUFACTURING CORP.** has been purchased by George Miller, president of the firm . . . **DAYSTROM, INC.** has acquired the majority stock interest in **WESTON ELECTRICAL INSTRUMENT CORPORATION** of Newark, N. J.

* * *

HOWARD S. ORCUTT has been appointed chief engineer of the rectifier division of *Pyramid Electric Co.* of North Bergen, N. J.

He joined the firm after serving *Federal Telephone & Radio Co.* for eleven years, most recently as senior engineer, rectifier department, components division. Prior to that Mr. Orcutt served as assistant engineer for the *Consolidated Edison Co.* of New York City.

Mr. Orcutt is a member of the AIEE, the Society for Advancement of Management, and is a licensed professional engineer in New York state.

* * *

WILSON H. OELKERS has been appointed vice-president in charge of purchasing for *Philco Corporation.* He has been with the company since 1934 . . . **CARL F. NORBERG** was elected president of *The Electric Storage Battery Company* succeeding **S. WYMAN ROLPH** who retired after 38 years of service . . . **MYER H. COGAN,** founder and president of the *Symphonic Phonograph and Electronics Corp.* of Boston, passed away recently in his home in Brighton, Mass. He was 52 . . . *La-Pointe Electronics Inc.* has named **LAWRENCE E. KEARNEY** to the post of sales manager. He has been with the company since 1950 . . . **NELLO CODA** has been promoted to the post of chief engineer of the electronics division of *Erie Resistor Corporation* . . . *Automatic Manufacturing Corporation* of Newark, N. J., has appointed **KENNETH C. MEINKEN, JR.** to the post of vice-president in charge of commercial sales. He was formerly general sales

H. WARD ZIMMER, president of Sylvania Electric Products Inc. and pioneer in the electrical-electronics industry, died recently in New York City at the age of 57. He served his company for 36 years, having joined one of the firm's predecessor organizations in Emporium in 1919. Mr. Zimmer held various executive posts with many of Sylvania's divisions and was elected executive vice-president of the firm in 1950. He was named president of the company in April 1953. Mr. Zimmer, a native of Emporium, maintained his headquarters at the company's corporate offices in New York. He was widely known for his development of new manufacturing techniques and processes.

NOW! 5 brilliant new additions to the famous HORIZON high fidelity line!

NEW SPEAKER SYSTEM

the National CATENOID

The National Catenoid Speaker System is the first basic improvement in loud speaker design in more than ten years. A true corner horn, (not a back loaded or semi-horn) the Catenoid is the only practical means of reproducing the power and dynamic quality of rich bass tones.

The Catenoid System consists of a full catenoidal horn from the 30 cycle region to 300 cycles; a direct radiator from 300 to 6500 cycles, and a high frequency tweeter unit from 6500 to beyond 17000 cycles per second.

Bass response extends smoothly to very lowest fundamentals — high frequencies are free from harshness, directional effects — and the mid range gives a feeling of presence little short of miraculous!

IMPEDANCE: 8 OHMS. CAPACITY: 30 WATTS. SIZE: 36″ HIGH, 40⅛″ WIDE, 27½″ DEEP. Available in hand-rubbed walnut or mahogany or with Formica wood grain finishes in blonde mahogany, walnut or natural mahogany to resist scratches, scuffs, burns or liquids.

HORIZON Criterion, AM-FM TUNER

FM sensitivity — .5 microvolts for 20 db quieting! Exclusive FM mutamatic tuning. Full band AM. Binaural provision.

HORIZON 20, 20-watt amplifier

Utilizes revolutionary new "unity-coupled" output stage. Frequency response is ± 1 db 20 cps to 20 kc at full rated output.

HORIZON 10, 10 watt amplifier

Built-in preamp-control unit 3 inputs, 3 record equalization curves, loudness control, separate bass and treble controls. "Unity Coupled" output stage.

HORIZON 5, preamp-control

4 inputs, 7 record equalization curves, loudness volume control, separate bass and treble controls. Plugs into tuner or 20-watt amplifier.

NEW SPEAKER SYSTEM

the National FANTASIA

Exclusive coffee or end table design featuring laboratory-developed dual clusters of distributed ports and internal vents with dual heavy-duty drivers for exceptional peak-free bass in minimum size. 16 ohms. Available in Formica wood grain finishes — blonde, natural mahogany or walnut.

NEW SPEAKER SYSTEM

the National WELLESLEY

Distributed ports. Dual 8-inch drivers. Equalized super tweeter. Incredibly smooth response over entire audio spectrum. Impedance 16 ohms. Available in Formica wood grain finishes in hand-rubbed blonde, walnut or mahogany.

NEW SPEAKER SYSTEM

the National COPLEY

A two-way system of moderate cost featuring heavy duty 8″ driver and superb high flux density tweeter for silky highs. New porting system. Impedance 8 ohms. In Formica wood grain finishes in blonde, walnut or mahogany.

NEW RECORD CHANGER

the HORIZON 100

Jam-proof! Stall-proof! Quiet! Intermixes all size records! 4-pole motor, 2-knob control, weighted turntable, automatic idler disengagement, shut-off and muting switch, universal spindle, rubber turntable mat, stylus pressure adjustment, 2 plug-in heads. Complete with blonde or mahogany base, G. E. cartridge, all cables and connectors.

tuned to tomorrow

Distributed in Canada by Canadian Marconi Company, 830 Bayview Avenue, Toronto, Ontario. For foreign sales, contact American Steel Export Company, 347 Madison Avenue, New York, N. Y.

National NC

Products are sold only through authorized distributors

WRITE FOR COMPLETE DETAILS ON 16 SUGGESTED HIGH FIDELITY SYSTEMS TO DEPT. R-155

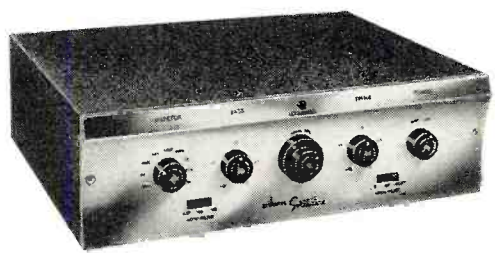
NATIONAL COMPANY INC., 61 SHERMAN ST., MALDEN 48, MASS.

craftsmen GOES DIRECT!

Bringing these Savings to You . . .

Effective March 1, Radio Craftsmen will begin a new policy—
"Selling directly to you."

The same fine Craftsmen Components that have previously been sold only through High Fidelity Dealers and Radio Parts Distributors can now be purchased direct from the factory—at tremendous savings. This new sales policy is designed to offer you the finest High Fidelity Equipment at the lowest possible price.

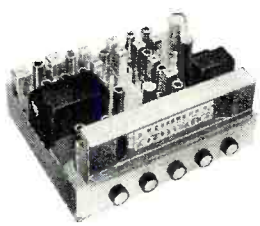


CRAFTSMEN *Solitaire*

Here is the finest, most flexible unit offered by any manufacturer. All you need for a professional home music system is the Solitaire, a fine record player and speaker. This exceptional new unit contains a full 20 watt power amplifier, a preamplifier and an exclusive sharp cut-off filter, housed in an attractive cabinet of leather etched steel. Inputs for magnetic phona cartridge, FM-AM tuner, tape recorder and TV receiver. Six record equalization positions. Contour type loudness control, and separate bass and treble tone controls giving 15 db boost and 13 db attenuation. Sharp cut-off filter system removes both high and low frequency noises. Basic amplifier is based on Williamson Utra-linear design. Frequency response: ±0.5 db, 20-20,000 cycles. IM distortion less than 2% at 20 watts. Size: 4 x 14½ x 11½", Weight 25 lbs.
Price was $113.50 NOW ONLY **$86.50**

C10 FM-AM Tuner

There are more C10 tuners now in use than any other FM-AM tuners ever made. The proof of its exceptional performance and durability is in the thousands of installations in homes, leading radio and TV stations, schools and hospitals. Has independent, continuously variable tone controls, built-in preamplifier, and two cathode follower outputs. Frequency Response: 20 to 20,000 cps. Sensitivity less than 5 microvolts. AFC for simplified, "no-drift" tuning. 12 tubes including rectifier. Weight—17 lbs.
Was $131.50 NOW ONLY **$107.50**



C1000 FM-AM Tuner

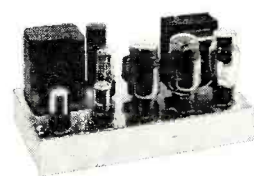
Far more than just a tuner, the C1000 is a complete control center for your Hi-Fi system. Here is a superior FM-AM tuner, a complete preamplifier with 4 positions of record equalization and input circuits for TV, tape recorder and phono. Has two AM bandwidths; broad for local Hi-Fi and sharp for distant or noisy stations. FM sensitivity: 2 mv for 30 db quieting. AFC and 2 cathode follower outputs. Wt. 25 lbs.
Was $179.50 NOW ONLY **$161.00**

C900 Basic FM Tuner

For use with Solitaire or C350 Preamplifier. Designed for broadcast monitoring where low distortion, ultimate stability, and high sensitivity are needed. Exclusive printed IF coils (20.6 mc); variable amplified AFC and lower over-all distortion than any station. Frequency response ±½ db 20-20,000 cycles. Overall IM distortion for 100% modulation less than .05%. Sensitivity, 2 microvolts for 30 db quieting.
Weight 17 lbs.
Was $119.50 NOW ONLY **$99.50**

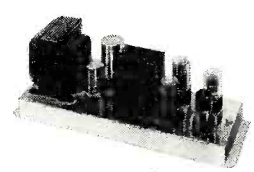
C810 Basic FM-AM Tuner

For use with the Solitaire or C350 preamplifier. Does not have built in preamplifier or tone controls. Exceptional FM sensitivity (4 mv. for 30 db of quieting) and wide band AM for true high fidelity performance. Frequency response ±1 db 20-20,000 cps.
Weight 21 lbs.
Price was $134.50 NOW ONLY **$97.50**



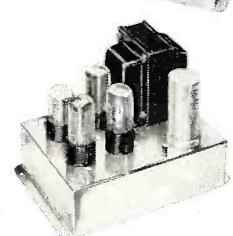
C550 30 Watt Amplifier

Here is maximum ruggedness, dependability and flawless reproduction at any volume level. Thirty full watts of audio power with only 0.1% harmonic and 0.5% IM distortion. Frequency response is far beyond the audible range (±1 db 10-100,000 cps.) Special thermal time delay protects circuit. KT66 output tubes used exclusively for maximum efficiency. Wt. 33 lbs.
Was $109.50 NOW ONLY **$89.50**



C400 Audio Amplifier

Exceptional performance at low cost. Streamlined narrow chassis for ease of installation. Push-pull 6V6 beam-tetrode tubes plus 13.5 db negative feed back provide 10 watts output with frequency response of 15 to 20,000 cps. (±1 db). Harmonic distortion less than 1%; hum and noise level 70 db below rated output. Five tubes including rectifier. Weight 13 lbs.
Was $42.90 NOW ONLY **$29.50**



C450 Audio Amplifier

Ideal for budget Hi-Fi systems. Has same high quality craftsmanship as other Craftsmen amplifiers but with lower output of 6 watts. Frequency response: 20 to 20,000 cps. (±1 db) with only one percent harmonic distortion. Push-pull 6W6GT beam-tetrode output tubes. Only 6 x 8½ x 6 inches. Weight 10 lbs.
Was $29.50 NOW ONLY **$19.50**

Order direct from factory and save. Only by selling direct can Craftsmen offer you these exceptional units at so low a price. Don't delay—Order by Mail Today.

The Radio Craftsmen Inc. Dept. R4 4403 N. Ravenswood Ave. Chicago 40, Illinois

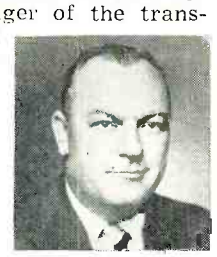
Southern California: Henry Radio, 11240 West Olympic Blvd., Los Angeles, California

World's Largest Exclusive Makers of High Fidelity Equipment

manager of the company . . . **SENATOR ARMAND DAIGLE** has been elected a director of *RCA Victor Company, Ltd.* of Montreal . . . *ORRadio Industries, Inc.* has named **FLOYD REID** to the post of development engineer . . . *Olympic Radio & Television Inc.* has upped **JACK RAVDIN** to the post of vice-president in charge of engineering and manufacturing and appointed **BENJAMIN PARZEN** to the post of director of engineering and research . . . **MORRIS SALIT** has been elected president of *Industrial TV Utilities Company* of New York . . . **JAMES V. ROUGHAN,** formerly vice-president and sales manager of *Price Electric Corporation,* has been promoted to the position of executive vice-president and assistant to the president of the firm . . . **SAMUEL OLCHAK** is the new general sales manager of *DeWald Radio Mfg. Corp.* He was formerly associated with such firms as *Tele-King Corp.* and *CBS-Columbia* . . . **S. GANGI** has been appointed general manager of *George Rattray & Co., Inc.,* manufacturer of precision potentiometers . . . **JAMES H. GILL** is the newly-appointed head of advertising and sales promotion for *Sparton Radio-Television* . . . **LYLE J. BRISKNER** has been appointed manager of the customer relations department of the *Electronic Products Corporation* of Santa Barbara, California . . . Appointment of **F. P. RICE** to the newly-created position of director of manufacturing and purchasing has been announced by *Allen B. Du Mont Laboratories, Inc.* . . . **DAN DICKMAN** has been appointed chief engineer for *Glass-Soldering Engineering,* Pasadena manufacturer of hermetic seals for the electronics industry . . . **HOWARD S. GLEASON** has been named manager of automation research for *Stromberg-Carlson Company* . . . *Crest Transformer Corporation* has appointed **CONRAD E. DeHORN** to the post of chief engineer and director of quality control . . . **F. J. GAFFNEY** has been elected vice-president for engineering of *Marion Electrical Instrument Company* . . . **KENNETH R. BROCK** is the new sales and advertising manager of *Browning Laboratories.*

* * *

FREDERICK K. HANKINSON has been appointed sales manager of the transformer department of *Federal Telephone and Radio Company,* Clifton, N. J., a division of *International Telephone and Telegraph Corporation.*

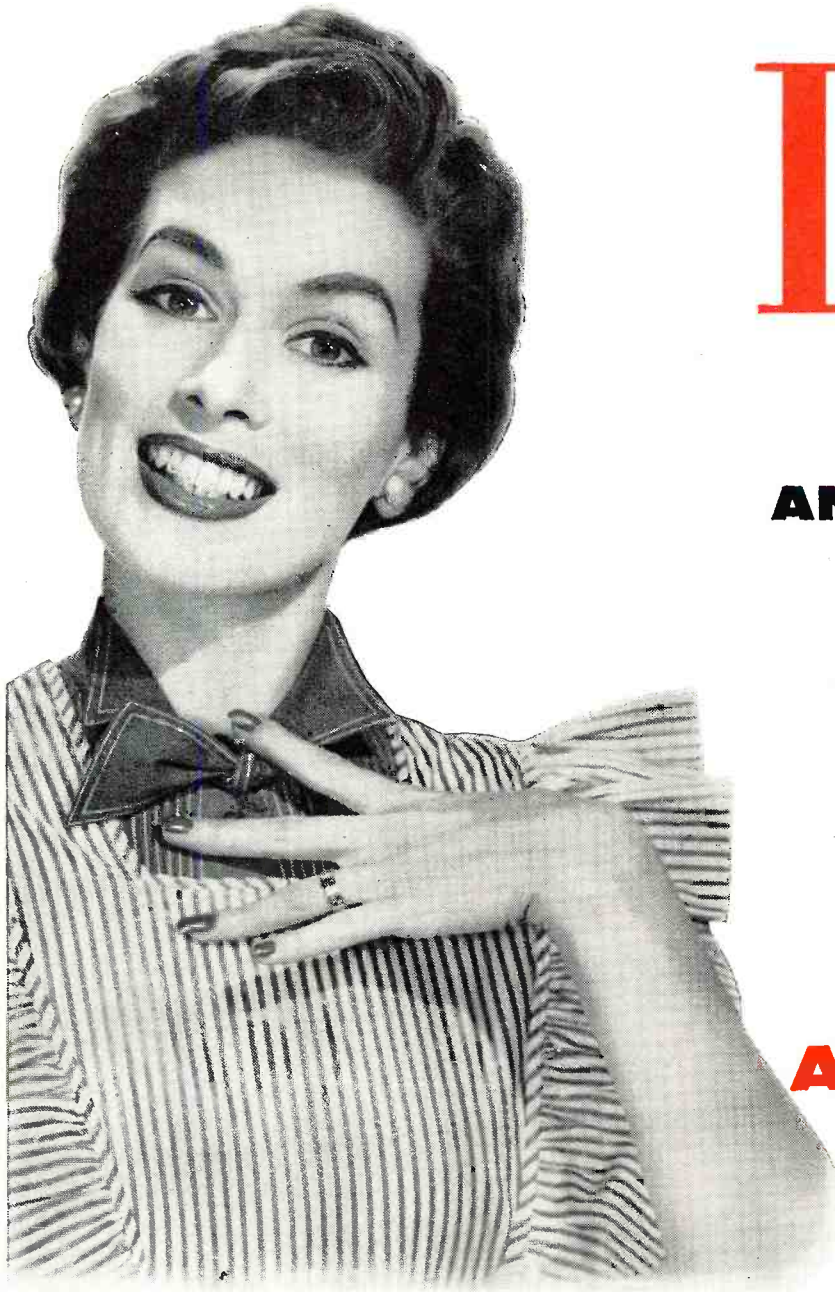


He brings to his new post a ten-year background of transformer sales experience, having served with *Langevin Manufacturing Corporation* of New York and the *American Transformer Company* of Newark, N. J.

The company's transformer facilities now encompass 25,000 square feet in the Clifton plant and include all the latest types of machines and equip-

(*Continued on page* 80)

WHO'S THE ONE YOU TALK TO



It's a

AND WOMEN BUY

A Crossley, Incorporated survey shows that this Seal influences 53% of *all* women in their purchases of everything from raisins to refrigerators . . .

and . . . *CBS TUBES* have the Good Housekeeping Guaranty Seal! When you

SO-O-O-O ADVERTISES

CBS is the *first and only tube* manufacturer to address its advertising to women.

CBS tubes will be consistently advertised throughout the year in Good Housekeeping and Life, reaching 17,171,419 readers every time an advertisement appears!

CBS-HYTRON Main Office: Danvers, Massachusetts • *A DIVISION OF CBS . . . THE COLUMBIA BROADCASTING SYSTEM, INC.*

A member of the CBS family: CBS Radio • CBS Television • Columbia Records • CBS Laboratories

ON MOST SERVICE CALLS?

Woman . . .

. . . BY THIS SEAL

install CBS tubes you leave no question in your customer's mind about the quality of the tubes you supply. Keep *your* customers happy — with CBS tubes, the tubes with the *Good Housekeeping Guaranty Seal* on the carton.

. . . CBS TO WOMEN

And it's women you talk to on most service calls.

Quality products through *ADVANCED-ENGINEERING*

CASH IN WITH THIS NEW CBS TUBE SALES PROMOTION KIT!

Ask your distributor for special offer, or mail coupon *today*.

CBS-Columbia • CBS International • and CBS-Hytron

CBS-HYTRON, Danvers, Mass.

Please rush me the new CBS TUBE *SALES PROMOTION* KIT, PA-70, containing:

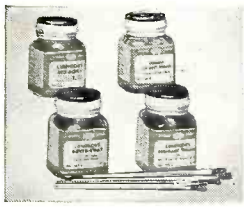
1. Three Truck Posters 2. Metal Frame for Truck Posters 3. Window Display with three-dimension Giant CBS Tube Carton 4. New Inside/Outside Decal

I enclose $2.00 to cover the cost of this kit.

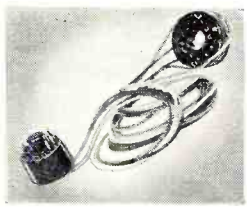
Name.....
(please print name and address)

Street.....

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



G-C LUMINOUS LITE-KOAT KIT
Coat dials, switches, etc., with this long-life, non-poisonous "glow in the dark" coating.
No. 184-0 NET $1.95

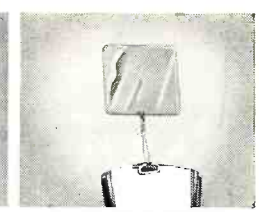


G-C PICTURE TUBE EXTENSION
Extends picture tube leads from chassis to tube when servicing set. Complete, 48 inches.
No. 8856 NET $1.50

G-C ELEC., RESISTOR CEMENT
Ideal for resistors, appliances, etc. Heat-proof, hardens like porcelain.
No. 27-2 2-oz. bottle NET $0.39

G-C SILVER PRINT
Pure silver compound used to repair printed circuits. Handy for touch-up, labs, etc.
No. 21-2 Troy oz. NET $4.65

G-C DE-OX-ID KIT
Handy contact cleaner for switches, controls, relays. Kit contains 2 oz. De-Ox-Id and needle-type injector.
No. 8460 NET $0.99

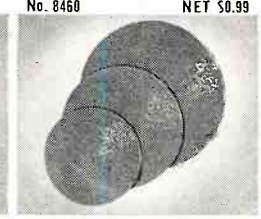


G-C TV PORTO MIRROR
Heavy chrome plated mirror for adjusting TV sets. Rubber lined spring clamp.
No. 8198 NET $2.58

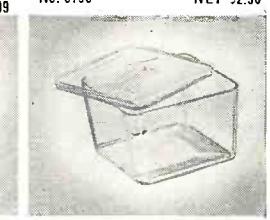
G-C STRIP-X
Removes insulating enamel from wires for easy soldering. Simply dip and wipe!
No. 26-2 2 oz. bottle NET $0.39

G-C CREME-O-WAX POLISH
White, non-staining polish for furniture, TV and radio cabinets. Dries to hard gloss.
No. 95-16 16-oz. bottle NET $0.66

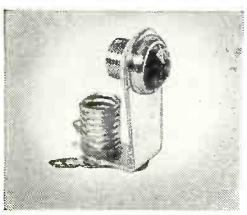
G-C CABINET REPAIR KIT
Contains 10 shades of shellac sticks, stains, varnish, brushes, everything for cabinet repairs. Easy to use.
No. 901 NET $4.50



G-C RECORD TURNTABLE FELT
Ready-cut replacements, center hole.
No. 1292 7⅞" dia. NET $0.30
No. 1293 9⅞" dia. .42
No. 1294 11⅞" dia. .51



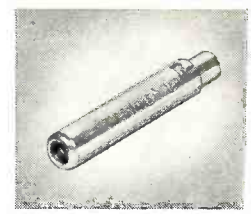
G-C PLASTIC STOCK BOX
Handy, covered polystyrene box for stocking screws, nuts, resistors, capacitors, etc. 4x4x2½.
No. 8022 NET $0.36



G-C ½" JEWEL SIGNAL LIGHT
Miniature screw base jewel in red, green, blue, amber, opal, clear (specify). 7/16" mtg. hole.
No. 7910 NET $0.27

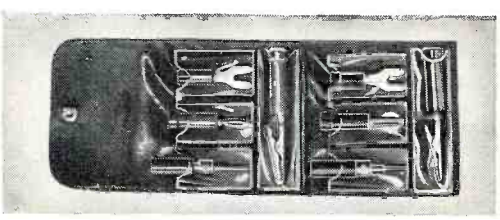
GENERAL GC CEMENT

Ask For These RADIO-TV SERVICE AIDS ...at Your Jobber

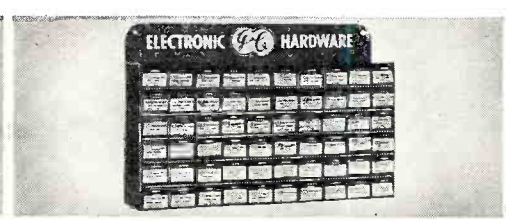


G-C FUSE CONNECTOR
Regular type used on car radios, etc. 2½" long x ⅜" dia. For ¼" fuses.
No. 1749 NET $0.15

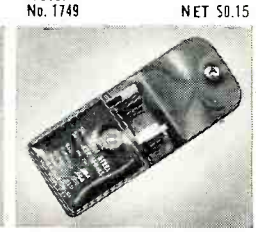
G-C INSPECTION MIRROR
Get into those hard-to-reach corners, inspect coils, connections, etc.
No. 5090 NET $0.33



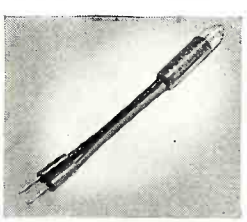
G-C TEST LEAD PLUG INTERCHANGE KIT
Easy to switch alligator clips, banana plugs, spade lugs, phone tips. Fitted plastic case holds one each in red and black.
No. 7743 NET $1.95



G-C ELECTRONIC HARDWARE LAB
Contains 60 most popular items in G-C 50 Line, each in hinged cover box. Good looking steel rack (9" x 13½" x 2½") for bench or wall mounting included in kit without charge.
No. 3660 NET $19.50

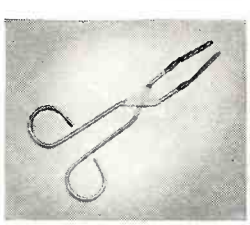


G-C SWEDISH STEEL SHIMS
Leatherette kit includes 16 high grade shims for speaker repair. Sizes: .004", .006", .008", .010".
No. 701 NET $0.54

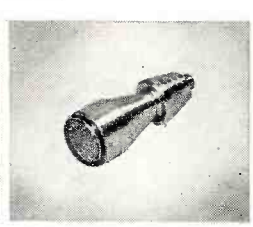


G-C NE-O-LITE TESTER
Neon glow lamp circuit tester for many uses. 60 V. AC to 550 V. AC-DC.
No. 5100 NET $0.36

G-C ALLEN-BRISTO WRENCH KIT
Complete kit for both hex and spline type screws. Leatherette case, 12 wrenches.
No. 5028 NET $1.08



G-C TUBE & PARTS EXTRACTOR
Originally designed for Signal Corps. Spring steel, cadmium plated. Prongs rubber cushioned
No. 5092 NET $0.99



G-C MINIATURE TUBE PULLER
Suction, vacuum principle tool prevents tube breakage, burned fingers. Easy to use, saves time.
No. 5093 for 7-pin tubes NET $1.08
No. 8106 for 9-pin tubes 1.08

G-C UHF HOLLOW LINE CAPS
Seals round and oval hollow line ends. Easy to slip cap over end of line, eliminates-heat sealing.
No. H8912 Box of 8 NET $0.30

G-C BO ELIMINATOR
Eliminates Barkhausen Oscillation in horizontal sweep output tubes. Easy to install and adjust.
No. 8749 NET $0.75

G-C BEAM-O-CENTER
Beam adjuster fits in back of tube yoke coil to center picture. Bakelite housing. Easy adjusting.
No. 8956 NET $1.05

G-C TV HIGH VOLTAGE PLIERS
Insulated long nose pliers made of high impact Bakelite. Absolutely shock-proof.
No. 8387 NET $0.99

G-C ALIGNMENT BENCH KIT
Includes 16 most needed tools in handy stand-up bench rack.
No. 8281 NET $7.74

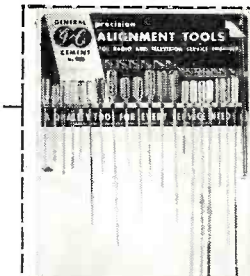
GENERAL CEMENT MFG. CO.

904 Taylor Ave. • Rockford, Illinois

FREE! Postcard brings your big G-C Catalog.

Ask Your Jobber for the GC *SPECIALS OF THE MONTH*

G-C ALIGNMENT TOOL KIT
No. 9200
NET $13.95



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- ★ DC/RMS sine voltage ranges: 0-1.5, 5, 15, 50, 150, 500, 1500 volts. Reads up to 30,000 V. with HVP probe.
- ★ Resistance ranges: 0.2 ohms to 1000 megs in 7 ranges.
- ★ 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.
- ★ Large 4½" meter in can't-burn-out circuit.
- † Calibration without removing from cabinet.

- ★ Zero-center for TV-FM discriminator alignment.
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- ★ New compact size for extra-easy portability (8½x 5x5")
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A PORTABLE SCINTILLATION COUNTER

By **IRVING G. SNYDER**
Technical Director, Stamco Instrument Corporation

Complete technical details on a nuclear radiation counter that, although not too simple, can be constructed at home.

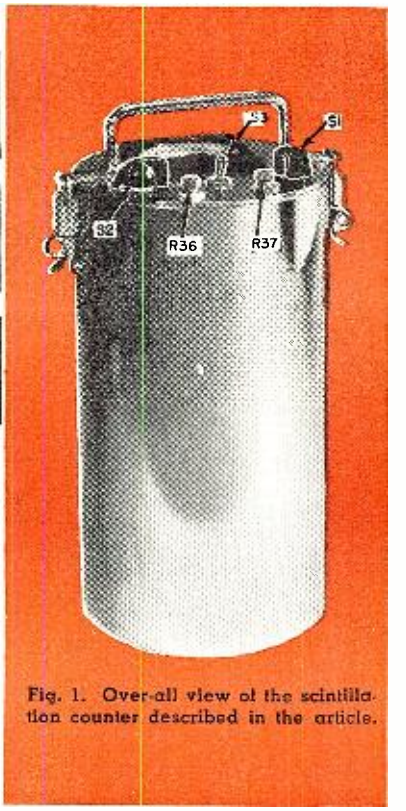


Fig. 1. Over-all view of the scintillation counter described in the article.

DURING the past few years, since it became apparent that uranium prospecting is profitable, the demand for prospecting instruments has increased tremendously. The Geiger counter has become rather well known to many, with details of its operation and construction available from many sources.

More recently, and particularly during the past twelve months, a relatively new instrument has become popular. This is the scintillation counter. Because of its greater sensitivity, this instrument has met wide acceptance and virtually replaced the Geiger counter in all but the more rudimentary surveys. Although widely accepted, the scintillation counter remains a stranger to most persons. Specific information concerning the principles of operation and general construction has not been readily available.

In order to correct this situation, this article offers detailed information on the electrical and mechanical construction of such a device along with a brief discussion of the basic principles of operation. See Fig. 1.

Principle of Operation

The principle of scintillation counting is not entirely new. Counting the occurrence of ionizing particles, alpha and beta emanations, was originally accomplished by visually counting the scintillations that the human eye could see. This process was slow and the accuracy of the count was determined by the skill of the person watching the medium—which was zinc sulphide or a similar luminescent material.

The introduction of Geiger counters, the first of the pulse ionizing devices, coupled to electronic counters practically eliminated the application of this type of counting. Since 1944, however, highly efficient luminescent materials which are sensitive to gamma rays plus light sensitive photomultiplier tubes have been used for radiation detection, measurement, and analysis.

Fig. 2 is the schematic diagram of a portable scintillation counter, the major sections of the circuit being outlined in dotted boxes. The detector assembly may be roughly described as a combination of a luminescent crystal and a light-sensitive photomultiplier tube. Optically coupling the crystal to the photocathode section of the tube allows light emitted with the occurrence of gamma rays to be converted to electrical current. Each pulse of light causes a pulse of current to pass through the tube.

EDITOR'S NOTE: *In view of the many requests from our readers for a scintillation counter, your Editors have finally worked up an article on the construction of such a unit that can be home-built. We do want to caution our readers that this is not a simple construction job. Only the trained technician should attempt this project. In addition, before buying any of the parts for this instrument, the over-all cost of the unit should be considered. For example, the photomultiplier tube will cost $50.00 and up and the smallest practical crystal (1" x ½") will run around $40.00.*

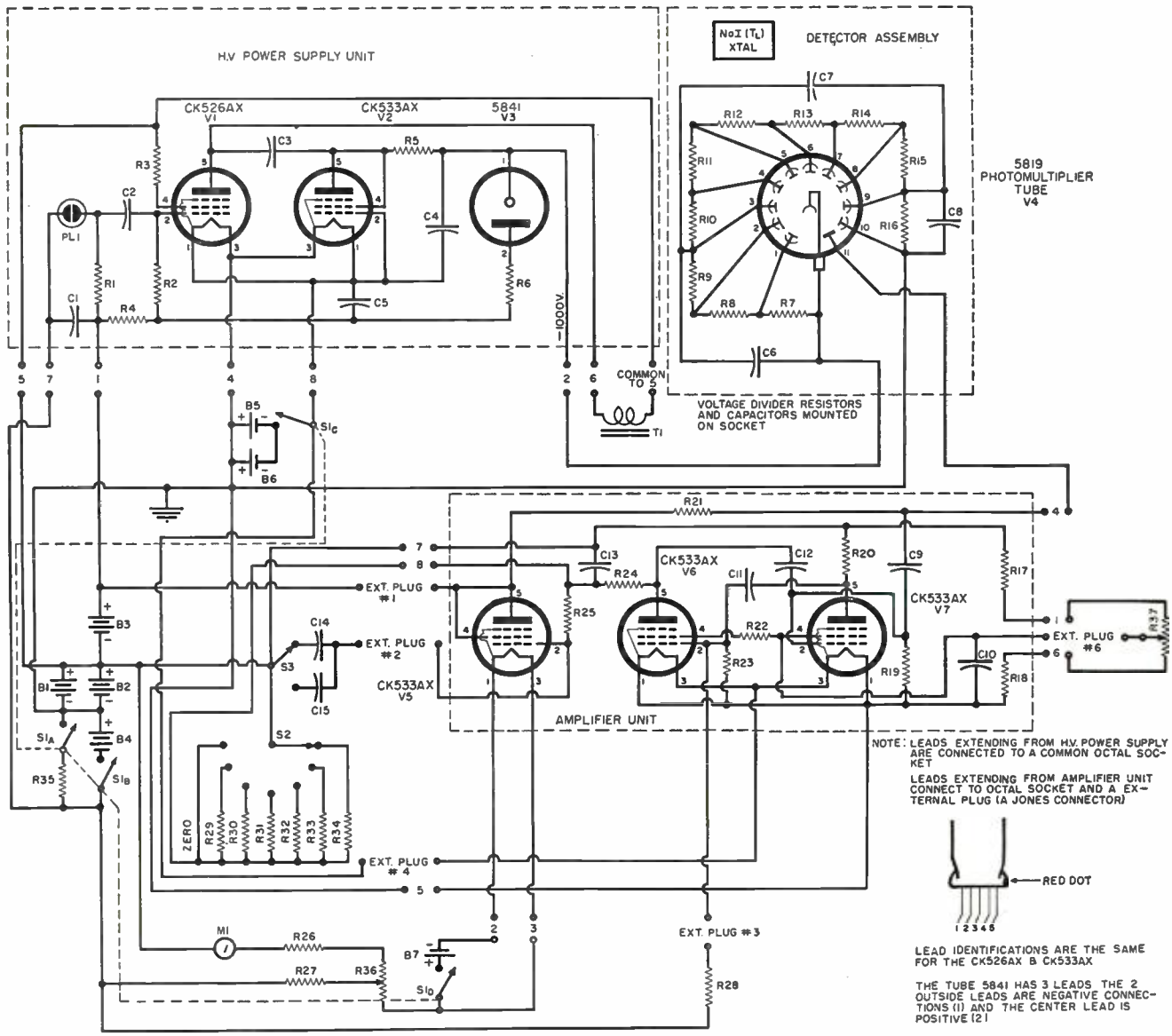
The photomultiplier tube is similar in operation to the ordinary phototube, but has ten additional elements between the usual cathode and anode. These elements are known as "dynodes" and serve to "multiply" the current flow started as photoelectrons at the cathode. The tube used in this circuit has an amplification factor of up to 1,000,000. In order to serve its function, each individual element above the cathode must be raised approximately 100 volts above the preceding element. A source of 100 volts could be coupled between each of the elements, but this is obviously impractical.

The most efficient and practical method of supplying the proper potential to each element is through the use of a suitable divider network, as shown. A 1000 volt potential across the network may be provided by any good d.c. supply. For use in a portable instrument, the high voltage supply should be as compact and light as possible.

A suitable high-voltage supply is shown in the schematic. Being of simple construction and because it uses commercially-available, portable-radio batteries and standard components, it is practical, efficient, and reliable. The combined voltages of B_1, B_2, B_3, and B_4 are applied across capacitor C_1, connected in parallel with a neon glow lamp, PL_1. When the voltage across C_1 reaches the firing potential of PL_1, the capacitor discharges, producing a pulse in the grid circuit of V_1. This relaxation oscillator produces pulses of fairly constant amplitude at a frequency of about 100 cps. V_1 is alternately conducting and non-conducting, pulling surges through the reactor in its plate circuit. Thus a high voltage is developed across this inductance and passed on to V_2. V_2 is a simple rectifier and V_3 is a glow-discharge regulator. The rectified and regulated high voltage appears as a negative 1000 volts with respect to ground.

Pulses appearing in the plate circuit of the photomultiplier tube as a result of light falling on its photocathode must be changed to some apparent indication to be of any value to the user of this device. The section of the circuit labeled "Amplifier Unit", coupled to a meter, accomplishes this function. Pulses are coupled to the grid of V_5, amplified and passed on to V_6 where they are further amplified. A simple feedback is used for greater efficiency. A 1 megohm potentiometer, R_{37}, is employed to control the amplitude of the pulse output of this amplifier. V_7 is connected as a simple rate meter, ac-

Fig. 2. Complete schematic diagram of the scintillation counter. The potentiometers R_{30} and R_{37}, as used by the author, were of the type designed to be used with a small knob. These are apparent in the photograph of Fig. 1. Since these controls are used for calibration and occasional adjustment only, they could be of the slotted shaft type. Since the construction of this unit is so compact, it is imperative that the smallest sizes of such components as fixed capacitors, potentiometers, and resistors, be obtained.



R_1, R_2—4.7 megohm, ½ w. res.
R_3—68.000 ohm, ½ w. res.
R_4, R_5, R_6, R_{30}—10 megohm, ½ w. res.
R_7—44 megohm, ½ w. res. (two 22 megohm res. in series)
R_8, R_9, R_{10}, R_{11}, R_{12}, R_{13}, R_{14}, R_{15}, R_{16}, R_{25}—22 megohm, ½ w. res.
R_{17}, R_{18}—220,000 ohm, ½ w. res.
R_{19}—470.000 ohm ½ w. res.
R_{20}—150.000 ohm, ½ w. res.
R_{21}, R_{37}—1 megohm, ½ w. res.
R_{22}—27,000 ohm. ½ w. res.
R_{23}—270.000 ohm, ½ w. res.
R_{24}—56,000 ohm, ½ w. res.
R_{26}—33.000 ohm, ½ w. res.
R_{27}—680.000 ohm, ½ w. res.
R_{28}—1.5 megohm, ½ w. res.
R_{29}—20 megohm, ½ w. res.
R_{31}—2 megohm. ½ w. res.
R_{33}—200,000 ohm, ½ w. res.
R_{32}, R_{34}—100,000 ohm, ½ w. res.
R_{36}—50,000 ohm linear taper pot
R_{37}—1 megohm linear taper pot
C_1—.002 μfd., 150 v. capacitor
C_2—200 μμfd. mica capacitor
C_3, C_4—.0047 μfd., 1500 v. capacitor
C_5—.1 μfd., 200 v. capacitor
C_6, C_7, C_8—100 μμfd., 600 v. mica capacitor
C_9—15 μμfd. mica capacitor
C_{10}, C_{13}—.01 μfd., 150 v. capacitor
C_{11}—56 μμfd. mica capacitor
C_{12}—5 μμfd. mica capacitor
C_{15}—.1 μfd., 150 v. capacitor
PL1—NE-2 neon glow lamp
S_1—4-pole, 2-pos. rotary switch
S_2—S.p. 7-pos. rotary switch
S_3—S.p. 2-pos. rotary or toggle switch
B_1, B_2—67½ volt battery (Burgess K45)
B_3, B_4—22½ volt battery (RCA VS084)
B_5, B_6, B_7—1½ volt flashlight cell
T_1—300 hy. reactor (UTC 0-13 "Ouncer," or P-13 in plug-in type)
M_1—0-50 μa. meter, ruggedized (size optional)
V_1—CK526AX (Raytheon)
V_2, V_3, V_6, V_7—CK533AX (Raytheon)
V_3—5841 voltage regulator (Victoreen Instrument Co., 3800 Perkins Ave., Cleveland 14, Ohio)
V_4—Type 5819 (or 6199 smaller size) (RCA) This is the photomultiplier tube with photocathode in end of the glass envelope; operating potential 100 volts per stage.
1—6-conductor socket (Cinch-Jones S-306-AB)
1—Plug (Cinch-Jones P-306-FHT)
2—Octal tube sockets
2—Turret Plugs (Vector C-12T)
5—Battery mounting brackets for B_3, B_4 (#14, 50c each), B_5, B_6, B_7 (#7, 60c each) Available from Acme Model Engineering Co., 8120 7th Ave., Brooklyn, N. Y.
Crystal—Thallium activated sodium iodide, no smaller than 1" diameter and ½" thick, sealed in airtight container with a transparent window to allow light scintillations to be transmitted to the photocathode of the photomultiplier tube. Available complete and ready for mounting on phototube from The Harshaw Chemical Co., 1945 E. 97th Street, Cleveland 6, Ohio. When ordering, the supplier should be informed that the crystal will be used in a portable instrument and what type of photomultiplier tube is being used (the manufacturer's name and type number). This crystal is supplied with instructions covering coupling between its window and the end of the phototube. The constructor must place the crystal so that it will not change position with respect to the tube and so that no outside light will enter. Good mechanical support may be afforded and light kept out by the use of Scotch Type 33 tape. This black plastic tape should be wrapped around tube envelope, around junction between tube and crystal, and around the crystal itself.

cepting the amplified pulses applied directly to its grid. Each pulse allows V_7 to conduct momentarily in proportion to the amplitude of the pulse. The voltage drop across a resistance, R_{27} and R_{30}, in the cathode circuit of this tube appears as a deflection of the meter connected to the bottom of the resistor.

The intensity of a given field of gamma radiation, at least when measured with a scintillation counter, is usually expressed as being equivalent to a certain number of counts per unit of time, such as counts per second. Most other expressions, when applied to scintillation counting, are rather ambiguous. Therefore, this rate meter circuit must be calibrated with reference to a certain meter deflection being an indication of a certain frequency of pulses appearing in the plate circuit of the photomultiplier tube. This rate meter circuit is both frequency and amplitude sensitive to the pulses appearing at the grid of V_7. We may, therefore, calibrate and extend the limits of the meter deflections to a very wide range of frequencies by merely controlling the amplitude of the pulses as they appear to V_7.

As an example, if pulses of a given amplitude occurring at the grid of V_7 at a frequency of 100 cps cause the meter to deflect to full scale, we may cut the amplitude of the pulses in half and reduce the meter deflection to half scale. Naturally, if the amplitude remains the same and the frequency is decreased by one-half, the effect will be the same. S_2 is a frequency range selector for the rate meter circuit, since it linearly affects the amplitude of the pulses that are coupled from the output of V_5 and V_6.

Through the selection of the various ranges, the full-scale meter deflection of the meter may be used to indicate a wide range of frequencies from approximately 50 cps to 10,000 cps in six steps. The seventh position of S_2 has no resistance in it. This position places the rate meter circuit in a "no-signal" stage, allowing V_7 to be biased so that no current flows through the meter, effecting a "zero".

Close frequency calibration of the rate meter is also dependent upon the amplitude of the pulses impressed upon the grid of V_5. The output amplitude of this amplifier will be proportional to the amplitude of the input. R_{37} is, therefore, the master frequency calibration control of the instrument since it will directly control the output amplitude of the amplifier tubes.

Nuclear emanations from radioactive materials occur at random intervals so that any indication of their frequency of occurrence is merely an average indication. Counting an average frequency may be more accurately accomplished if the count is taken over a rather long period of time, especially if the frequency is quite low. In order to provide the user with a method of making precise frequency measurements and also allow him to note sudden changes, two time constants are provided. S_3 may be used to select either a fast or slow meter response or a short or long time constant.

Construction

Fig. 4 is a photograph of the portable scintillation counter without its case. The largest single component visible is the cylindrical detector assembly. Housed in a 20 gauge, 2¼" diameter steel tube which serves as a magnetic shield for the photomultiplier as well as a mechanical support, this assembly is larger than would ordinarily be used because of the large size of the crystal in this particular instrument.

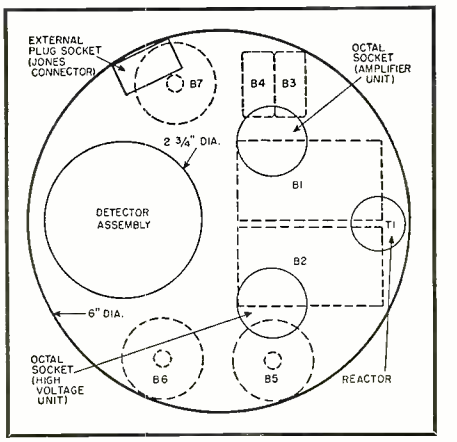
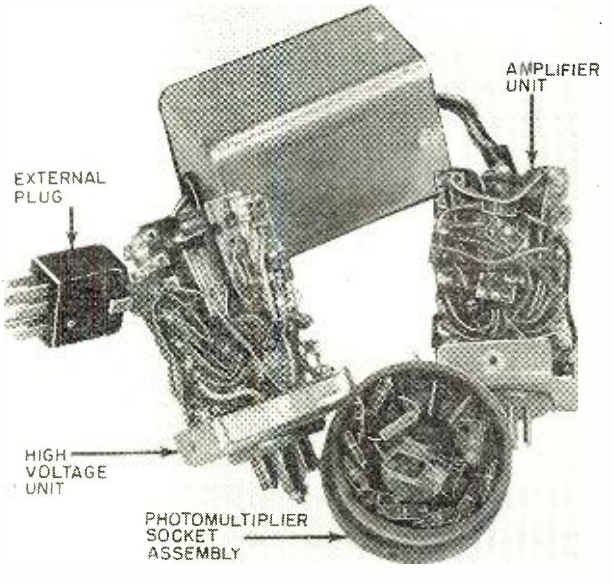
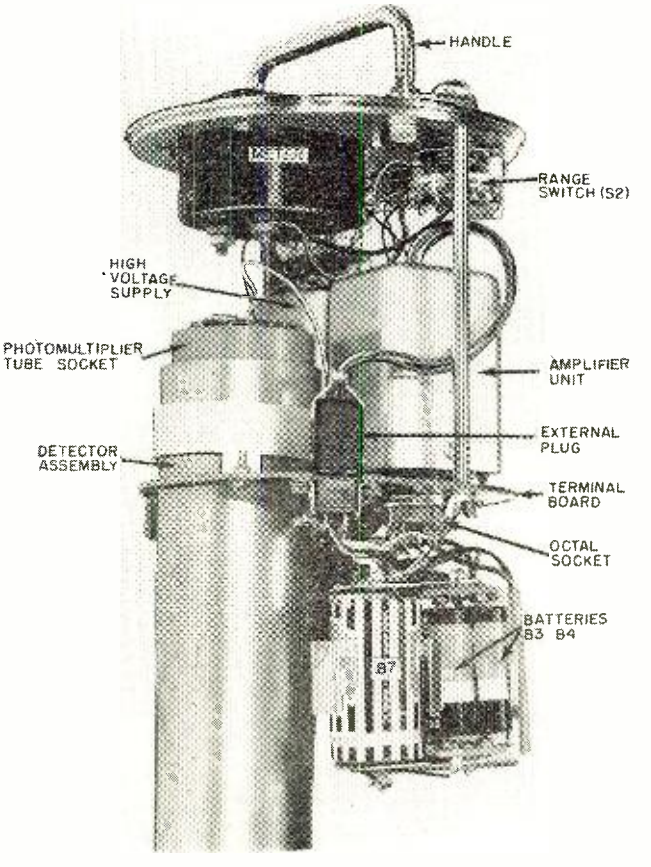


Fig. 3. Top view of mounting board, showing general layout of the component parts.

Designed and used for aerial prospecting, the subject of the photograph employs a 2" crystal and a photomultiplier tube having a maximum diameter of 2¼" and a length of nearly 6". The tube socket may be seen extending from the top of the assembly. Adjacent to the detector assembly are the two *Vector* turrets housing the high voltage and amplifier units.

Fig. 4. Two internal views of the counter showing the various mechanical and electrical circuit elements. The photo below shows details of the high-voltage unit, the photomultiplier socket assembly, amplifier unit, and external plug. From the photograph, it is obvious that because of the super-compact assembly technique, the wiring of this unit will not be easy. In addition to the problems which will be encountered in the electrical circuitry, there are certain mechanical details which will require considerable effort. Although the circular type of construction is most convenient under normal operating conditions, it is not imperative that it be followed. Any desired shape or size of housing can be used equally as well.



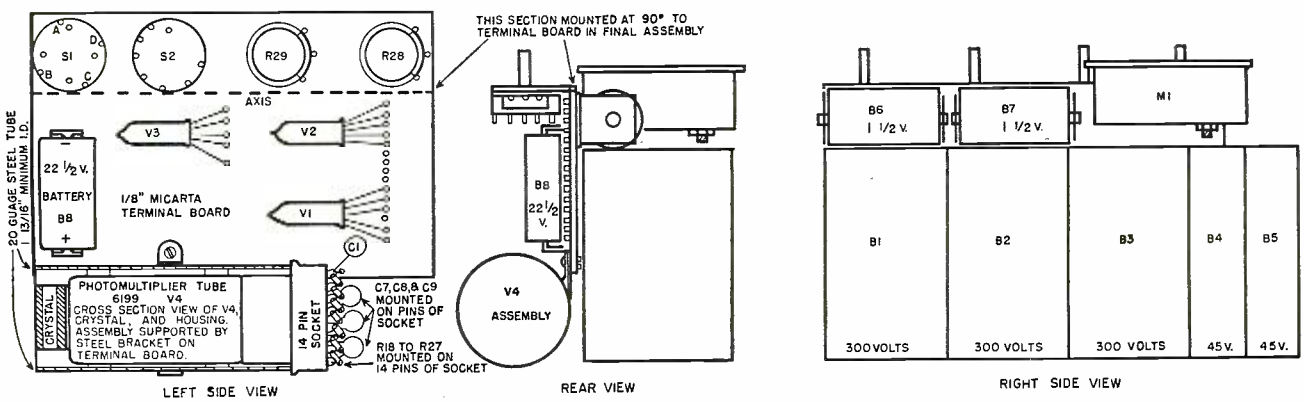


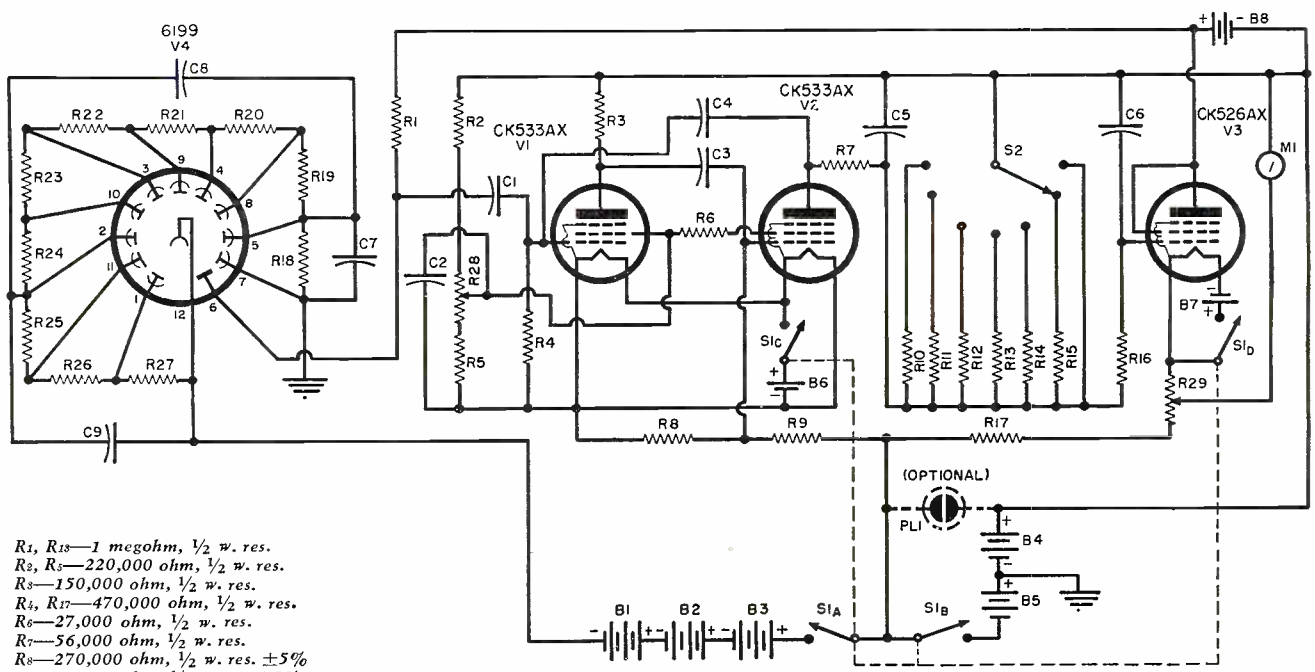
The octal sockets for the plug-in turrets, the socket for the external connecting plug of the amplifier unit, the reactor (not visible), the detector assembly, and the battery mounting bracket assembly are all mechanically supported by a phenol-impregnated fiber terminal board 6" in diameter. A single, 16-conductor cable connects all of the panel-mounted switches and controls to the rest of the units.

The 3" meter and carrying handle are also mounted on the panel which serves as the cover for the case. Two steel rods connect the upper and lower parts of the instrument. By attaching the rods to the terminal board with butterfly head screws, service access is simplified. The layout diagram for the terminal board, Fig. 3, illustrates the position of the batteries and other components not shown in the photograph. Because this layout requires a cylindrical case, the constructor may find it inconvenient. All component units may be laid out differently to accommodate the shape of whatever container is available to the individual. One must remember, however, that any material placed between the radioactive source and a detector is going to absorb some rays, thereby cutting down the efficiency of the instrument. Because of this, it is important that the wall that will come between any incident radiation and the crystal be of lightweight material such as aluminum. If the only case available is made of heavy material, such as thick steel, cut a hole of suitable size and cover it with a lightweight "window".

-30-

Schematic diagram and mechanical details of a somewhat simpler form of scintillation counter that has been tried and tested. The author, in this case, has built the unit in a rectangular form instead of the circular arrangement in the initial unit. Basically, the changes consist of using a smaller photomultiplier tube and using 900 volts of battery instead of a power supply for the high voltage. A few additional points are in order. An optical coupling fluid (Dow Chemical Co.) must be used to couple the glass window of the crystal package to the end of the 6199 photomultiplier tube. Sponge rubber strips should be used between the glass envelope of the 6199 and the steel tube shield. The crystal should be held in place against the 6199 by means of "Scotch" electrical tape. The electrical coupling from pin 6 of the 6199 to the grid of V_1 should be kept as short as possible. The subminiature tubes, V_1, V_2, and V_3, may be held in place by any suitable mechanical means. Any housing can be used in this construction providing heavy walls do not surround the portion of the 6199 assembly where the crystal is located.





R_1, R_{18}—1 megohm, ½ w. res.
R_2, R_3—220,000 ohm, ½ w. res.
R_3—150,000 ohm, ½ w. res.
R_4, R_{17}—470,000 ohm, ½ w. res.
R_6—27,000 ohm, ½ w. res.
R_7—56,000 ohm, ½ w. res.
R_8—270,000 ohm, ½ w. res. ±5%
R_9—3.3 megohm, ½ w. res. ±5%
R_{10}—20 megohm, ½ w. res.
R_{11}—10 megohm, ½ w. res.
R_{12}—2 megohm, ½ w. res.
R_{13}—200,000 ohm, ½ w. res.
R_{15}—100,000 ohm, ½ w. res.
R_{16}, R_{18}, R_{19}, R_{20}, R_{21}, R_{22}, R_{23}, R_{24}, R_{25}, R_{26}—22 megohm, ½ w. res.
R_{27}—44 megohm, ½ w. res.
R_{28}—100,000 ohm linear taper pot
R_{29}—50,000 ohm linear taper pot
C_1—150 μμfd., 600 v. capacitor

C_2, C_5, C_6—.01 μfd., 600 v. capacitor
C_3—560 μμfd., 600 v. capacitor
C_4—500 μμfd., 600 v. capacitor
C_7, C_8, C_9—100 μμfd., 600 v. capacitor
PL_1—NE-51 neon bulb
B_1, B_2, B_3—300 volt battery (Eveready 493 or Burgess U-200)
B_4, B_5—45 volt battery (Eveready 455)
B_6, B_7—1½ volt battery (Eveready D99)
B_8—22½ volt battery (Eveready 412)
S_1—4-pole, 2-pos. switch (Mallory 3242J)

S_2—S.p. 7-pos. rotary switch (Mallory 31112J 12-pos. unit was used)
M_1—0-50 μa. meter
1—Mount for PL_1—(Drake No. 101N)
Misc.—Mounting brackets and connectors for batteries are available where batteries are purchased.
V_1, V_2—CK533AX tube (Raytheon)
V_3—CK526AX tube (Raytheon)
V_4—6199 photomultiplier tube (RCA)
Crystal—See parts list, Fig. 2

A TRANSISTORIZED PORTABLE RECEIVER

This new commercially available receiver features long battery life and exceptional performance.

ANOTHER commercially engineered, all-transistor receiver has made its appearance with the release of *Raytheon's* Model 8-TP-1 superheterodyne portable. The receiver uses 8 transistors and is powered by 4 of the 1.5 volt, size "D" flashlight cells in series. Battery life is estimated at 500 hours for an operating cost of about 1/10 of a cent an hour. This is less than battery costs for standard tube, battery-operated portables.

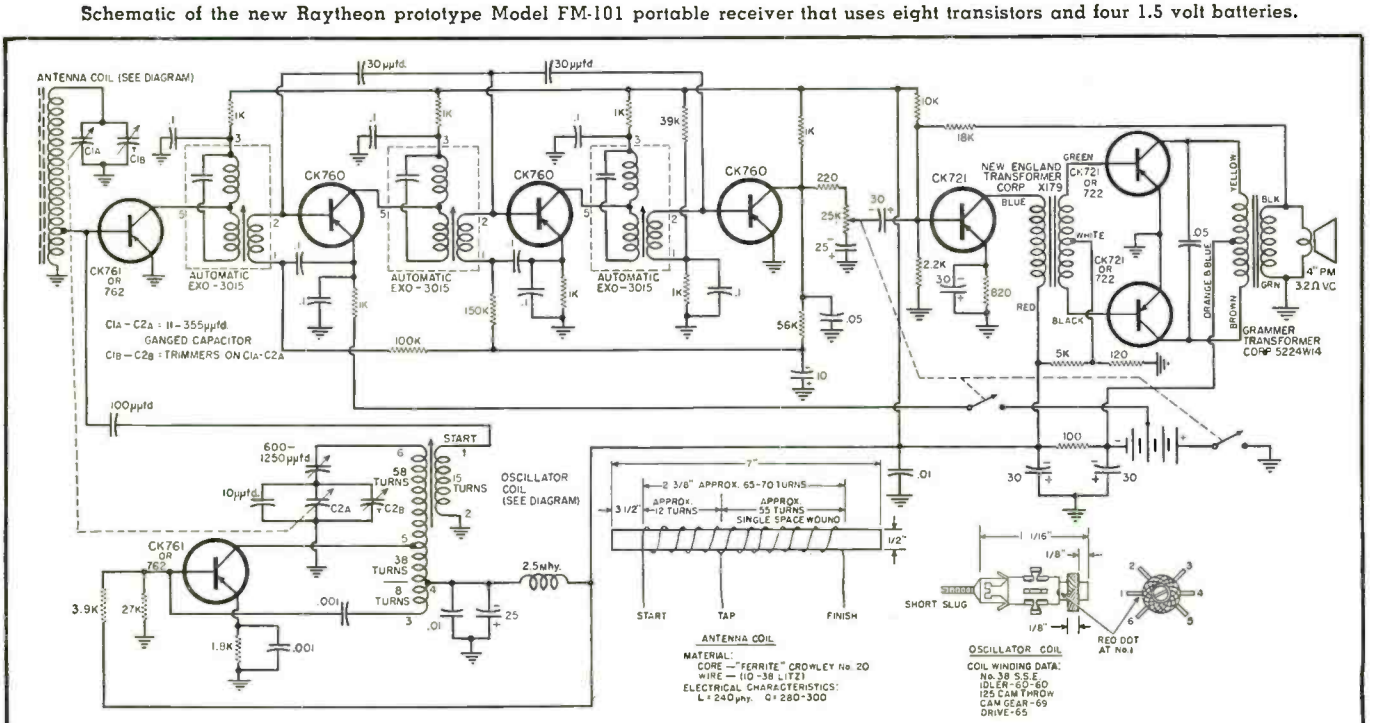
The Model 8-TP-1 measures 2 5/8" thick, 6 3/16" high, and 9 3/16" wide at the bottom. It weighs 5 pounds with batteries. The circuit of the prototype design (Model FM-101) is shown in the schematic below.

It uses two type CK760 high-frequency transistors as i.f. amplifiers; two type CK761 high-frequency units as mixer and oscillator; one CK760 or CK761 as the second detector; and three CK721 or CK722 transistors in the audio section of the set.

The performance of the prototype is very satisfactory and compares very favorably with conventional vacuum-tube portables. It covers the broadcast band from 530 kc. to 1620 kc.; has a sensitivity of 300-500 μv. per meter; a rated power output of 100 milliwatts with a maximum power output of 200 milliwatts; battery voltage of 6 volts; and a total current (no signal) of 7 ma. The total current at 100 milliwatts' output is 30 ma. According to the company, it is possible to obtain a power output of up to 1/4 watt by using two CK721 or CK722 transistors in class B push-pull operating at 6 volts, into a 250-ohm output transformer without exceeding the power-handling capabilities of these transistors.

The set is currently being marketed on a nationwide basis by *Raytheon* distribution outlets. —30—

Schematic of the new Raytheon prototype Model FM-101 portable receiver that uses eight transistors and four 1.5 volt batteries.



Automatic Manufacturing Company
65 Gouveneur St., Newark 4, N. J.

New England Transformer Company
Somerville, Massachusetts

Gramer Transformer Corporation
2734 N. Pulaski Rd., Chicago 31

Since this circuit is based on a commercial design, many special components are involved. According to Raytheon, with the exception of the oscillator coil, all transformers are available from the companies named and the antenna coil can be easily built. For those who wish to duplicate this receiver, obtain an oscillator coil approximating the original and then experiment.

MAKE READY FOR TRANSISTORS

By ELBERT ROBBERSON

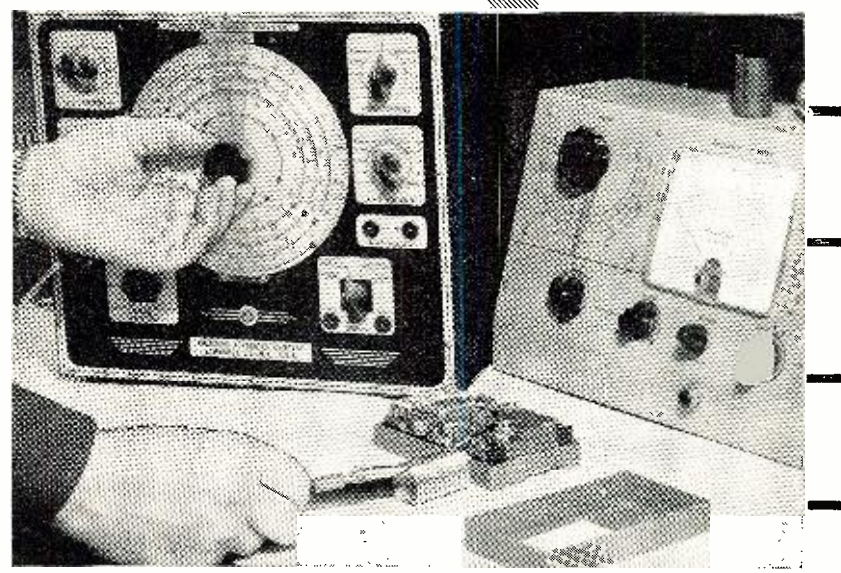


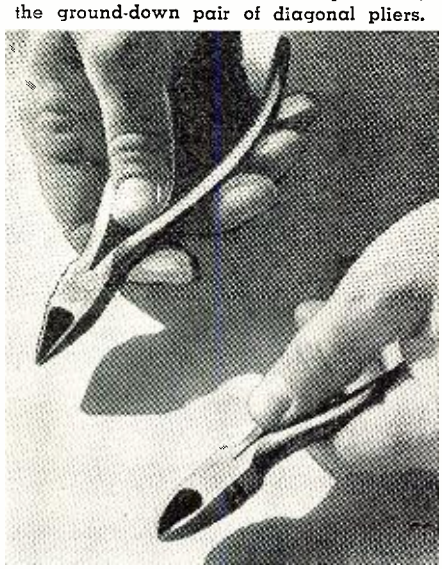
Fig. 1. To inject signal and i.f. frequencies into transistor amplifier stages, use an inductor as shown with a.c. operated generators. Battery-operated signal generators will be found useful for transistor testing in audio and signal stages.

Are you ready to service that first transistor radio plunked down on your service bench? If not, read this.

THE first thing you know, somebody is going to march into your place, plunk down a small plastic case, say "this don't work," and you'll be faced with your first transistorized-radio repair job. If you haven't made preparations, this little job is going to make that first television repair seem like splicing a lamp cord.

The transistor is here to stay. There will be more of them in the hands of the public every day. The man who is tooled up for them should not only hang onto his hair a little longer, but also harvest some extra cabbage. Here are a few pointers for a start.

Fig. 2. For working on miniaturized circuits, some special tools will help such as the ground-down pair of diagonal pliers.



The first thing noticeable about transistorized equipment is that it is *compact*. A pair of snub-nose pliers and the trusty old iron may have been usable up to now in midget radios, but the old "midgets" are Gargantuan by transistor standards. Reconcile yourself to getting some tools to match the new construction.

Pliers are out. You'll need two or three shapes and sizes of tweezers instead. For cutting, conventional broad-nosed diagonals won't do. Either grind off the excess metal, as shown in Fig. 2, or use a stout pair of slender scissors. A very useful accessory is a large reading glass, for which a holder may be made to leave the hands free for the required "micromanipulation."

Soldering should be done with a light iron or soldering pencil, with a fine tip. Care is required not to overheat anything. Some of the new components are irreparably damaged by excess heat, so hold a piece of aluminum or copper on the lead of any delicate part being soldered (between the component and the joint) to conduct away some of the calories.

On my very first transistor job, I had to check an amplifier's audio output. I connected in an oscillator, tied the v.t.v.m. to the output, and all I got were the programs from the two closest broadcast stations. I knew the cure for this. I put a heavy bypass capacitor across the amplifier input to scuttle the r.f. This killed the broadcast stations, but now all that came through was a steady rumble of 60-cycle hum.

By this time I saw that ordinary procedures wouldn't do. You can't connect a lot of outside stuff to transistor circuits. You have to sneak up on them.

When signal levels are really low, noise voltages that were never noticed before are liable to come in like a sawmill slicing a keg of nails. Careful grounding of equipment, bypassing, and the other common procedures *may* eliminate this trouble. But again, they may not. It depends upon location and the equipment involved. You might find that the mere connection of your instruments is all that is required to put a set out of operation.

One cure for the trouble is to use nothing but battery-operated service equipment to eliminate a.c. line coupling. Some can be purchased, see Fig. 3, some of it may have to be improvised. If you are inclined toward making your own, a set of transistor signal generators, both r.f. and a.f., as well as a.c. and d.c. sensitive voltmeters, and a voltohmmeter would be a natural.

Another artifice which will keep stray currents out of the gear under observation is to couple in test signals by induction. This is feasible in audio circuits only if transformers are used. Connect the output of the a.f. oscillator to another transformer or a choke, and line up its core with that of the input to the circuit under test, and signal will be fed in. See Fig. 1.

It is relatively simple to feed in an i.f. frequency current using a fairly high-inductance coil, such as an r.f. choke, to inject the generator signal into the i.f. transformer windings. A smaller coil can be used in the same manner to feed in voltage at signal frequencies. By working through the set in this order, first making sure the speaker and output circuits are good,

then moving toward the front, it is possible to check out an entire set without making any physical connection into the circuits.

Low signal levels are not the only complication in servicing this gear. You may run into components that would be ruined just as soon as you clipped on your favorite testing instrument. The reason is that many transistor components are rated at voltages quite a bit under the potentials the testers may apply.

For instance, it could be ruinous to try testing capacitors by conventional means. A transistor coupling capacitor (having a value of say, 3 μfd.) may be rated at *3 volts*. Just one application of a capacitor bridge which shoots about 70 volts into the capacitor might be more than this baby can take. So, mark the fact that test voltages must not exceed the safe ratings of the components. Also, test polarities must be watched. With vacuum tubes, nothing much happens if you connect a negative test voltage to the plate circuit. But if you connect a negative voltage to the collector of an *n-p-n* transistor, you may soon be in the market for a basket of new ones.

Fairly low-value capacitors can safely be checked by clipping on a standard shunt wire or inductor, and measuring the resonant frequency of this *L-C* circuit with a grid-dip oscillator or "*Q*" meter. Larger values can be checked by how well they hold a charge at rated voltage. This can be measured with the usual vacuum-tube voltmeter, using the ohmmeter section or an external battery of the rated voltage.

Now, how about testing transistors? Happily, the day will probably never come when people will drop in off the street with a matchbox full of transistors to be tested. Transistors just don't need it. Unless you smash them with a hammer, pull off their pigtails, or give them a lethal shot of current by accident, they should last longer than anything else in the equipment. But suppose you have a doubt. How can we tell if that little lump is "transistoring" like it should?

The simplest way to find out is by a test of its working gain. A rig for this test can easily be made up, using a simple circuit such as the one shown in Figs. 4 and 5. With an a.c. v.t.v.m., measure the signal voltage into the rig, and the signal voltage appearing at the output. The gain can then be taken from the chart in Fig. 6, and compared to the rated value, or that of transistors that are known to be good.

For transistors used in oscillators, use an oscillator test circuit, preferably one approximating the circuit in which the unit is used. Output can then be observed with a scope or checked with the r.f. probe of a sensitive voltmeter.

Just as everyone says, transistors are somewhat similar in function to vacuum tubes, and you can regard the transistor as a triode all you want. The vacuum-tube variety of triode has a

Fig. 3. The use of a battery-operated oscillator will avoid hum and noise pickup from the a.c. line. The receiver shown under test is the Regency transistor radio.

cathode, a plate, and a grid in between. Application of voltage to the grid may be said to condition the surrounding space so that the cathode-to-plate path is conductive, or not. In the transistor, we have an emitter, a collector, and a base in between. The application of current to the base conditions it, so that the emitter-collector path is conductive, or not. It is that simple.

There are differences, to be sure. Current is not the only thing that affects base activity. Light, heat, and electric fields also influence operation. But if the transistor is protected from these other stimuli, the desired current control will be maintained. Their heat sensitivity shows up in several ways. One piece of pocket equipment I've worked with breaks into oscillation if it is kept in a warm pocket for long.

We are accustomed to running tubes so hot they can't be touched. Some transistors, on the other hand, are permanently out of business after

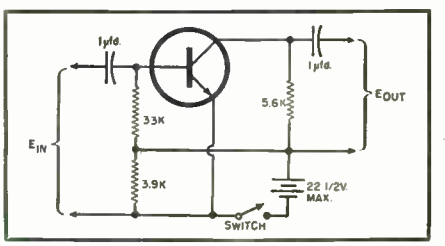


Fig. 4. Circuit for testing transistors used in amplifier stages. Connections are shown for an "n-p-n" type transistor.

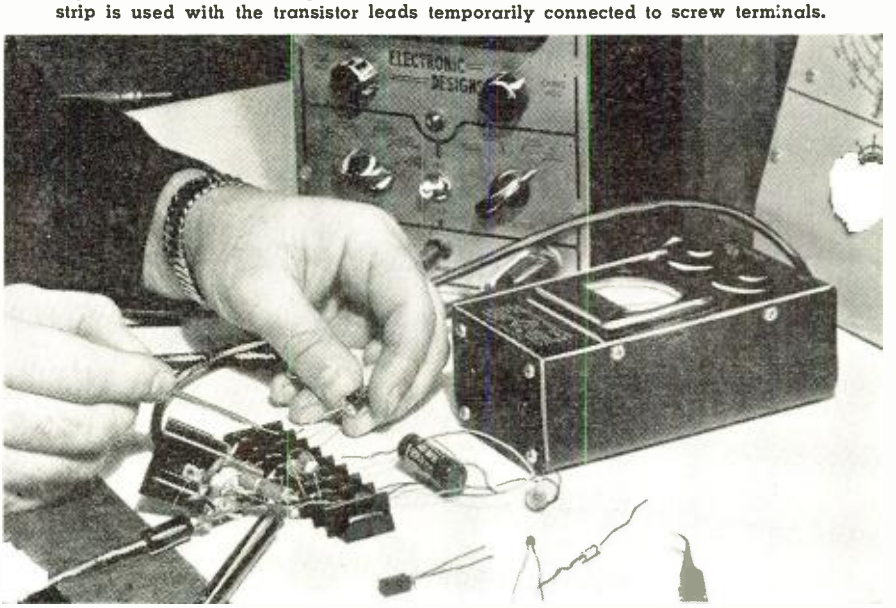
reaching about 150 degrees. Others will stand more heat, but be careful, and find out if equipment brought in for service has been overheated.

Some transistors are decidedly photoelectric, so that a difference of several decibels in stage gain may be observed depending upon whether or not they are in light or darkness. A little black-tape masking will cure this, of course, if it is undesirable.

Battery polarity depends upon the

(*Continued on page 78*)

Fig. 5. "Breadboard" setup of the test circuit shown in Fig. 4. A Jones terminal strip is used with the transistor leads temporarily connected to screw terminals.



New TV TURRET TUNER

By WALTER H. BUCHSBAUM
Television Consultant
RADIO & TELEVISION NEWS

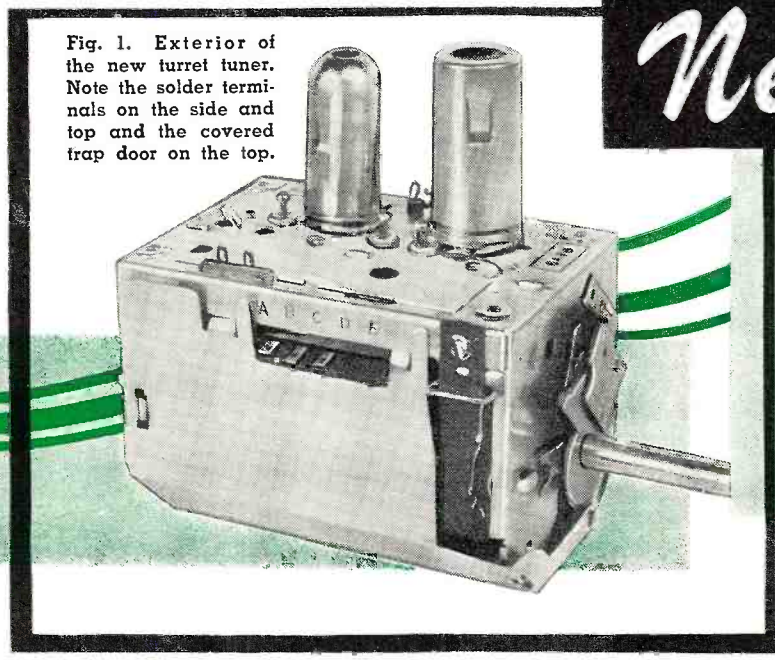


Fig. 1. Exterior of the new turret tuner. Note the solder terminals on the side and top and the covered trap door on the top.

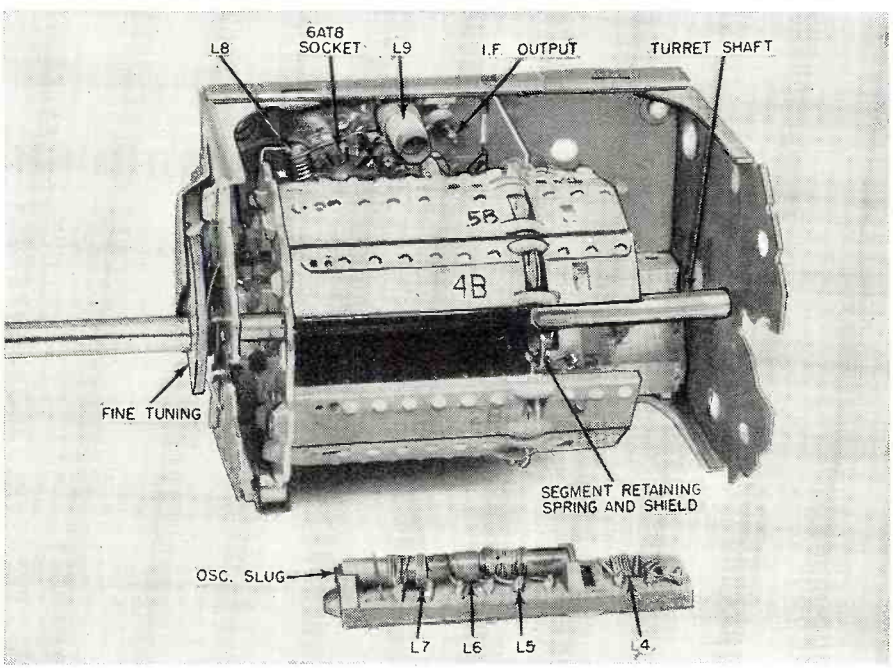
First report on the new streamlined Standard Coil TV tuner that uses fewer parts and is easier to service.

AFTER being the most widely used TV tuner for over six years, the *Standard Coil Products* v.h.f. turret tuner has finally been changed and a completely new version of it has come out. Although the new turret tuner uses compact circuitry, it has the same chassis dimensions and mounts exactly in the same space as the earlier tuners. The reason for this is that many manufacturers provided chassis space for the older tuners. Also, for replacement purposes, the new tuner will be more adaptable in the old size. Eventually, the size of the turret tuner will be reduced to utilize the space savings made possible by the new design.

The new turret tuner retains all of the desirable service features of its predecessor and has some additional welcome modifications. Fig. 1 shows the external appearance of the new turret tuner. One major difference which is at once apparent is that the detent spring and roller is at the front instead of at the center of the unit. Another difference is the location of the terminals for the heater, "B+," and a.g.c. leads, which are solder lugs at the center of the side panel. The two solder lugs pointing upward from the tuner chassis are for connection to the antenna lead-in.

To keep oscillator radiation to a minimum, a one piece, snap-on shield is used which can be removed without unsoldering anything, and which exposes the entire tuner as shown in Fig. 2.

Fig. 2. Bottom view of the new tuner with the shield removed. Note the single coil strip which includes all the necessary coils formerly found on two strips.



Mechanical Features

The most outstanding innovation in the new turret tuner is that a single coil segment is used for each channel in place of the original two segments. This is shown in Fig. 2. Near the center of the turret is a steel disc which has the double function of shield and retaining spring for each coil segment. Each segment has a slot with reinforced sides which fits into a tooth on the steel disc as shown in Fig. 2. The tooth protrudes sufficiently so that it can be pressed open by a finger, which is some improvement over the previous spring system which required either a screwdriver or strong fingernails to remove a coil segment.

As illustrated in Fig. 2, the oscillator coil, L_7, is aligned by the same method as in the earlier turret tuner and can be adjusted from the front of the tuner. Only the channel selector knob and plaque must be removed in most TV sets. The single antenna coil, L_4, located at the rear of the coil segment, is separated from the coil form by the shield—retaining spring disc. Two r.f. coils, L_6 and L_5, are located on the same coil form as the oscillator coil and provide coupling of the mixer grid to the oscillator.

A completely disassembled view of the new tuner is shown in Fig. 3, and illustrates that, just as in earlier versions, turret and coil segments as well as the fine tuning assembly can be removed for servicing without unsolder-

ing. Fig. 3 also shows the curious fact that there are eleven contact springs, but the coil segments shown have only nine contact points. The reason for this will become apparent when the u.h.f. operation of the tuner is explained. For v.h.f., only the nine contacts are active; on u.h.f., special segments are used having eleven contacts, one more at each end.

A close examination of Fig. 3 also reveals that the original method of riveting each contact spring to the insulating board has been replaced with a special snap-in design. This will allow the service technician to replace broken or worn contact springs simply by unsoldering the wiring at one end of the spring and gently slipping the entire spring out of its slot. A new contact can then be installed without having to replace the entire contact assembly as in earlier models.

In the top view of Fig. 4 is shown the trap door whose shield can be removed by simply inserting a screwdriver and lifting it up. The main purpose of this trap door is to allow access for insertion of a u.h.f. crystal which is supplied with a u.h.f. adapter coil segment. Once this crystal is in place, subsequent u.h.f. coil segments do not need separate mixers; one unit works for all u.h.f. channels. The conventional test point at the mixer grid resistor is brought out under the trap door, accessible through a hole in the snap-on shield, see Fig. 1. The trimmer and i.f. coil adjustments are all available at the top as shown in Fig. 4.

Electrical Features

The circuit diagram of Fig. 5 shows the turret tuner featuring a pentode r.f. amplifier. The same mechanical features and basic electrical circuit are used for the cascode model.

Notice that the antenna input circuit is quite different from the previous tuners. Earlier models used a different, balanced antenna coil for each channel, requiring at least four contacts for the r.f. input stage. Actually, there was a fifth contact for a grounded center tap to provide good balance.

The new circuit simplifies the switching problem greatly by using a new broad-band input coil. T_1 in Fig. 5 is actually a broad-band "balun" which appears as a 300-ohm balanced termination to the antenna lead-in for all v.h.f. channels. The output of the "balun" is low impedance, unbalanced, and feeds the r.f. amplifier grid. L_1-C_1 and L_2-C_2 in Fig. 5 are traps to reduce FM interference and improve i.f. rejection characteristics. For operation in the v.h.f. band these traps have no effect and only the switched coil, L_4, in conjunction with C_5, tune the r.f. input grid.

The location of C_5 on the chassis is shown in Fig. 4, which also shows the input "balun." The "balun" consists of two hollow ferrite cylinders with the coil wound lengthwise and through the center of each cylinder. This arrangement provides extremely tight coupling and gives the broad-band characteristic

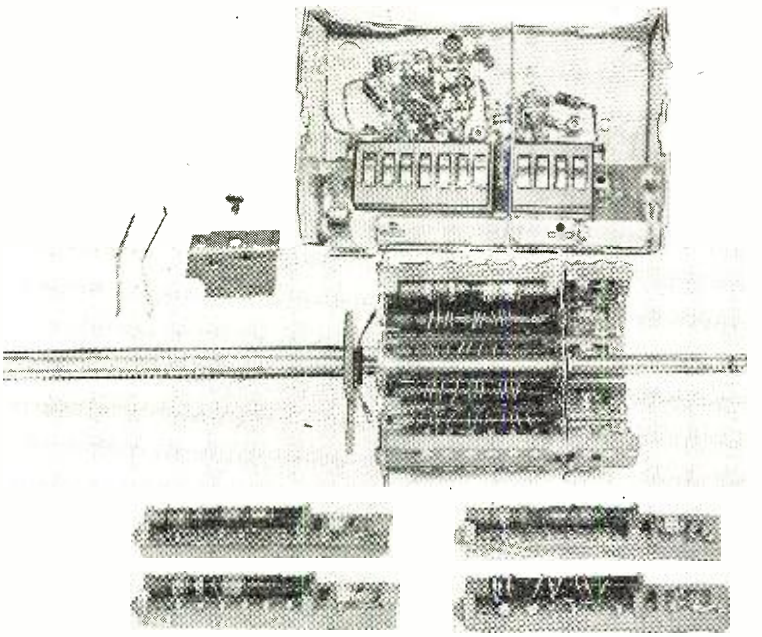


Fig. 3. Completely disassembled tuner, with four channel segments in foreground.

which is the essential feature of this transformer.

A simple overcoupled transformer is switched in between the r.f. output and the mixer input stage. Trimmer C_7 tunes the r.f. tube plate and C_{11} adjusts the mixer grid circuit. The amount of coupling is determined by the spacing of the two coils L_5 and L_6 on the coil segment, shown in Fig. 2. The oscillator signal is coupled to the mixer grid by induction from the oscillator coil, L_7, to the mixer grid coil, L_6. The cold side of the mixer grid coil goes to the test point at the top of the chassis which can be used for r.f. alignment.

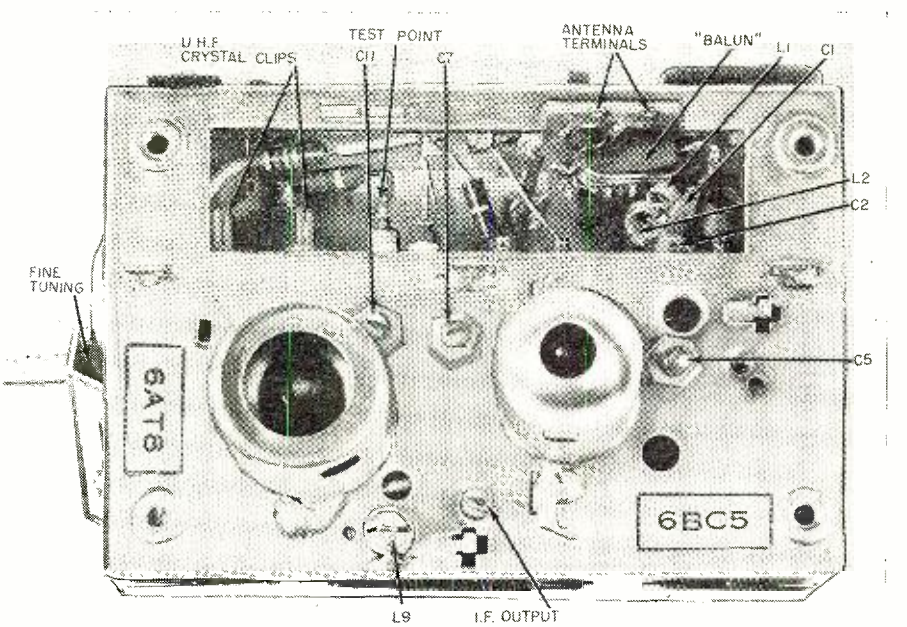
In the circuit of Fig. 5, the mixer and oscillator are part of a single 9-pin miniature tube, the 6AT8, which consists of a pentode and triode. The advantage of this tube over the double triode lies in the greater gain and better conversion ratio obtainable with a pentode mixer. Other tuners have used the 6U8 or similar pentode-triode combinations.

The i.f. output coil, L_9, can be tuned to any desired spot in the 41 mc. i.f. band. Somewhat unique is the screen trap coil L_8, which helps in rejecting interference. As seen in Fig. 2, L_8 consists of a few turns of enameled wire wound on a threaded slug. By turning the slug the coil can be tuned over a limited range. Actually this is a factory adjustment which hardly ever needs attention from the service technician.

The triode oscillator is rather simple and consists of a plate tuned circuit with two means of frequency adjust-

(*Continued on page* 148)

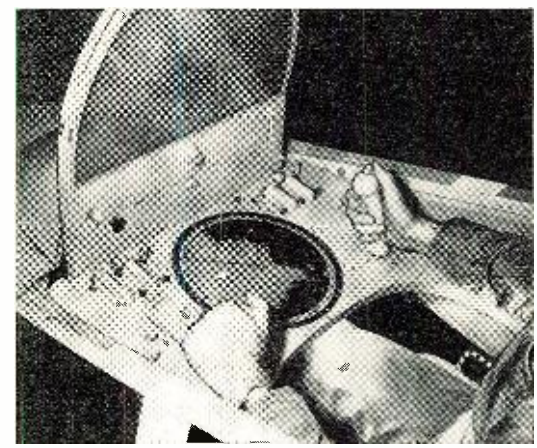
Fig. 4. Top view with trap door cover removed showing the clips for the u.h.f. mixer crystal and the "balun" used to give balanced 300-ohm antenna input.



A REVOLUTIONARY TELEVISION TUBE

Technician examines transparent-plate TV tube which is being used in a joint project sponsored by the Office of Naval Research and Bureau of Aeronautics designed to simplify aircraft instrument panels

Mockup of cockpit showing position of the two TV screens. One plate is mounted vertically while a second lies horizontally between pilot's hands.



Obviously, this new design is not suited for home viewing—however, its basic design principles, with further development will lead to a new concept in home TV viewing. The present-day tube will, in time, be replaced by a flat disc viewing screen.

A REVOLUTIONARY television picture tube which consists of a transparent flat plate, developed in connection with a long-range program for simplifying aircraft instruments, was unveiled recently in El Segundo, California, by the Office of Naval Research and the Bureau of Aeronautics.

Describing the epic tube, naval experts said that as now envisioned, a pair of these units would be used on each plane. One instrument would feature a semi-circular plate mounted vertically and directly in front of the pilot. This would be transparent and would thus not interfere with the pilot's vision during contact flight. Altitude, speed, and attitude of the aircraft would be shown on the plate, and physical features such as mountains, which the pilot sees during contact flight, would be depicted artificially. This instrument would tell the pilot all he needs to know to fly the aircraft about its three axes: pitch, roll, and yaw.

The second instrument would consist of a round plate mounted below the first, just inside the cockpit rim. Broad physical features of the earth below would be depicted by analogy and the appearances would be somewhat similar to that of a radar map.

The novel TV tubes will not be used to present an actual picture of what is happening in the vicinity of the aircraft. Rather, the display which the pilot sees would be an analogy of the visual world which he would see if flying by contact or in good weather.

The tube's inventor, William Ross Aiken, who is director of research at the West Coast lab of *Willys Motors,* and formerly with the University of California Radiation Laboratory, revealed that the model developed for the demonstration, was approximately the size and shape of a metropolitan city's telephone book. It is about three inches thick, as compared to the standard picture tube which has an average depth of about 20 inches.

The new tube consists of a phosphor screen sandwiched between glass plates. It functions by electronically exciting selected areas or spots on the phosphor screen. This is accomplished as follows: An electronic beam is injected along a horizontal edge of the tube. This beam flows in a field-free region along the edge of the phosphor screen and adjacent to a row of transverse deflection plates. Through control of the voltages on these deflection plates, the beam is bent vertically at any desired place along the edge of the tube. The beam then flows vertically in a second field-free region between a series of transparent deflection plates and the electrically charged phosphor screen of the tube.

Deflection of the beam into the screen at any desired vertical level is made possible by controlling the voltages on the transparent deflection plates. Through this means, the position of the spot created by the deflection beam may be controlled exactly.

The tube is controlled by circuit means capable of changing the voltage on horizontal or vertical deflection plates in a sequential manner, that is, all plates are at a high voltage except those plates opposite the position at which it is desired to bend the beam.

One of the advantages of the new deflection system is that it has extremely powerful focusing ability, that is, the convergence angle is large and beam blowup, which normally occurs in other types of TV tubes, is not a problem here.

The strong focusing action in the new tube makes possible a very small spot on the phosphor screen, which results in high definition and brightness because a larger amount of beam current can be concentrated in a small area.

The tube, which has a 15-inch screen, employs electrostatic control, which eliminates the necessity of using magnetic components, which would require substantial power and, in addition, are heavy and costly.

Applications of this principle are limited only by the imagination and "know-how" of the engineers. —30—

A NEW APPROACH TO LONG-DISTANCE TRANSMISSION

A coiled copper wire inside a flexible coating has interesting potentialities.

This hose-like tube is the new Bell long-distance wave guide. Unlike standard wave guides it can carry signals around curves.

BELL Telephone Laboratories has developed a new and radically different medium for transmitting television and telephone conversations over long distances. The new medium, a long-distance wave guide, is radically different from modern cable or radio relay systems in that it uses a hollow metallic tube roughly two inches in diameter.

Scientists at the Lab believe that this new unit may someday carry tens of thousands of cross-country telephone conversations and hundreds of television programs simultaneously. By contrast, the top capacity for the most modern coaxial cable systems is 1860 two-way telephone conversations or 600 telephone conversations and two TV programs simultaneously on a pair of coaxial tubes. Modern coaxial cables have eight such tubes, two of which are kept as spares for emergencies.

Wave guides made of solid metal tubing have been widely used for some time for short distances. It would be possible to use these solid metal tubes for long distances if they were perfectly straight, but this is impractical. The new long-distance wave guide is also a hollow tube but it is constructed of a thin copper wire, very tightly coiled and wrapped inside a flexible outer coating which holds the coiled wire in place. This type need not be straight and can actually carry signals around corners.

Although this new form of transmission is still in the experimental stage, a recent long-distance test was made at Holmdel in a copper pipe 500 feet long. Engineers bounced signals back and forth in the tube for distances of 40 miles. They calculated that in comparison, the same waves could have traveled only 12 miles in a coaxial cable with the same loss in strength.

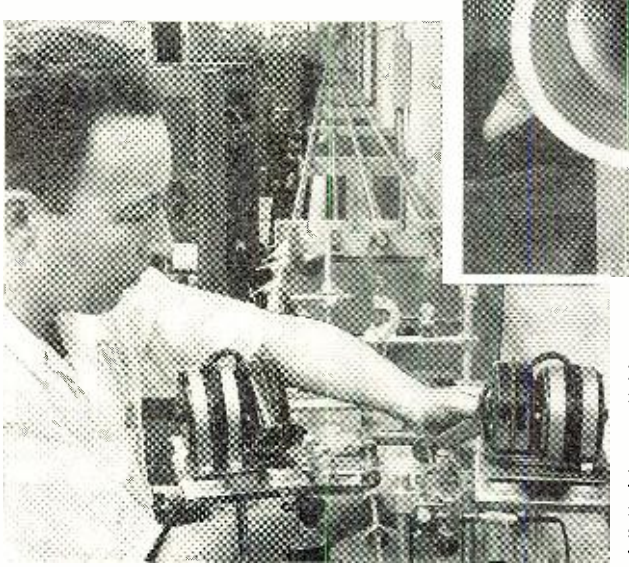
The new transmission system operates even above the "super high" band of 30,000 mc. The carrier frequency for the new wave guide is about 50,000 megacycles.

A major difference between transmission through the new wave guide and through previous systems is that the higher the frequency in the wave guide, the less the loss through attenuation. This is exactly the reverse of other forms of transmission.

Beyond the prospect of an improved transmission with the long-distance wave guide is the possibility of learning how to use tiny wavelengths on the order of one millimeter, about 1/25th of an inch. If this should become possible, the wave guide of the future may be no thicker than a fountain pen and still carry tens of thousands of telephone messages.

As a result of this experimental work, the engineers hope to use the new wave guide in a variety of ways. One such application might be with a heavy protective coating so that the hollow tubes can be run underground which would put them out of sight and out of the reach of the elements. This latter consideration offers possibilities of reduced maintenance cost and even better service. —30—

Length of the experimental wave guide. It is of flexible copper and approximately 2 inches in diameter. Carrier frequency is 50,000 mc.



A Bell Labs engineer tests transmission through the new wave guides of various sizes. The 2-inch diameter was found to be the best.

A REFERENCE-SHIFT MODULATOR

By **DALE HILEMAN, K6DDV**
Collins Radio Company

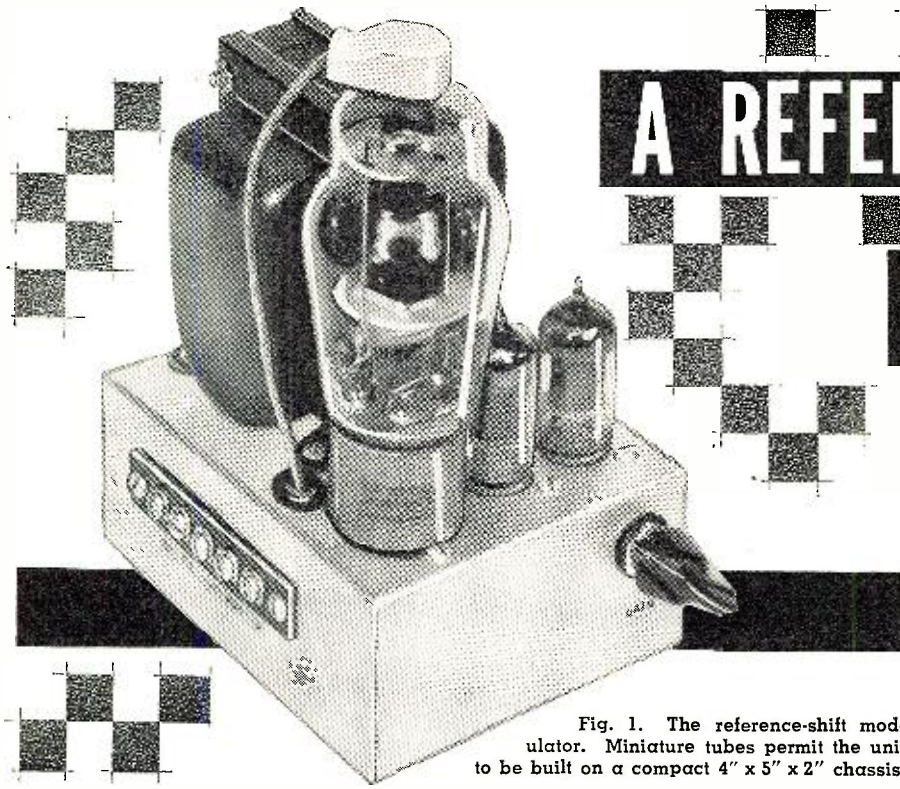


Fig. 1. The reference-shift modulator. Miniature tubes permit the unit to be built on a compact 4" x 5" x 2" chassis.

Construction details on a Heising modulation system that is simple and inexpensive, yet is unusually effective.

PROBABLY the most expensive item in a plate modulator is the modulation transformer. For this reason many rigs which might otherwise deliver twice the r.f. output employ screen modulation, control-grid modulation, or some other equally unsatisfactory form of efficiency modulation.

The expense of a modulation transformer can be avoided by the use of Heising (choke-coupled) modulation in which a relatively inexpensive filter choke replaces the modulation transformer. With this system the final r.f. amplifier operates at usual class C efficiency.

Until recently, however, the Heising system has been about as popular as a capitalist in Moscow. Since the old Heising system employs a conventional class A amplifier as modulator, the plate efficiency of the modulator is 30 per-cent at best. And since the plate dissipation of a conventional class A amplifier tube is maximum at zero power output, the input is limited to a value equal to the rated plate dissipation, therefore the full power output capabilities of the tube cannot be realized.

These objections to the Heising system can be overcome by a circuit in which the modulator plate current is made a function of the applied audio voltage; that is, if the plate current is limited to the value required by the audio level. By this means the modulator dynamic plate current can be increased beyond the value which, under static conditions, would produce maximum plate dissipation. The increase in plate current not only increases power output, but the greater plate-current swing increases the efficiency. In fact, if the plate current is swung from saturation to cut-off, the theoretical maximum efficiency of 50 per-cent can be approached.

Two systems that fulfill these requirements have recently been brought to light. Described in the October, 1953 issue of *"CQ"* was the class K modulator[1], a system developed in 1952 by Richard J. Klensch (K2AZJ) and the author. The plate current of the modulator tube is controlled by an audio clamp tube in the screen circuit, and the modulator tube is operated at zero bias so that a high plate current can be obtained within a reasonable excursion of the screen voltage.

With the class K system the author successfully modulated 90 watts with a single 807. In this system, however, a good deal of power is wasted in the modulator screen-voltage dropping resistor. Since the modulator tube is zero-biased, the driver must deliver modulator grid losses; as a consequence, the driver tube necessarily consumes excessive plate power. Also because of the modulator grid-power requirement, a relatively expensive driver transformer is usually necessary.

In the April, 1954 issue of *"CQ,"* Bill Orr described the bias-shift modulator.[2] In this system, which was invented over 19 years ago, modulator plate current is controlled by a shift in the control-grid bias on the modulator tube. As the audio level is increased, the modulator grid bias is reduced to increase the modulator plate current.

In this system the modulator tube can be a triode so that no screen-grid dropping resistor is involved. Also the modulator tube draws little or no control-grid current so that the driver tube need consume negligible plate power. The bias-shift system is therefore superior in most respects to the class K system except that the bias-shift system requires a fixed-bias supply and class K does not.

Reference-Shift Modulator

The reference-shift modulator avoids the disadvantages of both the bias-shift system and class K system. The driver consumes negligible plate current; no power-consuming clamp tube is employed; no driver transformer is used.

The reference-shift system is basically a bias-shift system in which the modulator bias is positive instead of negative. As the audio level increases, the positive bias voltage applied to the modulator grid increases; as the audio level decreases, the positive bias voltage decreases.

The author is indebted to Henry S. Keen, W2CTK, who suggested the unique cathode-follower driver circuit that made possible the reference-shift modulator. Mr. Keen had devised a controlled-carrier, screen-modulation system in which the d.c. positive voltage applied to the screen is equal to the audio modulating voltage. He suggested that his circuit might be applicable to the Heising system if a zero-bias tube were used as modulator. Mr. Keen also pointed out that a power tetrode can be operated as a zero-bias tube if the driving voltage is applied directly to its screen grid and to the control grid through a 20,000-ohm resistor.

The reference-shift modulator circuit is shown in Fig. 3. The modulator is an 807 (V_3), its plate connected to the final r.f. amplifier in the conventional Heising fashion. The modulator grids are connected as if the tube were

a class B zero-bias amplifier. The cathode-follower driver, one section of a 12AU7 (V_{2B}), is direct-coupled to the modulator grids.

The driver is a "bootstrap" circuit in which its output level determines the d.c. reference voltage applied to its grid. Its d.c. grid voltage, in turn, determines its d.c. cathode voltage.

The cathode voltage is divided in half by R_{12} and R_{13} and rectified by CR_1 to provide a d.c. reference voltage, which is filtered by C_7 and applied to the grid through R_{11}.

During no-signal conditions, a few milliamperes of driver plate current flows, producing a cathode voltage of about 35 volts. This voltage is divided in half by R_{12} and R_{13} so that the resulting reference voltage, applied to the grid, is about 17 volts. Under these conditions, the d.c. cathode voltage is twice the reference voltage. The difference in these two voltages constitutes the no-signal bias value.

The 2:1 ratio of cathode voltage to reference voltage, however, occurs only with no signal input. As an audio signal is applied through C_6 to the grid, the resulting a.c. cathode voltage, impressed on the already existing d.c. cathode voltage, causes an increase in the reference voltage. The increase in reference voltage, in turn, causes an increase in d.c. cathode voltage. This "bootstrap" action occurs during the first one or two cycles or until the reference voltage is equal to half the d.c. cathode voltage plus half the peak a.c. cathode voltage.

Therefore, as the signal level increases, the reference voltage not only remains equal to half the rising d.c. cathode voltage but increases beyond that value by half the peak a.c. cathode voltage. Finally, at maximum signal level when the peak a.c. cathode voltage is about 90 volts, the d.c. cathode voltage and the reference voltage are also about 90 volts. Under these conditions, the cathode voltage swings between zero and 180 volts.

If at this point you do not fully understand the reference-shift circuit, do not be discouraged; you are little worse off than the author! But rejoice; the modulator works despite the rather obscure principles of operation of the reference-shift circuit.

The purpose of the driver circuit is to supply the modulator grid circuit with an a.c. audio voltage on which is impressed a positive d.c. voltage somewhat greater than, or equal to, the audio voltage. Thus the d.c. modulator grid voltage, and the resulting modulator average plate current, is a function of the audio level.

The time constant of C_7, the back resistance of CR_1, and other circuit values is great enough that the reference voltage cannot vary at an audio rate but small enough that it can follow the average audio level and vary at a syllabic rate.

Note that the value of driver coupling capacitor C_6 is only 500 $\mu\mu$fd.; there are two reasons for this: first so that its effect on the rectifier-circuit time constant is negligible, and second so that the low-frequency response of the amplifier is reduced to increase the communication effectiveness of speech transmission.

Fortunately, the circuit values which provide the best operation of the bias-shift circuit do not also cause ratings of components to be exceeded: The maximum rated plate current of the 12AU7 is 20 ma., but the maximum driver plate current is only 10 ma. The maximum rated cathode-to-heater voltage, 180 volts, is reached but not exceeded. The maximum rated back voltage of the 1N38, 100 volts, is approached but not exceeded. The maximum rated d.c. control grid current of an 807 is 5 ma., but the maximum grid current of the 807 modulator is 4 ma. In the preceding statements the author is, of course, basking in the protection of the usual 20 per-cent tolerance applied to ratings of electronic components in the hope that these tolerances can also be applied to these measurements.

With a plate voltage of 350 to 600 volts, the resting plate current of the modulator is in the neighborhood of 35 ma., and the maximum plate current is about 100 ma. The plate current of the final r.f. amplifier should be about 100 ma. Therefore, the total plate current to the modulator and final swings between 135 and 200 ma. The exact values of course depend upon the driver and modulator plate voltages.

Performance

In the theology of ham radio, a Heising modulator using only one coupling choke cannot produce 100 per-cent modulation. However the author observed with the reference shift circuit, as did Bill Orr with his bias-shift circuit, that the modulation percentage is so close to 100 per-cent that the difference cannot be accurately measured using conventional scope techniques.

(*Continued on page* 156)

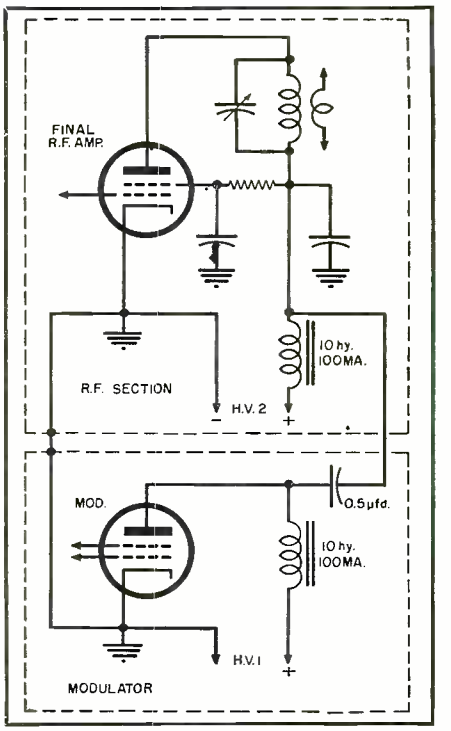
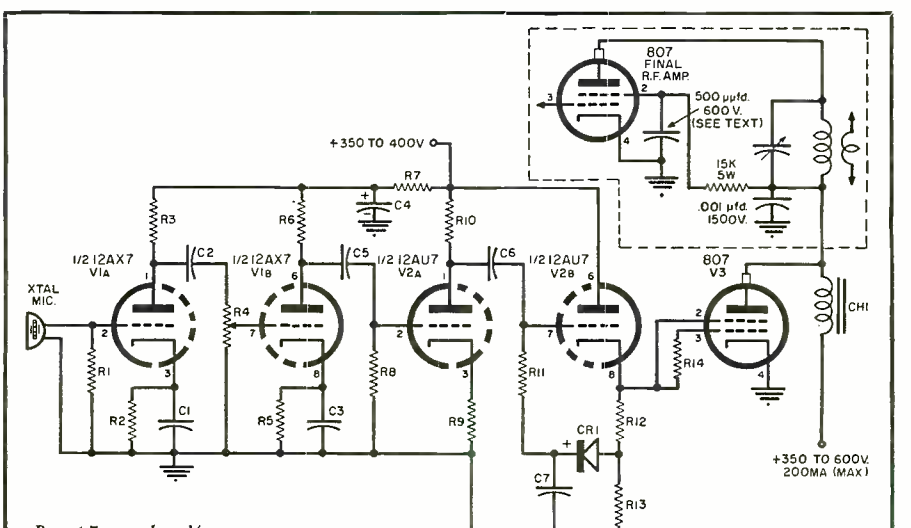


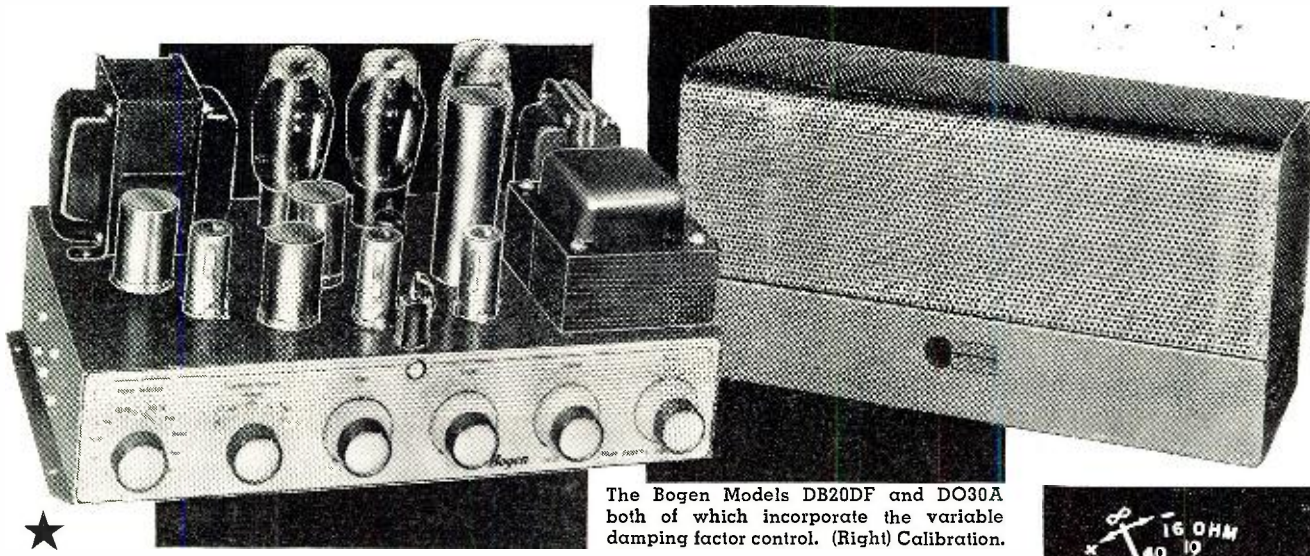
Fig. 2. A parallel-feed system for use with separate power supplies. The modulator and final amplifier use a common ground and the plate circuits are capacity-coupled.

Fig. 3. The reference-shift modulator circuit. Miniature tubes are used in the speech-amplifier and driver circuit and the modulator is an 807. No transformers are used. Values shown for components in the final r.f. amplifier circuit do not necessarily apply to any 807 final but depend on operating conditions.



R1—4.7 megohm, ½ w. res.
R2, R5—5600 ohm, ½ w. res.
R3, R6—470,000 ohm, ½ w. res.
R4—2.2 megohm pot
R7—100,000 ohm, ½ w. res. (see text, "Design Considerations")
R8—2.2 megohm, ½ w. res.
R9—10,000 ohm, ½ w. res.
R10—220,000 ohm, ½ w. res.
R11—1 megohm, ½ w. res.
R12, R13—100,000 ohm, ½ w. res.
R14—22,000 ohm, 1 w. res.

C1, C3—1 μfd., 100 v. capacitor
C2, C5—270 μμfd. ceramic capacitor
C4—8 μfd., 450 v. elec. capacitor (see text, "Design Considerations")
C6—500 μμfd., 600 v. capacitor
C7—.003 μfd., 500 v. mica or ceramic capacitor
CH1—5 hy., 200 ma. choke
CR1—1N38 crystal diode
V1—12AX7 tube
V2—12AU7 tube
V3—807 tube



The Bogen Models DB20DF and DO30A both of which incorporate the variable damping factor control. (Right) Calibration.

PATENT PENDING

REDUCING LOUDSPEAKER DISTORTION

By **CHARLES A. WILKINS**
Assistant Chief Engineer
David Bogen Co., Inc.

Details on a new control circuit which permits adjustment for ultimate damping, thus reducing speaker distortion.

FOR MANY YEARS manufacturers of audio amplifiers have realized that this component has reached the practical limits of perfection. The efforts of the industry are now being directed, in the main, toward the maintenance of quality while reducing cost. Today, even the lower priced high-fidelity amplifier can faithfully reproduce a range of frequencies that exceeds the limits of hearing. However, the case for the loudspeaker is not nearly so gratifying.

One of the most stringent (and usually one of the most disappointing) tests that one can make on his sound system is to attend a live symphony concert and then while the memory of the sound is still fresh, to go home and try to get the same clean, wide-range sound and wide dynamic range on his home equipment. Try it some time!

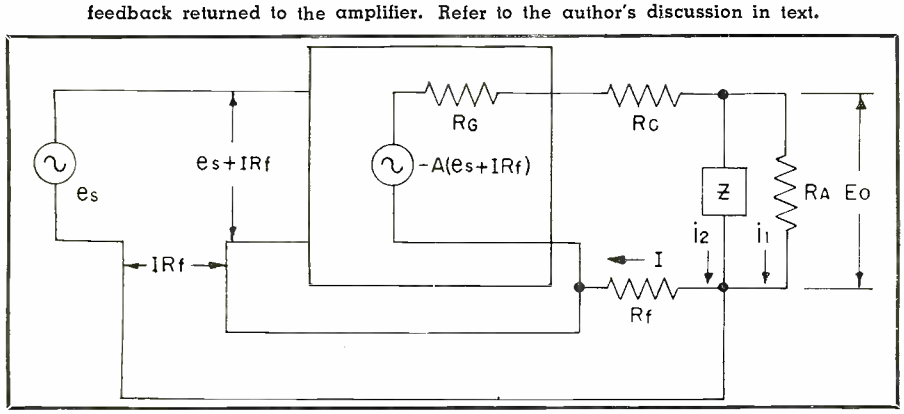
That the loudspeaker is the weakest link in the chain of equipment that typifies the modern high quality reproducing system is a matter of common knowledge and uncommon concern. The average speaker is incapable of handling moderate amounts of power in the range below 60 to 80 cycles without generating large amounts of distortion—far more than would be tolerated in the remainder of the system. Values in excess of 10 per-cent are commonly encountered below 50 cycles in even the finest, costliest speakers when they are operated at the moderate power level required for concert listening in the home. Values for less expensive units may run very much higher, perhaps 50 per-cent and more.

EDITOR'S NOTE: There are quite a few amplifiers on the market today that incorporate some form of variable damping. From the information we have gathered, it is obvious that there is widespread disagreement on the part of manufacturers regarding the design of this variable damping circuit. Even the engineers disagree on the basic principles.

On the assumption that our readers want to keep abreast of current trends in the audio field, we are presenting herewith one company's analysis of the problem.

We might ask what types of distortion are present in the bass range. First, there is harmonic distortion, or frequency "doubling" and "tripling." If the speaker is called upon to reproduce a 32-cycle tone, the sound generated will usually be mostly 64 cycles and 96 cycles. Since these two unwanted tones are higher in frequency than the fundamental, the resulting sound will be louder than if the fundamental were reproduced (Fletcher-Munson effect). The speaker will sound as if it had more bass because our ears are less sensitive to pitch at these low frequencies. But this is false or artificial bass. Second, there is intermodulation distortion, or frequency adding and subtracting. This characteristic causes a muddiness in the bass and actually the creation of a synthetic bass. It is apparent that

Fig. 1. Equivalent circuit of amplifier driving a speaker load with the current feedback returned to the amplifier. Refer to the author's discussion in text.



when we try to reproduce music which is a complex sound of many different tones, we hear not only artificial and synthetic bass but a general muddy blending of the sounds from the individual instruments. All this induces fatigue in the listener who consciously or unconsciously tries to sort out and make sense from this aural confusion in the bass range.

What are the sources of speaker distortion? There are several. 1. The nonlinearity of voice coil and rim suspensions which hold the voice coil and cone to the speaker frame. 2. Fringing effects that occur when the voice coil is driven out of the linear flux region of the magnetic field. 3. Mechanical and acoustical resonances that occur in the speaker and its enclosure. The last, if appreciable, will lead to boominess and hangover which color all reproduction. The speaker can be more easily overdriven at and near the frequencies of these resonances and generate large amounts of distortion that *are not* harmonically related to the fundamental; this type of distortion is most objectionable to the ear.

Another question might arise and that is why conventional negative feedback does not help the situation. The motional impedance of the speaker—the business end, so to speak, in which both sound and distortion are generated—is isolated from the amplifier output terminals by the d.c. voice coil resistance. Since the negative feedback is taken from the amplifier output terminals, its effect on the behavior of the motional impedance is quite limited. If we could reach in and cancel out the d.c. voice coil resistance, the problem would be solved.

SPEAKER CHARACTERISTIC	ULTIMATE DAMPING (Positive Current Feedback)	LOW DAMPING (Negative Current Feedback)
Distortion	Greatly decreased	Greatly increased
Low Frequency Response	Requires equalization due to overdamping[2]	Speaker and enclosure resonances accentuated
High Frequency Response[1]	Maximum flatness	Accentuated
Transient Damping	Excellent	Very poor
Hangover	Greatly decreased	Greatly increased
Equivalent Effect on Magnet Weight	Increase	Decrease

[1] No effect with 300-cycle filter in circuit [2] Compensated by 300-cycle filter

Table 1. Characteristic effects of low damping and "ultimate damping" on speaker system as compared with an average damping factor of approximately plus 30.

Outside of placing a wide-range microphone in front of our speaker and using the voltage generated by the microphone as the over-all negative feedback source[1]; or by including a pickup coil in addition to the voice coil from which the negative feedback voltage may be derived as a motional voltage[2]; there remains but one way of encompassing the motional impedance within our over-all negative feedback loop, and that is to sample the current flowing through the speaker. It is immediately apparent that the waveform of the speaker current will contain the distortion information that we desire.

The type of circuit necessary to sample the speaker current can best be investigated by examining the simple equivalent circuit of Fig. 1 which shows an amplifier driving a speaker load wth an input signal e_s applied to the input. E_o represents the voltage developed across the radiation resistance R_A or air load of the speaker. It is this voltage that is radiated as sound. Any non-linear or frequency discriminating elements present can be lumped and represented as an impedance Z in parallel with R_A. The current through both R_A and Z passes through a feedback resistor R_f and develops a voltage IR_f across it. This voltage is added to the input signal voltage e_s.

The current through R_f is the sum of the useful current through R_A and the distortion current through Z

$$I = i_1 + i_2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

The voltage developed across R_A and Z is:

$$E_o = -A(e_s + IR_f) + IR_G + IR_C + IR_f \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2a)$$

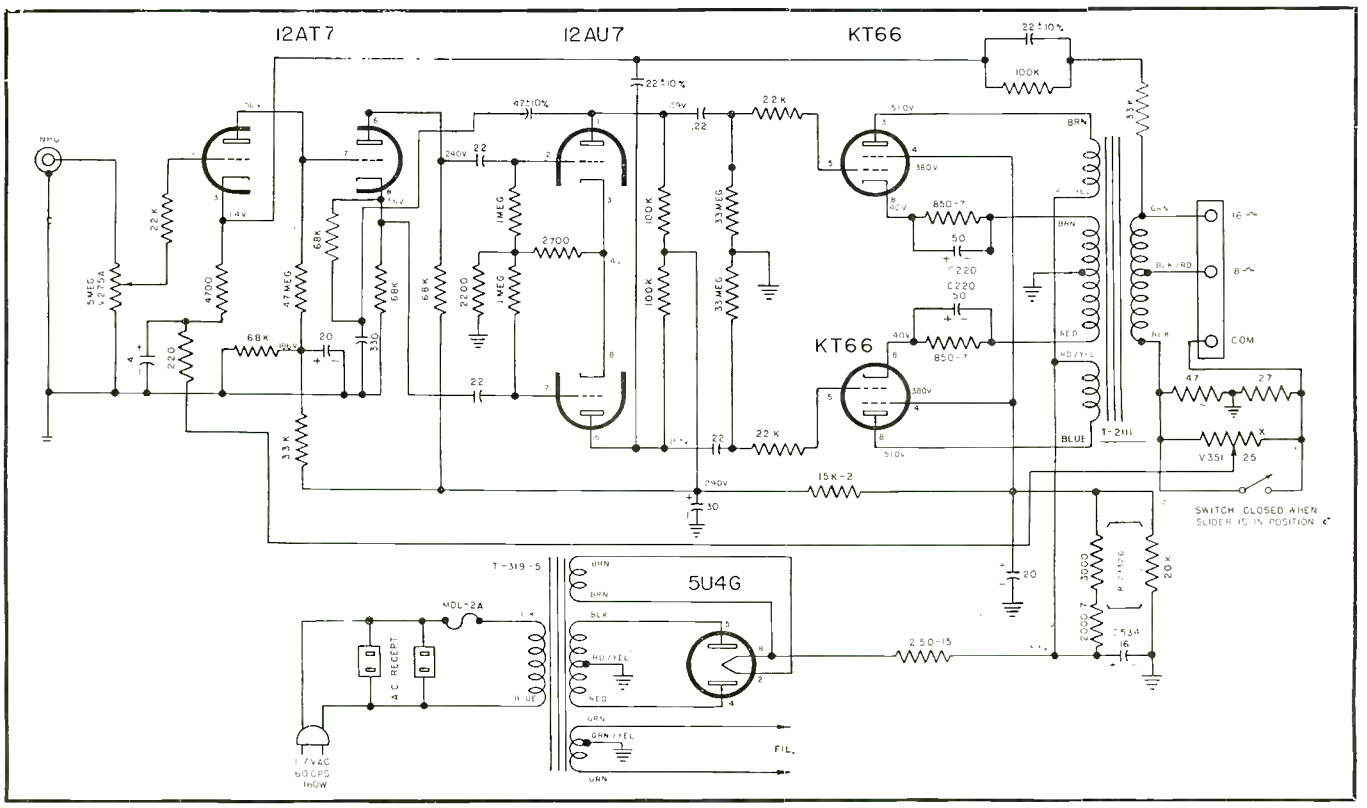
which can be rearranged as:

$$E_o = -Ae_s + I(R_G + R_C) - IR_f (A - 1) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2b)$$

Since we desire to make E_o a faithful reproduction of e_s, we must make:

$$E_o = -Ae_s \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Fig. 2. Schematic diagram of the Bogen Model DO30A basic power amplifier. This unit incorporates the "ultimate damping" feature.



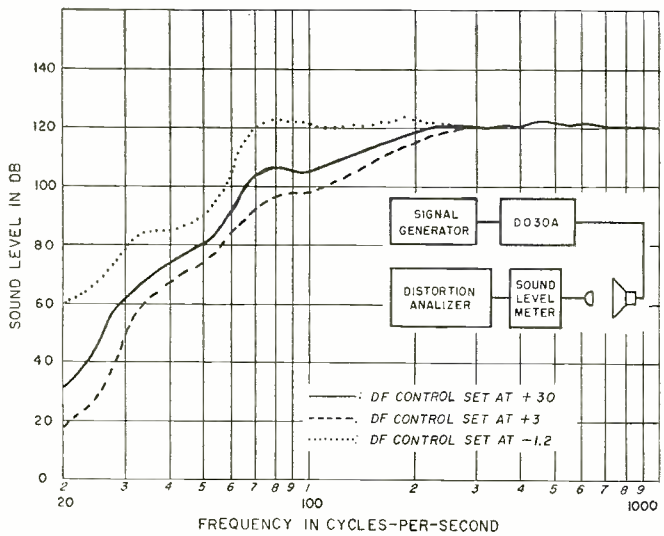


Fig. 3. Acoustic measurement showing the effect of amplifier damping factor on distortion generated by loudspeaker. Five per-cent distortion contours are shown here.

We can accomplish this by making the last two terms of equation (2b) cancel each other, which means that:

$I(R_G + R_C) = IR_f(A-1)$ . . (4)

The I term goes out and leaves us with a value of R_f to accomplish the cancellation, which is:

$R_f = (R_G + R_C)/(A-1)$ . . . (5)

Now it is not obvious from this analysis whether we have to use *positive* current feedback or *negative* current feedback to reduce the distortion, so let us probe a little further. Without going through a lengthy technical derivation, the source resistance R_o of the amplifier, when connected as shown in Fig. 1, can be written as:

$R_o = R_G - R_f(A-1)$ . . . . (6)

Substituting into equation (6) the value of R_f we found in equation (5), we see that:

$R_o = -R_C$ . . . . . (7)

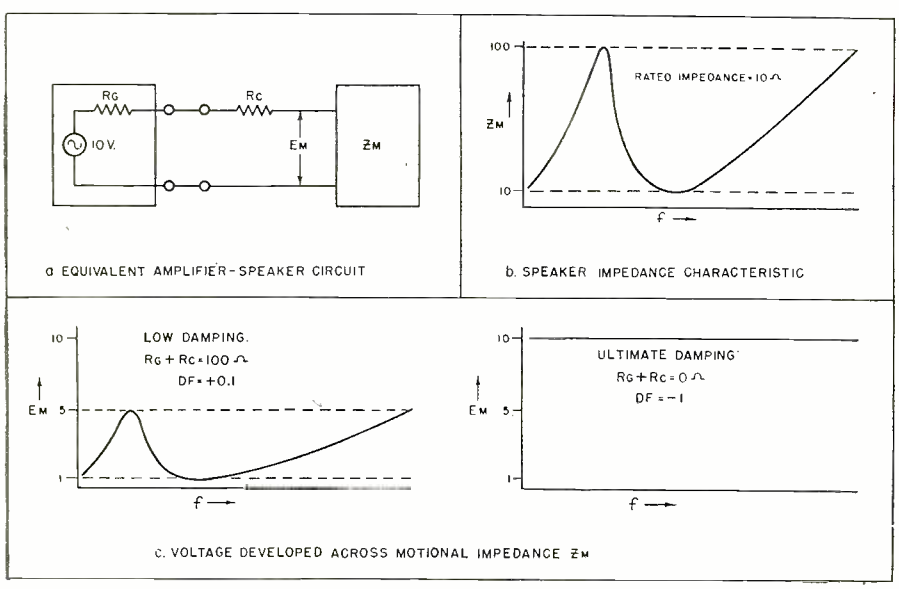
which means that the source resistance of the amplifier must be just *negative* enough to cancel the d.c. resistance of the speaker voice coil. This, then, is definitely *positive* current feedback that has been applied. *We have reached in and canceled out the d.c. voice coil resistance.* To this condition of adjusting the source resistance to exactly cancel the voice coil resistance, we have assigned the term "ultimate damping."

Negative voltage feedback must be used around the amplifier to reduce distortion generated in the amplifier itself to within acceptable limits. In the practical circuit to be described later, the current feedback is added to the negative voltage feedback to accomplish the adjustment of the amplifier source resistance. The design of the amplifier is such that when adjusted for ultimate damping a minimum of 17 db of negative voltage feedback remains active to minimize amplifier distortion. This circuit is called the "variable damping factor control"[3] and has been incorporated into *Bogen* Models DB20DF and DO30A. It enables the listener to adjust the source resistance of the amplifier between the wide limits of about +1—through infinity—to −1 (*ultimate damping*). The relationship between source resistance R_o and damping factor DF is a simple one.

$DF = R_C/R_o$ . . . . . (8)

R_C is the d.c. voice coil resistance.

Fig. 4. Simplified explanation of the effect that damping has on the voltage developed across the motional impedance, Z_M, of the speaker.



The schematic of amplifier Model DO30A is shown in Fig. 2. The "variable damping factor control" circuit consists of the simple bridge circuit on the secondary side of the output transformer. Loudspeaker current flows through the 0.47-ohm and the 0.27-ohm resistors and produces a voltage drop that is proportional to the current flow. This current-proportional voltage is sampled by the slider of the 25-ohm potentiometer and fed back through the low-pass filter composed of the 220-ohm resistor and the 4 μfd. capacitor to the cathode of the first stage where it is added to the overall negative voltage feedback. At a certain central position of the 25-ohm potentiometer slider, there will be no voltage developed between the slider and ground and, therefore, no current feedback. On either side of this particular setting, the slider will sample either a positive or a negative current-proportional voltage, depending on whether the slider is moved toward the 0.47-ohm or the 0.27-ohm resistor, respectively. Positive current feedback will reduce the amplifier source resistance, while negative current feedback will increase it.

The low-pass filter limits the effect of the control to frequencies below 300 cycles:

1. To influence the apparent efficiency of the speaker in the frequency range that requires modification of response because of either too much bass or too little bass as caused by under-damping or over-damping the speaker system.

2. To circumvent tweeter oscillation (if one is used in the speaker system) which might result in damage when adjusting the damping to the negative range. (Assuming the efficiency of the tweeter to be much higher than that of the woofer as is usually the case, a resistor or pad is generally connected in series with the tweeter to reduce its sound level to equal that of the woofer. Thus, if the speaker system is properly balanced, it would be impossible to cancel total tweeter resistance before completely cancelling that of the woofer. But some people like exaggerated highs and their speakers must be protected.)

3. To restrict the damping action to the bass range where it is most needed and most effective.

Fig. 3 shows the actual measured effect of various control settings on the *acoustical* distortion generated by a typical 12-inch coaxial speaker housed in a bass-reflex cabinet. These curves *are not* frequency response curves but are 5 per-cent harmonic distortion contours for different damping factor values; they portray the maximum sound power obtainable from the speaker before its distortion exceeds 5 per-cent. From these curves, we see that with a damping factor of −1.2, which is exceedingly close to ultimate damping, this speaker can be driven about 30 db harder at 20 cycles than is possible with a fairly represen-

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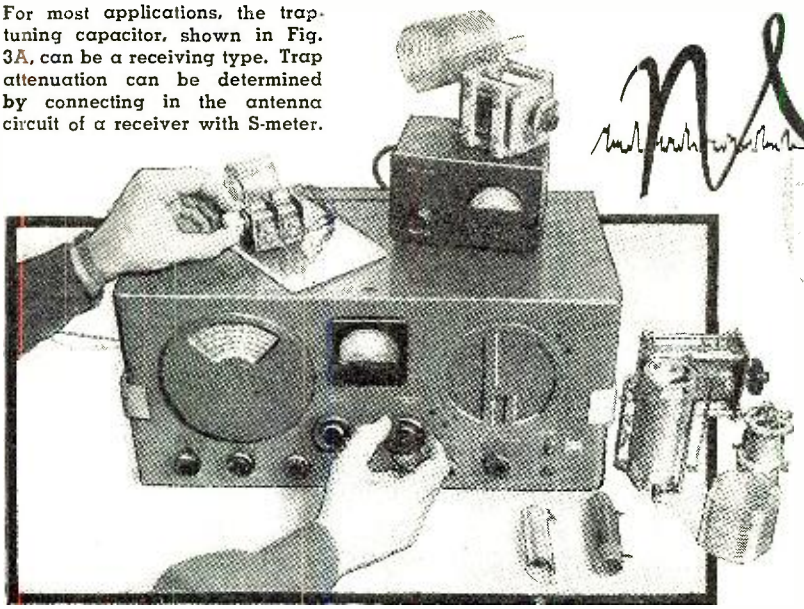
For most applications, the trap-tuning capacitor, shown in Fig. 3A, can be a receiving type. Trap attenuation can be determined by connecting in the antenna circuit of a receiver with S-meter.



HUNTING HARMONICS ON 2738

By
WARREN PHILBROOK

New FCC regulations on second-harmonic emission from radiotelephone transmitters mean new wavetrap jobs.

A LOT of boatmen are going to be bothering marine-radio technicians this season for wavetraps on the 2738-kc. channel of their radiotelephone transmitters. The reason is that many of the old-time sets still on the air put out messy signals. When second-harmonic emission from these clunkers (and improperly-adjusted new sets) began interfering with the 5476.5-kc. airways channel, the axe fell. Kill the harmonic or go off the air, was the order to the boatmen.

In its order the FCC stated, "Harmonic attenuation and elimination is rather a simple problem when only one frequency is involved since a simple trap circuit will usually suffice to reduce the intensity of the harmonic to a level which will not cause objectionable interference." So the flurry over traps commenced.

Actually the first question is, "To trap or not to trap?" Some transmitters won't need one—they're "clean" already. These the manufacturers will certify. But some of the older rigs aren't backed up this way. And, if the transmitter is one of those bearded antiques with an output circuit similar to that of Fig. 1A more than a trap is called for. Using low-*Q* tank and direct coupling into an untuned antenna is the fastest way to make harmonics—trap or no trap. To legalize this kind of rig some modification is necessary!

The circuit of Fig. 1B qualifies when properly adjusted, usually without needing any accessories. It has the advantage that the original channel-switch wafers can still be used for all necessary tuning, and all it requires in addition is a "tank-resonating" capacitor (C_2), an antenna-coupling capacitor (C_1), and the antenna-tuning coil (L_1). Basically the circuit is now a pi-network.

To tune a transmitter with the circuit of Fig. 1B first resonate the plate "tank," either by the plate-inductor clips or tuning capacitor, whichever is provided, *with the antenna disconnected*. Do not touch the plate tuning again. Then connect the antenna and adjust antenna-coil tuning for resonance which will be indicated by maximum output and maximum tube plate current. Adjust tube loading for rated plate current and proper modulation by varying the value of the antenna-coupling capacitor. The last two adjustments may be touched up as necessary.

Now, suppose the transmitter has a respectable circuit. As the FCC says, eliminating a harmonic with a trap can be a simple problem. But, on the other hand, it *can* be a toughie. In the first place, you can't call up the corner store and order a dozen traps. You make them yourself. Even this sounds easy—just a parallel coil and capacitor in the antenna lead—until you get down to cases. Then you remember that connecting coils in the antenna lead may reduce transmitting efficiency. And the cold, hard law says the harmonic must be down 40 db from the fundamental. How do you make sure of that? To measure second-harmonic output accurately, you usually need a field-strength meter. You don't get these at the corner store, either. Accordingly, there is as much of a problem in finding the strength of the harmonic as there is in eliminating it.

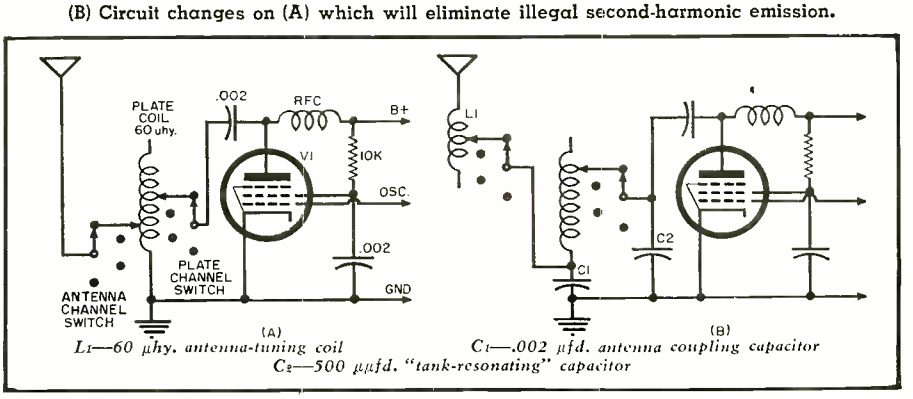
Fortunately, it is possible to get a safe enough approximation of the ratio of fundamental carrier to harmonic emission by using a communications receiver with a properly-calibrated S-meter. Calibration can be checked with a standard signal generator. Counting one S point worth 6 db, the signal on 5476.5 kc. should be down at least 7 S points from the level on 2738 kc.

Use the receiver-antenna connection scheme of Fig. 2. With the receiver tuned to 2738 kc., turn on the transmitter and adjust R for a carrier reading of S9. Then switch to 5476 kc. If the S meter reads below S2, the transmitter is respectable. If not, it *does* need a trap. How shall we build it?

In the usual marine-radio installation, extreme care must be taken in introducing anything in the antenna circuit. Long antenna systems are not too critical, but the usual small boat

(*Continued on page* 150)

Fig. 1. (A) Output circuit found in some of the older radiotelephone transmitters. (B) Circuit changes on (A) which will eliminate illegal second-harmonic emission.



*L*₁—60 μhy. antenna-tuning coil
*C*₁—.002 μfd. antenna coupling capacitor
*C*₂—500 μμfd. "tank-resonating" capacitor

AN ELECTRONIC COMBINATION LOCK

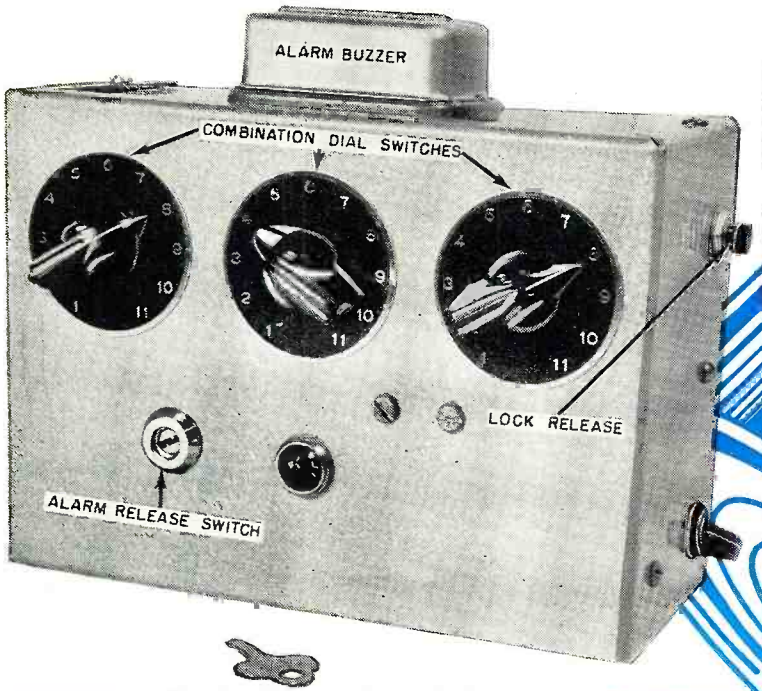


Fig. 1. Although the author's unit, as shown above, employs only three dials any number can be added for greater safety.

By **LOUIS E. GARNER, JR.**

Not even the slickest intruder can beat this lock with its special time delay relay and alarm system.

MOST mechanical combination locks have a serious disadvantage which prevents their being completely foolproof. The safety afforded by the lock depends primarily on the number of possible combinations which may be set. Although only one is right, if a potential intruder or burglar has sufficient time, he may continue trying combinations until the right one is found.

Not so the "electronic" combination lock shown in Fig. 1. In addition to the safety afforded by the number of possible combinations, this lock has several additional features which make compromise virtually impossible.

First, when the operator starts setting the combination, he has a limited amount of time in which to complete the operation. If he knows the combination, he has no difficulty in setting it within the specified time limit. If he doesn't set the combination properly within this time, however, an alarm buzzer or bell will sound and will "lock on." No amount of resetting the dials will silence the alarm once it sounds.

Secondly, unless the operator knows the combination in advance, he cannot tell when the proper combination has been set until the time limit expires. There are no tumblers to drop into position, nor any special sounds to indicate when the dials are properly set. A potential intruder may accidentally set the right combination several times while attempting to "beat" the lock, but nothing will happen until the time delay is over.

Even cutting the main power source will not allow the intruder to gain entry, for the combination lock requires power to *release* the door latch. If the power is cut, it becomes impossible to open the lock, unless a special "stand-by" power source has been installed.

In addition, depending on the number of dials used, as few as 10 and as many as 10,240,000,000,000 combinations are possible. Any one of these combinations may be set up in a few minutes' time without requiring the services of a skilled locksmith. Thus, where maximum protection is desired, a different combination might be used every week, or even every day.

Circuit Description

The complete schematic diagram for the electronic combination lock is given in Fig. 2. An interior view of the wired model is shown in Fig. 4.

Although the power source is a 117 volt line, a transformer, T_1, is used to obtain six volts and actual circuit operation is on 6 volts exclusively. This permits the ready substitution of a 6-volt storage battery as a "stand-by" power source for emergency work.

Normally, relays RL_1 and RL_2 are open, lock-switch S_2 is closed, and combination dial switches S_3, S_4, and S_5 are in their "off" positions. A small amount of current flows through R_1, RL_2, and S_2.

Each of the rotary combination switches (S_3, S_4, and S_5) consists of two wafers. Referring to Fig. 2, the upper switch wafer is used for the actual combination, while the lower switch wafer is used to supply power to time delay relay RL_1.

Suppose that any one (or all) of the combination switches are turned to one of the numbered positions other than the proper dial combination (2-5-8 in Fig. 2). For purposes of illustration, we might suppose the combination 3-2-6 to be tried. As soon as any switch is turned from its "off" position, power is supplied to relay RL_1. This relay does not close immediately, however. A delay of from 1 to 30 seconds occurs (depending on the choice of relay).

During this period nothing happens, even if the rotary switches are turned to other positions, including the right combination (unless all three are simultaneously returned to the "off" position).

After the time delay, however, RL_1 closes, supplying power to the center arm of S_3. Assuming this arm to be in position "3", resistor R_1 is essentially shorted out, closing RL_2 and setting off the alarm buzzer B.

Resistor R_1 is chosen to supply sufficient power to RL_2 to hold it closed, but not enough power to close it when open. Thus, once RL_2 closes, the alarm buzzer continues to sound even if all three dial switches are returned to their "off" positions. The alarm buzzer may be silenced only by opening the *"Alarm Release"* switch S_2, *located inside the protected area.*

If any one of the dial combination switches is not properly set at the instant the time delay is over and RL_1

closes, the same action occurs—RL_2 is closed and the alarm buzzer is sounded. This is true even if only one of the switches is turned, with the other two left in their "off" positions.

Suppose, now, that the proper combination has been set within the time delay period. With the circuit wired as shown in Fig. 2, switch S_3 would be set to position "2", switch S_4 to position "5", and switch S_5 to position "8".

When RL_1 closes, power is supplied to the center arm of S_3 and to switch terminal "2", from here to the center arm of S_4 and to its terminal "5", and from here to the center arm of S_5 and its terminal "8". Finally, power is applied across the electric latch release or solenoid terminals "A" and "B". In the demonstration model, shown in the photographs, power is supplied to a pilot lamp (PL_1) to indicate that the proper combination has been set.

Push-button switch S_1 may be used to operate the electric latch release if desired. It bypasses the entire combination system. Normally, this switch is located at a guard's desk inside the protected area and is used to admit visitors and workers during regular hours.

Lock switch S_2 serves as an *"Alarm Release"* switch and opens the RL_2 circuit. It is located within the protected area. A toggle, push-button, rotary, or any simple s.p.s.t. switch may be substituted for the lock switch in the model.

Circuit Modifications

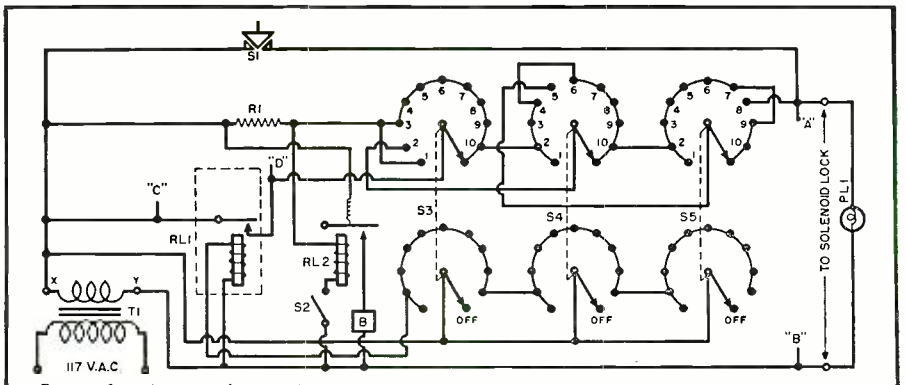
The basic combination lock circuit given in Fig. 2 may be modified considerably by the builder or installer. Both simpler and more complex circuit arrangements are possible to meet special requirements. A few of the more common modifications follow:

"No Alarm" System: The alarm feature may be left out simply by omitting R_1, RL_2, S_2, and the alarm buzzer. All other features of the basic system are retained, however, including both the time delay and the guard's release switch (S_1).

Simple Combination Switch: An even simpler circuit results if the time delay feature and the alarm feature are both omitted. Only the upper sections of switches S_3, S_4, and S_5 are needed. Points "C" and "D" are connected together and relay RL_1 omitted. With this arrangement, there is no time delay and no alarm . . . the lock will release whenever the switches are properly set.

Using With a Time Switch: In some installations it may be desirable to combine the "electronic" combination lock with a conventional time lock arrangement. This may be done simply by connecting a time switch in series with the power line to the combination lock circuit. The combination lock will then be operable only over specified periods of time.

Increasing The Number of Possible Combinations: The model shown uses three 11-position rotary switches in the combination selection circuit. With this arrangement, one thousand combinations are possible. The number of combinations may be increased or decreased simply by changing the number of switches in this part of the circuit, or by using switches with a different number of positions. The basic wiring arrangement is the same regardless of the number of switches used.



R1—7 ohm, 5 w. res. (see text)
RL1—Time delay relay (Amperite 6N010)
RL2—S.p.s.t. 6 v. relay (Guardian 200-M1, 6 v. coil)
S1—S.p.s.t. push-button switch
S2—S.p.s.t. rotary (or toggle) lock switch
S3, S4, S5—D.p. 11-pos. rotary switch (Centralab 1413)
B—Buzzer (Edwards #725)
PL1—Pilot lamp socket and jewel (on demonstration model only)
T1—Fil. trans., 6.3 v. (Stancor #P-5014)
RL3—D.p.d.t., 117 v. relay (Guardian 200-M2 with 115 v. coil) (See Fig. 6)
1—6 v. "hot shot" or storage battery

Fig. 2. As the schematic diagram clearly indicates, the wiring is relatively simple.

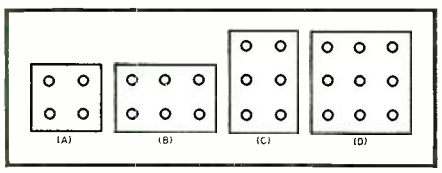


Fig. 3. Several possible panel layouts should more than three dials be desired.

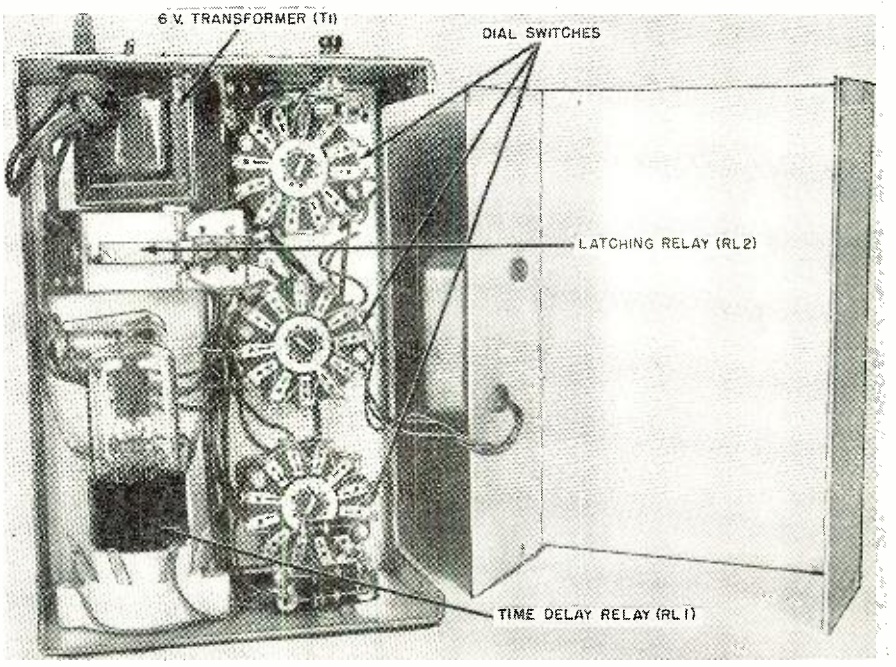
Where more than three dials are used, they may be arranged in rows rather than in a single line in order to conserve space. Several possible arrangements are given in Fig. 3. Dial arrangements for a four-switch lock (Fig. 3A), for a six-switch lock (Figs. 3B and 3C), and for a nine-switch lock (Fig. 3D), are shown.

As the number of dial positions is increased, the number of possible combinations increases so rapidly that the chances of a potential intruder guessing the combination of a 6-dial, 21-position lock are negligible. The odds for getting the right combination are 64,000,000 to 1.

Special Alarm Features: Under some conditions it may be desirable to use another alarm in place of or in addition to the standard buzzer. In such a case, relay RL_2 may be used to control almost any desired alarm circuit; for example, it may be used to switch a heavy-duty relay to turn on floodlights, or it might be used to release tear gas in the protected area. It could

(*Continued on page* 158)

Fig. 4. The tube-like component at bottom left of this internal view is the time delay relay.



Double Troubles in TV RECEIVERS

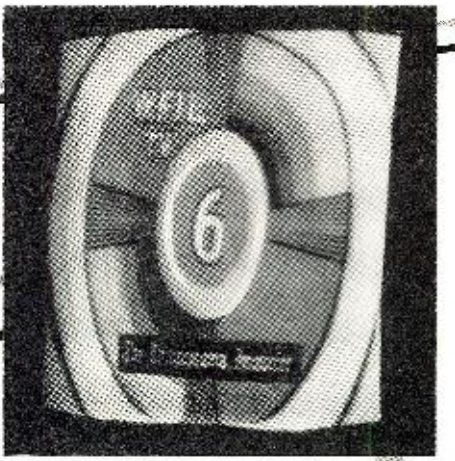
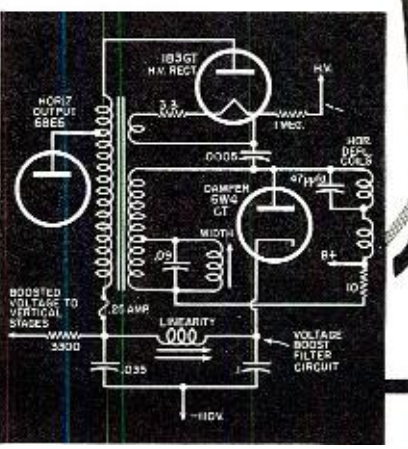


Fig. 1. Case of reduced width accompanied by pincushioning is shown left. This occurred in an Olympic Model DX-214 TV receiver and was caused by a defective width coil shown below, and misadjusted picture tube corrector magnets for the yoke.



By **MATTHEW MANDL**

When TV picture troubles come in pairs, don't overlook the secondary symptoms. They will help localize trouble.

THE experienced television service technician makes his initial diagnosis of trouble symptoms from inspection of the defects which are evident in the picture and in the sound from the speaker. The accuracy of such an analysis saves considerable servicing time, whether at the bench or in the customer's home. Sometimes the evidence is such that it points directly to the source of trouble and hence often localizes the circuit which is at fault before the chassis is removed from the cabinet.

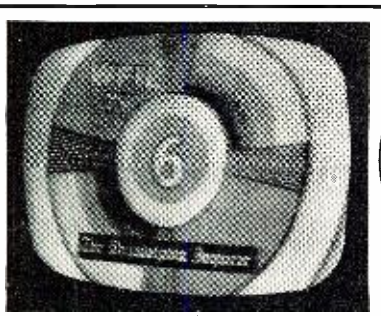
Symptoms caused by single troubles are easy to localize and consist of such defects as picture tearing, snow, ghost reception, and hum from the speaker. On occasion, however, more than one trouble might be in evidence and it is important to recognize each symptom which appears on the screen to save time during the repair procedure which follows after the chassis is out of the cabinet. Some of the more common *double troubles* of this sort are illustrated and discussed herein and will serve as a guide to stimulate closer observation of defects which appear on the screen of a defective receiver.

Pincushion and size. Fig. 1 shows a picture which has reduced width. In addition to this symptom, however, pincushion effect is noticeable at the right side and the other picture edges are not symmetrical. Pincushioning often occurs when a wide focus (cosine) yoke is employed in conjunction with cylindrical face-plate picture tubes such as the 21EP4, 21JP4, 21FP4, etc. The manufacturer provides a corrective device in the nature of two permanent magnets which are suspended from the yoke housing by flexible extension rods. The procedure for correction usually consists of reducing height and width sufficiently so that the raster or picture edges can be seen. The corrector magnets are then adjusted by moving them closer or farther away from the flare of the picture tube. When the four edges of the picture are straight, the height and width controls are re-adjusted to expand the picture to fill the mask.

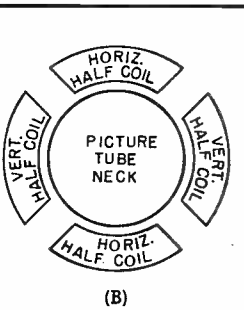
When the picture is shrunk as shown in Fig. 1 because of some fault in the horizontal sweep system, the corrector magnets can be adjusted to straighten the sides before servicing the horizontal section. If the pincushion effect were ignored and the picture restored to full size by correcting the fault in the horizontal system, the pincushion effect would not be noticeable and would probably be overlooked.

The reduced picture in Fig. 1 was caused by a defective width coil in the circuit also shown in Fig. 1. The

Fig. 2. The picture shown in (A) suffers from keystoning and poor definition. The keystone effect is due to shorted turns in the left-hand vertical deflection yoke coil shown in (B).

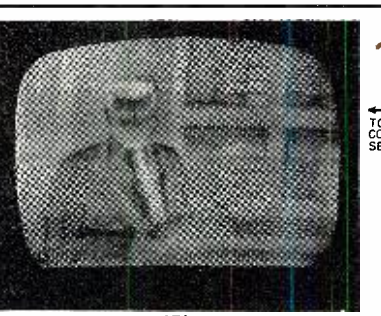


(A)

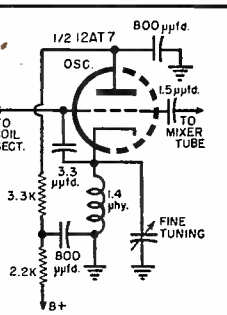


(B)

Fig. 3. Negative picture and decreased height shown in (A) are due to defective fine tuning control (B) and vertical output amplifier tube. The circuit is from a G-E 24C101.



(A)



(B)

reduced efficiency of the horizontal system lowered the voltage boost potential which, in this receiver, also applied "B" voltage to the vertical output tube. Hence the height was also affected to a slight degree.

Keystone and definition. Fig. 2A shows a picture with a slight keystone effect. In addition to this, however, the vertical wedges of the test pattern are obscure. The latter symptom indicates that the bandpass of either the tuner or the video i.f. stages (or both) is incorrect. Since the horizontal wedges are clear, it indicates that the focus is all right. Thus, in addition to correcting for the keystone effect at the left of the screen, the tuner tracking and video i.f. alignment should also be checked so that the bandpass can be widened to improve picture definition.

The slight keystone is caused by some shorted turns in the deflection yoke. As shown in Fig. 2B, the vertical deflection coil sections are at each side of the picture-tube neck and the horizontal coil sections are above and below the tube neck. This arrangement is necessary because the magnetic fields of a coil influence the electron beam at right angles and hence the vertical coil sections on each side of the tube sweep the beam from top to bottom. If the left vertical coil section has some shorted turns, it will cause the defect shown in Fig. 2A. The particular section of the yoke which causes keystoning is of academic interest only, since the usual practice is to replace the entire yoke when servicing the defect.

Tuner tracking and video i.f. alignment to correct for the obscure vertical wedges should only be undertaken by following the step-by-step procedures detailed in the service notes for the receiver in question. Such procedures have been established by the manufacturer as the most simple and accurate means of adjusting the receiver and hence should be followed carefully using the type of equipment recommended. An inferior sweep generator with a nonlinear sweep or an inaccurate marker may cause the alignment of the receiver to be poorer than it was originally.

If height and width are at an abnormal setting so that the picture is blown up above normal, a keystoned pattern will not be noticeable. Under this condition the service technician will try vainly to correct for proper vertical and horizontal linearity. In such an instance it is a good idea to check vertical and horizontal size and adjust the controls so that the picture is reduced in size. When this is done, such defects as keystoning and pincushioning are more readily in evidence.

Negative picture and height. Fig. 3A illustrates the double defect of a negative picture as well as a reduction in height. In such an instance it is advisable to adjust the height control to see if the lower portion of the picture can be made to fill the mask. If not, servicing of the vertical section is indicated as well as correction of the negative picture.

The negative picture shown in Fig. 3A was due to a defective fine tuning control, shown in Fig. 3B. The control had an open circuit condition which made it inoperative and the tuner could not be brought into proper resonance for the stations tuned in. The result was a video signal overload.

(A negative picture can also occur in a strong signal area when the heater of the video amplifier tube opens. In such an instance there is often sufficient tube capacity to transfer the strong signal through the defective stage. Since the tube does not amplify, there is no phase reversal across the tube and hence, a positive-going signal is applied to the grid of the picture tube instead of a negative-going signal. The result is a negative instead of a positive picture.)

The insufficient height in this receiver is caused by a defective vertical output amplifier tube.

Picture pull and sync loss. Fig. 4A shows a picture in which the vertical sync is unstable, causing the picture to roll. At the same time, there is an edge pull. The latter symptom is indicative of hum entering the horizontal sweep circuit. This condition can be caused by a cathode-heater short in one of the tubes. If a tube which handles the video signal is involved, it would cause a hum bar to appear since the hum reaching the grid of the picture tube will alternately darken a section of the screen. The lack of the hum bar in Fig. 4A, however, indicates that the defect is confined to the stages after the sync take-off point in the video amplifier.

The edge pull indicates the hum is entering the horizontal circuits, and the vertical roll indicates that the hum component is also entering the vertical system and affecting the sync because of the phase difference between the 60-cycle hum signal and the vertical sweep frequency. For this reason, the two symptoms point to the fact that the trouble must be confined to the sync separator and amplifier stages. In the receiver which produced the picture shown in Fig. 4A, a cathode-heater short existed in the 12SN7GT sync clipper tube, shown in Fig. 4B.

Foldover and focus. Fig. 6B shows severe foldover along the bottom section of the screen as well as poor focus.

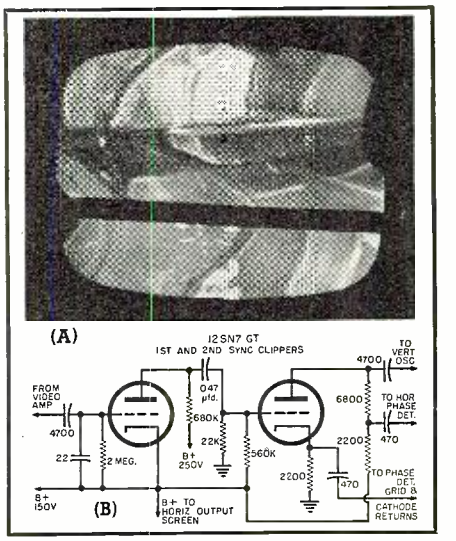


Fig. 4. Pulling at the edges and vertical roll shown in (A) were caused by cathode-heater leakage in sync clipper of (B).

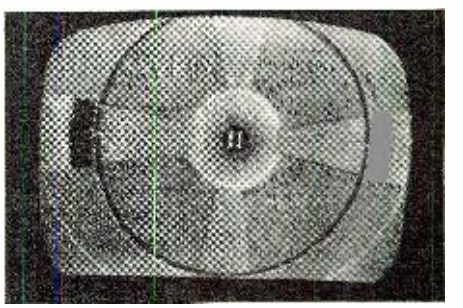


Fig. 5. This picture exhibits the twin symptoms of snow and incorrect vertical positioning due to separate troubles.

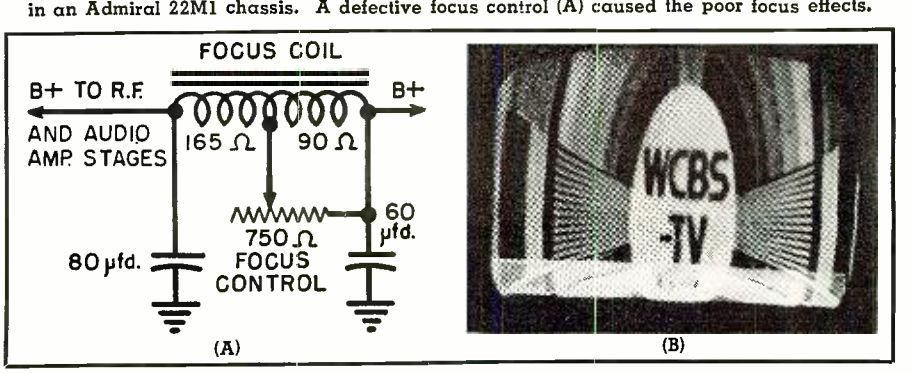
The poor focus is indicated by the obscure horizontal wedge. In a well-focused receiver, the horizontal wedge should be clearly defined to the center circle. The focus should not be affected by the trouble which causes the foldover.

The foldover condition was caused by a leaky coupling capacitor to the vertical output tube. When this was corrected, the poor focus was still in evidence and it was traced to a defective focus control potentiometer shown in Fig. 6A.

Snow and linearity. Fig. 5 shows two symptoms: pronounced snow and incorrect vertical positioning. In this instance there was no trouble in the

(*Continued on page* 147)

Fig. 6. The foldover shown in (B) was due to a leaky capacitor to the vertical output tube in an Admiral 22M1 chassis. A defective focus control (A) caused the poor focus effects.



Erasing Troubles in MAGNETIC RECORDERS

By **JAMES A. McROBERTS**

Practical hints for repairing the troubles that occur in the erase heads and circuits of tape recorders.

TAPE and wire recorders provide erasers for removal of the previous magnetic history of the wire or tape sound track. The history may be a prior recording or undesired magnetic orientation which would result in high noise during reproduction. Erasing is performed almost universally immediately before recording and simultaneously with recording for the latter reason. Troubles develop with erasers, which may be classified symptomatically as failure to erase, partial erasure, intermittent erasure, and unwanted erasure. The causes and cures of these symptoms will be treated in this article following a brief resumé of normal erasing.

Erasing Mechanisms

Erasing comprises two distinct steps although these steps merge into one operation in practice. First, the sound track is saturated with magnetic flux. Next, the movement of the tape away from the high flux density of the erasing gap allows the flux in the sound track to decrease steadily and uniformly. Erasing may be performed by a steady magnetic field (the so-called d.c. erase and bias) or by an alternating magnetic field at an ultrasonic rate (the a.c. field and bias). The same type of magnetic bias is employed as is used for erasing; d.c. bias goes with d.c. erase, and a.c. with a.c. D.C. erasure utilizes a permanent magnet or an electromagnet. The a.c. erase is furnished by a bias oscillator operating at an ultrasonic frequency (30 to 150 kc.)

The erase gap may be on its own magnetic structure or head, or may be separate. Fig. 1 shows a combination a.c. erase-record head. Note that bias current is used for erasing, and that part of the magnetic bias is supplied by leakage (magnetically) since the erase and bias windings are on the same magnetic structure or head. Note too, that the tape (or wire) is curved around the magnetic structure to assist in the maintenance of good contact in addition to that due to pressure pads when used. L_1 is the erase winding, L_2 is the bias coil, and L_3 is the recorder coil.

The erase coil may be on a separate head from the record coil. Also, mixing of bias and recorder currents may be realized prior to reaching the coil of the separate recording head. We consider troubles in erasing next, and take up complete failure to erase first.

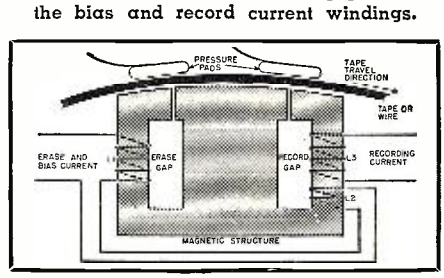
Erase Troubles

No erasure. Complete failure to erase results from lack of any appreciable magnetic flux across the erase gap. The result is recording of the new program on the old program as the direct symptom, with both at about the same volume in subsequent reproduction.

If permanent magnet erasing is used, the magnet may not be moved into contact with the tape or wire during record. The magnet may have lost its magnetism; test with a spring paper clip or other magnetic material. Do not use tools; only demagnetized tools must be used when working on recording heads. The pressure pad may have lost its ability to hold the tape or wire in contact with the magnet's gap. The magnet may have been removed and reversed as to polarity; try reversal.

An electromagnetic d.c. erase head may develop a defective coil. Test by inserting a milliammeter in series with jumpers if required; do not use an ohmmeter to check resistance as this may magnetize the head. Make certain to check all switches by shorting each one with a jumper and attempting to erase; if erasing is now accomplished, the switch is open.

Fig. 1. Cross sectional diagram of a typical combination record-erase head showing the magnet structure, gaps, and the bias and record current windings.



When a.c. erase is used, and it is faulty, check the pressure pads (if used) and switches as suggested previously. Also, the head may be open—do not test with an ohmmeter but use a neon tester as shown in Fig. 4 to check for voltage from the bias source and across the head. An alternative method is to employ a voltmeter with crystal probe in conjunction with a resistive voltage divider (about a 5 to 1 stepdown to prevent damaging the crystal), also shown in Fig. 4. Still another alternative is to break the circuit at "X" (see Fig. 4) and insert a resistor of about 1000 ohms across the break; the voltage drop across this resistor may be metered with crystal probe and voltmeter.

Dual-track heads with separate record and erase segments may have been turned upside down on replacement—check to see if the erase gap actually erases the right track.

The bias oscillator may be tested by measuring the grid bias of the oscillator tube. The output of the oscillator may be tested by any of the methods for measuring a high frequency voltage mentioned previously.

Imperfect or partial erasure. The entire width of the sound track and its thickness must be subjected to a magnetic field sufficiently intense to drive enough flux through the tape or wire to saturate it, otherwise only partial erasure will occur. The position of the tape against the erase head should be checked first whenever this symptom occurs. Two frequent causes are shown in Fig. 5, namely, the tape is not held in contact with the gap over its entire width due to the pressure pad being non-parallel to the gap (Fig. 5A), and the case of the worn guide causing the tape to drop a little so that the sound track may not be covered completely by the erase gap (Fig. 5B). The first case may be corrected by reforming the pressure pad or its arm. The second may require a new guide or cover—check the gap for excessive wear, maybe a new head is needed too. A piece of brass shim may be soldered to the shield to act as a guide for a temporary repair.

The erase gap may be partially filled with some magnetic material from the wire or tape so that the flux is short-circuited, reducing the amount of flux

through the wire or tape. Also, some erase heads have a back gap and it, too, must be clean to prevent improper erasing. Removal of this magnetic material (oxide of iron from the tape coating or scrapings from a wire) may be accomplished with a toothpick. A better instrument is a small piece of feeler stock which has been shaped to a point slightly less than .005 to .01 inch for most erase heads. The piece of feeler stock must be demagnetized and free from sharp burrs. Work under a magnifying glass with plenty of light when gouging out material from the gap—and above all, be very careful that you do not pit the magnet pieces. Very hard compactions of oxide may be softened with carbon tetrachloride used sparingly and applied with a sharpened toothpick.

A badly worn erase gap (the oxide on the tape coating is an abrasive) will so lengthen the gap with resultant opposition to magnetic flux that the sound track may not be saturated. Fig. 6 shows the effects of wear on the gap and pole pieces.

A misaligned erase head will also yield partial erasure. To correct this fault, loosen the screws holding down the erase head and set the head so that the erase gap is perpendicular to the tape where it makes contact with it. Use a magnifying glass during this operation. Tighten the screws holding the head. On those machines in which one head is used for both erasing and recording, with individual segments for each function (see Fig. 3), check to make certain that both the erase gap and the record gap are perpendicular to the tape. Some readjustment of the drive or pressure roller may be necessary to effect this.

Actually, a misaligned erase head will also result in low volume in recording and loss of high frequencies during playback on those machines in which the erase lamination is part of a single head which also contains the record-playback lamination. Although the method outlined previously for correcting a misaligned head will do the trick, a more exact method will be useful.

Use a reel of head alignment tape containing a steady, one-frequency note of about 7000 cycles per second. (A 5000 cps note will be sufficient for the lower-priced machines; a 10,000 cycle note can be used for the professional type instrument.) Set the recorder at playback and connect a vacuum tube voltmeter across the speaker voice coil or output of the amplifier. Slowly rock or turn the head back and forth relative to the test tape running past the head until a maximum reading is obtained on the voltmeter. At this point, tighten the screws holding the head in position.

A satisfactory alignment can also be made using a reel of recorded tape. Merely adjust the head so that the music on the tape comes across with the highest volume.

Insufficient output of the bias oscillator yielding insufficient flux will result in partial erasure and bad recording too. Test with the voltmeter as shown in Fig. 4, or by measurement of the grid bias of the oscillator tube. Poor output of the bias oscillator will manifest itself as both poor erase and poor recording. Poor erase but good recording should lead the troubleshooter to suspect the erase head.

The series test resistor of Fig. 4 may be used to check the current flow if known, by using Ohm's law and observing that the applied voltage will be less across the heads so that the total current will be less due to the added resistance. The amount of the drop will be about 20 per-cent for a 1000-ohm resistor at 100 kc. and more at lower frequencies of the bias oscillator. The presence of numerous shorted turns may be found by this method. A few shorted turns will not be indicated but the symptom of low erase with good recording (meaning proper bias) will point to the erase head.

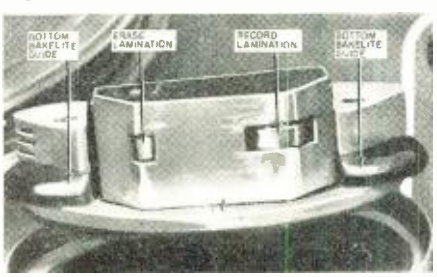
For a d.c. erase head, the pull test with a spring clip or other magnetic material is rather crude but is the only cheap substitute for a fluxmeter or replacement of the permanent magnet or electromagnet. A milliammeter may be used to measure the current through such a coil and the reading may be compared to that for a good recorder or the manufacturer's data.

Intermittent erasure. Any of the causes of partial erasure or total failure to erase may be reasons for intermittent erasing. The grid of the bias oscillator should be monitored with a voltmeter, a neon tester should be placed across the recording head, and a toothpick can be held against a pressure pad to detect wobbles or intermittent contact of the pad. The same toothpick can be used to shim the tape up or down to detect irregularities in its contact with the head.

Unwanted erasure. Unwanted erasure is relatively easy to find. A magnet may stay in position during pickup or playback, or a bias oscillator (separate bias oscillator types) may keep running due to failure of the switch to open the circuit. Many machines have special interlocks so that erasing can not happen during playback, however, interlocks fail and visual inspection will find the trouble rather easily. —30—

Fig. 2. Leads from an erase circuit to erase lamination in combination head need not be disconnected for testing. Merely unscrew head and tilt it back.

Fig. 3. Front view of combination record-erase head similar to that of Fig. 1. Erase segment is at the left.



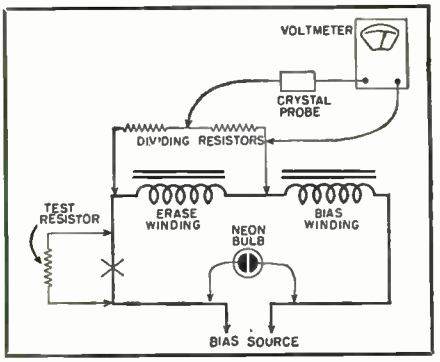


Fig. 4. Test methods for checking the erase and bias oscillator voltages.

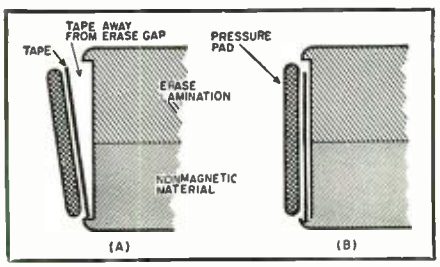


Fig. 5. Two causes of partial erase of tape. (A) shows a misaligned pressure pad; (B) shows a worn groove on the bottom guide with the result that the upper sound track of the tape (double track recording) is not completely in line with the erase lamination or gap.

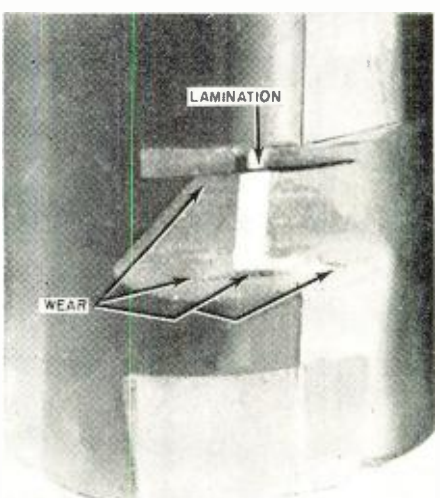
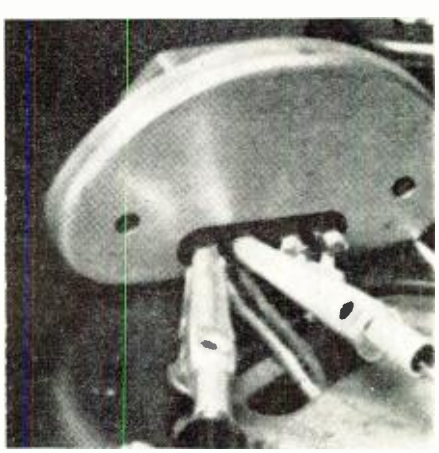
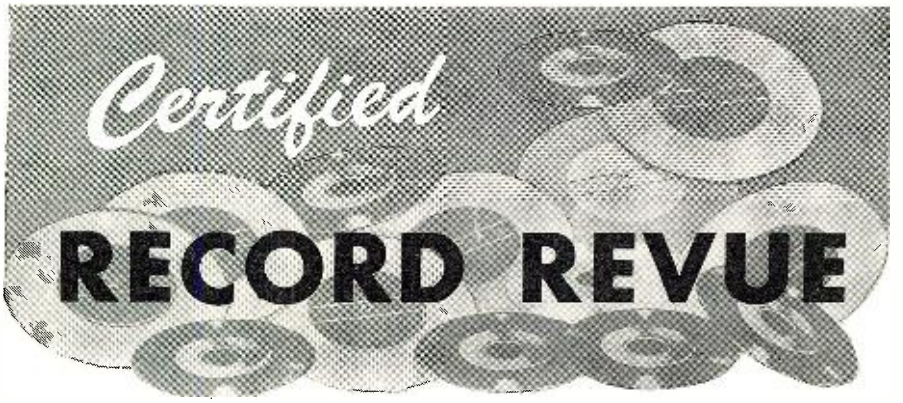


Fig. 6. Front view of an erase head showing the deep wear at erase gap as observed under magnifying glass.





By **BERT WHYTE**

THE record industry is certainly full of turmoil these days. The price war (if it can be called that) continues unabated. Some companies who bravely defied *RCA, Columbia,* and *London* by maintaining the old $5.95 price, have had to modify their stand and join the cut-price parade. As I predicted last month, slumping sales figures of the "holdouts" are gradually forcing them into line. As I write this, there are still quite a few record companies who seem grimly determined to stand by the old price. I really feel sorry for them, because it is a pretty hopeless battle. This "holdout" situation is having other effects. For one thing, many records scheduled for release are being held back, while production costs are being re-evaluated, and "reappraisals" on pricing occupy the attention of sales directors.

In the midst of the price uproar, a totally unexpected development startled the record world. The great *EMI Company* of England (*Angel Records* in this country) bought *Capitol Records* for a reported $8,000,000. Insiders say that the desire of *EMI* for a "pop" catalogue in this country led to the acquisition. This "merger" poses some interesting questions. Will the classical affiliations of *Capitol Records* continue to record under that label, or will they too become a part of *Angel Records?* Or will they be abandoned? The case of Italian opera recordings on the *Cetra* label is slightly fantastic. Mr. Dario Soria, astute mentor of the *Cetra-Soria* label, sold out to *Capitol Records* a few years ago. Then Mr. Soria became president of *Angel Records* in this country, and now the *Cetra* recordings have come full circle and are back in the fold and presumably, under Mr. Soria's direction! You just can't keep up with the wheeling and dealing in this record industry!

The discount houses in New York are in the midst of a real cat and dog fight and some of the prices on records are fabulous. You can get almost any of the major labels for as little at $2.50, and some of the smaller labels are going for $1.50-$1.98! Presumably the same thing is happening in other urban centers, so once again, I'll try to get in as many reviews as possible, to help you in your buying. And once more, let me caution you to check prices carefully, especially if you are buying from a non-discount type of store. I *think* the prices given here are correct, but things change so swiftly they may be wrong.

Equipment used this month: *Weathers* arm, oscillator, and cartridge; *Components Corporation* turntable; *McIntosh* C108P preamp, two 30-watt *McIntosh* amplifiers; *Jensen* tri-axial speaker in *Karlson* enclosure; *Electro-Voice* "Georgian" speaker. Tape equipment: *Ampex* 600 for monaural. *Ampex* three-channel for stereophonic.

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 publisher of this magazine.

NIELSEN

SYMPHONY #5
MASKARADE OVERTURE

Danish State Radio Symphony Orchestra conducted by Thomas Jensen. London LL1143. RIAA curve. Price $3.98.

CONCERTO FOR FLUTE AND ORCHESTRA

Danish State Radio Symphony Orchestra conducted by Thomas Jensen.

CONCERTO FOR CLARINET AND ORCHESTRA

Danish State Radio Symphony Orchestra conducted by Mogens Woldike. London LL1124. RIAA curve. Price $3.98.

THREE MOTETS

Danish State Radio Madrigal Choir conducted by Mogens Woldike.

COMMOTIO

Georg Fjelrad, organist. London LL-1030. RIAA curve. Price $3.98.

EXCERPTS FROM MASKARADE

Danish State Radio Symphony Orchestra conducted by Thomas Jensen. London LD9156. RIAA Curve. Price $2.98.

This month *London* unleashes a veritable flood of new recordings by the modern Danish composer, Carl Nielsen. London has championed this composer's works before and rightly so, for this is certainly one of the major talents in 20th century music. Before heart failure killed him in 1931, Nielsen had built up a formidable reputation in Europe as a symphonist. The earlier recordings of his 1st and 3rd symphonies on *London* and his 6th on the *Mercury* label, were well received in this country, and this appreciation of his genius has prompted this magnum issue.

In the short space of this review, I cannot go into a detailed analysis of these works. And in fact if I had the space, I'm not at all certain it would be a good idea. For this is very personal music that requires subjective listening, and your own particular philosophic concepts. I am referring here more to the 5th symphony than the other works. All of Nielsen's symphonies have had "programs" ascribed to them, partly through the composer himself (many of his symphonies have titles) but mostly through the agencies of other minds. In this Nielsen might be likened to Mahler. However, there the resemblance ends. . . . Mahler's works clearly show his obligations to Beethoven and Wagner. Nielsen's symphonies are among the least derivative ever written. It is as if he had never heard a symphony, before he himself wrote one. The 5th symphony is in two huge movements, and within that framework Nielsen has composed music that has no counterpart for sheer overwhelming power. After the eerie and mysterious opening and a dark-hued developmental section, about half way through the first movement a side drum begins a savage and insistent beat. Strings and brass take up a sonorous counterpoint along with a repetitive figure for high woodwinds. Together this builds and builds to one of the most awe-inspiring outpourings of sound ever recorded. Quite possibly this represents about the maximum dynamic range it is now technically feasible to record. The first movement ends quietly, but once again power asserts itself in the second movement. Here a slow and a fast fugue are orchestrated to a climax of terrifying proportions . . . an enormous burst of musical energy that leaves an indelible imprint on the listener.

The flute and clarinet concertos are typical of this composer. Completely unlike anything you may have heard for these instruments, they combine grace and wit with some astringent, perhaps even acrid writing. The side drum plays an important part in the clarinet concerto, as it does in many other Nielsen works.

The "Three Motets" are remarkable for the polyphonic purity of their construction, harking back to the 16th century. In fact, in the third motet there is a direct quotation from Palestrina. In spite of this, the music is still essentially modern in concept and could only have been written by a 20th century composer. The choral work is utterly beautiful and the balance is so fantastically good, that when it is heard through two speakers, the effect is almost stereophonic. "Commotio" was one of Nielsen's last works and it is interesting to hear his ideas on organ composition. Nielsen believed that much latter day writing for the organ was vulgar, because it was imitative. The composers were trying to make the organ sound like an orchestra. Nielsen based "Commotio" on the structural strength of a Bach "Toccata," and it is thus . . . from the opening fantasia to the closing fugue and coda.

"Maskarade" was Nielsen's contribution to comic opera, and the gay sparkling music of these excerpts is in marked contrast to the other works. The "Maskarade" overture is included with the 5th symphony to fill out the disc and is repeated on the ten inch disc of excerpts. Throughout all of these works, the sound is magnificent. As has already been noted with the 5th symphony, dynamics are very wide indeed. The same applies to frequency response and generally low distortion content. String tone was particularly good and Nielsen's beloved woodwinds are reproduced with fine intonation and "liveness." The percussion, especially the all-important snare drum, is remarkably clean and accurate. There are a few pedal notes in "Commotio" that hi-fi fans will find rewarding. All in all, one of the most significant issues in recent months, and one which should command the attention of the more serious music lover. Nielsen's music is a unique experience, and while it may take some acclimatization, it is well worth the effort. The RIAA curve was generally better with a little bass boost. Surfaces were good.

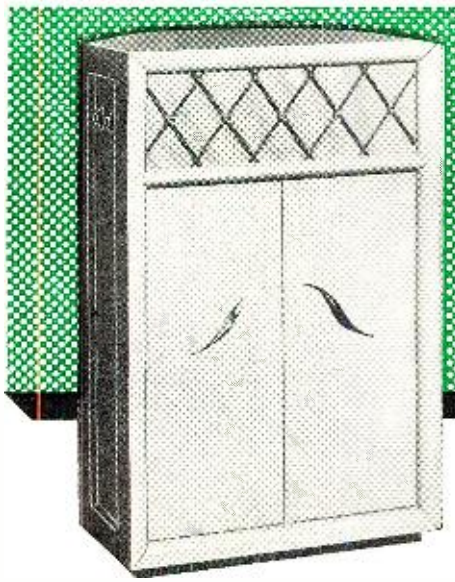
FURTHER STUDIES IN HIGH FIDELITY

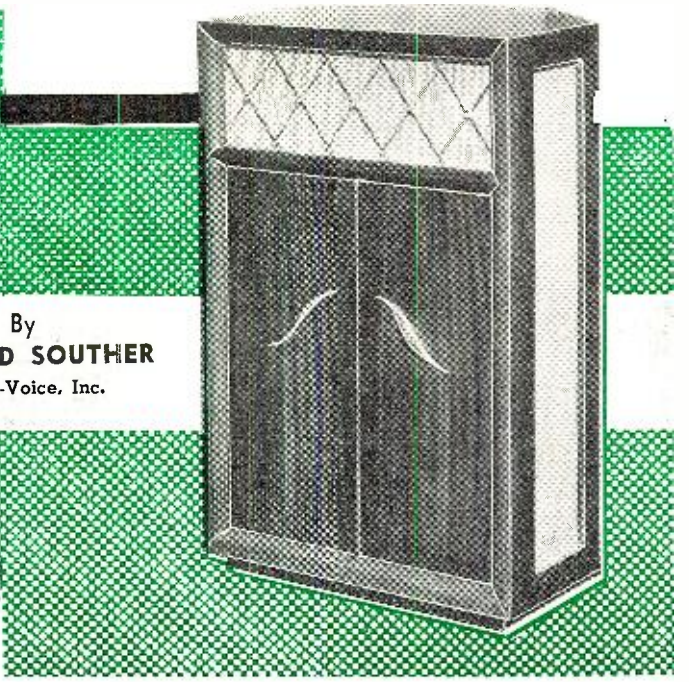
Capitol SAL9027. RIAA Curve. Price $4.98.

This is the successor to "A Study in High Fidelity," which has been a best-seller for *Capitol.* More or less on the same format as the previous album, this is all musical in content, one side being devoted to "pop" material, and the other to classical. Most of the material is excerpted from previously released albums, with two notable exceptions. "La Bomba" was especially written for the "pop" side, and the third movement of Carlos Chavez's "Toccata for Percussion" was especially recorded for the classical side. These two are worth the price of admission. The recording in both cases is close-up and the

(*Continued on page* 113)

THE "GEORGIAN"





By
HOWARD SOUTHER
Electro-Voice, Inc.

Complete details on the theory and construction of the Electro-Voice loudspeaker system which utilizes the Klipsch "K" type of indirect radiator for the extreme bass range.

THE complete illusion of reality in music reproduction demands that full consideration be given to the generation of the widest frequency response range possible in the speaker system. This must be accomplished uniformly and with reasonable efficiency for reasons of practical economy; the distortion which accompanies this wide response range must be retained below the threshold of the individual's perception. The intermodulation distortion threshold is on the order of 3%.

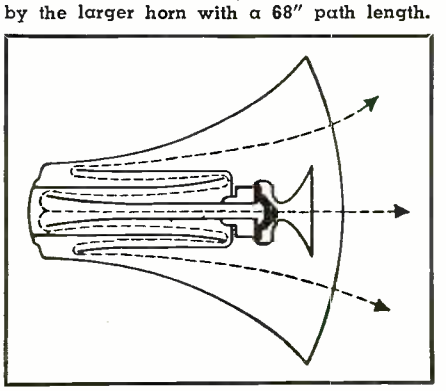
The "Georgian" utilizes the famous *Klipsch* "K" horn with the special *E-V* Model 15WK driver in the bass section. An electrical network makes the first crossover at 300 cps to a compression type, horn-loaded, mid-low frequency driver with 68" path length. From 1000 to 3500 cps, a special *E-V* diffraction horn, through an acoustical crossover, gives smooth, augmented treble tones. These last two assemblies are coaxially combined in the Model 848HF unit as shown in Fig. 1. Above 3500 cps, the *E-V* "Super Sonax" very-high-frequency driver takes over to provide the extended high frequencies out to and beyond the range of audibility. This multiplicity of crossover points and the specially designed crossover network permits a smooth transition from one section of the spectrum to another. Besides, the "Georgian" is the first loudspeaker system ever to incorporate a "presence" control as well as a "brilliance" control.

The construction of the "Georgian" is arduous and time-consuming, but the results are commensurate with the effort. The factory-built product sells for just under $500.00 but the home-built system can be fabricated, complete with drivers, for about one-half this amount. The character of the sound delivered is totally different from that heard in prior systems, due principally to the fact that all driving components are compression operated. This feature provides hitherto unobtainable efficiency. Efficiency, in a way, is a criterion of speaker excellence, for a system which is 100% efficient possesses little distortion and approaches perfection itself.

Interior Assembly or "K" Horn

For the novice at woodworking it will be better, perhaps, to consider using hardwood plyboard for the construction of the rather complicated bass horn. Sanding the cut edges smooth will be facilitated and a misdirected nail will have less tendency to split the ½" sections. To insure a complete understanding of the construction and also to acquire approximate templates, it is recommended that the pieces be laid out (Fig. 2) to scale on large sheets of corrugated cardboard. Allowing for a difference in thickness of ¼", these sections may then be put together with gummed tape, insuring a saving by minimizing miscuts of the the expensive lumber.

Fig. 1. Cross-sectional view of the E-V 848F compound coaxial midrange assembly, showing how the frequencies above 1000 cps are propagated from one side of the diaphragm through the smaller diffraction horn, and how the lower frequencies are loaded by the larger horn with a 68" path length.



After this has been accomplished, use the templates as a guide and lay them on top of the 4' x 8' plyboard sheets so that the least waste is effected. After checking measurements carefully, draw in the outline of the various piece parts and saw them out completely before attempting any assembly whatsoever.

Sand all edges. All mating edges should be sawed as straight as possible and then sanded smooth. This will guarantee a tight fit and prevent air leaks in the final horn. A tight fit is especially necessary in the case of the two critical cavities leading to the back of the driver cone.

Step No. 1: Assemble first the top and bottom units, details 7 and 8, to which are attached the wedge-shaped horn surfaces. (Drawing reference F —details 18, 19, and 22.) By sawing the compound angles after assembly, a proper fit later will be assured. Use either "Weldwood" or "Woodlock" glue and when nailing together as specified, make certain that the glue oozes out uniformly from the joints as the pieces are butted together. Assemble the two sides (details 2 and 3) to the top and bottom sub-assemblies, making certain that side detail 2 is on the left side of the unit when looking at the front.

Step No. 2: Form the two side channel sub-assemblies, shaped like boom-

(*Continued on page* 62)

Fig. 2. Mechanical details of the various piece parts required in the construction of the Electro-Voice "Georgian".

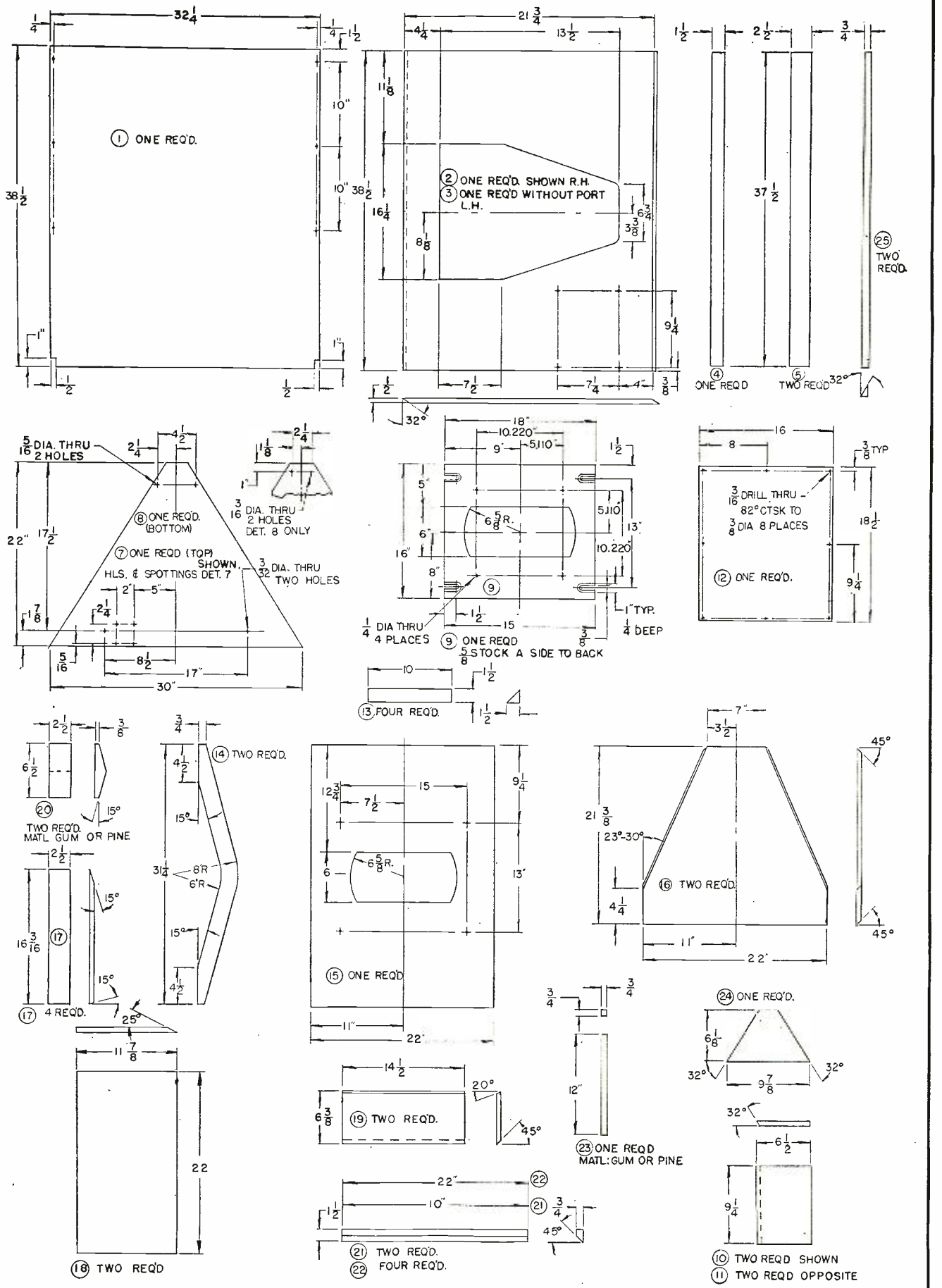
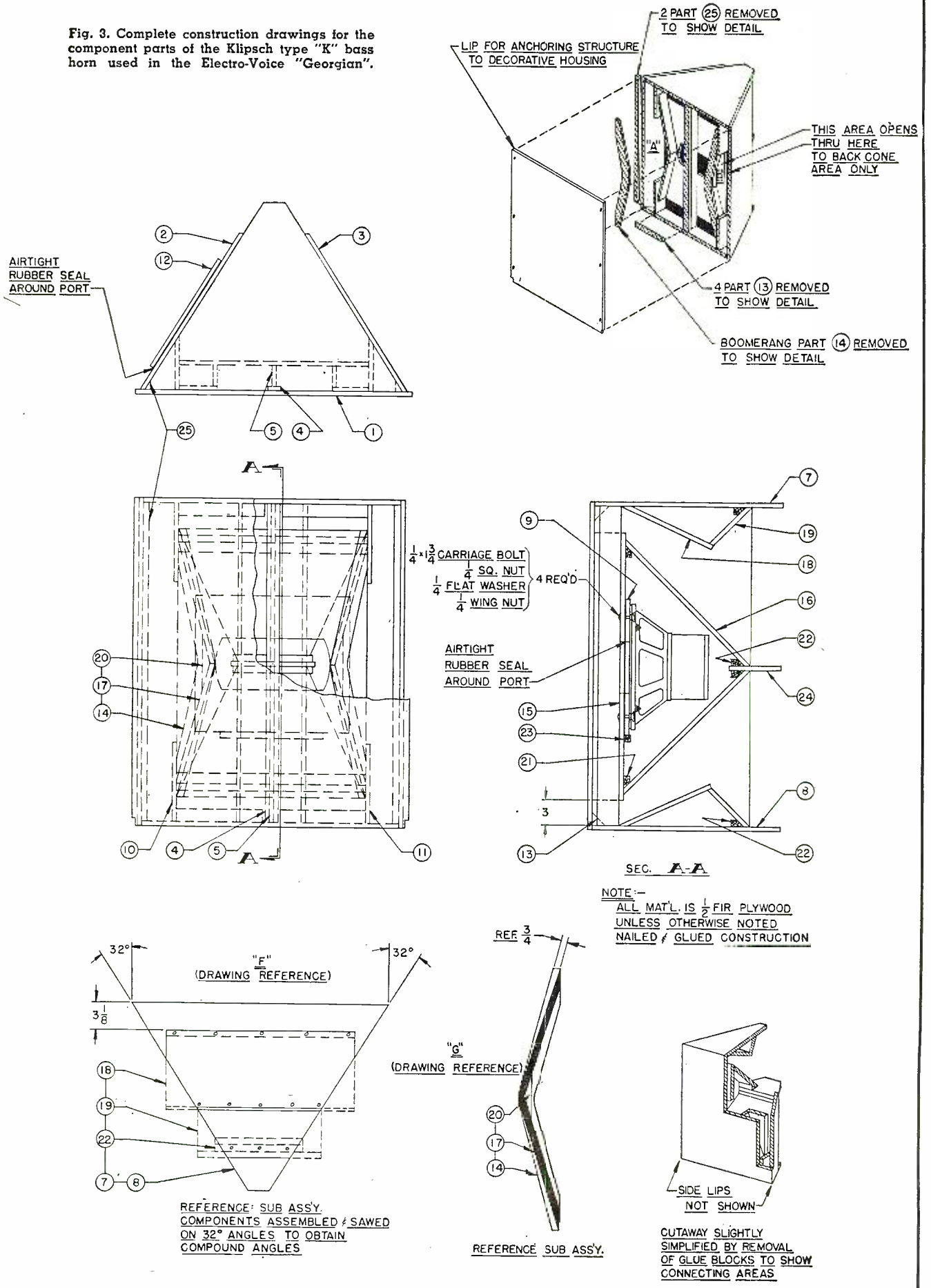


Fig. 3. Complete construction drawings for the component parts of the Klipsch type "K" bass horn used in the Electro-Voice "Georgian".



erangs, which constitute part of the throat section. (See G—details 14, 17, and 20.) Fix these in position on the front sub-panel, detail 15, and fabricate the remainder of the throat section by adding details 4, 9, 10, and 11. Fill all crevices with a generous application of glue. Before going further, double check these joints, as they will soon become inaccessible.

Step No. 3: Now carefully sand and recheck for smoothness the edges of the sloping boards and wedges which form part of the rear compartment of the 15WK very-low-frequency driver. (Details 16, 21, 22, and 24.) Assemble these parts to the back of detail 15. Insert this assembly into the previously formed outer assembly consisting of sides, top, and bottom.

Step No. 4: Now apply the two triangular fillets (detail 25) on the forward edges of details 2 and 3. These are used to strengthen and support the front board. All surfaces must be flush across the front of the bass horn before applying detail 1, the front board. This is the most difficult operation in the entire construction because it is hard to see after applying the front board whether there are leaks due to mismating of the surfaces. Add wedges, detail 13. *Do not mount the front board yet.*

Step No. 5: The hardware should be inserted which will allow the 15WK mounting board to be clamped into position. Detail 23 is a guide runner to facilitate insertion of the 15WK on its mounting board. This is not absolutely necessary. The carriage bolts should be staked into the back to prevent their coming out later and falling down into the interior should the driver need servicing. Carefully glue and nail on the front (detail 1) making certain that all surfaces mate perfectly and that sufficient glue is used to insure an absolute air-tight seal of all joints.

Step No. 6: The bass enclosure is now complete except for testing. Make a duplicate of the cover or door for the low-frequency driver, detail 12, and also a duplicate of the 15WK mounting board, detail 9. In detail 12 provide a valve or seal so that air may be forced into the interior and then sealed off. Provide also a "U" shaped piece of glass tubing inserted through another hole in this board and seal off with wood dough, clay, or putty. Duplicate detail 9 should be solid, without the throat opening, but with a rubber gasket as shown. Place water in the "U" shaped tube and force air into the 15WK back chamber until the water rises an inch or so in the glass tube. Remove the air pressure and seal off the inlet. The water should remain elevated in the tube a minimum of five seconds. If the fall of the water is more rapid than this, check for leaks with a flashlight on the interior and with a helper outside to observe the cracks. Paint the bass horn flat black if a decorative shell is to be used so that the horn will not show through grille cloth. (*Continued on page* 94)

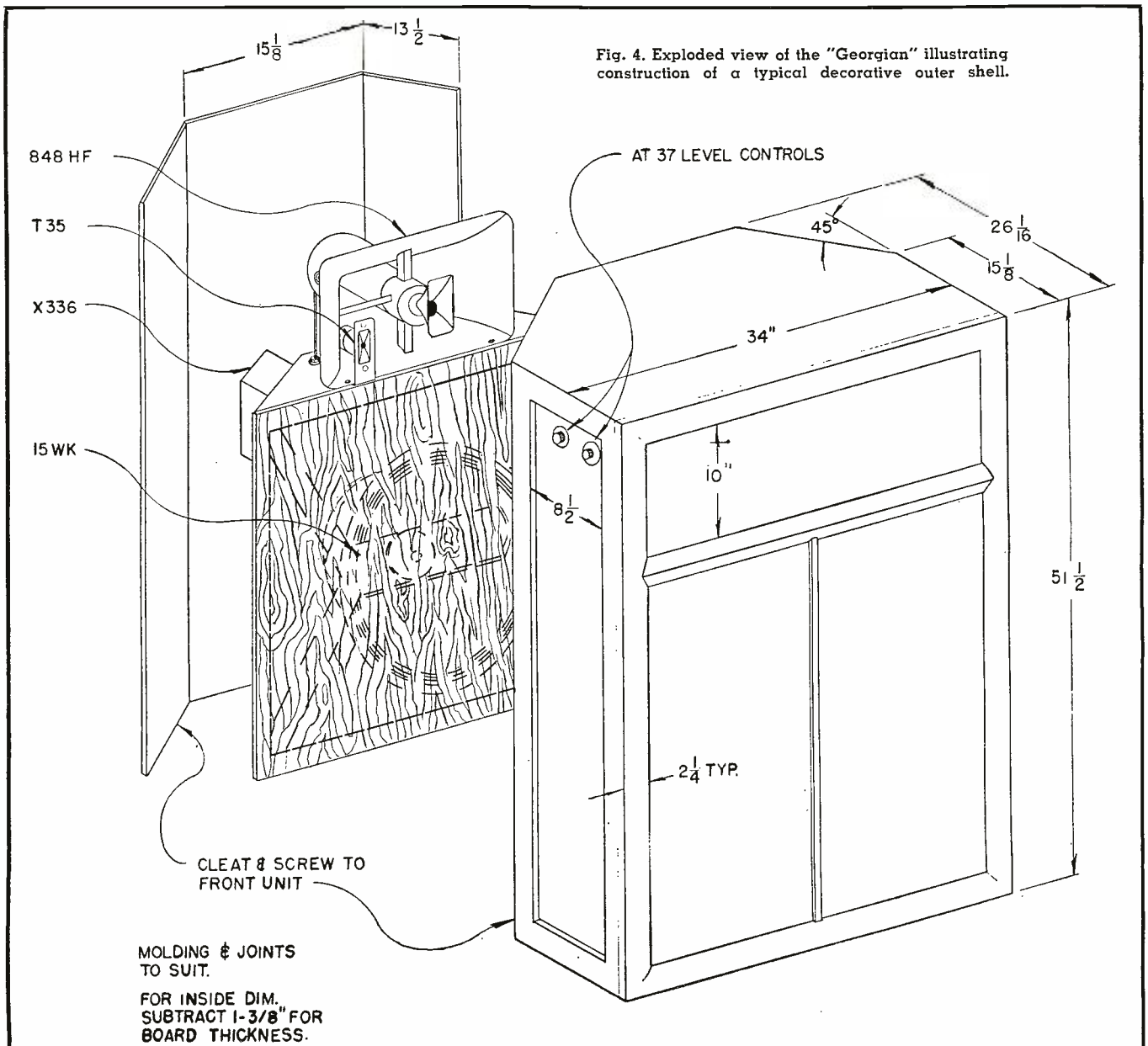


Fig. 4. Exploded view of the "Georgian" illustrating construction of a typical decorative outer shell.

RECORDED "ECHO" ADDS REALISM TO MUSIC

By **JACK THORNTON**

Fig. 1. The actual wiring has been replaced by white cords for purposes of illustration. Additional pickup is seen above regular heads. Steel spring under a head mounting bolt holds the extra head in place. See article.

Your home tape recorder can, with slight adjustment, be used to provide interesting and dramatic "sound effects."

A HOME-TYPE tape recorder can open new fields for school and civic musical programs: cathedral-like acoustical effects from a small chorus . . . ethereal solo voices . . . dramatic orchestral performances. Professional "production numbers" can be staged with minimum sound equipment. Although the tape recorder brought inexpensive recording to groups and individuals, few realize the machine's possibilities in creating—not recordings—but special musical effects. Outlined here is one such effect which, with its many possible variations, will give the amateur producer something unique for stage, radio, or athletic field programs.

Basically the tape machine is used to cause additional controlled "liveness," or "brilliance." This may be slight, or may approach an actual echo or reverberation. Thus a small chorus in a small auditorium seems to be singing in a great cathedral. A solo voice or instrument can rise celestially above a chorus or orchestra whose music is heard in normal acoustical perspective. A narrator's voice can reverberate dramatically. Experiments will show other applications in musical shows as well as in vocal echo chamber effects for plays and programs.

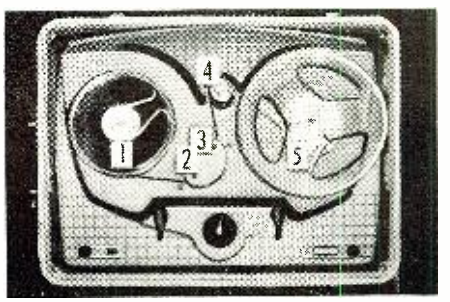
Principally, you'll need a tape recorder and an amplifier. The amplifier may be a public address system unit or almost any other capable of operating a loudspeaker from microphones. It must have two separate microphone input channels; they may be either high or low impedance. The tape recorder must meet several requirements. Refer to Fig. 2 for an illustration of one general type machine. Note that the tape leaves the supply reel (1) at left. It passes over the erasing head (2) which removes the previous magnetic patterns. Next the tape crosses the recording head (3) then moves over a "capstan"—or wheel —(4) which pulls the tape along and determines its speed of travel. The take-up reel (5) stores the tape for rewinding and playback. On playback the tape travels the same path but with the erase head idle and the recording head becoming a playback pickup. (The erasing head and recording head may be mounted in a single housing, but a close examination of the surface over which the tape moves will show two separate heads contacting the tape.) The same amplifier within the machine serves in turn as recording driver and playback amplifier.

For the special effects to be described a tape recorder must have an additional head, making three in all: erase, recording, and a *separate* playback. Some of the more expensive machines already have this arrangement. If your machine is of this type you may bypass the next four paragraphs which deal with adding an auxiliary head to other machines.

Referring again to Fig. 2 you'll see the tape is exposed along its path of travel from the recording-playback head to the capstan and take-up reel. This is necessary in adding the extra head. In many machines the tape is readily accessible. In others it may be exposed by removing a metal housing. With a few machines the tape runs in a slot which is an integral part of the recorder's top surface. This arrangement is not adaptable unless the tape is accessible from below, from inside the machine.

A further requirement demands that there be space between the machine's existing record-playback head and its drive capstan, or between the drive capstan and the take-up reel. About an inch-and-a-quarter to an inch-and-a-half space is needed, depending on the size of the extra head. Fig. 1 will give you an idea regarding the space required and the mounting of the additional head. It should not be more than two inches from the existing head for best results.

Fig. 2. A tape recorder of the type suitable for adaptation. The numbers on the photo are referred to in the text proper.



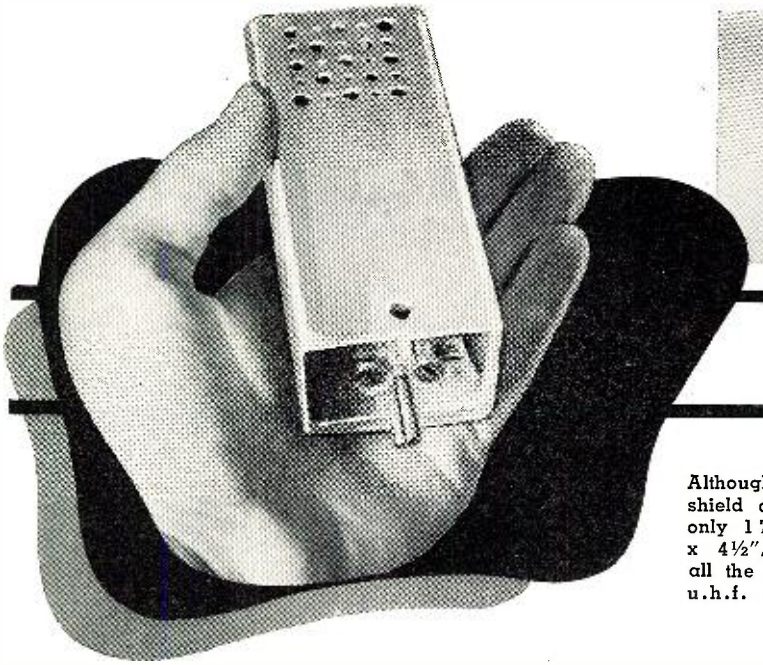
If your machine fills these requirements you're ready to proceed. The extra head should be a *single* one—playback only. A full-track model is preferred and of the smallest possible physical size. Before ordering, check the amplifier you plan to use as a part of this setup. Note whether it has high-impedance microphone inputs, or low-impedance. (A radio repair shop can clear any doubt about this.) Obtain a playback head to match the amplifier's microphone input impedance. Many makes and models in pickup heads are available. It is suggested that you outline your needs to a local radio technician. Usually he will have catalogues describing heads in some detail and often picturing them. In high-impedance design the full track unit for a *Concertone* machine is a possibility. *Brush* manufactures a pickup in low-impedance rating.

Mount the extra head about one-and-one-half to two inches past the existing record-playback head if possible. The additional head of the machine in Fig. 1 is clamped down with a steel spring held under one of the original-equipment head's mounting screws. If space is available, the extra head may be mounted with wing-bolts through a slot cut in the machine's top surface. This will allow adjustment of distance for best effect. Take care that the pole-pieces on the working surface of the head contact the tape squarely. Then to the electrical terminals on the head attach a shielded wire of the type used to connect a phonograph pickup with

(*Continued on page* 121)

A BASIC UNIT FOR 420 MC.

By E. J. GAUSS, WØEOS



Although this compact shield can measures only 1 7/16" x 1⅞" x 4½", it contains all the essentials for u.h.f. operations.

If you have been scared away from the wonderland of u.h.f. by the seeming complexity of the circuitry, this is for you. This unit can be used as a transmitter, receiver, transceiver, local oscillator, signal generator, or other u.h.f. gear.

THE wonderland of u.h.f. begins at 300 mc. with its pocket-sized antennas of high gain. Because vacuum tubes of conventional design as used in conventional circuits fail to function at these frequencies, special techniques must be adopted.

These techniques go by the nickname "plumbing." This word frightens away many would-be u.h.f. experimenters because it suggests machine shops rather than standard construction methods. A simply constructed unit that could serve as a basis for u.h.f. experimentation is what is really needed. If the would-be experimenter could use the same plumbing for both transmitting and receiving and still be able to use this plumbing when he tries something more advanced, he might be encouraged to work in the ultra-high frequencies. It is for this group of experimenters that the unit to be described was developed.

For the desired variety of circuit applications only the essential u.h.f. elements remain constant. The unit must contain these essential u.h.f. elements. All components entering into the u.h.f. phase of the circuit must be included while the d.c. and lower frequency elements should be external, subject to the whims or ideas of the experimenter.

For the essential circuit, a parallel line is placed in the plate circuit of a double triode with each plate driving one side of the line. The grids are tied together and a u.h.f. choke for power connection is provided. The heater and cathode have u.h.f. isolation from the exterior. The u.h.f. unit is then complete. (Fig. 1.) All one has to do is feed in the correct d.c. (or low-frequency quench in the case of a superregenerative receiver) and out comes the desired result. It is as simple as it sounds. The u.h.f. circuit proper is inside the unit, out of trouble and, hence, one can treat the unit with no more difficulty than one treats a standard circuit element. Indeed, it is convenient to think of the unit as one circuit element complete in itself.

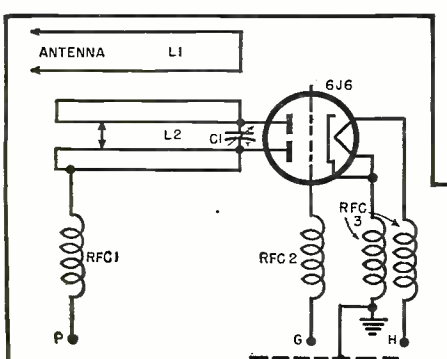


Fig. 1. Circuit of the basic unit as discussed by the author. When the circuit of Fig. 2A is added to this unit, transmitter operation is obtained. For receiver use, the circuit of Fig. 2B is added.

C_1—1.5-7 μμfd. ceramic trimmer capacitor
L_1—2" hairpin of #26 d.c.c. wire
L_2—Parallel line (See Fig. 3 and text)
RFC_1—20 t. #26 d.c.c. wound on ¼" form (See text)
RFC_2—22 t. #26 d.c.c. wound on ¼" form (See text)
RFC_3—Dual unit, 15 t. ea., two wires #26 d.c.c. interwound on ¼" form

As a transmitter or oscillator it performs quite well. Useful output has been obtained at frequencies as high as 548 mc. (with C_1 in Fig. 1 removed). For this higher limit, tube variation is noticeable. Some 6J6's oscillate at higher frequencies than others. In the amateur band, with its top at 450 mc., little trouble is encountered as it is far enough below the limit of oscillation. In the circuit suggested in Fig. 1, 0.3. to 0.4 watt of useful output can be obtained with a plate current of 25 ma. and a voltage of 150. A little output goes a long way at this frequency and it should be remembered that antenna gains of 20 db are not too hard to obtain.

As the described operation gives a plate dissipation of just short of four watts, continuous operation is not advised. For continued operation the plate voltage should be lowered to reduce the dissipation to below three watts. Even so, the unit behaves well in normal c.w. or push-to-talk telephony since the off periods allow the tube to cool down, keeping the average dissipation below the ideal maximum of three watts. For radiotelephone operation the transmitter should be plate modulated for best results. A single 6AQ5 or 6V6 will supply ample modulation. A choke works satisfactorily in place of a modulation transformer and may be a filter choke with a high enough (60 ma.) current rating.

As a receiver the unit lends itself to service as a superregenerative detector. It is suggested that an external quench coil should be used as shown in Fig. 2B. The quench frequency should be between 400 kc. and 4 mc. or about $\frac{1}{1000}$ to $\frac{1}{100}$ of the signal frequency. The detector is used like any other superregenerative receiver with the exception that antenna coupling is fixed and not variable.

As a test oscillator or as part of a transmitter of higher power the unit can be run continuously with 150 plate volts only with forced air cooling. The alternative is to use a lower voltage. At 100 volts the dissipation is about 1.5 watts but, of course, the output is down too.

The unit is constructed between two bulkheads in a standard shield can 1 7/16"x1⅞"x4½". The lower one is made from ¼-inch lucite and supports

the tuned line, the tuning screw, and the output hairpin. The upper bulkhead is made from sheet aluminum and supports the tube socket and the power terminals.

The line is made from two pieces of ¼-inch copper tube 2¼ inches long. One end of each is slotted with a hacksaw for about ½ inch. The tube is then squeezed back together with pliers, the joint soldered, and the inside tapped with a standard 8-32 tap. If a 10-32 tap is available, the tube diameter need not be reduced in this way. Similarly if rod rather than tube is used, it may be drilled and tapped in any convenient way.

The sliding contact is made from two small strips of phosphor bronze easily salvaged from the wiper contacts of a discarded broadcast tuning capacitor. The bronze wipers are sweat-soldered to a small bushing and the joint is reinforced with a few turns of copper wire. Fig. 3 offers a detailed view of the wiper and parallel line assembly. The wipers are bent so that they give positive contact on the copper tubes. An 8-32 two-inch screw is placed through the wiper assembly, a nut is screwed down tight enough to prevent excessive play but loose enough to permit free rotation of the screw, and the nut is soldered to keep it from working loose.

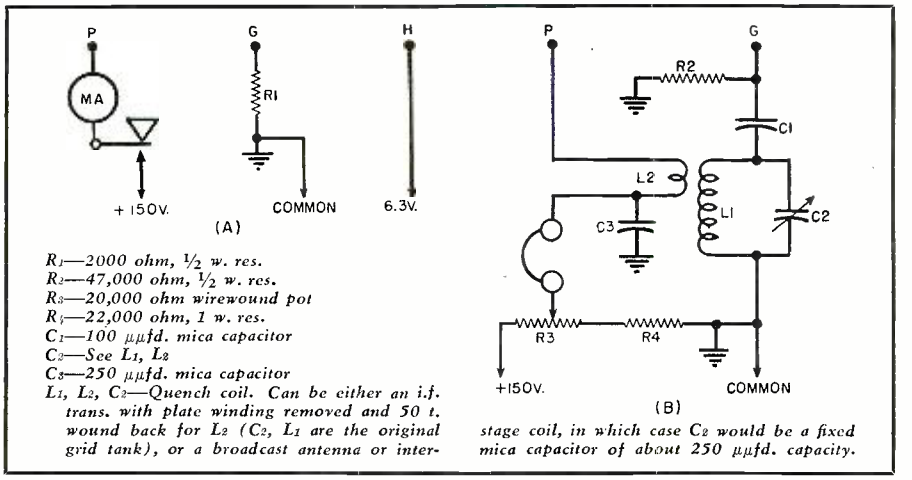
It is easier to solder the tube socket to the line before it is mounted on the bulkhead. Care must be taken to keep the soldering neat and symmetrical. Much u.h.f. energy can be lost through sharp burrs or excessive blobs of solder. The socket is then mounted on the metal bulkhead and the chokes are added. The most convenient way of making the chokes is to wind them on cellulose tape. This method was fully described in the author's article, "Make Your Own U.H.F. Chokes," May 1953 issue of RADIO & TELEVISION NEWS.

The loop assembly has three parts, *i.e.*, a piece of No. 26 d.c.c. wire, and two tube socket lugs. Suitable lugs can be obtained from a tube socket—loctal molded types offer a good source. These are placed in the drilled holes of the lucite bulkhead as shown in Fig. 4. The lugs are then heated with a soldering iron to force them the rest of the way through the plastic. The resulting terminals are straightened if necessary before the lucite cools and the loop is soldered on, care being taken not to force the lugs out of line.

The unit is then mounted in the can.

The best circuit for frequency determination is that shown in Fig. 2A. Lecher wires are attached to the loop terminals and a milliammeter is placed in the plate as indicated. Nodes are shown by variations in plate current rather than by the conventional light bulb. First, with the shield can removed, the tank capacitor (C_1, Fig. 1) is adjusted to bring the oscillator into the desired range. Then with the shield replaced the final measurements are made. It is important that in these final measurements the shield be left on as the frequency will be somewhat different with the shield removed. Important relationships to be remembered for the Lecher wire measurements are: 400 mc. =14¾"; 420 mc. = $14\frac{1}{32}$"; 450 mc. =13⅛"; and 500 mc. = $11\frac{13}{16}$".

The unit can be used as a transmitter, a receiver, a transceiver if you wish, a local oscillator, a signal generator, or what have you. With such a unit the door is opened for the serious u.h.f. experimenter. —30—



R_1—2000 ohm, ½ w. res.
R_2—47,000 ohm, ½ w. res.
R_3—20,000 ohm wirewound pot
R_4—22,000 ohm, 1 w. res.
C_1—100 μμfd. mica capacitor
C_2—See L_1, L_2
C_3—250 μμfd. mica capacitor
L_1, L_2, C_2—Quench coil. Can be either an i.f. trans. with plate winding removed and 50 t. wound back for L_2 (C_2, L_1 are the original grid tank), or a broadcast antenna or interstage coil, in which case C_2 would be a fixed mica capacitor of about 250 μμfd. capacity.

Fig. 2. (A) Circuitry to be added to the basic circuit of Fig. 1 to provide transmitter operation. (B) Quench circuit for receiver operation. For AM modulation of the transmitter, the modulation choke or transformer is used in place of the key. The receiver may be connected to an a.f. amplifier by replacing the headset with a plate-to-grid audio frequency transformer.

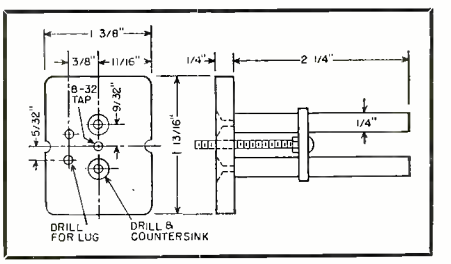


Fig. 3. Layout of the lucite bulkhead and the parallel line assembly used in unit.

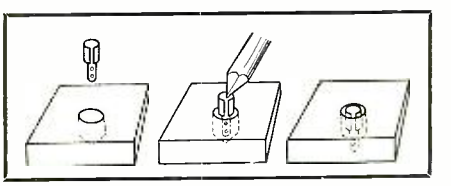
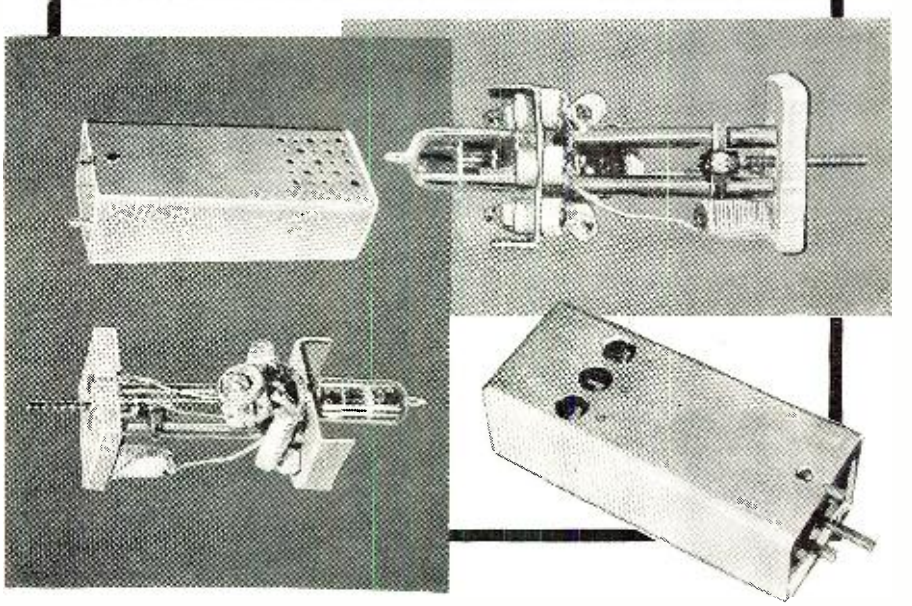


Fig. 4. Detail of method for mounting lugs for the antenna loop. The hole is drilled to a depth of 3/16" in the ¼" plastic. The hole diameter should be larger than the clip part of the lug allowing expansion when the plug is inserted. Refer to text.

Three views of the unit. Photograph at left is the disassembled view showing the tank capacitor, antenna loop, and ventilation holes drilled in shield. A hole is also drilled in the top to allow tube clearance. In the photo at top right details of the parallel line resonator and wiper contacts are shown. Feed-through insulators support the power terminals. In the bottom photo, the holes are drilled in the side of the shield can to allow access to the power terminals.



SERVICING ELECTRIC GUITARS

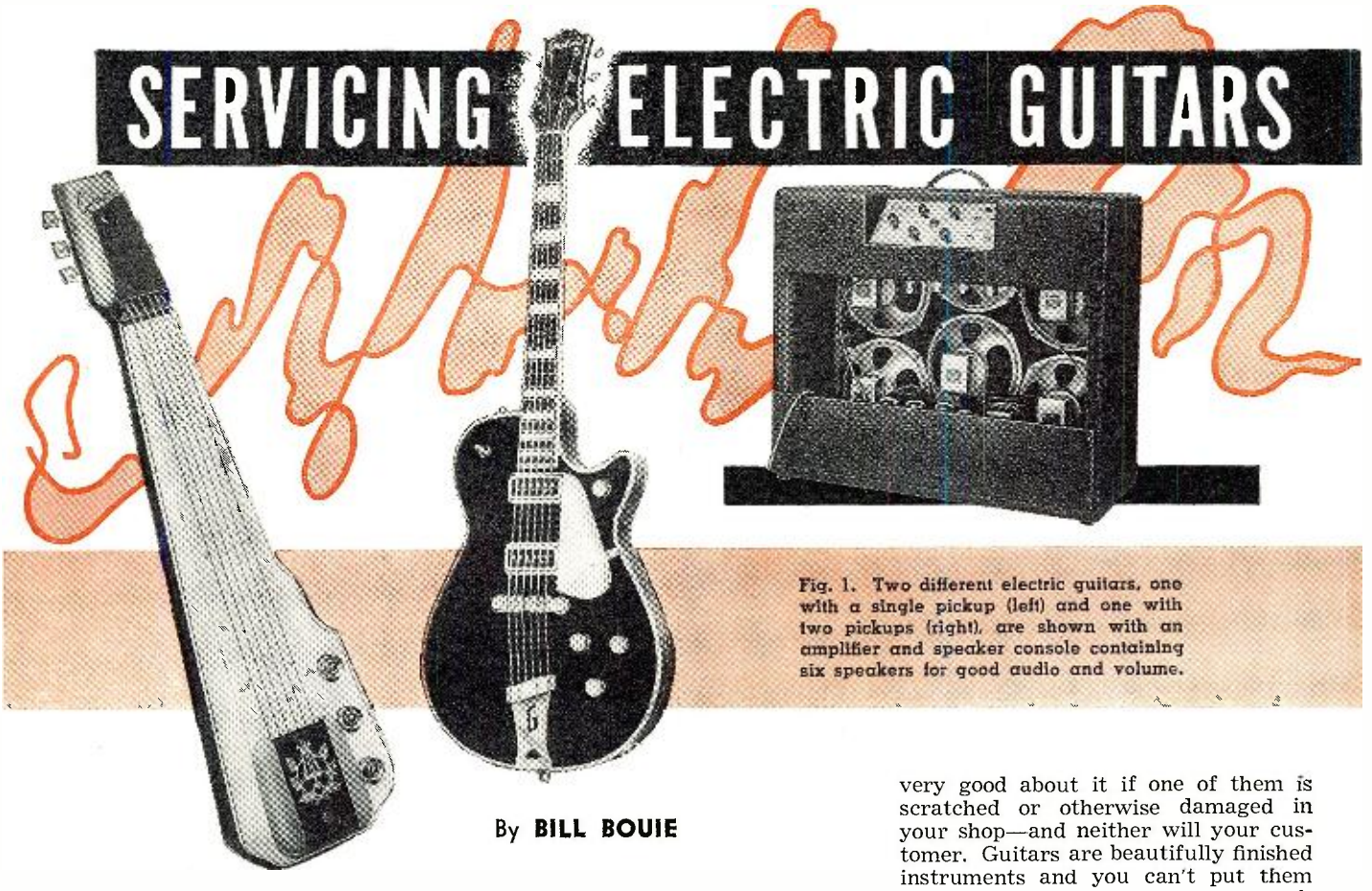


Fig. 1. Two different electric guitars, one with a single pickup (left) and one with two pickups (right), are shown with an amplifier and speaker console containing six speakers for good audio and volume.

By **BILL BOUIE**

Part 2. The electric guitar amplifier and pickup have a few peculiarities which can make their servicing a tough problem if you don't know the tricks given here.

LAST month's article discussed how most electric guitars operate, what frequently goes wrong with them, and what to ask the owner who brings one to your shop for servicing. This article will tell how to track down defects in guitar operation and how to cure specific troubles.

Equipment Required

The equipment required to service and repair these instruments is no different from what you commonly use. If your test rack contains a v. t. v. m., audio generator, oscilloscope, distortion analyzer, etc., which you normally use, fine, you can use them on electric guitars, too. But if your shop doesn't have this array of test apparatus, you can still do OK with a multitester, the 400-cycle (or other) audio signal from your r.f. generator, and a tube tester, together with some common sense.

While the following items are not test apparatus, they do come under the heading of equipment required. If you find your work on electric musical instruments warrants it, keep one or two spare amplifiers on hand for use as substitutes. Then when the customer brings in his amplifier for repair, he won't lose time off his job if you can't give it back to him the same day. You can lend him one of your spares to keep him working until his own equipment is ready. Your spare amplifiers should be 10- or 15-watt jobs working into a 10- or 15-inch speaker. Both amplifier and speaker should be housed in a neat-looking cabinet. The amplifiers used with electric guitars are usually in full sight of the public and a beat-up looking job would be an eyesore.

Make up two or three connecting cables and keep them handy in the shop. These should be made of standard microphone cable, about eight or 10 feet long, with a microphone plug at each end. You'll find them handy as substitutes when making preliminary tests. Also carry a small supply of the standard replaceable parts used in musicians' amplifiers. This will save you a couple of days of waiting for a replacement to come in from the parts distributor. You can't stock everything, but a little experience will tell you which parts to keep on hand for quick repairs.

There is one more item. A large, soft piece of thick cloth is required to place the guitar on when working on its circuits. An old army blanket will do very nicely, but keep it clean and free from bits of metal, screws, etc. As stated previously, electric guitars can be quite costly, and you won't feel very good about it if one of them is scratched or otherwise damaged in your shop—and neither will your customer. Guitars are beautifully finished instruments and you can't put them down just any old place on the work bench without scratching them.

Preliminary Tests

If it is not readily apparent which unit is at fault, a series of short preliminary tests will quickly isolate the defect to either the guitar, the amplifier, or the connecting patchcord. Make these tests while questioning the customer about the complaint.

Connect the amplifier to the power line and turn it on, assuming, of course, that conditions deem this feasible. Plug one end of the patchcord into the amplifier and tap the end of the free plug with your finger. A loud hum from the speaker indicates that the amplifier is passing a signal. If no hum is heard, the patchcord may have broken connections. Substitute a new patchcord, if one is available, or make a continuity test on the suspected cable with your ohmmeter. If the patchcord is OK, then the defect is in the amplifier.

To make a quick check on the pickup circuit, connect the guitar to a spare amplifier, or plug a headset into the output jack on the instrument. Striking the strings and manipulating the volume control will produce sounds if the pickup circuit is operating. If a headset is used, the unamplified sounds from the pickup will be quite weak, but a little experience will enable you to judge the general condition of the pickup circuit. No sound output indicates a defect in the pickup circuit, assuming that electric-type strings are used on the guitar.

Most of the troubles in the connect-

ing cable result from loose or broken connections at the plug terminals. Cut off the old leads and make a new set of connecting leads on the end of the cable. Don't use the twisted end of the shield braid to connect directly to the plug. Instead, cut off the exposed braid to a length of about one-quarter inch, twist a couple of turns of solid hookup wire around the exposed braid and solder it in place. Connect the free end of the hookup wire to the ground terminal on the plug. The center conductor goes to the center terminal on the plug. See Fig. 2 for the proper way to connect the cable leads.

When replacing plugs, use the shielded metal microphone plug, instead of the kind with the Bakelite shell, to eliminate possible hum pickup. For cable replacements use standard single-conductor, shielded microphone cable.

Repairing the Pickup Circuit

Breakdowns in the pickup circuit in the guitar are rare occurrences. The most common defect encountered is a noisy remote volume control, caused by dirt and corrosion forming on the resistance element. Cleaning the control with a good cleaning liquid containing a lubricant will restore noise-free operation for an indefinite period, since the lubricant in the cleaner prevents corrosion from forming again on the element.

A quick continuity test on the pickup circuit and a check on volume control action can be made without removing any part of the pickup circuit. Simply insert a microphone plug, shell removed, into the output jack on the guitar and connect an ohmmeter across the terminals. Rotating the volume control will vary the reading in accordance with the degree of volume-control resistance in the circuit. With the control set for maximum volume, any reading above a few thousand ohms indicates an open or high-resistance lead in the pickup coil. An open in the pickup coil places the ohmmeter directly across the output terminals of the volume control and it is this resistance that would be indicated.

To remove the pickup unit, all the strings should be taken off the guitar. You might ask the customer to take off the strings, since he will probably prefer to do it, anyway. With the strings off, remove the pickup mounting screws and lift it up and out. Two soldered connections attach the pickup to the associated circuit. An open or short in the pickup can be determined by disconnecting one lead and connecting the ohmmeter across the pickup terminals. In case an open circuit is indicated, this will usually be found at the point where the two external connecting leads are soldered to the fine wire of the coil. Unwind the external leads the necessary few turns and make the repair. Extensive unwinding of the pickup coil is not recommended if the defect appears to be deep inside the windings. In this case, the manufacturer would prefer that you return the pickup unit to the factory where the job can be done according to his specifications.

(One manuufacturer is quick to point out that, "When the pickup device itself, that is, the magnet and coils, is encased in a metal covering, the repairman should never attempt to pry apart the covering and the base plate if they are soldered or otherwise sealed together. Repairmen do this repeatedly to see if the fine wire leads coming off the coils and passing to the outside of the containing receptacle are broken. There seldom is a breakage of this nature, but after the repairman has pried the container apart, there is bound to be a broken wire, so fine that it can not be restored to working order.")

Usually, the leads on the volume and tone controls are long enough to permit maneuvering them individually over to the pickup mounting hole where they can be worked on. This applies also to the pickup selector switch when multiple pickups are used. But in cases where the leads are too short to permit this, the entire pickup circuit must be removed. Remove all mounting nuts and the controls, jack, and switch will drop into the body of the guitar. The whole circuit can then be pulled up through the pickup mounting hole.

All replacements made should have the exact values of the manufacturer's original parts. Be sure that your volume and tone controls have the right taper, usually indicated by a code letter on the body of the control.

Fig. 3 shows schematic diagrams of two dual pickup arrangements, which permit selection of either pickup, or the simultaneous use of both. Fig. 3A shows individual volume and tone controls for each pickup. In Fig. 3B, the controls are common to both pickups. Note, also, the use of a remote treble tone control consisting of the .5-megohm rheostat across the .002-μfd. capacitor.

Remounting the pickup circuit in the guitar calls for a little patience and ingenuity, since the parts must be

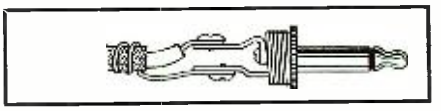


Fig. 2. Shown here is the correct way to connect single conductor, shielded cable to a microphone plug. Note that the shield is not brought to the screw.

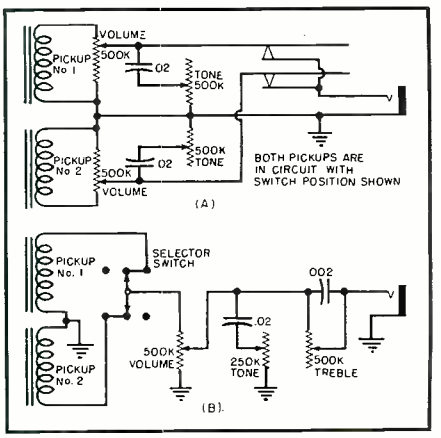
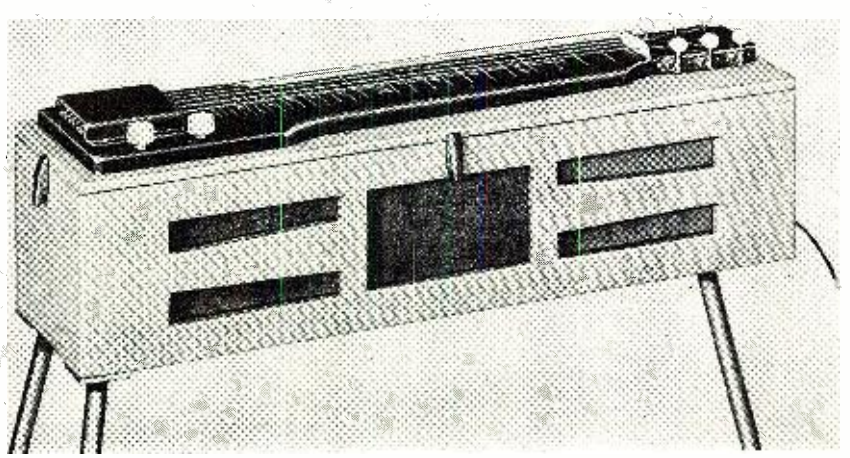


Fig. 3. Schematic diagrams of dual-pickup circuits used in Gibson electric guitars. In (A), individual volume and tone controls are used for each pickup. In (B), a single set of controls serves both.

"snaked" back into the proper mounting holes. The remote controls can be worked into place by means of thin carpet thread or radio dial cord. Insert an end of the cord down through the control mounting hole and bring it up through the pickup mounting hole. Twist the cord around the shaft or body of the control so that it can be pulled over to and up through its mounting hole. Hold the top of the control with long-nosed pliers and release the cord. Working with the guitar turned face down may facilitate the job. Don't scar the instrument when tightening the mounting nuts. This same method may be used to mount the selector switch and the output jack.

Other convenient methods for remounting controls may occur to you in the form of jigs which can be easily

A console-type Hawaiian electric guitar is shown here. The guitar sitting atop the box has a single pickup; the box contains both the speaker and the amplifier unit.



constructed. A simple jig for snaking the output jack into place can be constructed from part of an old microphone plug and a two-foot length of stiff wire.

Repairing the Amplifier

Bench tests on the amplifier can follow any of the routine test procedures. Tubes are the first suspects. It might be practical to test all tubes first, since you will have to test them anyway. Make a record of the condition of each tube, a copy of which should be given to the customer later.

Power supplies normally come next. Make a resistance check for possible shorts, then a voltage check for proper supply voltage values. This clears the way for step-by-step stage analysis. But first you should check the loudspeaker. Disconnect one lead at the speaker terminals and connect an audio signal across the speaker leads to the voice coil. Press the cone slightly while listening to the output. Sometimes, one of the thin leads going to the voice coil will separate causing a dead or intermittently operating speaker.

If the speaker is OK, it can be used as an audible output indicator while you inject your audio signal into the plate and grid of each stage, working back toward the input, until the defective stage is found. If you are well equipped with signal-testing apparatus and you wish to take gain-per-stage readings or distortion checks as you go along, by all means do so. The methods indicated here are only suggestions and are not intended to supersede your own tried and true procedures. However, a test on the power supply and the loudspeaker should always precede any stage-by-stage analysis.

Be especially critical of all coupling capacitors. They are a common ailment and a ripe source of intermittent troubles. Also, look for any discoloration among the resistors, indicating excessive heating from possible overload.

Don't assume that the trouble is the result of "bugs" in the circuitry and start redesigning the set. Design "bugs" are taken out by the manufacturer long before his equipment goes into production. Of course, if the customer wants some modern circuitry built into an old amplifier, that's another story.

When the defective stage is found, a voltage and/or resistance check will quickly locate the faulty part. Use exact replacements, or equivalent parts of high quality to make the repair.

Typical Amplifier

Fig. 4 is a schematic diagram of the *Gibson* model GA-30 amplifier. This popular amplifier provides an output of 14 watts, using two *Jensen* speakers, one eight-inch and one twelve-inch, for true tone reproduction over a wide range of frequencies. Four input jacks accommodate three electric instruments and one microphone. Separate volume controls are used for the microphone and for the electric instruments.

A type 6SL7 phase-inverter tube feeds a pair of 6V6GT's in a push-pull output stage. The d.c. for the heaters is provided by the drop across the bias resistor in the common cathode circuit of the 6V6GT output tubes. A feedback loop from the speakers connects to the cathode of the 6SJ7 instrument input tube. Control of the feedback frequencies is provided by a switch which cuts in or shorts out the .0007-μfd. feedback capacitor. Bass and treble tone controls are incorporated in the input to the first triode of the 6SL7 phase inverter.

The amplifier is powered by a 5Y3-GT. The a.c. line is fused with an AG two-ampere fuse. Input jacks and all controls are mounted on a common panel on the lower back of the cabinet.

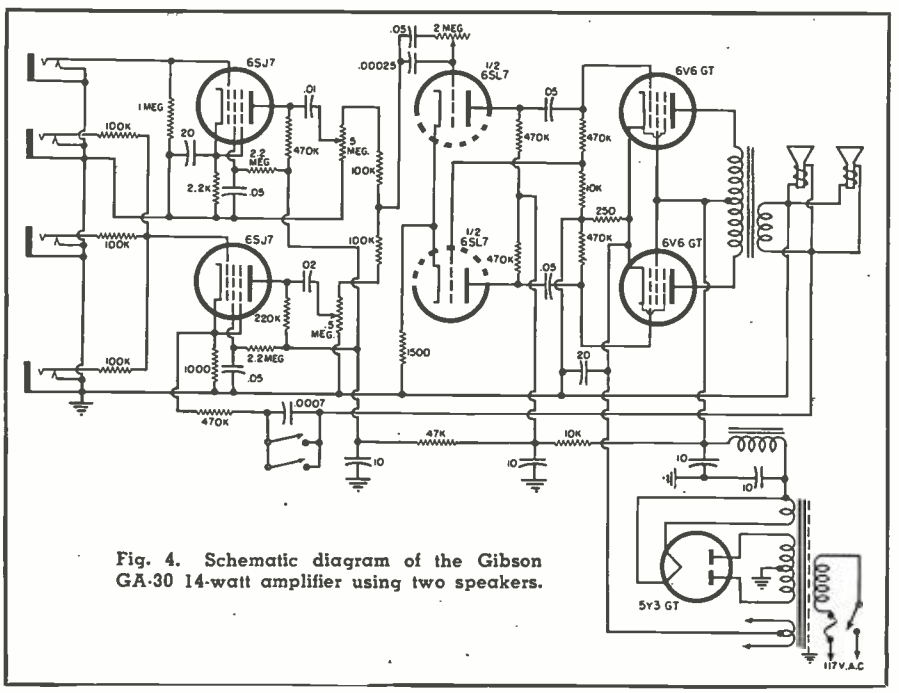


Fig. 4. Schematic diagram of the Gibson GA-30 14-watt amplifier using two speakers.

Some amplifiers contain a novel circuit arrangement that can be cut in and out at the will of the player. This is a special oscillating circuit which modulates the output stage to provide a sustained tremolo effect on the output tones. The tremolo effect is turned on and off by a remote switch.

It is assumed that while troubleshooting the amplifier, you were on the lookout for such things as badly discolored resistors, capacitors with leaky wax impregnation, frayed wiring, noisy volume controls, and the like. Make a list of all these sources of future trouble and inform the customer that the items should be replaced, if he is to expect trouble-free operation. Quite often, this will lead to a complete overhaul, especially if the amplifier is an old one. But use your judgment in this. It's a bit foolhardy to attempt a major overhaul if the amplifier is on its last legs. You'll either have to rebuild it completely at quite a cost, or find yourself "married" to an unpredictable headache.

After repairs have been completed on the amplifier, it's a good idea to do a bit of housecleaning on it. Clean all the dust and dirt from the chassis and cabinet. Wipe off the tubes with a clean damp cloth. Tighten all loose nuts, screws, and mountings, especially the chassis and speaker mounting nuts. Polish the cabinet a bit to brighten it up. These things take only a minute or two, but you'll be surprised what they mean to the customer. He may not have the technical know-how to fully appreciate what you did to fix his amplifier, but he'll certainly be impressed if you hand him back his equipment shining like new.

The final check on the equipment is always made by the customer. Make sure there are no loose objects lying around to set up acoustic rattles and buzzes when he hits a full chord at high gain, then sit him down in a corner and let him work out on the instrument. Put the amplifier on the floor where it is normally played, instead of parking it up on the test bench or counter.

Make a point of submitting to the customer a detailed list of all work done. Provide him, also, with a check list of general conditions existing in the equipment, together with your own recommendations, if any.

Getting the Business

Probably one of the best ways to obtain business is to visit the local musicians' union offices and put a small sign on the bulletin board announcing that you specialize in the repair of electric musical instruments. Also, you might consider running an ad in the union house organ.

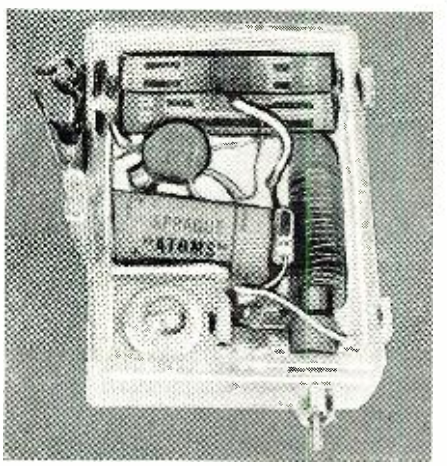
Small signs in the windows of music stores will be helpful, and, of course, put one in your own window. Be sure to call on all music stores and leave business cards with them.

The best advertisement of all will probably be word-of-mouth recommendation from satisfied customers. —30—

ARE YOU READY FOR CONELRAD?

By JOSEPH CHERNOF

The "Conelrad" receiver in operation. A hearing-aid type earpiece and small plastic box comprise the entire receiver.



The transistorized receiver housed in its plastic case. Power requirements are very low and battery life is, as a result, long. For maximum sensitivity and best possible performance, use as long an antenna as you can and incorporate a good ground system.

Construction details on a personal receiver which tunes the 640 and 1240 kc. Civil Defense bands, is compact, and cheap.

WHAT would you do if enemy bombers were to attack our country? How do you find out quickly what is happening and what to do? This is one of the major problems facing our Civil Defense authorities today. It has been generally agreed that, in case of attack or other emergency, cities would be evacuated as rapidly as possible, but the question still remains as to what happens to the evacuated people afterwards and how instructions and information are to be communicated to them. The best answer to date is *Conelrad*. Briefly, what *Conelrad* means is that during times of emergency, all TV and FM broadcasting stations will remain off the air. Every AM broadcasting station in the country will either go off the air or shift its transmitter frequency to one of two frequencies; *i.e.*, 640 or 1240 kc.

The system is officially entitled "Plan for *CON*trol of *EL*ectromagnetic *RAD*iation." This step has been found necessary to prevent any possibility of enemy planes or guided missiles being navigated by homing equipment tuned to the operating frequency of a broadcasting station in the vicinity of the intended target location. By having all AM stations in the country operate on one of these two frequencies, no frequency-of-radiation homing device will be able to function properly. Enemy bombers that might have planned to use the signals from some of our powerful clear-channel radio stations, such as KFI in Los Angeles or WJR in Detroit, for navigational markers would find nothing but a jumble of signals at 640 and 1240 kc.

A further refinement of *Conelrad* now under development would provide that each station in a community be on alone for a few seconds at a time, then transferring control to another station in the same area, but always maintaining the same program material. This would protect against the possibility of an enemy aircraft riding the beam in on an extremely powerful station in a particular area.

It would seem that the responsibility of the individual citizen and particularly of the electronic technician and experimenter would be to provide themselves and their families well ahead of time with some means for receiving *Conelrad* broadcasts under any or all emergency conditions. This means exact calibration marks on the dials of home and car radios so that either may be easily and quickly tuned to 640 or 1240 kc. if necessary. Do not depend on tuning your radio to these frequencies at the time of emergency since most stations will not be on the air continuously and it would be almost impossible to keep tuning about the dial until one is picked up.

The calibration may be done very easily using any r.f. signal generator, but if one is not available, many stations throughout the country run frequent *Conelrad* tests, so by contacting your local radio station, you should be able to find out at what times and at what frequencies such tests are being conducted.

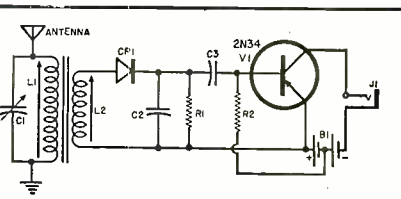
It would also be highly advisable to have available at all times a portable battery-operated radio. The average portable radio is fairly cumbersome to carry about over any appreciable distance and its power requirements are high enough to make it impossible to keep in operation continuously. A better choice would be a unit small enough to be carried in the pocket with very low battery requirements. The writer would like to describe one small, highly portable receiver suitable for civil defense and other emergency use.

The basic requirements of portability and low battery drain immediately suggest use of the transistor as a logical answer. It was therefore decided to construct a unit using two transistors, one as detector and the second for audio amplification. Some difficulty was experienced in making the transistor behave as an efficient detector. Since one of the basic characteristics of the transistor is its rather low input impedance as compared to the ordinary vacuum tube in similar applications,

(*Continued on page* 88)

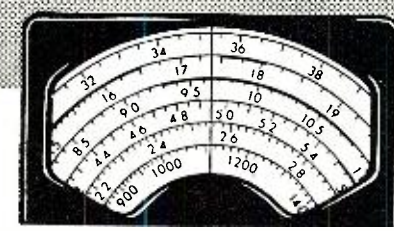
Fig. 1. Diagram of the "Conelrad" receiver. No "on-off" switch is required as plugging earpiece into the jack completes the battery circuit and puts receiver in operation.

R1, R2—220,000 ohm, ½ w. res.
C1—50-400 μμfd. adj. padder capacitor (J. W. Miller 160-B or equiv.)
C2—.0047 μfd., 200 v. capacitor
C3—25 μfd., 25 v. capacitor
L1, L2—Antenna coil (Modified J. W. Miller #6300 coil, see text)
J1—Open-circuit jack
CR1—1N34 germanium diode
B1—Two 1½ volt miniature penlite cells
1—Single earphone (Trimm or equiv.)



V1—2N34 transistor (Transitron Electronic Corp.)

International SHORT-WAVE



Compiled by KENNETH R. BOORD

IN A special broadcast, your short-wave editor, Ken Boord, will present a half-hour program of Holy Week and Easter organ melodies over TGNB, 9.668, and TGNC, 11.850, Apartado 601, Guatemala City, Guatemala, Central America, on *Easter Sunday,* April 10, at 0430-0500 *GMT (equivalent to Saturday, April 9, at 2330 EST, 2230 CST, 2130 MST,* or 2030 *PST).*

Harold Van Broekhoven, director of the station, says: "We will verify all *correct* reports with our QSL card and would appreciate an International Reply Coupon with each report—which is a small help towards defraying the cost of postage. To send a QSL card *by airmail* from Guatemala, we should have *three* IRC's." (An IRC costs 13c at your post office and is good for one unit of return first-class surface mail postage from any country which is a member of the Universal Postal Union.—K. R. B.)

Under the name, *Radio Cultural,* TGNA is owned and operated by The Central American Benevolent Association—a mission founded in 1890 by the well-known scientist-Bible teacher, Dr. C. I. Scofield. Its transmitting equipment consists of two *Eimac* 4-100A transmitters which operate with a *listed* power of 5 kw., although power usually is slightly lower than 5 kw. *Currently,* operating time is 1227-1405 and 2227-2300 in *Spanish* over TGNA, 720 kc. and 5.9525, and 0300-0445 in *English* over TGNB, 9.668, and TGNC, 11.850.

For the 5.9525 outlet, TGNA uses a double dipole antenna directed NE-SW which covers Central America and Mexico. For TGNB, two *Quad* antennas with reflectors on a mast 124 feet high are employed, while TGNC also uses a *Quad* antenna 112 feet high; the *Quad* antennas are directed to USA-Canada.

For about four years, TGNA has used temporary studios, but now new studios are being constructed on the grounds of the station. TGNA is a member of the Pan American Christian Network, and is "absolutely non-political, non-polemical, and non-commercial," station officials point out.

* * *

Around the World

(Note: This is the season when many stations will change from winter to summer schedules; in such cases, you may find schedules one hour earlier than listed herein.—K. R. B.)

Alaska—ALE, 3.435A, Ketchikan, noted 0935-1025 at fair to excellent strength with *test* transmission for receiver tuning and circuit alignment purposes; is an outlet of the Alaska Communications System. (Morris, Ohio)

Albania—ZAA, 7.850A, *Radio Tirana,* noted opening *English* session 2030; woman gave wavelength as 38.20 m.; fair level, occasional CWQRM. (Cox, Dela., others) Niblack, Ind., others also report *English,* starting with news, 2200. *This is truly a tough one to log due to usually heavy CWQRM on the spot.*

Anglo-Egyptian Sudan — Via airmail, Bengtsson, Sweden, reports the Sudan Broadcasting Service has *English* daily now 0715-0730, 1500-1515, from *Radio Omdurman,* 6.410, 7.100. *This one changes frequencies often and data sometimes is confusing.*

Australia—VLH9, 9.680, Melbourne, good level 1300 with BBC news relay, then ABC news 1309-1315, with some QRM from XEQQ, Mexico; VLX4, 4.8975, Perth, Western Australia, strong when tuned 1317; VLW9, 9.610, also Perth, fair to good 1323 tune-in; VLM4, 4.920, Brisbane, Queensland, noted 1315 with Queensland news, excellent level; VLQ9, 9.660, also Brisbane, fair level 0745. (Cox, Dela.) VLB11, 11.900, Melbourne, noted opening 1045 with *English* to South, Southeast Asia. (Morris, Ohio) VLC9, 9.615, noted closing 1345 in Eastern North American transmission, good signal but with heterodyne-QRM. (Fleischman, Quebec, many others) *Much of the QRM on this spot around that time is from Radio Moscow in Asiatic languages to the Far East.*

Azores—CSA93, 4.867A, Ponta Delgada, powerful level with classical music when tuned 2050. (Cox, Dela.) Heard closing 2100. (Churchill, Va.) *Re-opens* 2115A; also heard around 2245-2300; should close 2400A. (Ferguson, N. C.) *First daily sign-on* is 2000. (Pearce, England)

Bahamas—*Nassau Telephone Station* noted *testing* on 4.887A at 1319, strong level; *English only.* (Cox, Dela.) And at 2220-2240. (Esser, Pa.)

Bolivia—CP5, *Radio Illimani,* 5.970A, La Paz, noted 0300A to close 0400. (Mathieu, Mass.) Heard in Sweden 0200-0400A sign-off. (DX-Radio, Sweden)

Brazil—PRA8, 11.865, Recife, often observed at good strength 2230, *after Radio Luanda,* 11.862A, Angola, closes. (Niblack, Ind.) *Radio Record,* PRB22, 9.505, Sao Paulo, weak around 0115 in Portuguese; PRC22, 9.750A, good signal around 0120 in Portuguese; is Rio Grande do Sul, "Radio Gaucha." (Diaz, Ind.) *Sunday* edition of "Brazil Calling" *(English)* noted 2130A over ZYK3, 9.565, Recife. (Cox, Dela.) And *weekdays* 0105-0125A, but with severe QRM from Lima, 9.562A, Peru. (Himber, Calif.; Foster, Ill.)

Don and Helen Smith of the staff of the Far East Broadcasting Co., Inc., Box 2041, Manila, look over DZH7's new 10 kw. Collins 21M transmitter. A second, similar transmitter is on order from USA to be used, when delivered, on 19- or 25-meter band. The new transmitter, operating as DZH7, 9.730, is now on the air 0900-1700, 2100-0100 GMT. Wants reception reports, particularly from listeners in Asian countries who will listen regularly to certain programs and report reception. Reception report forms for this purpose are available. May test soon on 9.730 for listeners in eastern part of North America.

Canada—VE9A1, 9.540, Edmonton, Alta., noted 0000, poor to fair. (Dexter, Iowa) CHNX, 6.130, Halifax, N. S., good around 0130. (Gillette, Ky.; Powers, Ohio) CBNX, 5.970, St. John's, Newfoundland, runs 300 watts, 1100-0330; good in Minn. around 0245 to closedown. (Mann) CFRX, 6.070, Toronto, Ont., noted 1445-1515, good level. (Swenson, Minn.)

CBC's *International Service* has been entirely *revamped* and *new* schedules include a *(new)* North American Service 0115-0150, CHOL, 11.720, CKLO, 9.630. *Will send full program schedule on request* to CBC, International Service, Montreal, Quebec, Canada.

Canary Islands—*Radio Atlantico,* Las Palmas Gran Canaies, noted 2200 tune-in when announced was *testing* on 9.420, 9.485; however, was heard on 9.420, *varying* at times to 9.427A; program was mostly classical music 2200-2300 (*not* closedown); QSA3-4, S5-7; heard another day when closed 2230 after religious-type music; may need to use crystal filter due to QSB, CWQRM at times. (Sutton, Ohio) Noted 2301 with dance music; *asked for reports.* (Pearce, England)

China—*Radio Peking* noted on 3.960A with nice signal, better than the 3.915 outlet, in *Home Service* 0915, parallel 6.103 and other *Home Service* channels. Has *moved* to 9.665AV from 9.670AV (has been as low as 9.653A); heard with news 0300, 0900; opens on 7.170A at 0855 now, parallel 5.970 *(new),* 6.103, 7.500, 9.080 with *Home Service* transmission. (Balbi, Calif.) Heard opening in *English* 0900 on 15.105, good level in N. Z. (Hardwick) Chinese session around 2200 is *best* over 11.300, excellent level some days. (Marutz, Ind.) Good on this channel at 1430 with news; at 0300 with news over 11.960. (Hardwick)

Colombia—*Radiodifusora de Occidente,* 4.768, Cali, good level in Spanish 0745 sign-off. (Dexter, Iowa) The *new* station, "La Voz del Tolima," 6.040A, noted closing on a *Sun.* at 2330 with National Anthem; call seems to be *announced* as "HJLB." (Niblack, Ind.) Heard closing *weekdays* 0300; believes call

(*Continued on page* 133)

(NOTE: Unless otherwise stated, all time herein is expressed in Greenwich Mean Time (GMT). Subtract 5 hours for EST, 6 for CST, 7 for MST, and 8 for PST. "News" refers to newscasts in the English language. To avoid confusion, the 24-hour clock has been used to designate the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200, while from 1 p.m. to midnight they are shown as 1300 to 2400. The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.)

It Has Everything . . .

Beauty – Operating Convenience – Quiet Performance

Quiet, constant-speed operation is obtained with a precision helical gear drive. This was developed for H. H. SCOTT by international authority Professor Earle Buckingham of M. I. T., designer of the drive mechanism for the Mt. Palomar 200 inch telescope.

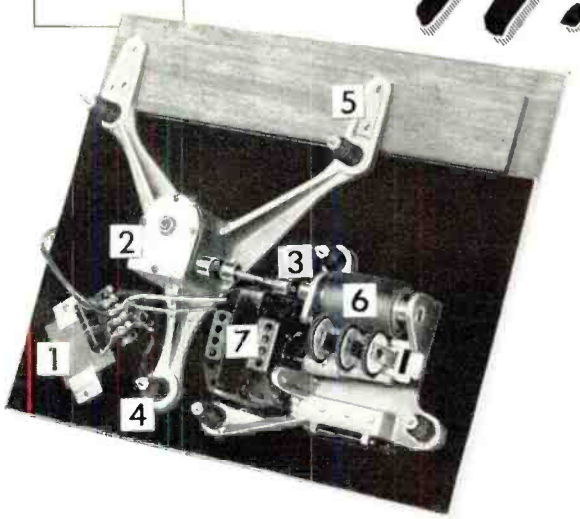
FREE TECHNICAL BULLETIN RN-455

THE NEW

H. H. Scott

STROBOSCOPIC TURNTABLE

The 710-A incorporates major new contributions to turntable engineering. These include: dual-stage mechanical and torsional filtering, expanded-scale optical stroboscope, Vernier speed drive and integral connection of pickup-arm mounting-board to main turntable bearings.



Revolutionary NEW design

1. **Expanded scale optical stroboscope,** with electronic peak pulsing for greatest clarity, is visible even while record is playing, for exact speed control at all times.

2. **Precision helical drive gears,** of hardened steel and nylon, for smooth silent flow of power to turntable. Gears housed in an oil-filled transmission for quiet trouble-free operation.

3. **High-compliance torsional filtering** reduces annoying speed variations, such as wow and flutter, to less than 0.1%, far below audibility.

4. **Dual-stage mechanical filtering** between motor and turntable reduces motor rumble to more than 60 db below recording level, an outstanding engineering accomplishment.

5. **Integral pickup-arm mounting board,** accomodating all leading pickup arms, is rigidly connected to turntable bearings by a heavy aluminum casting. This eliminates acoustic feedback and other undesirable vibration differences between pickup arm and turntable.

6. **Vernier speed drive** with special long-life neoprene idlers permits separate adjustments of 33⅓, 45, and 78 rpm speeds by ±5% to match the pitch of accompanying musical instruments. Convenient push-button selection of each speed and OFF position. Unique clutch permits cueing turntable.

7. **Heavy-duty induction motor,** with dynamically balanced-rotor and extremely low external hum field, designed specially for this turntable.

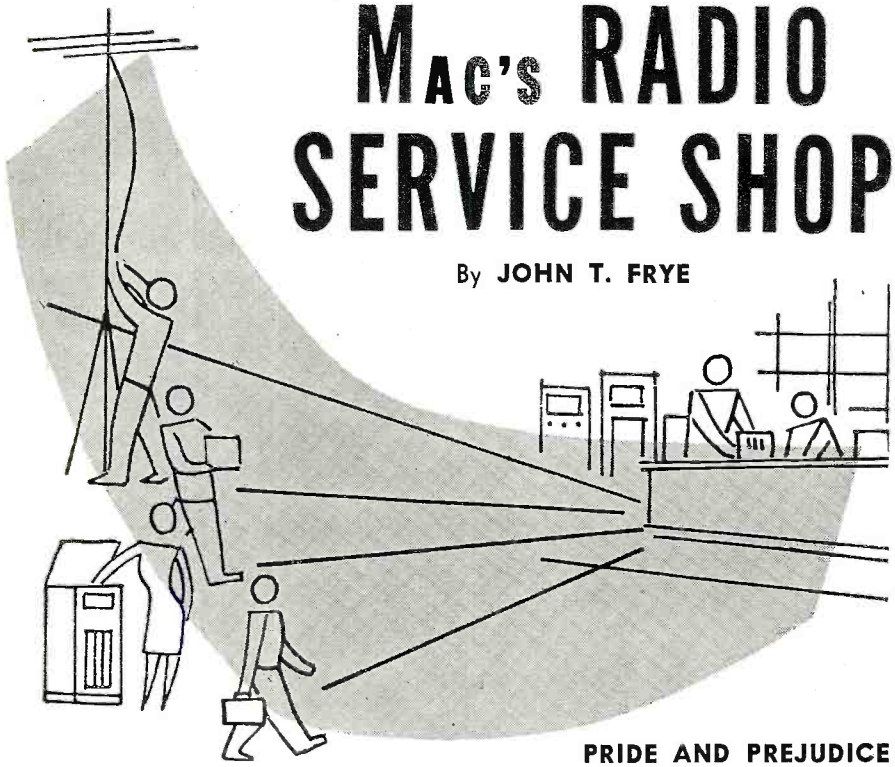
Prices *710-A Turntable, finished in stainless steel with mahogany pickup-arm mounting board. $102.00* Net*
710-X1 Hand-finished modern mahogany base for convenient, attractive installation: $14.95 Net*

*West Coast Prices: *710-A $107.10*
710-X1 $15.70

H. H. SCOTT inc. 385 PUTNAM AVENUE, CAMBRIDGE 39, MASSACHUSETTS

MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE



PRIDE AND PREJUDICE

"HEY, MAC," Barney called to his employer; "how's about my taking the tape recorder home with me this evening to perform a little experiment?"

"What kind of an experiment?" Mac asked cautiously.

"Nothing that will hurt your precious recorder," Barney promised, "I have long had a yen to know exactly how I sound when I'm talking over my ham rig. There's no way of finding out without a recorder. You can't talk and at the same time listen to yourself satisfactorily in a pair of phones plugged into a monitor. My idea is to plug our signal-tracing r.f. probe into the microphone jack of the recorder, ground the shielding lead, and let the hot probe tip pick up modulated r.f. from my transmitter. The crystal diode in the probe will demodulate this signal and feed the audio component into the recorder. All I have to do is call a snappy CQ and then play back the tape and hear how I sound. It's the only way I'll ever know precisely how *my* voice sounds when I am speaking over *my* transmitter."

"Well, I've been listening to *your* voice for a long time," Mac said mocking Barney's accentuation, "and believe me it's no treat. However, from a purely technical point of view, I see nothing wrong with the idea. I suggest you put the recorder a little distance away from the transmitter so that r.f. will not get into some of the audio circuits and overload them. That can easily happen to any audio equipment placed in a strong r.f. field. However, you'll have to wait until tomorrow, because the recorder is not here. I took it home a couple of days ago to do a little experimenting of my own."

"What kind of experimenting?" Barney demanded. He always considered it a personal affront if Mac did anything in the electronic line without first briefing him in great detail.

"I've been building a kind of special bass-reflex cabinet to use with the recorders at the high school," Mac explained. "The superintendent asked me to help him with a problem he has. They have a couple of dandy recorders over there, but the teachers simply do not make use of them. When he tried to find out why, they told him that it was too much bother to lug the heavy recorders around, set them up, pack them away again, etc. What's more, some of the teachers in the music and speech department objected to the loss in fidelity that was occasioned by the small speakers used in the portable tape recorders."

"Sounds to me as though you're solving the fidelity problem with a large speaker in a bass-reflex cabinet, but at the same time you're aggravating the problem of the recorders being too heavy to carry around," Barney observed. "I can just see a frail school teacher using one hand to carry the tape recorder and trying to lug that bulky speaker cabinet along with the other."

"You're forgetting I said this was a special type of cabinet," Mac chided with a teasing grin. "It is built so the large flat top is perfect for holding any ordinary tape recorder in proper operating position. On the bottom of the cabinet are four rubber-tired wheels of the kind found on tea carts. Two of these swivel; the other two are fixed parallel to the wide dimension of the cabinet."

"I get it!" Barney interrupted. "A recorder is ordinarily left right on top of this rolling cabinet with the large speaker plugged into the 'External Speaker' jack of the recorder. That means the people listening will hear *all* that is on the tape instead of just part of it as they have been doing with the smaller speaker. What's more, the whole business can be easily wheeled from room to room without disturbing the magnetic tape recorder in any way."

"You've got the idea. The superintendent was over last evening, and after pushing the cabinet all over the basement and listening to me play a high-fidelity pre-recorded tape through that cabinet-mounted speaker, he was most enthusiastic. In fact, he insisted I start immediately building another exactly-similar unit."

"Say! I think you've got something there," Barney said excitedly. "We both know many people who buy tape recorders and use them a lot for the first few months, but then they park them away in a clothes-closet to collect dust. When asked why they don't use the machines more, they usually say it is just too much bother to get the recorder out, set it up, and then pack it away each time. If they had one of these rolling cabinets of yours, they could keep the recorder right out where it would be ready for use at a moment's notice. It could sit alongside the TV set for recording the many fine programs often heard there. If something interesting came on the radio-phonograph combination, or if you wanted to make a tape recording of a record, the recorder could be wheeled over to it and the program taped. When Mom heard a good recipe starting on her kitchen set, she could have the recorder taking it down in a matter of seconds."

"You're right, of course," Mac agreed. "Having the recorder always ready for instant action any place in the house would double its usefulness —and its use. At the same time, don't overlook the fact that employing that high-fidelity speaker in a proper cabinet will greatly increase the pleasure of listening to the tapes being played back. In the beginning, the small speakers it is necessary to use in portable recorders were fairly adequate for reproducing the limited range of frequencies that could be put on tape; but in the past few years tremendous strides have been made in tape recording techniques. Only a fine speaker in a good cabinet can do full justice to the quality of recording and playback put out by even popular-priced machines these days. Some manufacturers have improved the quality of reproduction by using two or even three speakers in the recorder cabinet. While this definitely sounds better than a single speaker, it is not the complete answer.

"Few enlightened people will contend that two or three small speakers mounted inside the recorder case that is already pretty well occupied with the tape-transport mechanism and amplifier will equal the reproduction possible with a high-fidelity speak-

Sylvania "600 ma" Tubes

99.7 proof*

FOR SERIES-STRING TV

In a 15-tube series string, analysis proved that 99.7% of all probable combinations of Sylvania types operated within 2% of the heater-current design center. Sylvania's tight heater-current limit is one of the most important contributions to tube performance for series string operation.

Best for Service In 4 big ways

WHEN YOU SERVICE TV SETS using series-string-heater tubes, don't take chances on call backs. Here are four big reasons why only Sylvania "600 ma" tubes give you the uniform, dependable performance that insures customer satisfaction.

1. Less heater voltage variations—even distribution of tube voltages throughout the series string insures better tube life.

2. Less heater burn-outs—heater burn-outs are reduced because the controlled heater warm-up of 11 seconds is uniform from tube to tube throughout the circuit.

3. Less time for normal set operation—controlled heater warm-up brings set to normal operation in less than half the time.

4. More uniformity—because Sylvania makes everything but the bulb, quality is controlled from raw materials straight through to finished product.

Write for this handy reference guide to Sylvania tubes for series string television. It's both a brochure and wall chart! Write Department D34N.

All Sylvania TV PICTURE TUBES now have heaters specially controlled for series string operation!

SYLVANIA

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LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

er or speakers mounted in a proper baffle. And when you add speakers, you add weight, which is always a serious matter with equipment supposed to be portable. By using an auxiliary speaker system when you want high quality reproduction, you can keep the recorder proper light and compact—as it must be for maximum versatility.

"Being the tape recorder fan that I am," Mac continued earnestly, "it worries me to know that many of these wonderful little machines are sitting virtually unused, just as you describe. I felt so sure that a combination quality-speaker-and-mobile-recorder-stand such as the one I've built would go a long way toward putting these recorders back into use that I actually wrote to a couple of speaker manufacturers and tried to persuade them to build these units and put them on the market. With their facilities, they could design a cabinet that would be a beautiful piece of furniture and still be a strong, mobile stand and correctly designed baffle."

"What did they say? Were they all bursting with enthusiasm? Are you headed for your first million?"

"They were afraid to tackle the project. Naturally, a few problems exist. For one thing, the voice-coil impedances of recorder speakers vary all the way from three to eight ohms. The voice coil impedance of the speakker used in the cabinet would have to be a compromise value to work with all recorders, or a matching transformer would have to be used. For that matter, though, some of these rolling speaker cabinets could contain additional space for compact high-fidelity amplifiers; and then the speaker could be used with TV sets, radios, record-players, *and* tape recorders for high-fidelity reproduction. However, this would result in a much more expensive unit; and right now I am mainly interested in something that will break down the prejudice keeping tape recorders from getting the constant use they deserve. They are worth the effort.

"And speaking of prejudice," Mac went on smoothly, "that reminds me of something else a little closer to our everyday work. I'm beginning to worry about a prejudice concerning TV service that is taking root in the public mind. What especially concerns me is that I'm afraid we service technicians have planted this prejudice and are still nourishing it; yet I'm sure when it attains its full growth—and it's growing like a weed—we'll be sorry we ever let such an unfavorable idea get started."

"You *know* I don't love a mystery," Barney complained. "Give! Tell Uncle Barney all about it."

"The idea is shaping up like this in the minds of the majority of customers: a good TV service technician can and will perform *all* service work right in the customer's home. If he suggests taking the set to the shop, he immediately stands revealed as (*a*) a bumbling and untrained worker who is afraid to let the customer know how long it takes him to locate the trouble, or (*b*) an unethical chisler who only wants to get the set out of the house so he can run up a fantastic bill by replacing parts not defective, steal good parts, etc., etc.

"As service technicians, we know that in the words of the song, this 'ain't necessarily so.' A number of TV troubles render making repairs in the home highly impractical or unnecessarily expensive. Take a set that needs alignment. No technician who has proper respect for his equipment is going to lug his expensive and delicate scope, sweep generator, marker generator, probes, etc., into the customer's home and try to align the set on the floor or on a makeshift workbench without proper grounding facilities. If the customer insists on the set's staying in the house, all the technician can do is 'touch up'—a misnomer if there ever was one—the trimmers by looking at the picture. We both know what kind of an alignment job that produces.

"Or suppose the set has an intermittent condition that only shows on a long and unpredictable cycle. The customer would scream like a panther if you charged him for the time spent sitting around waiting for the set to cut out; yet not charging for this time at your regular rate means you are cutting your own throat. With the chassis on the intermittent bench in the shop, the technician could watch for it to cut out while he went right ahead with his other work. This way the customer's bill could actually be much lower; yet the technician would not be losing valuable time and money."

"How do you mean we technicians started this stupid fallacy?"

"In the beginning, when TV service was new, we tried to show how smart we were by repairing as many sets as possible in the home. We prided ourselves on being able to go in with only a v.o.m. and a tube caddy and having the set going in a few minutes. When all sets were comparatively new and tube failures constituted seventy-five per-cent of the trouble you could do this. You can still take care of a very high percentage of TV trouble right in the house, and most technicians greatly prefer to make the repair at the residence if they can do it right and in a reasonable length of time. They should not, however, be afraid to recommend that the set be taken to the shop when the symptoms and common sense dictate this step.

"Once more," Mac concluded, "we can learn from the medical profession that has already taught technicians so much. Doctors no longer treat a patient in the home until he is *in extremis* before taking him to a hospital. Whenever his condition is puzzling, when the doctor feels extensive tests should be made, or when close observation is needed, they send the patient to the hospital. There he can benefit

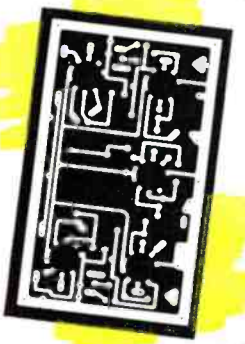
NEW 1955

Heathkit

Engineering Features

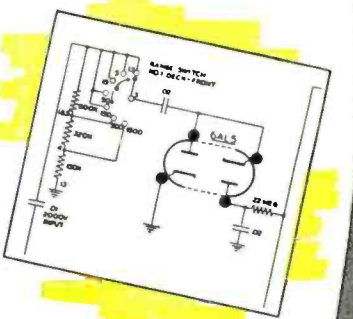
New PRINTED CIRCUITS

One of the many tremendous improvements in the new 1955 Heathkits is the use of an etched metal process printed circuit board. Printed circuits will be used in Heathkits whenever they will affect construction simplification, performance stabilization, and lend themselves to instrument design. Now for the *first* time a kit instrument company offers the advantages of modern printed circuit instrument construction technique. For the *first* time consideration has been given toward reducing kit assembly time. Also this is the *first* time that printed circuit boards have been hand soldered on a volume basis. Offered only by Heathkit, the pioneer and leader in kit instrument design.



New PEAK-TO-PEAK VTVM CIRCUIT

New 6AL5 full wave rectifier in AC input circuit permits full scale peak-to-peak measurements. Seven ranges — upper limits 4000 volts peak-to-peak. Just the thing you TV servicemen have needed in making TV circuit voltage checks. Precision resistor voltage divider limits AC RMS level to 150 volts. Prevents overloading the rectifier—extends upper limit AC RMS ranges to 1500 volts—further protects meter and circuitry against AC flash-over or arcing. Another definite example of continuing Heathkit design leadership in the kit instrument field.



New HIGH READABILITY PANELS

New 1955 Heathkits feature complete panel redesign. Sharp white lettering applied to the beautiful charcoal gray panels, provide a new high in readability. Lettering is easy-to-read open style and panel calibrations are vividly clear against the pleasing soft gray background. New knobs of exclusive Heathkit design.

New 3" UTILITY SCOPE

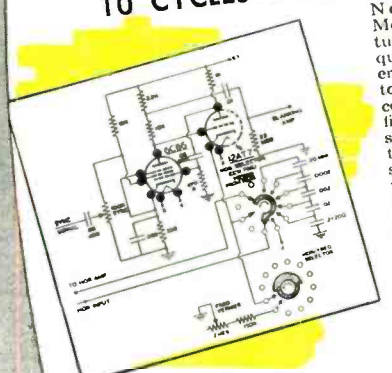
The new 3" Scope is a "natural" for the well rounded line of Heathkit instruments. Small in size, 11¾" deep, 6½" wide, 9½" high, yet big in performance. Just think of the value an Oscilloscope for $29.50. Brilliant intensity, sharp focusing, wide positioning range. An ideal portable Scope for the TV serviceman—a second shop scope—modulation monitor for you hams (deflection plate terminals in rear of cabinet). Performance to spare for all general scope applications. See specifications on following page.

New STYLING *New* COLOR

New styling and coloring is responsible for tremendous improvement in Heathkit appearance. The new instrument panel color combination is high definition white lettering in a soft charcoal gray panel. Cabinet color is a lighter feather gray. The satin gold baked enamel cabinet for the WA-P2 Preamplifier is further indicative of the modern pacesetting trend in Heathkit styling.

New SCOPE SWEEP CIRCUIT 10 CYCLES — 500 KC

New 1955 Heathkit Model 0-10 Scope features a new wide frequency range sweep generator covering 10 cycles to 500,000 cycles. This coverage is available in five virtually decading sweep ranges and is five times greater than the sweep frequency range usually available. Excellent retrace time characteristics, actually less than 20% at 500 KC. Use of the free running Heath circuit provides a larger margin of stability and a new high in Heathkit Scope performance.



Continuing PROGRESS FUTURE LINE EXPANSION

The outstanding improvements featured in the 1955 Heathkit line are representative of the progress characterized by Heath Company operation. Long range planning will provide a continuing succession of new kit releases to further expand the Heathkit line which already represents the world's greatest selection of electronic kits. The innovations in the 1955 line, are representative of additional new models scheduled for release for the coming years.

SEE THE INSTRUMENTS ON THE FOLLOWING PAGES

HEATH COMPANY • • Benton Harbor 15, Mich.

from the use of elaborate non-portable test equipment, can receive x-ray, diathermy, and similar treatment impossible in the home, and can be closely watched all the time. In the time required to make three or four house calls, a doctor can visit twenty patients in a hospital. Were it not for this more efficient use of the doctor's time, medical expenses would be even higher than they are; and doctors would be still harder to get hold of.

"The man who insists that all work on his TV set must be performed on his living room floor might do well to think about this a bit. Let him look around until he finds a service technician he thinks he can trust, and then let him trust that technician and follow his advice just as he follows the advice of his family physician. Ninety-nine times out of a hundred, he will get better, less-expensive service by doing so." —30—

TV SERVICE MONTH

ALL TV service dealers who sell and use G-E tubes can participate in the huge advertising campaign and contest for consumers to be sponsored by the General Electric Tube Department from April 19 to May 19—"TV Service Month."

A directory of the thousands of service dealers that handle G-E tubes will be published in an advertisement in "Look" magazine. In addition, an emblem will be given to each service dealer, to be displayed by him, identifying that dealer's shop as headquarters for the $25,000 cash prize jingle contest for consumers.

The concept of a "TV Service Month" will be publicized through every possible channel to focus attention on the service dealer as a friend and neighbor. The campaign will also urge the consumer to order long-put-off repairs.

Ad mats, "talking postcards," mailers, store banners, window streamers, and contest entry blanks are available from G-E tube distributors. —30—

Contest entry blanks, banners, and window displays for the $25,000 jingle contest for consumers sponsored by G-E are available to service dealers who handle G-E tubes.

NEW *Heathkit* 5" PUSH-PULL OSCILLOSCOPE KIT FOR COLOR TV

First color television service Oscilloscope with necessary high sensitivity and full 5 megacycle bandwidth.

New 5UP1 CR tube

New printed circuit construction, all components mounted on high insulation surface resulting in uniformly low circuit capacities.

New type wide frequency range Heath sweep generator 10 cycles to 500,000 cycles.

New cabinet styling and color harmony—charcoal gray panel with high readability white lettering.

New electronic positioning controls for instantaneous, definite positioning without bounce or overshoot.

BRAND NEW DESIGN: The new Heathkit Model O-10 Oscilloscope would be something special at any price, but is almost unbelievable at $69.50. Completely re-designed scope has broadband amplifiers for color TV work and offers brilliant overall performance. Vertical frequency response within 5 db from 5 cps to 5 mc. Even more astounding, the response is down less than 1½ db at 3.58 mc. the color TV sync burst frequency. It is essential that scopes for color work have these broadband characteristics.

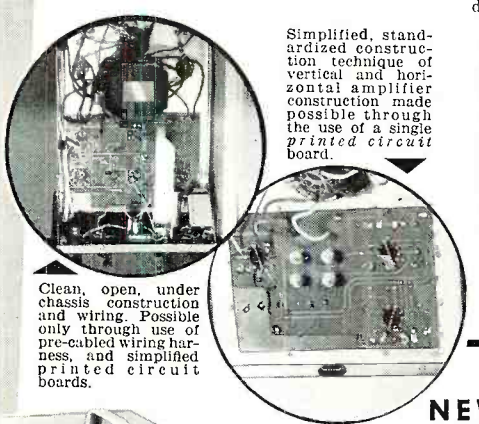
PRINTED CIRCUITS: Two printed circuit boards used in this fine instrument to insure stable, consistent performance. Problems solved by pre-engineering of boards, and their use guarantees completed unit that will have same characteristics as lab development model. Printed circuits simplify construction and save labor.

NEW SWEEP CIRCUIT: Sweep circuit operates with exceptionally good linearity from 20 cps to over 500,000 cps. 5 times the usual range for scopes in this price range. An entirely new circuit introduced for the first time in any Heathkit.

MODEL O-10

$69.50

Shpg. Wt. 27 lbs.



Simplified, standardized construction technique of vertical and horizontal amplifier construction made possible through the use of a single *printed circuit* board.

Clean, open, under chassis construction and wiring. Possible only through use of pre-cabled wiring harness, and simplified printed circuit boards.

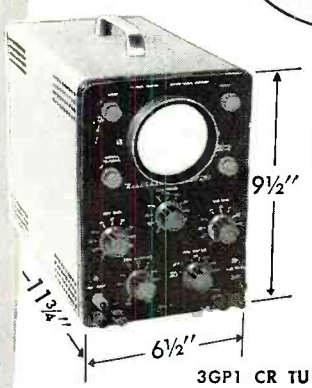
FEATURES: Other outstanding characteristics of this professional oscilloscope are: Built-in 1V peak-to-peak reference for calibration of plastic CRT face-plate; 5" 5UP1 CRT; push-pull hor. and vert. deflection amplifiers; hor. trace width expandable to 3 times diameter of CR tube to allow inspection of any small portion of the signal; deflection sensitivity, .025 volts per inch; wiring harness pre-formed and cabled to save construction time and insure professional appearance and operation. Incorporates efficient retrace blanking. Frequency compensated step attenuator at the vertical input. Entire tube face useable. No foldover on vertical over-load. Performance obtainable only in much more expensive laboratory models.

Uses 5UP1, 6AB4, 6BO7, 12BH7, 6CB6, 12AT7, 2-12AU7, 6X4, 1V2, and 6C4. Quality components used throughout so that outstanding performance characteristics may be maintained for years to come. Plastic molded condensers are used in all coupling and by-pass applications. The "new-look" in Heathkit styling produces professional appearance in keeping with the professional performance of this instrument.

NEW *Heathkit* 3" PRINTED CIRCUIT OSCILLOSCOPE KIT

MODEL OL-1

$29.50 Shpg. Wt. 15 lbs.



3GP1 CR TUBE

New compact utility Scope—lightweight—portable for service work.

Deflection plate terminals—ideal for ham transmitter modulation monitoring.

New easy-to-build printed circuit board with high insulation factor.

New Heathkit instrument styling—charcoal gray panel with high readability white lettering.

New Heath twin triode sweep generator 15–100,000 cycle sweep.

EXCEPTIONAL VALUE: The brand new Model OL-1 Utility Oscilloscope is designed especially for portable applications so that outside servicemen or persons performing field tests can have the advantages of a scope available. Then too, it is ideal for home workshop, the ham-shack, or as an "extra" scope for the service shop. It is compact, light in weight, and surprisingly versatile in operation. An outstanding instrument for the price.

Front panel controls are "bench-tested" for ease of operation and convenience. Printed circuit board used for constant circuit performance. Assembly time cut in half!

SPECIFICATIONS: Vertical amplifiers feature frequency response within 1 db from 10 cps to 100 kc, and within 5 db from 5 cps to 500 kc. Vertical sensitivity .2 volts per inch at 1 kc, with input impedance of 12 mmfd shunting 10 megohms.

Horizontal response within 1 db from 10 cps to 200 kc, and within 5 db from 5 cps to 500 kc. Hor. sensitivity .25 volts per inch at 1 kc, input impedance of 15 mmfd shunting 10 megohms. Sweep generator covers 10 cps to 100,000 cps with stable positive lock-in circuit. Cathode follower input in both vert. and hor. amplifiers; push-pull vertical and horizontal deflection amplifiers; 3" CRT; electronic positioning controls for wide range of vertical and horizontal spot deflection; provision for internal and external sync; 60 cycle line sweep. New modern color styling and unusual performance make this instrument an outstanding value.

NEW *Heathkit* 5" PRINTED CIRCUIT OSCILLOSCOPE KIT

MODEL OM-1

$49.50 Shpg. Wt. 24 lbs.

5BP1 CR TUBE

VERSATILE INSTRUMENT: The new Model OM-1 general purpose Oscilloscope represents an outstanding dollar value in reliable test equipment. Full 5 inch CRT. Printed circuit boards for ease of assembly, constant circuit characteristics, and rugged component mounting. Includes all the design features necessary for servicemen, students, experimenters, radio amateurs, etc. Frequency response of amplifiers flat within 1 db from 10 cps to 100 kc, and down only 7 db from 10 cps to 500 kc. Sweep generator range from 20 cps to 100,000 cps. Also features new Heathkit color styling with charcoal gray panel and high definition white lettering for readability even under subdued lighting conditions.

DESIGN FEATURES: A full-size, versatile oscilloscope at a price you can afford. Other features are: adjustable spot shape control; RF connections to deflection plates; direct coupled centering controls; external and internal sweep and sync; 60 cycle line sync; built in 1 volt peak-to-peak panel terminal reference voltage; professional appearance of cabinet, panel, and knob styling.

HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15, MICHIGAN

Ready for Transistors

(*Continued from page 41*)

type of transistor. The *n-p-n* transistors operate with the collector positive, just as do vacuum tubes. However, *p-n-p* and point-contact transistors require negative collector polarity. Reverse polarity is harmful, and may result in destruction of the unit.

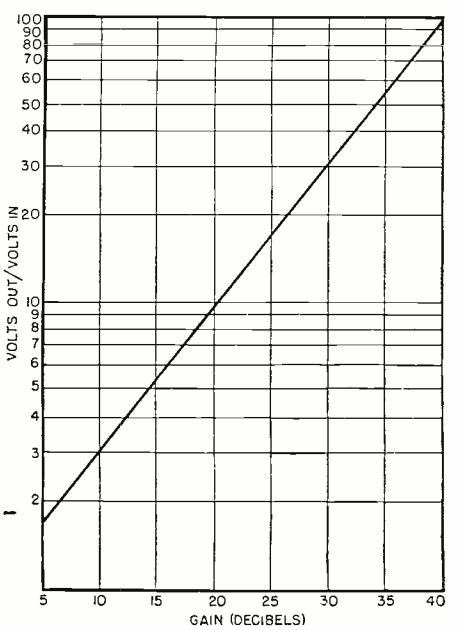
Contact resistance, such as in sockets or switches, may be significant. Instances have occurred where the increased internal resistance of an aging battery has sufficiently coupled the various stages through its common resistance to cause undesirable feedback. In making measurements on any printed circuit, remember that the printed "wires" may have considerable resistance.

Perhaps the best preparation in the world is just to get some transistors, some of the tiny resistors and capacitors that go with them, and see how a few different circuits work. You'll have fun and you may run across some pointers that will help later on. For example, I installed some shelf-new miniature electrolytics in an experimental job and it wouldn't work at all. After a process of elimination, I found that it is necessary to "form" these particular capacitors before using. Connect any suspected units to a battery of their rated voltage through a 10,000 ohm resistor. Keep them connected until they stop drawing current.

If you are a one-hand-in-the-pocket advocate when working on live circuits, you'll find it a little strange, but entirely safe, to get into this gear with both hands.

All in all, transistor equipment is nothing to be afraid of—if you're ready for it! —30—

Fig. 6. Conversion chart for finding the gain of a transistor in an amplifier after measuring input and output voltages.



NEW Heathkit VACUUM TUBE VOLTMETER KIT

PRINTED CIRCUIT DESIGN

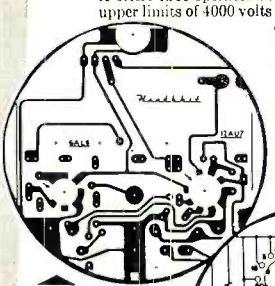
New charcoal gray baked enamel panel with high readability, white lettering. New soft feather gray cabinet, subdued pilot light indicator.

New printed circuit board for faster, easier construction—exact duplication of Lab development model.

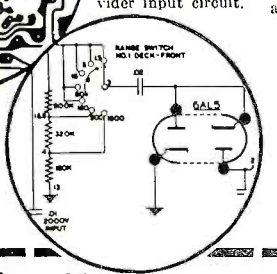
Another outstanding example of continuing Heath Company pioneering and leadership in the kit instrument field. A new **printed circuit** VTVM. New peak-to-peak circuit—new styling and new panel design. A prewired, prefabricated printed circuit board eliminates chassis wiring, cuts assembly time in half, assures duplication of Engineering pilot model specifications, and virtually eliminates possibility of construction error.

CIRCUIT:

A 6AL5 tube operated as a full wave AC input rectifier permits seven peak-to-peak voltage ranges with upper limits of 4000 volts P—P. Just the ticket for you TV servicemen. Voltage divider in the 6AL5 input circuit limits applied AC input to a safe level. This circuitry and the isolation of the meter in the cathode of the 12AU7 bridge circuit affords a high degree of protection to the sensitive 200 microampere meter.



Full wave rectifier in AC input circuit. Read peak-to-peak and RMS volts with upper limit of 4000 P—P and 1500 volts RMS. Voltage divider input circuit.



The first kit instrument to offer a labor-saving, error-free *printed circuit* board. Your instrument an exact wiring replica of Engineering development model.

RANGES:

Seven voltage ranges. 1.5, 5, 15, 50, 150, 500 and 1,500 volts DC and AC RMS. Peak-to-peak ranges 4, 14, 40, 140, 400, 1400, 4000. Ohmmeter ranges X1, X10, X100, X1000, X10K, X100K, X1 meg. Additional features are a db scale, a center scale zero position, and a polarity reversal switch.

New easy-to-read open panel layout. Off-on switch now incorporated in the selector switch.

IMPORTANT FEATURES:

High impedance 11 megohm input—transformer operated—1% precision resistors, 6AL5 and 12AU7 tube—selenium power rectifier— individual AC and DC calibrations—smoother improved zero adjust control action—new panel styling and color—new placement of pilot light—new positive contact battery mounting —new knobs—test leads included.

The new V-7 also sets the pace as a kit instrument style leader. Smart, good-looking charcoal gray panel and soft feather gray cabinet. High readability panel with sharply contrasting white calibrations. The pleasing, eye catching, modern styling is in harmonious balance with the outstanding circuit design improvements. Easily the best buy in kit instruments.

MODEL V-7

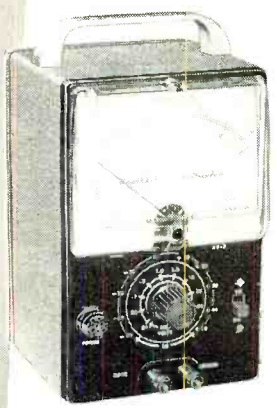
$24.50

Shpg. Wt. 7 lbs.

New peak-to-peak meter scale—new color harmony—new knobs.

Heathkit AC VACUUM TUBE VOLTMETER KIT

MODEL AV-2



$29.50 Shpg. Wt. 5 lbs.

Extreme sensitivity has been emphasized in the design of the Heathkit AC VTVM. Ten full scale RMS ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts. Frequency response is substantially flat from 10 cycles per second to 50 KC with input impedance of 1 megohm at 1 KC. Will accurately measure as low as 1 millivolt at high impedance. Total db range is —52 db to +52 db. An excellent kit for measuring the output of phono cartridges and the gain of amplifier stages. Use it also to check power supply ripple, as a sensitive null detector, and for compiling frequency response data. Features one knob operation, 200 microampere Simpson meter and precision resistors.

Heathkit AUDIO WATTMETER KIT

Read audio power output directly without using external load resistors with the new Heathkit Audio Wattmeter. Built-in non-inductive load resistors provide impedances of 4, 8, 16, and 600 ohms. Flat response from 10 CPS to 250 KC. Full scale power ranges are 0–5 MW, 0–50 MW, 0–500 MW, 0–5 W and 0–50 W. Model AW-1 will operate continuously at 25 watts and has a duty cycle of 3 minutes at 50 watts. Total db range in five positions is —50 db to +48 db, using the standard 1 milliwatt 600 ohms.

MODEL AW-1

$29.50

Shpg. Wt. 6 lbs.

Heathkit 30,000 VOLTS DC PROBE KIT

Measure up to 30,000 volts DC with the Heathkit VTVM and the 336 high voltage Probe. Precision resistor provides multiplication factor of 100. Can be used with any 11 megohm input VTVM. Housed in a Polystyrene two color sleek plastic probe body for safety of operation.

No. 336

$4.50

Shpg. Wt. 1 lb.

Heathkit PEAK-TO-PEAK PROBE KIT

No. 338-C

$5.50

Shpg. Wt. 2 lbs.

Peak-to-peak values not exceeding 80 volts at a DC level of not more than 600 volts, can now be read directly by using 338-C Probe with previous model Heathkit VTVM's or any VTVM with 11 megohm input resistance. Probe construction features a modern printed circuit board for easy assembly. Frequency range 5 KC to 5 MC.

Heathkit RF PROBE KIT

The Heathkit RF Probe will permit the measurement of RF voltages up to 250 MC with an accuracy of ±10%. The limits are 30 volts AC and a DC level of 500 volts. Designed for any 11 megohm input VTVM. Modern styling, Polystyrene aluminum housing, Polystyrene insulation, and printed circuit board for easy assembly.

No. 309-C

$3.50 Shpg. Wt. 1 lb.

HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15, MICHIGAN

Within the Industry

(*Continued from page 29*)

ment for the manufacture of both military and commercial type transformers.

* * *

PHILIP J. WOOD has joined *Zenith Radio Corporation* as assistant to the vice-president in charge of radio and television sales.

He has over seventeen years of experience in radio and television sales, ten of which have been in a managerial capacity. From March, 1952 until he joined *Zenith* on February 1st of this year, he was distributor sales manager of *Stewart-Warner Electric*. Prior to that time he was a division manager for *Leo J. Meyberg*, California appliance distributor.

* * *

DAYSTROM, INC. has purchased the *Heath Company* of Benton Harbor, Michigan, manufacturers of the *Heathkit* line of electronic instruments. The company will be operated as a *Daystrom* division.

Robert Erickson, vice-president of the parent company, was named president of *Heath*. He will also continue as an officer of *Daystrom*.

With annual sales of $6,000,000, *Heath* has a line of more than 60 test instruments, amplifiers, transmitters, and receivers. The company owns a 22,500 square foot plant in Benton Harbor and operations will continue there. Purchase of *Heath* was made from Helen C. Anthony, widow of Howard Anthony.

Daystrom now has six wholly-owned subsidiary operations.

* * *

CBS-HYTRON has established warehousing facilities in Dallas, Texas to provide better tube distribution in the Texas, Oklahoma, Arkansas, and Louisiana areas . . . **THE GUDEMAN COMPANY** has moved its Sunnyvale, California plant to 190 Commercial street in that city. The company has plants in Los Angeles, Monrovia, Chelsea (Mich.), and Terryville (Conn.) in addition to its main factory in Chicago . . . **MICRO SWITCH** of Freeport, Illinois has opened a new assembly plant in Independence, Iowa. Initial production will provide employment for 50 to 100 persons . . . **BLONDER-TONGUE LABS. INC.** of Westfield, N. J. has opened a 30,000 square foot plant in Newark. This is the firm's second factory for the production of a line of electronic equipment on a contract basis in addition to the company's own line of amplifiers, u.h.f. converters, and master TV systems . . . **FAIRCHILD CAMERA AND INSTRUMENT CORPORATION** is building a new 24,000 square foot plant on Washington Boulevard adjacent to the Santa Ana Freeway in Los Angeles . . . A new West Coast sales office

NEW *Heathkit* TV ALIGNMENT GENERATOR KIT

Here is the most radically improved Sweep Generator in the history of the TV service industry. The basic design follows latest high frequency techniques which result in a combination of performance features not found in any other sweep generator.

SWEEP:

Sweep action is obtained electronically through the use of a newly developed controllable inductor, thereby eliminating all moving parts with their resultant hum, vibration, fatigue, etc. Frequency coverage entirely on fundamentals, is continuous from 4 MC to 220 MC at an output level well over a measurable .1 volt.

Controllable inductor sweep oscillator with output entirely on fundamentals.

Triple marker system 4.5 MC crystal controlled—3 sets of low loss, low capacity shielded cables included.

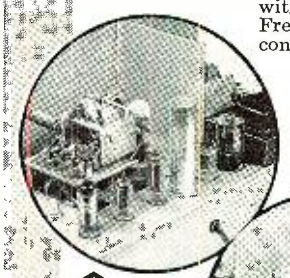
Electronically operated smooth continuously variable sweep circuit. No vibration, hum or noise.

Frequency coverage: 4 MC—220 MC continuous including FM spectrum. RF output well over 1 volt.

MODEL TS-4

$49.50

SHPG. WT. 16 LBS.



Triple marker system, 4.5 MC crystal controlled marker—continuously variable marker—provisions for external marker.

Automatic amplitude control circuit—constant output voltage regulated power supply.

MARKER:

The same instrument incorporates a triple marker system with a crystal controlled reference. A variable marker provides accurate coverage from 19 to 60 MC on fundamentals, and 57 to 180 MC on calibrated harmonics. A separate fixed crystal controlled 4.5 MC marker can be used for checking IF, bandpass, calibration, reference, etc. Provisions are also made for external marker use. A 4.5 MC crystal is supplied with the kit.

POWER SUPPLY:

The transformer operated Power Supply features voltage regulation for stable oscillator operation. Three sets of shielded cables are furnished with the kit. Sweep range is completely and smoothly controllable from zero up to a maximum of 42 MC, depending upon base frequency.

Here is a TV Sweep Generator that truly no serviceman can afford to be without for rapid, accurate, TV alignment work.

NEW *Heathkit* SIGNAL GENERATOR KIT

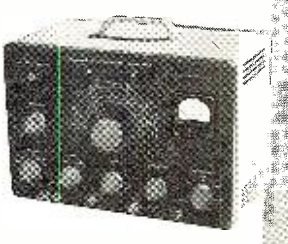
MODEL SG-8

$19.50 Shpg. Wt. 8 lbs.

The new Heathkit service type Signal Generator, Model SG-8 incorporates many design features not usually found in this instrument price range. Frequency coverage is from 160 KC to 110 MC in five ranges, all on fundamentals, with useful calibrated harmonics up to 220 MC. The RF output level is well in excess of 100,000 microvolts throughout the frequency range. The oscillator circuit consists of a twin triode tube, one-half used as a Colpitts oscillator, and the other half as a cathode follower output which acts as a buffer between the oscillator and external load, thereby eliminating oscillator frequency shift usually caused by external loading.

All coils are factory wound and adjusted, thereby completely eliminating the need for individual calibration and the use of additional calibrating equipment. The stable, low impedance output, features step and variable attenuation for complete control of RF level. A separate 6C4 triode acts as a 400 cycle sine wave oscillator, and a panel mounted switching system permits choice of either external or internal modulation.

Heathkit LABORATORY GENERATOR KIT



MODEL LG-1

$39.50

Shpg. Wt. 16 lbs.

The new Heathkit Laboratory type Signal Generator definitely establishes a new performance standard for a kit instrument. An outstanding feature involves the use of a panel mounted 200 microampere meter calibrated both in microvolts and percent modulation, thereby providing a definite reference level for using the Signal Generator in design work, gain measurements, selectivity, frequency response checks.

DESIGN:

Additional design features are copper plated shield enclosure for oscillator and buffer stages resulting in effective double shielding. Fibre panel control shaft extensions in RF carrying circuits, thorough AC line filtering, careful shielding of the attenuator network, voltage regulated B plus supply, selenium rectifier, etc.

RANGES:

Frequency coverage from 150 KC to 30 MC all on fundamentals in five separate ranges. Output voltage .1 volt with provisions for metered external or internal modulation. Output impedance termination 50 ohms. Transformer operated power supply.

Investigate the many dollar stretching features offered by the LG-1 before investing in any generator for Laboratory or Service work.

NEW *Heathkit* BAR GENERATOR KIT

MODEL BG-1

$14.50 Shpg. Wt. 4 lbs.

The Heathkit BG-1 produces a series of horizontal or vertical bars on a TV screen. Since these bars are equally spaced, they will quickly indicate picture linearity of the receiver under test without waiting for transmitted test patterns. Panel switch provides "standby—horizontal and vertical position." The oscillator unit uses a 12AT7 twin triode for the RF oscillator and video carrier frequencies. A neon relaxation oscillator provides low frequency for vertical linearity tests. The instrument will also provide an indication of horizontal and vertical sync circuit stability as well as overall picture size. Operation is simple and merely requires connection to the TV receiver antenna terminal. Transformer operated for safety.

HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15, MICHIGAN

and field office for military work has been opened by **GENERAL PRECISION LABORATORY** at 21 N. Santa Anita Ave., in Pasadena . . . **PERMACEL TAPE CORPORATION** has opened a modern one-story warehouse at 615 Livernois Avenue, Ferndale, Michigan to service the Ohio, Michigan, and Kentucky areas . . . **HEPPNER MANUFACTURING COMPANY** of Round Lake, Illinois is building an additional 10,000 square feet of plant area which will house its tool, die, and punch press departments.

* * *

DURWARD M. BRANIGAN has been promoted to the post of manager of distributor sales for the Tube Division of *Radio Corporation of America* succeeding Harold F. Bersche, who was upped to the post of manager of the marketing services department of the corporation's tube division.

Mr. Branigan will supervise the division's distributor field sales force and will have responsibility for sales of all division products handled through distributors. These products include receiving tubes, TV picture tubes, power tubes, test equipment, electronic components, and radio batteries.

* * *

SUPEREX ELECTRONICS CORPORATION has moved its offices and factory to a modern and larger building at 4-6 Radford Place, Yonkers, New York . . . **SANDS ASSOCIATES,** an industrial marketing consulting firm, has moved to new quarters in the Miller Building, 136 E. Figueroa Street, Santa Barbara, California . . . **ASSEMBLY PRODUCTS INC.** has moved from Chagrin Falls, Ohio to new quarters in Chesterland, Ohio . . . **PRECISION RADIATION INSTRUMENTS, INC.** has moved to a modern 10,000 square foot brick building at 4223 W. Jefferson Blvd. in Los Angeles. Its old facilities at 2235 S. La Brea Ave. are being retained as sales offices . . . **RECOTON CORPORATION** is now located at 52-35 Barnett Ave., Long Island City 4, N. Y. . . . **RESE ENGINEERING INC.** has increased its floor space by nearly 7000 square feet by moving to a new plant at 731-33 Arch Street in Philadelphia. The new quarters will house all operations.

* * *

HERMAN FIALKOV has been elected president of *General Transistor Corp.*, Jamaica, N. Y., manufacturer of transistors and germanium diodes.

He was formerly chief engineer of the germanium division of *Radio Receptor Co.*, is a graduate of the College of Engineering of New York University. He has served in engineering capacities with *Emerson Radio & Phonograph Corp.*, the *Mutual Broadcasting System*, and *Tele-Tone*. —30—

Heathkit TUBE CHECKER KIT

The Heathkit TC-2 Tube Checker was primarily designed for the convenience of radio and TV servicemen and will check the operating quality of tubes commonly encountered in this type of work. Test set-up procedure is simplified, rapid, and flexible. Panel sockets accommodate 4, 5, 6, and 7 pin tubes, octal and loctal, 7 and 9 pin miniatures, 5 pin Hytron, and a blank socket for new tubes. Built-in neon short indicator, individual 3-position lever switch for each tube element, spring return test switch, 14 filament voltage ranges, and line-set control to compensate for supply voltage variations, all represent features of the TC-2.

Results of tube tests are read directly from the large 4½" Simpson 3-color meter. Checks emission, shorted elements, open elements, and continuity. Wiring procedure has been simplified through the use of multi-wired color coded cable providing a harness type installation between tube sockets and lever switches. This procedure insures standard assembly and imparts a "factory built" appearance to the instrument. New Construction Manual furnishes detailed information regarding tube set-up procedure for testing of new or unlisted tube types. No delay necessary for release of factory data.

MODEL TC-2
$29.50
Shpg. Wt. 12 lbs.

Heathkit PORTABLE TUBE CHECKER KIT

The portable model is supplied with a strikingly attractive two-tone cabinet finished in rich maroon proxylin impregnated fabric covering with a contrasting gray on the inside of the detachable cover.

MODEL TC-2P
$34.50
Shpg. Wt. 15 lbs.

Heathkit REGULATED POWER SUPPLY KIT

MODEL PS-2
$33.50 Shpg. Wt 15 lbs.

Here is a source of regulated D.C. voltage for circuit development work. Power supply voltage and current drain to the circuit under test are constantly monitored by the 4½" panel mounted meter. Separate 6.3 volt at 4 ampere A.C. filament source available. The regulated and variable output voltage will be constant over wide load variations, and hum ripple will not exceed .012% at 250 volts under a 50 MA load. Completely isolated circuit, standby switch, and other desirable features, make the Model PS-2 extremely useful in a wide variety of applications.

Heathkit TV PICTURE TUBE TEST ADAPTER

The Heathkit TV Picture Tube Test Adapter used with the Heathkit Tube Checker Kit, will quickly check picture tubes for emission, shorts, etc. and determine tube quality. Consists of standard 12-pin TV tube socket, four feet of cable, octal socket connector, and data sheet.

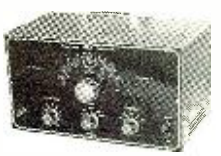
No. 355
$4.50 Shpg. Wt. 1 lb.

Heathkit DECADE RESISTANCE KIT

MODEL DR-1
$19.50
Shpg. Wt. 4 lbs.

Twenty 1% resistors are decaded in 1 ohm steps to provide any value between 1 ohm and 99,999 ohms. Sturdy ceramic switches with silver plated contacts insure reliable service. Use the Decade Resistance in bridge circuits, meter multipliers, calibrations, or any application requiring a wide range of precision resistance values.

Heathkit AUDIO GENERATOR KIT



Here is an Audio Generator with features generally found only in the most expensive instruments. Sine wave coverage from 20 cycles to 1 Megacycle—response flat ±1 db from 20 cycles to 400 Kc—continuously variable and step attenuated output. Because the output voltage is relatively constant over wide frequency ranges, the AG-8 is ideal for running frequency response curves in audio circuits. Once set by means of the attenuator, this voltage may be relied upon for accuracy within ± 1 db. Instrument features low impedance 600 ohm output circuit and distortion less than .4 of 1% from 100 CPS through audible range.

MODEL AG-8
$29.50
Shpg. Wt. 11 lbs.

Heathkit DECADE CONDENSER KIT

The Heathkit Decade Condenser provides a ready source of capacity values from 100 mmf to .111 mfd inclusive in capacity steps of 100 mmf. Silver plated contacts on husky ceramic switches, assure positive contact for each switch position. Precision silver mica condensers ±1% accuracy for close tolerance accurate work.

MODEL DC-1
$16.50
Shpg. Wt. 3 lbs.

HEATH company

A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* HIGH FIDELITY
PREAMPLIFIER KIT

Here is the exciting new Heathkit Preamplifier with all of the features you Audiophiles have asked for and at a down-to-earth price level. Beautiful satin gold baked enamel finish, striking control knobs and arrangement, attractive custom appearance and entirely functional design.

DESIGN:

Uses three twin triode tubes in a shock mounted chassis, 2-12AX7 and 1-12AU7. Features tube shielding, plastic sealed color coded capacitors, smooth acting controls, good filtering, excellent decoupling, low hum and noise level, and all aluminum cabinet. Special balancing control for absolute minimum hum level. Cathode follower, low impedance output circuit for complete installation flexibility.

SPECIFICATIONS:

Provides five switch selected inputs, 3 high level, and two low level, each with individual level controls—4 position LP, RIAA, AES, and early 78 equalization switch—4 position roll-off switch, 8, 12, 16 with one flat position. Separate tone controls, bass 18 db boost and 12 db cut at 50 CPS, treble 15 db boost, and 20 db cut at 15,000 CPS. Power requirements from Heathkit Williamson Type Amplifier power supply 6.3 volts AC at 1 ampere, and 300 volts DC at 10 MA. Over-all dimensions 12⅜" wide x 5⅞" deep x 3⅝" high.

APPLICATION:

The new Heathkit WA-P2 Preamplifier has been designed to operate with any of the Heathkit Williamson Type Amplifiers and is directly interchangeable with the previous Model WA-P1 Preamplifier unit. Order your kit today and enjoy completely smooth control over the operation of your Hi-Fi system. Obtain the exact tonal balance of bass and treble with the precise degree of equalization you want. Note that the design of the WA-P2 accommodates the newly established RIAA curve.

MODEL WA-P2
$19.75
Shpg. Wt. 7 lbs.

HAM EQUIPMENT

Heathkit AMATEUR TRANSMITTER KIT

The Heathkit AT-1 Transmitter has established a high reputation and has been enthusiastically accepted by hundreds of experienced operators as well as beginners. Power input up to 35 watts for the novice and suitable as a standby exciter for your higher powered rig later on.

Model AT-1 can be crystal or VFO excited and operates on 80, 40, 20, 15, 11 and 10 meters. The pre-wound coils with the oscillator and amplifier are switched simultaneously by the rugged band switch. Meter switch allows a reading of the final grid and plate current on the panel mounted meter. Modulator input and VFO power sockets are provided as well as a key jack for CW operation. Other features include a crystal socket, standby switch, key click filter, AC line filter, good shielding and a 52 ohm coaxial output. The 425 volt, 100 milliampere power supply and 5U4 rectifier are more than adequate for the 6AG7 oscillator multiplier and 6L6 amplifier doubler.

MODEL AT-1
$29.50
Shpg. Wt. 16 lbs.

Brand NEW

HEATHKIT VFO KIT

The new Heathkit VFO is the perfect companion to the Heathkit Model AT-1 Transmitter and it has sufficient output to drive any multi-stage transmitter of modern design. Good mechanical and electrical design insures operating stability. Coils are wound on stable, heavy duty, ceramic forms using Litz or double cellulose wire coated with Polystyrene cement and baked for humidity protection. Variable capacitor of differential type construction, especially designed for maximum bandspread. Kit is furnished with a carefully precalibrated scale which provides well over two feet of scale length. Smooth acting vernier reduction drive and illuminated dial provides easy tuning and zero beating.

Power requirements 6.3 volts AC at .45 amperes, and 250 volts DC at 15 mils. Just plug it into the power receptacle provided on the rear of the AT-1 Transmitter. Seven band coverage 160 through 10 meters with 10 volt average RF output. Uses 6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.

MODEL VF-1
$19.50
Shpg. Wt. 7 lbs.

Heathkit GRID DIP METER KIT

The invaluable instrument for Hams, servicemen and experimenters. Useful in TV service work, for alignment of traps, filters, IF stages, peaking compensation networks, etc. Locates spurious oscillation, provides a relative indication of power in transmitter stages. Use it for neutralization, locating parasitics, correcting TVI, measuring CL and Q of components, and determining RF circuit resonant frequencies. The variable meter sensitivity control, headphone jack, 500 microampere Simpson meter, continuous frequency coverage from 2 MC to 250 MC. Prewound coil kit and rack included.

LOW FREQUENCY COILS:

Low frequency range extended to 355 KC by the use of two additional coils. Complete with dial correlation curves. Set 341-A for GD-1B and set 341 for GD-1A. Shipg. wt. 1 lb. Price $3.00

MODEL GD-1B
$19.50 Shpg. Wt. 4 lbs.

Heathkit ANTENNA IMPEDANCE METER KIT

MODEL AM-1
$14.50
Shpg. Wt. 2 lbs.

Determine antenna resonance and resistance, transmission line surge impedance, and receiver input impedance. Works with one-half and one-quarter wave lines, half wave and folded dipoles, harmonic mobile and beam antennas. Resistance type SWR bridge —100 microampere meter—frequency range 0–150 MC—impedance range 0–600 ohms.

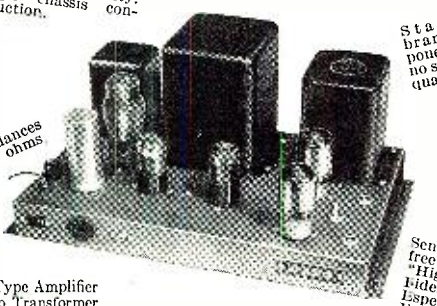
Heathkit ANTENNA COUPLER KIT

MODEL AC-1
$14.50
Shpg. Wt. 4 lbs.

For the Heathkit AT-1 Transmitter or any comparable Amateur Transmitter. Will handle power up to 75 watts at its 52 ohm coaxial input. Matches a wide range of antenna impedances with its L type tuning network and neon indicator. A tapped inductance provides coarse adjustment and a transmitting type variable condenser sets it "right on the nose." Will operate on the 10 through 80 meter bands.

HEATH company
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 15, MICHIGAN

New LOW PRICED HEATHKIT SINGLE UNIT Williamson Type High Fidelity AMPLIFIER KIT



Here is the newest Heathkit Hi-Fi Amplifier at the lowest price ever quoted for a complete Williamson Type Amplifier circuit. The W-4 Model has been designed for single chassis construction, and only for the new Chicago Transformer Company Model BO-13 "super range" high fidelity output transformer. This transformer, a new development in the Hi-Fi field, is being offered at substantial saving over transformers of comparable quality. It is outstanding in performance and on the basis of our tests, we find it equal in every respect to transformers used in the W-2 and W-3 Heathkit series.

LOW PRICES:

Through utilization of a single chassis with resultant economy obtained through elimination of duplicate sheet metal fabrication, connecting cables, plugs, sockets, and a new Chicago "super range" output transformer, a 20% price reduction has been made possible without sacrificing kit quality.

COMPONENTS:

The new Heathkit W-4 uses the same heavy duty power transformer and choke. It has all of the features of previous models including individual jacks and a wire wound control to balance the output tubes—plastic high quality capacitors and the exact circuitry previously utilized in Williamson Type Amplifiers. Intermodulation distortion and harmonic distortion are both at the same low level as in the W-2 and W-3 models.

CONSTRUCTION:

Here is the opportunity for even the economy minded Hi-Fi enthusiast to enjoy all of the advantages offered through Hi-Fi reproduction of fine recorded music. Simplified step-by-step Construction Manual completely eliminates necessity of electronic knowledge or special equipment. Assemble this Amplifier in a few pleasant hours.

COMBINATIONS AVAILABLE

W-4M with Chicago "super-range" transformer only. Single chassis main amplifier and power supply. Shipping weight 28 lbs. Express only **$39.75**

COMBINATION W-4 with Chicago "super-range" transformer only includes single chassis main amplifier and power supply with WA-P2 preamplifier kit. Shpg. wt. 35 lbs. Express only **$59.50**

NEW Heathkit 20 WATT High Fidelity AMPLIFIER KIT

MODEL A-9B

$35.50

Shpg. Wt. 24 lbs.

In keeping with the progressive policy of the Heath Company, further improvement has been made in the already famous Heathkit High Fidelity 20 Watt Amplifier. Additional reserve power has been obtained by using a heavier power transformer. A new output transformer designed and manufactured especially for the Heath Company, now provides output impedances of 4, 8, 16 and 500 ohms. The harmonic distortion level will not exceed 1% at the rated output.

FEATURES:

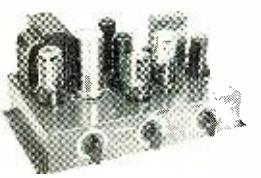
Outstanding features of the Heathkit 20 watt Amplifier include frequency response of ±1 db from 20 CPS to 20 KC. Separate (boost and cut) bass and treble tone controls. Four switch selected input jacks and a special hum balancing control. Flexibility is emphasized in the input circuits and proper equalization for all input devices is incorporated.

TUBE LINEUP:

12AX7 magnetic preamplifier and first audio amplifier. 12AU7 two stage amplifier with tone controls. 12AU7 voltage amplifier and phase splitter. Two 6L6 push-pull beam power output and 5U4G rectifier.

The Heathkit Model A-9B is excellent for custom installation and is designed for outstanding service at a very reasonable cost.

Heathkit SIX WATT AMPLIFIER KIT



MODEL A-7B

$15.50

Shpg. Wt. 10 lbs.

An outstanding value, this economically priced 5 watt Amplifier is capable of performance expected only in much more expensive units. Only 2 or 3 watts output will ever be used in normal home applications and Model A-7B will be more than adequate for this purpose.

SPECIFICATIONS:

Two switch selected inputs are available for crystal and ceramic phono pickups, tuner, TV audio, tape recorder, and carbon type microphone. Model A-7B features separate bass and treble tone controls, push-pull balanced output stages, output impedances of 4, 8, and 15 ohms, and extremely wide frequency range ±1½ db from 20 CPS to 20 KC. Not just a souped up AC-DC job. Full wave rectification, transformer operated power supply and good filtering, result in exceptionally low hum level.

MODEL A-7C

Provides a preamplifier stage and proper compensation for the variable reluctance cartridge and low level microphone. $17.50

Heathkit WILLIAMSON TYPE AMPLIFIER KIT

Here is the famous kit form Williamson Type *high fidelity* Amplifier that has deservedly earned highest praise from every strata of Hi-Fi music lovers. Virtually distortionless, clean musical reproduction, full range frequency response, and more than adequate power reserve.

OUTPUT TRANSFORMERS:

This outstanding Williamson Type Hi-Fidelity Amplifier is supplied with the famous Acrosound TO-300 output transformer. This quality transformer features the popular "ultra-linear" output circuit for clean maximum power level. Separate chassis for amplifier and power supply.

SPECIFICATIONS:

Frequency response within 1 db from 10 cycles to 100,000 cycles. Harmonic distortion at 5 watt output less than .5% between 20 cycles and 20,000 cycles. IM distortion at 5 watts equivalent output .5% using 60 and 3,000 cycles. Output impedances of 4, 8, or 16 ohms. Overall dimensions for each unit 7" high x 5½" wide x 11½" long.

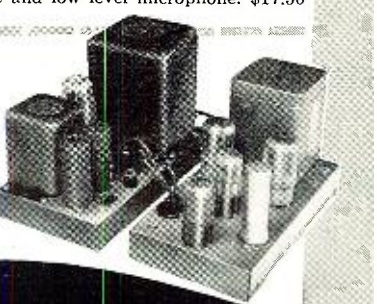
CONSTRUCTION MANUAL:

This fine kit is supplied with a completely detailed step-by-step Construction Manual and the only effort required is the assembly and wiring of the pre-engineered kit. Even the complete novice can successfully construct this Amplifier and have fun building it.

COMBINATIONS AVAILABLE:

W-3 Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer, Power Supply and WA-P2 Preamplifier.) Shipping weight 37 lbs. Shipped express only..... **$69.50**

W-3M Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer and Power Supply.) Shipping weight 29 lbs. Express only **$49.75**



HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15, MICHIGAN

Heathkit COMMUNICATIONS RECEIVER KIT

Separate BFO oscillator tube and circuit.

Continuous coverage 550 KC—35 MC on 4 Bands.

MODEL AR-2

$25.50

(Less Cabinet)

Shpg. Wt. 12 lbs.

Phone—standby—CW panel switch.

RF gain control with AGC on-off switch.

Electrical bandspread tuning with logging scales.

An excellent example of typical Heath Company ability to produce top quality kit merchandise at ridiculously low prices, is the AR-2 Communications Receiver. Here is a transformer operated all-wave receiver with all of the desired features and none of the disadvantages commonly encountered in so-called "economy sets."

Receiver employs high gain miniature tubes and IF transformers, chassis mounted 5½" PM speaker, headphone jack, slide rule dial with Ham Bands plainly identified, and easy tuning with direct planetary drive. Continuous frequency coverage from 550 KC to 35 MC on 4 Bands, with electrical bandspread tuning and logging scales. Other features are RF gain control with AGC on-off switch–phone-standby-CW panel switch—prewound coils in a shielded turret assembly and copper plated chassis and shielding.

Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector-first audio, 12A6 beam power output, 12BA6 BFO oscillator, and 5Y3 rectifier. A lettered control plate is provided for the cabinet of your choice or you can order the optional Heathkit cabinet featuring the full size aluminum panel.

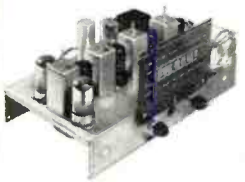
RECEIVER CABINETS

Proxylin impregnated fabric covered plywood cabinet available for BR-2 and AR-2 receivers. Includes aluminum panel, flocked reinforced speaker grill and protective rubber feet.

For BR-2 Receiver, Cabinet 91–9
Shipping weight 5 lbs. **$4.50**

AR-2 Receiver, Cabinet 91–10
Shipping weight 5 lbs. **$4.50**

Heathkit FM TUNER KIT



MODEL FM-2

$22.50

Shpg. Wt. 8 lbs.

Here is an FM Tuner that can be operated with your Hi-Fi Amplifier or through the "phono" section of the ordinary radio. Completely AC operated to eliminate problems usually encountered in "economy type" AC-DC tuner circuits. Features 8 tube circuit with separate mixer and oscillator, 3 double tuned IF stages followed by a limiter discriminator providing maximum sensitivity and selectivity across the full FM frequency band of 88 MC to 108 MC. The tuning unit is factory assembled and adjusted, thus eliminating tedious critical "front end" alignment problems. The attractive slide rule dial and vernier tuning combine to make the Heathkit FM-2 Tuner simple to operate.

Heathkit BROADCAST BAND RECEIVER KIT

MODEL BR-2

$17.50

(Less Cabinet)

Shpg. Wt. 10 lbs.

The Model BR-2 Broadcast Band Receiver is designed especially for the beginner without any sacrifice of quality. This receiver features a transformer operated power supply, high gain miniature tubes, sharply tuned IF transformers, new rod type built-in antenna, and a trouble-free planetary tuning system. Exceptional performance with unusually high sensitivity, good selectivity, and excellent tone quality from the 5½" PM chassis mounted speaker. Can be used either as a receiver, tuner, or phono amplifier. Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector, 12A6 beam power output, and 5Y3 rectifier.

HEATH COMPANY · Benton Harbor 15, Mich.

MAIL YOUR ORDER TODAY TO THE
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A SUBSIDIARY OF DAYSTROM, INC
BENTON HARBOR 15, MICHIGAN

WALNUT 5-1175

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- ☐ Best Way

(PLEASE PRINT)

QUANTITY	ITEM	MODEL NO.	PRICE

Enclosed find ( ) check ( ) money order for
Please ship C.O.D. ( ) postage enclosed for _____ pounds.

On Express orders do not include transportation charges—they will be collected by the express agency at time of delivery.

ON PARCEL POST ORDERS insure postage for weight shown.

ORDERS FROM CANADA and APO's must include full remittance.

Let 'Er Blow

By CLARK E. JACKSON

Don't let your antenna tower be a sucker for high wind velocities. Here is your "insurance" against disaster.

THE havoc resulting from the fury of hurricanes, especially along the Eastern seaboard, has included the total loss of numerous antenna towers, antennas, and rotators. Having witnessed the destructive effects caused by high wind velocities during 1953, it was with firm resolution that we gave serious study to the problems of safety and security for our next (and permanent, we hoped) installation.

Experience had shown, in our particular case, that for either optimum signal strength of TV signals or from 2-meter amateur communications, a height of about 60 feet off the ground produced the best results. Ours is a very hilly terrain in New England, and signals did peculiar tricks during seasonable changes of weather before we adopted the tower for obtaining more altitude.

Having made our decision to put up a 60-foot tower, the next step was to consider a design that could be quickly lowered to reduce potential hazard from future hurricanes. A multi-element beam antenna, even the 2-meter type, presents high resistance to wind and exerts tremendous pressures and strains on the tower, especially to unguyed sections. A "telescoping type" of tower seemed to best meet our requirements. The installation includes the *Tel-Ex-Pand* M-60 tower, the *JFD* "RotoKing" rotator, and a *Gonset* Model 1560 stacked 2-meter yagi beam antenna.

Patience and care have their rewards when putting up a tower. It is good insurance to take every precaution against rust as the first step in preventive maintenance. The best of steel towers will quickly rust, especially at welded spots, if any metal is exposed. Four coats of aluminum were sprayed on the tower for protection.

A solid footing is required to support the weight of the tower and accessories. An easy method is to form a concrete base fashioned from concrete blocks and ready-mix cement. Dig a 24" square about 18" deep. Level the bottom and place (side by side) two large concrete blocks. Wet the blocks and build a simple square wood frame around the blocks. Fill with one of the ready-mixed cements obtainable from your local hardware store.

Use large washers on long bolt heads and immerse them several inches in the wet concrete. Drop the tower base over the bolts and keep it level until the concrete sets. Then tighten the nuts to hold the base.

Heavy stranded guy wires (we used phosphor bronze) are secured, before erection, to the guy hooks at the top of each of the two lower 20-foot sections. Use heavy eyelets to prevent severe bends. The top section is not guyed. The six guy wires are each supplied with heavy galvanized 10-inch turnbuckles and are positioned near the building wall or other holding surface. Use heavy eyelets here too.

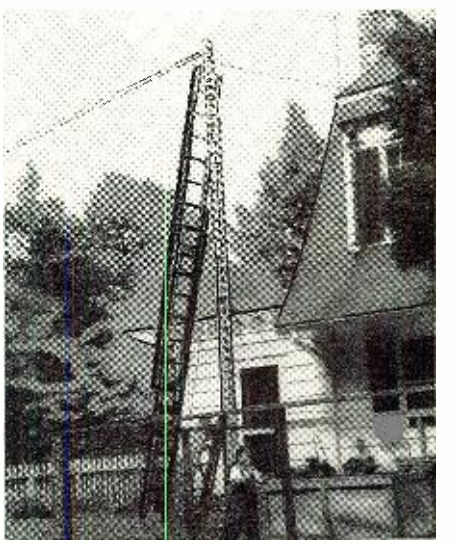
The tower (collapsed to 20 feet) is raised by means of a crank (supplied with the tower) after the lower guys have been made fast. Then the three remaining guys are secured as the extended tower approaches its maximum length.

Spring-loaded "dogs" automatically hold the sections in place. This relieves the airplane-type lifting cable of permanent strain after the tower is extended. The upper guys are now secured and tightened by means of the turnbuckles.

During "Hurricane Carol" last year, the tower was lowered, before the storm started, to 20 feet by simply loosening the top guy turnbuckles and letting the tower telescope down to 20-foot length. Later, during "Hurricane Hazel" (the worst in our area), it was not practical to reach home in time to lower the tower. Fortunately, the installation withstood the blow.

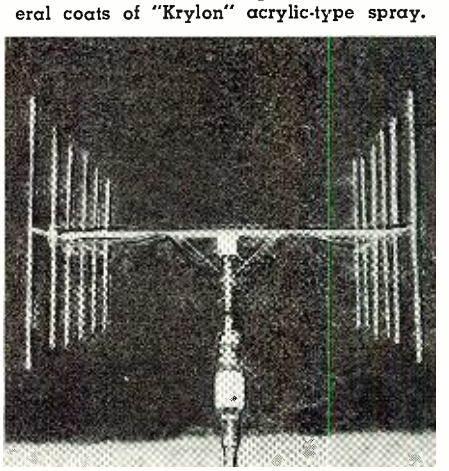
Our experience has shown that a tower and its antenna can take a real beating—provided that proper techniques are used in planning and making its installation. Next time we go away for a vacation—we'll lower the tower and never feel concern for its safety—no matter how hard she blows. -30-

A final touch-up with aluminum spray is given the installation to cover worn spots caused by scraping during tower's erection.

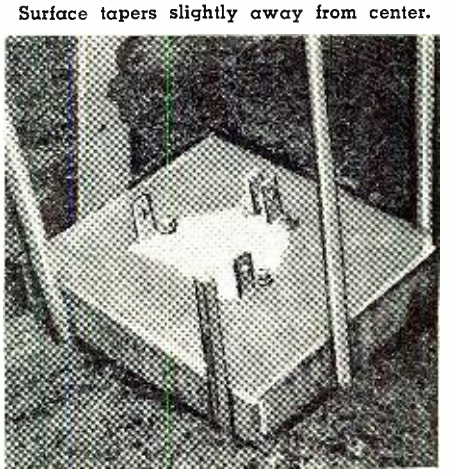


The collapsed tower, with its lower guy wires taut, is shown here just before the antenna rotator and antenna are mounted.

The 2-meter stacked array was given several coats of "Krylon" acrylic-type spray.



The tower base imbedded in wet concrete. Surface tapers slightly away from center.



Conelrad Receiver

(*Continued from page 69*)

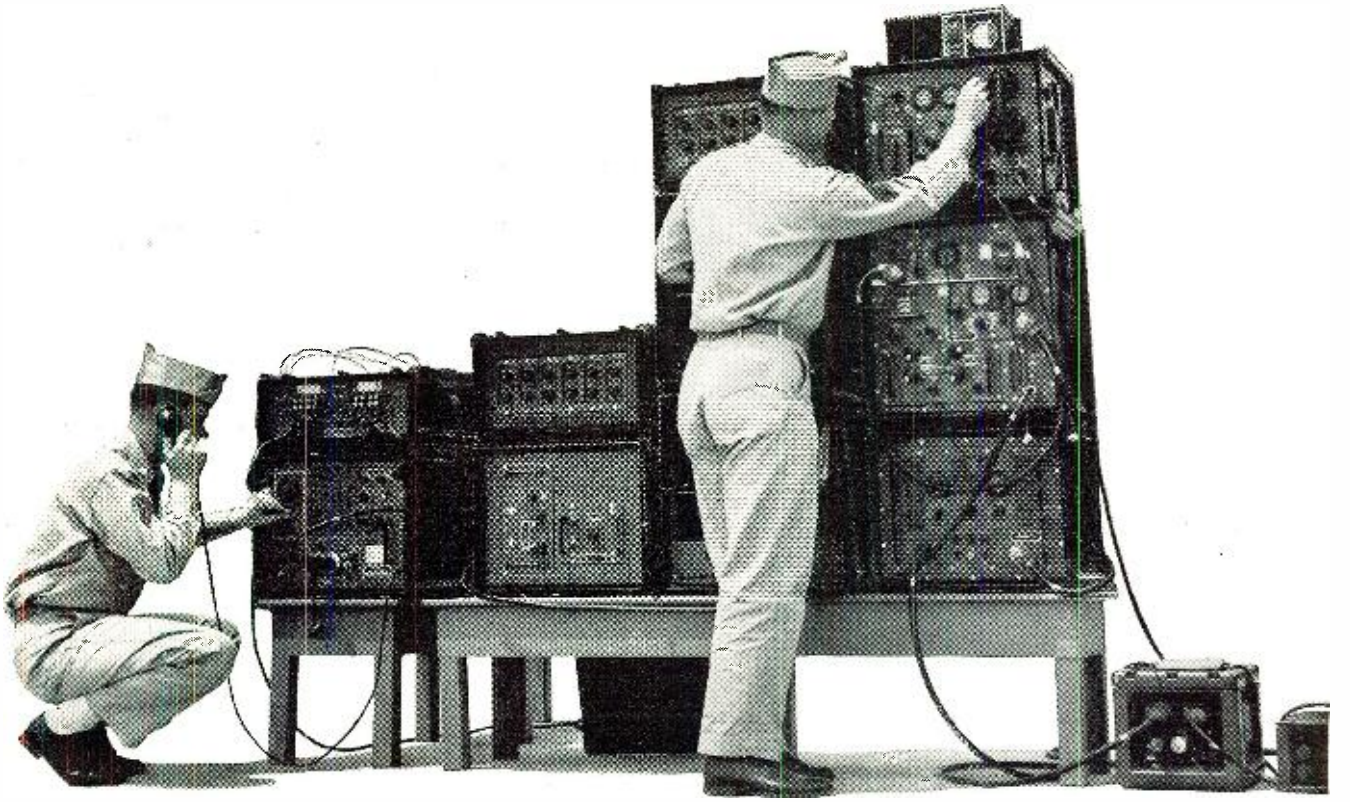
conventional antenna coupling circuits did not work well due to the loading effects of the transistor.

This could have been remedied by using one of a number of special input circuits, tapped coils, etc., but it was decided for simplicity sake to take a small sacrifice in gain and replace the transistor detector with a germanium diode, type 1N34. A *Transitron* type 2N34 transistor was used for audio amplification.

The complete schematic diagram of the *Conelrad* receiver is given in Fig. 1. The receiver input circuit consists of a *J. W. Miller* "High-Q Ferrite Antenna Coil" with the polyethylene insulated antenna wire removed. A secondary winding is added by winding about 50 turns of fine wire on a paper or light cardboard form which will fit snugly over the existing winding. This pickup coil is positioned to give the best compromise between sensitivity and selectivity and then fastened in place with a dab of nail polish. The original winding which is used as the primary of the coupling transformer is tuned by a 50-400 $\mu\mu$fd. padder capacitor. A possible refinement, not shown, would be to have two padder-type tuning capacitors switched into the circuit by a small slide-type switch. One could then be permanently tuned to 640 kc. and the other to 1240 kc. so that a rapid and precise switchover in tuning could be made. The transistor audio stage gives ample volume on local stations using a 3 volt "B" supply, in this case two penlite cells connected in series. No "on-off" switch is indicated, the receiver being turned "on" by plugging the earphone into J_1, thus completing the battery circuit. The single earphone unit clips to the case of the receiver when not in use.

The completed unit mounts very snugly into a small plastic box as shown in the accompanying photographs. As most old crystal set men will recall, a fairly long antenna and a good ground are required for best results. For this purpose, it might be handy to tape a roll of 25 to 50 feet of fine wire to the receiver case for use as an emergency antenna. The entire unit slips very nicely into pocket or glove compartment of a car.

Conelrad plans will be put into effect during any emergency periods which are designated as "Radio Alert". The authorization to return to normal operation is "Radio All Clear". The Air Defense Command, U. S. Air Force, will order the attack warning which will activate the *Conelrad* system. As soon as the "Radio Alert" order has been received by selected TV, FM, and AM broadcasting stations, the following sequence of operations will take place. 1. Normal program discontinued; 2. Transmitter carrier cut for 5 seconds; 3. Carrier returned to air for 5 seconds; 4. Carrier cut for 5 seconds; 5. Carrier returned to air; 6. Broad-



Tuning in for radio transmission. Each item of equipment is not much bigger than a suitcase.

A leapfrog telephone system for the Armed Forces!

A new communications system, which takes to the air when water or rough terrain prevents the stringing of wires, has been developed for the U.S. Signal Corps by Bell Telephone Laboratories.

The system uses cable and radio relay interchangeably over a 1000-mile range. It is easily portable, unaffected by climate, and rugged enough for global use. Twelve voices travel at once over a pair of wires or radio waves—as clearly and naturally as over the regular telephone system.

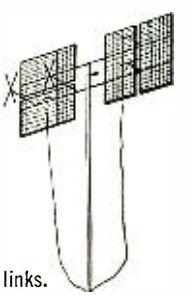
This is the first time a completely integrated wire and radio system of this large a channel capacity has been available for tactical use by the Armed Forces. It is already in production at Western Electric, manufacturing and supply unit of the Bell System.

The new system is a joint achievement of the Signal Corps, Bell Laboratories and Western Electric . . . one of the many results of long and fruitful co-operation. It shows again how techniques which the Laboratories develop contribute to our national strength.

Bell Telephone Laboratories

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

Amplifiers like this are used every 5¾ miles in the cable portions of the system. They are weatherproof, can be used on a pole or the ground, and will even work under water. The system uses a spiral wound cable developed by the Signal Corps.



Easily raised antennas send or receive for the radio links.

cast a steady 1000 cycle tone for 15 seconds; 7. Read a "Radio Alert" message; and 8. Remove carrier from the air for the duration of the emergency. (Certain stations return to the air broadcasting on either 640 or 1240 kc.)

No station identification will be used for obvious reasons, but information from any nearby station should be helpful during the emergency. —30—

DAYTON "HAMVENTION"

ON SATURDAY, April 2nd, the Dayton Amateur Radio Association is sponsoring its fourth annual "Hamvention" at the Dayton Biltmore Hotel.

The day-long program will feature many prominent speakers on all phases of ham radio. All classes of ham exams will be given by the FCC.

The affair will wind up with a banquet at 7 p.m. in the hotel ballroom. Tickets are $5.00 in advance or $5.50 at the door. Write D.A.R.A., P.O. Box 44, Dayton 1, Ohio for tickets. —30—

ALASKAN DX

IN ORDER to promote world-wide interest in working Alaskan amateur radio stations, the Anchorage Amateur Radio Club (KL7AA) is sponsoring an Alaskan DX Award. The requisites for earning this award are as follows:

1. Submit appropriate QSL confirmations for a total of ten Alaskan (KL7) QSO's which were made subsequent to January 1, 1955.

2. Of the total of ten QSO's required, there must be at least one from each of the four geographical areas of Alaska: Southeastern (the area bounded by British Columbia); Northeastern (Alaska north of the Arctic Circle); Aleutian (Aleutian Islands including Kodiak Island); Central (remainder of Alaska).

3. Of the total of ten QSO's four must be with members of the Anchorage Radio Club.

4. Alaskan amateurs are not eligible for this award.

5. QSO's may be with either phone or c.w. and may be on any authorized amateur band or combination of bands. Appropriate notation in the form of stickers will be awarded for single band awards.

Applications for the award should be made to Anchorage Amateur Radio Club, P.O. Box 211, Anchorage, Alaska. Return postage must accompany all QSL cards if the owner desires their return. —30—

P.A.'s INC. ELECT

P.A.'S INC. has named H. M. Munson of Bendix Radio to the post of president for the ensuing year with S. Oser of Tech-Master serving with him as vice-president.

Other officers named at the same meeting include A. Schneiderman of Olympic Radio as treasurer; B. Trimboli of CBS-Columbia as corresponding secretary; and S. Woolfson of Emerson Radio as recording secretary.

All purchasing agents of the electronic industry on the East Coast are eligible for membership in this growing organization.

For additional information on the association, contact the corresponding secretary at the Long Island City, New York offices of CBS-Columbia. —30—

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Commercial·Radio Operator

LICENSE

INFORMATION

TELLS HOW—

WE GUARANTEE

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

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

HERE IS YOUR GUARANTEE
If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training, without additional cost of any kind, until you successfully obtain your Commercial license.

TV Engineering INCLUDED IN OUR TRAINING AND COACHING

TELLS HOW—

OUR AMAZINGLY EFFECTIVE JOB-FINDING SERVICE HELPS CIRE STUDENTS GET BETTER JOBS. HERE ARE JUST A FEW RECENT EXAMPLES OF JOB-FINDING RESULTS:

CIVIL SERVICE

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

STATE POLICE

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

BROADCASTING

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

AIRLINES

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

TELLS HOW—

EMPLOYERS MAKE JOB OFFERS LIKE THESE TO OUR GRADUATES EVERY MONTH!

Letter from nationally-known Airlines: "Radio Operators and Radio Mechanics are needed for our company. Periodic wage increase with opportunity for advancement. Both positions include many company benefits such as paid vacations, free flight mileage allowance and group insurance."

Letter from nationally-known manufacturer: "We have a very great need at the present time for radio-electronics technicians and would appreciate any helpful suggestions that you may be able to offer."

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

Ours is the only home study course which supplies FCC-type examinations with all lessons and final test.

An Approved Member

ACT NOW! Get ALL 3 FREE

Your FCC Ticket is recognized by employers as proof of your technical ability.

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING AT HOME IN SPARE TIME:

Name and Address	License	Time
Harry G. Frame, Box 429, Charlestown, W. Va.	2nd Class	13 Weeks
Charles Ellis, Box 449, Charles City, Iowa	1st Class	28 Weeks
Omar Bibbs, 1320 E. 27th St., Kansas City, Mo.	1st Class	34 Weeks
Kenneth Rue, Dresser, Wisconsin	2nd Class	20 Weeks
B. L. Jordan, Seattle, Washington	1st Class	20 Weeks

CARL E. SMITH, E.E. Consulting Engineering, President

CLEVELAND INSTITUTE OF RADIO ELECTRONICS

Desk RN-75, 4900 Euclid Bldg., Cleveland 3, Ohio

MAIL COUPON NOW!

Cleveland Institute of Radio Electronics
Desk RN-75—4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

I want to know how I can get my FCC Ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur License), as well as a sample FCC-type lesson and the amazing new booklet, "Money-Making FCC License information." **Be sure to tell me about your Television Engineering Course.**

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Address .....

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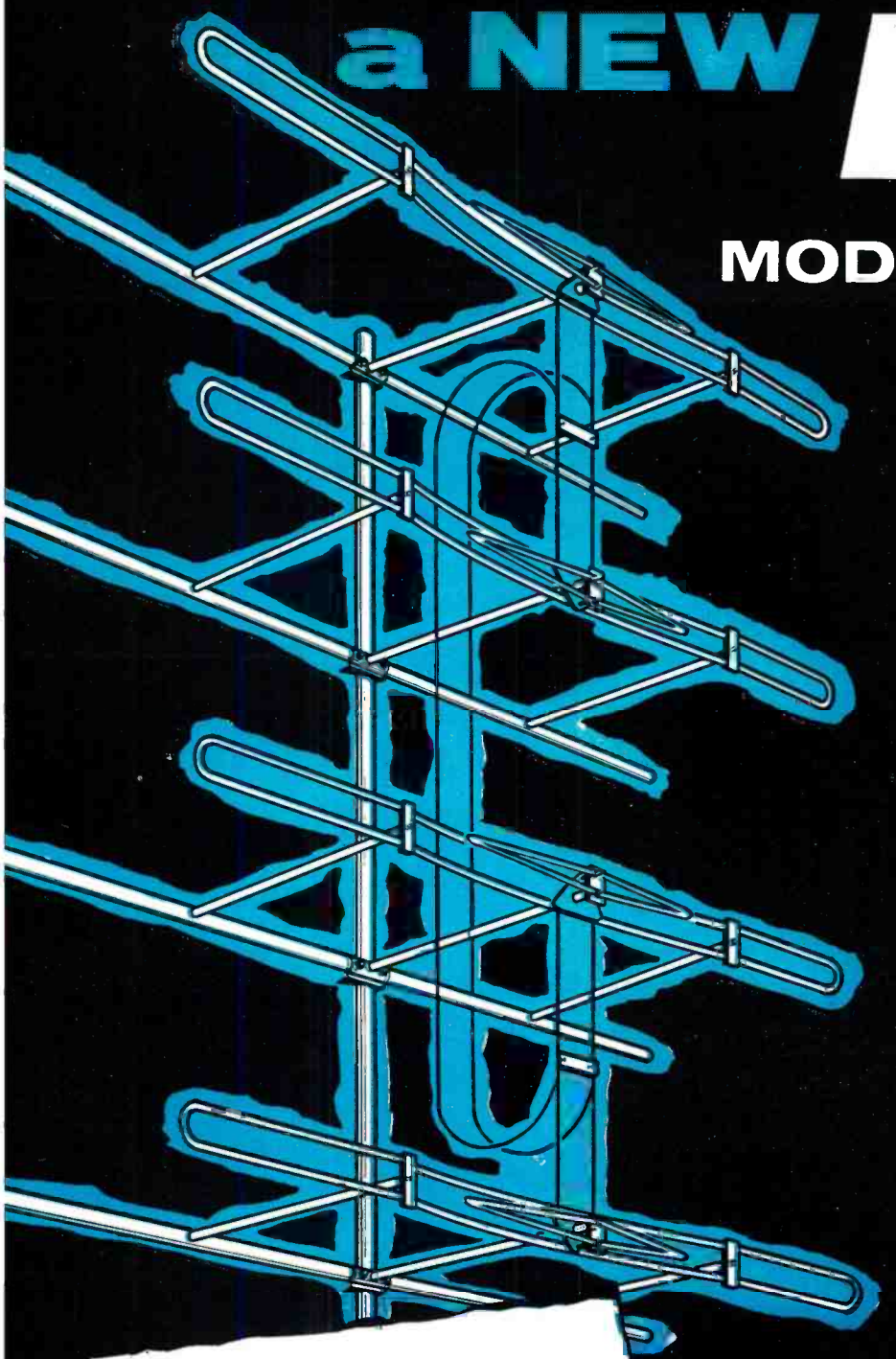
Special tuition rates to members of the U. S. Armed Forces

ANNOUNCING

a NEW FINCO®

MODEL F-4

(PAT. PEND.)



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FIDELITY PHASING*

* Dictionary: the highest degree of accuracy in the reproduction of a signal

Plus +

Now!

Finest Performance Ever Achieved on LOW-BAND

Acknowledged FINCO Superiority on HIGH-BAND!

"We will stake our reputation on this!"

M. L. Finneburgh, Vice-President,
The Finney Company,
speaking for the entire
FINCO organization:

"The new Finco Model F-4 (pat. pend.) is the closest approach to perfection yet conceived in TV antennas. The F-4 gives the greatest combined performance ever achieved in the Super Fringe Area . . . on both Low and High-band. Upon this, we stake our reputation."

NEW!

SENSATIONAL LOW PRICE
FIDELITY PHASING
LOW AND HIGH-BAND SUPREMACY
ENGINEERED FOR COLOR
UNCONDITIONAL WRITTEN WARRANTY
FREE TESTING ANTENNA TO QUALIFYING DISTRIBUTORS

WRITE, WIRE
OR PHONE
TODAY!

The FINNEY Company
DEPT. RN-45

4612 St. Clair Avenue
Cleveland 3, Ohio

The "Georgian"

(*Continued from page 62*)

Step No. 7: Mount the 15WK on the original detail 9 using four 3/16" carriage bolts with complementary washers and nuts. Attach two leads (fixture wire No. 18) and allow sufficient length to feed through a minimum sized hole in the door, detail 12. Putty this hole and continue the leads on to a *Jones* two-terminal barrier strip placed conveniently close to this hole. This will facilitate final wiring.

Now mount the Model 848HF midbass and treble assembly with the accompanying hardware on top of the bass section. The T35 is installed last and is positioned over the mounting holes shown on the top which correspond to the holes in the mounting bracket for this driver. Wire the units to the crossover which may be situated on the side of the bass assembly. The two AT37 level controls must have leads with sufficient slack to enable mounting later on the outer decorative shell if one is used.

Step No. 8: Set the two level controls at about half rotation and feed the crossover with signal from a good source. Adjust the spacing from the corner, measuring 3½" from the back edges of boards 2 and 3 to the walls adjacent. Phasing is required in the treble range because of the separation of the drivers. The 15WK leads may be reversed while playing. One way the lower range will sound full and rich, and an out-of-phase condition with this unit is readily apparent. For proper phasing see Fig. 6. Reset the controls for the best musical balance with average source materials *and at the level usually* used in the playing area. This is important, as the sensitivity of the ear changes at different levels for different parts of the spectrum.

Decorative Housing

The outer decorative shell, shown in Fig. 4, is in the style of the *Electro-Voice* "Georgian". If the proportions of the two side vents and the front upper opening are retained, the design may be modified to suit individual taste. Grilles, for instance, can be made from diamond patterned expanded metal type "Shelf-X", obtainable at any steel supply house. This metal can be sheared to size, and plated as desired

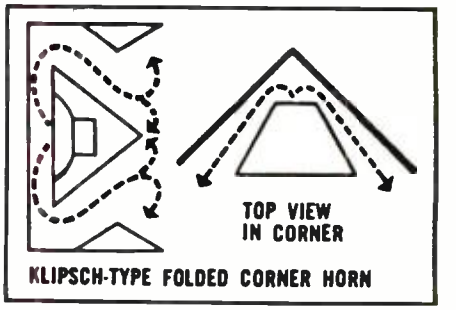


Fig. 5. Schematic illustration of path taken by sound wave in Klipsch folded horn.

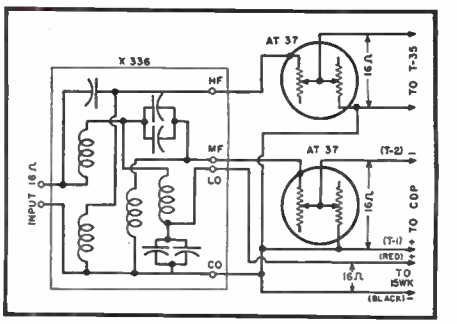


Fig. 6. Wiring diagram of the "Georgian" showing crossover network schematic. Note markings on drivers for proper phasing.

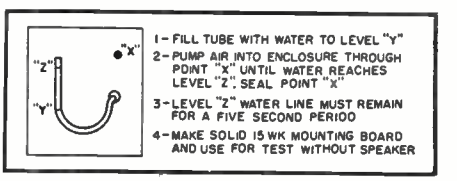


Fig. 7. Testing procedure for air tightness.

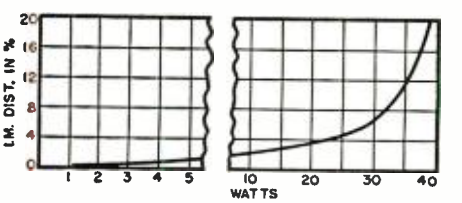


Fig. 8. Intermodulation distortion as measured at various powers. 60 cps was used as carrier modulated by 2 kc. at 4:1 ratio.

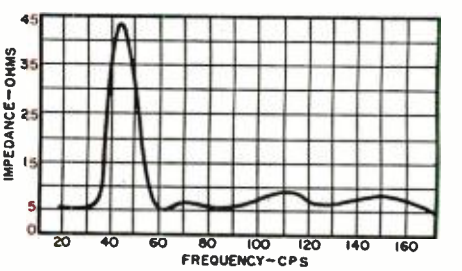
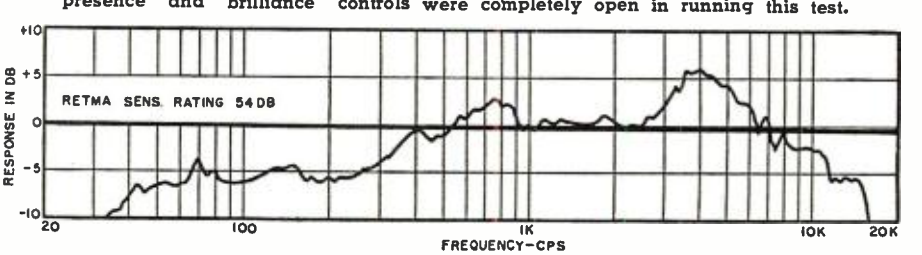
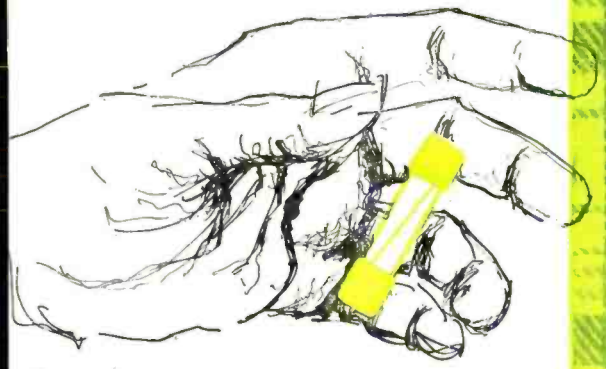


Fig. 9. Impedance characteristic measured with the "Georgian" in typical room corner.

Fig. 10. Machine-run composite curve of frequency response of the "Georgian." The region 200 cps and lower is the result of a simulated corner situated in free space out-of-doors, while the curve above 200 cps was run in an anechoic chamber. The "presence" and "brilliance" controls were completely open in running this test.



THE RIGHT FUSE AT HAND : TIME SAVED : YOUR PROFIT



YOUR BENCH BOX
For the average TV-radio service operation this box provides the perfect container for the right number of fuses you should keep on hand. Supplied to you as a service by your distributor. The cover lists the fuses most widely used in TV, radio and communications service. You or your distributor salesman can replenish your stock quickly by checking what is in the box against the listing on the lid.

Ask your distributor today for full information on these time-saving money-making service aids. Littelfuse also provides illustrated price sheets, cross-reference sheets and fuse guides. For your convenience Littelfuse products are listed and cross-referenced in all Howard Sams Photofact folders.

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LITTELFUSE

FUSE DISPENSER
Ideal where your service turnover is greater. A revolving drum with self-dispensing channels to hold the individual boxes of fuses. No time lost in looking for the proper fuse—no time lost taking inventory of your stock—no time lost because you do not have the right fuse

ONE CALL KIT
One call is all. This kit provides the fuse you need for 94% of all TV fuse service calls. A real service, the perfect assortment in the perfect container for your portable tool box.

by your local plating service. The interior speaker system assembly can be secured to the shell in a variety of fashions. Grille cloth should be the new plastic material called "lumite," which has about 60/40 open mesh, and does not affect the high-frequency response. This is obtainable from your local radio parts house.

The frequency response characteristic under free field conditions is shown in Fig. 10.

Fig. 8 shows the intermodulation distortion as measured at various power levels. Note that at the relatively high power level of 5 watts, the distortion is only about 2 per-cent. This is exceptionally low for loudspeaker systems.

The impedance characteristic, Fig. 9, denotes very high reactive components in the extreme low portion of the spectrum. This accounts, in part, for the unique extension of the bass range.

-30-

DISTANT OPERATION OF TV ROTATOR

By DON M. LIDENTON

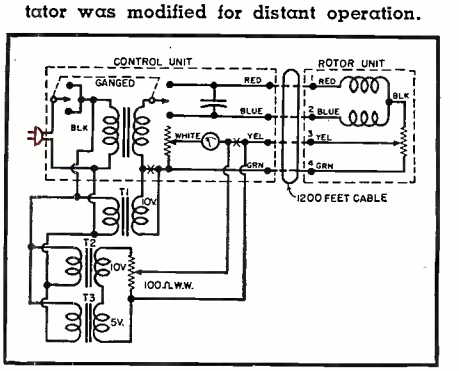
I HAD the problem of making a TV set work at a clubhouse down in a valley. A TR-12 rotator manufactured by *Radiart* was used with a cable 1200 feet long, almost a quarter of a mile. The antenna was mounted in a tall tree up on a hill where the signal was much better than in the valley, and an open wire line of 450 ohms impedance was used to bring the signal into the club.

It was found that the loss in the rotator cable was so great that the operation was feeble and at times, doubtful. Therefore, the secondary of a 10-volt heater transformer (T_1) was connected in series with the secondary winding of the transformer in the rotator control box. This gave the rotator plenty of power.

The next problem was to make the meter register correctly. The voltage loss in the green wire was so great that it added to the drop picked up through the variable resistor in the rotor unit and made the meter read full scale for any position. To correct this, the secondaries of transformers T_2 and T_3, 10 and 5-volt heater transformers respectively, were connected in series and properly phased so that the voltage picked up from the 100-ohm variable resistor could be used to cancel the drop in the green wire.

These extra transformers and the resistor were mounted in a box and set alongside the rotator control box. The same type of modification could probably be used with other rotators. -30-

Schematic diagram showing how a rotator was modified for distant operation.



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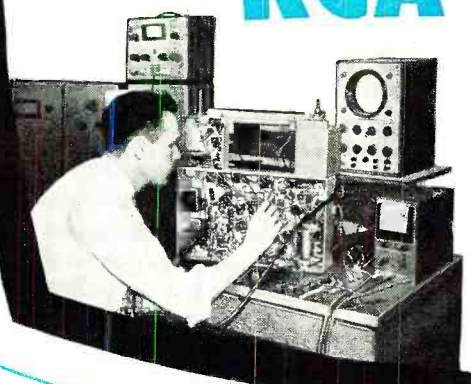

Study Television Servicing—from the very source of the latest, up-to-the-minute TV and Color TV developments. Train under the direction of men who are experts in this field. Take advantage of this opportunity to place yourself on the road to success in television. RCA Institutes, Inc. (A Service of Radio Corporation of America), thoroughly trains you in the "why" as well as the "how" of servicing television receivers.

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Mail coupon in envelope or paste on postal card. Check course you are interested in. We will send you a booklet that gives you complete information. *No salesman will call.*

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Thousands of men in the radio-electronics industry have successfully trained themselves as qualified specialists for a good job or a business of their own—servicing television receivers. You can do this too.

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

Spot Radio News

(Continued from page 20)

The sheer face of the mountain was found to provide a location most closely approaching an airborne transmitter. So on this site, there were installed four commercial FM transmitters for the v.h.f. range, and a c.w. transmitter for u.h.f., with a klystron output tube rated at 4-kw. average power. On the summit of the mountain, there's a u.h.f. transmitter operating on a frequency of 1046.4748 megacycles, a 3-kilowatt 100-megacycle transmitter and a third modified transmitter operating on 192.8 megacycles. On the lower site of the mountain are located v.h.f. transmitters operating on 92 and 210.4 megacycles.

To receive the 1046-megacycle signals, a receiver with a signal bandwidth of about 500 cycles between points 1-db down from the maximum response, is used. A noise figure of about 11 db has been attained with this set. This narrow bandwidth and low noise figure have been found to yield a sensitivity of approximately 160 db below 1 watt. The receiver is a double superhet, with the local oscillators crystal-controlled from multiplier chains, operating from a 100-kilocycle primary frequency standard. The output circuits of this chassis were designed specifically to operate with 1-5 ma. strip-chart recorders and 0 to 10-volt high-impedance totalizing equipment.

The very-high receivers were constructed particularly for the Cheyenne program. A triple superhet circuit is used in the models. Frequency for oscillator injection voltages are controlled by the same 100-kilocycle primary standard as is employed for the 1046-megacycle receiver.

Four fixed receiving locations are used for pickup of the Cheyenne mountain signals; they range up to 226 miles from the mountain, with provisions for semifixed recordings at Anthony, Kansas and Fayetteville, Arkansas, 393 and 617 miles, respectively, from the transmitter site.

To provide a sufficient amount of effective radiated power and to prevent reflections from the mountain

NEW TV GRANTS SINCE FREEZE LIFT

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

STATE	CITY	CALL	CHANNEL	FREQUENCY	POWER*
Arkansas	Jonesboro	.....	8	180-186	11.7
Indiana	Anderson	.....	61	752-758	24.5
Puerto Rico	Mayaguez	.....	5	76-82	1.48

NEW CALL LETTER ASSIGNMENTS

STATE	CITY	CALL	CHANNEL	FREQUENCY
Florida	Miami	WGBS-TV	23	524-530
South Dakota	Rapid City	KOTA-TV	3	60-66

*ERP = (effective radiated power, kw.) ..... Call letters to be announced

NEW TV STATIONS ON THE AIR

(As of April 25, 1955)

The following new stations bring the lists published in previous issues up to date.

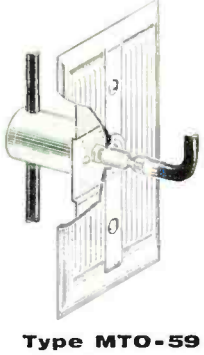
STATE, CITY	STATION	CHANNEL	FREQUENCY RANGE (IN MC.)	VIDEO WAVELENGTH (IN FT.)	VIDEO POWER (IN KW.)
Alabama					
Dothan	WTVY	9	186-192	5.25	28.2
Florida					
Tampa	WTVT	13	210-216	4.65	316
Oregon					
Portland	KLOR	12	204-210	4.79	230
Tennessee					
Jackson	WDXI-TV	7	174-180	5.61	83.2
Territories					
Fairbanks, Alaska	KFIF	2	54-60	17.8	13.8
Canada					
Brandon, Manitoba	CKX-TV	5	76-82	12.74	19.3
Moncton, New Brunswick	CKCW-TV	2	54-60	17.8	5
Peterborough, Ontario	CHEX-TV	12	204-210	4.79	260

WPFA-TV, channel 15, Pensacola, Florida; WTVE, channel 24, Elmira, New York; WTRI-TV, channel 35, New York; KMPT, channel 19, Oklahoma City, Oklahoma; WBTM-TV, channel 24, Danville, Virginia; WACH, channel 33, Newport News, Virginia; WKNA-TV, channel 49, Charleston, West Virginia; and WCAN-TV, channel 25, Milwaukee, Wisconsin, have gone off the air. WDTV, channel 2, Pittsburgh, Pennsylvania, has changed its call letters to KDKA-TV.

The frequency of the video carrier = 1.25 + channel lower freq. limit. Total number of TV stations now on the air in U.S.: 431 (120 of which are u. h. f.).

Effective Distribution with B-T LABS Masterline TV TAP-OFFS

Type MTO-11 for Outdoors



Type MTO-59 for Indoors

TV set connections to the line have been the most critical and troublesome points in distribution systems. This is no longer the case. B-T Tap-Offs are the simplest means ever devised for connecting TV receivers to a feeder line or riser. Installation is practically automatic. There is no break made in the line and no splices are required. Precise impedance match is assured, and because the line is not damaged, B-T Tap-Offs may be removed at any time without affecting continued performance.

These ingenious, low-cost compact connectors have a flat response across the entire TV band. Shunted capacitance is less than 1 mmf, thereby virtually eliminating the cause for ghost reflections, picture smear and loss of signal strength. Insertion loss is less than ½ db, permitting their use in many instances without preamplification. A built-in network gives 17 db inverse isolation (34 db set-to-set) which may be increased where required.

Type MTO-11 is completely weatherproofed and is designed for outdoor applications in connecting 59/U cables to RG-11/U lines. A messenger cable clamp is built on for added convenience in installation and for additional strain relief.

Type MTO-59 is intended for indoor applications in connecting 59/U receiver leads to 59/U riser cables. Unit is designed to provide a wall outlet, and is furnished with a flush wall plate.

Type MTO-11 ..... each **$7.00** list
Type MTO-59 ..... each **7.00** list
Packed 6 to the carton

For complete specifications and installation data, write to Dept. CD-4

BLONDER-TONGUE LABORATORIES, INC., WESTFIELD, NEW JERSEY

B-T LABS

Manufacturers of TV Amplifiers, Boosters, Converters, Accessories, and Originators of the B-T Masterline and 'Add-A-Unit' Master TV Systems

slopes, a specially-designed horn-type radiator has been installed at the summit site for use with the 1000-megacycle transmissions. And for the v.h.f. transmissions, corner-reflector type antenna systems are used on the mountain.

SATELLITES HIT THE HEADLINES

several weeks ago when the Commission authorized an experimental low-cost, low-power station installation at Manson, Washington, to retransmit very-high station signals on high-band channel 16. The grant was made to a community-TV company. No operator will be required and call letters will be spelled out in Morse code.

Other acts of the FCC included the issuance of grants to applicants in Arkansas, Indiana, and Puerto Rico; these are listed on page 98, this issue.

COMPATIBLE COLOR TELEVISION

can now serve as a revolutionary tool for diagnosis, consultation, teaching, and research in the field of medicine and biology. So revealed Dr. Alfred N. Goldsmith, during an address in Washington before the Armed Forces Institute of Pathology.

Stressing the importance of color for remote diagnosis, Goldsmith said that patients can be examined in desired detail, and either while stationary or in motion. It becomes possible, he said, to transmit electrocardiograms and electroencephalograms, either as a unit or with magnification. And received images may be viewed without modification, or they may be electronically sharpened, increased in contrast, or amplified in brightness to any desired extent. . . . In effect, emphasized the eminent scientist, color TV can and will give medicine a scope as wide as the country . . . . . L.W.

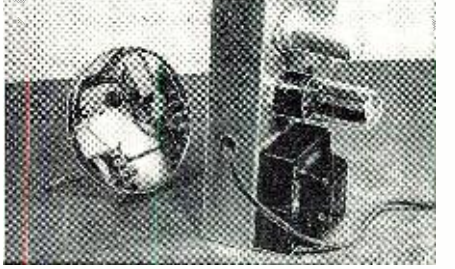
SHAVING MIRROR USE

THOSE small shaving mirrors with folding stands are handy to have around the electronics lab. Set up behind a piece of gear on the workbench, they permit the worker to see parts both above and below the chassis at the same time —convenient when making circuit adjustments!

They're just the ticket for reflecting light into the dark corners of larger pieces of equipment, too.

You can pick up the mirrors in dime stores, drugstores, and in the notions section of most department stores. Pick one with a plain rather than a magnifying mirror. Plain mirrors are cheaper and are easier to use in the lab. —30—

An inexpensive shaving mirror can be used in the lab to check top and bottom chassis.



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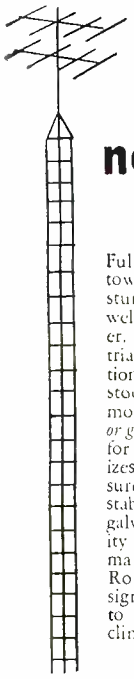
for LARGER PROFITS MORE SATISFACTION GREATER EASE IN HANDLING

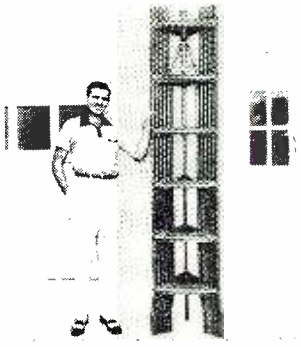
3 added towers to solve ALL your needs



no. 6 tower

"All-Purpose" tower

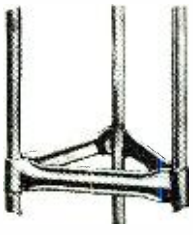
Fulfills 75% of your general tower needs—is structurally as sturdy—yet *costs less* than the well-known Rohn No. 10 Tower. Ideal for home and industrial installations, communication requirements . . . eliminates stocking many different tower models. *Self-supporting to 50 ft. or guyed to 120 ft.!* Easy to climb for fast, efficient servicing. Utilizes *"Magic Triangle"* which insures *far* greater strength and stability. Permanent hot-dipped galvanized coating. Dependability — a feature customers demand — is assured with the Rohn No. 6 Tower . . . designed to "stand up" for years to the rigors of weather and climatic conditions.



Package Tower

"Space Saver"— cuts storage space 300% or more!

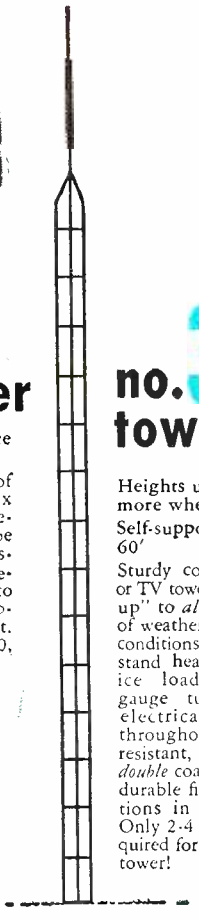
Popular PT-48 has almost 50′ of sturdy tower within a compact 8′ x 20″ package! "Magic Triangle" design is adapted to a pyramid shape using a wide 19″ base with progressively decreasing size upward. Decreases your overhead . . . easy to transport and assemble — cuts shipping costs. Galvanized throughout. Available in heights of 24, 32, 40, 48, 50 and 64 feet!



Both Towers Feature

THE ROHN MAGIC TRIANGLE

For structural superiority, famed wrap-around "magic triangle" design is featured in these all-steel towers. Towers have full 2½" wide corrugated cross-bracing welded to tubular steel legs. The exclusive design assures dependable strength and permanence.



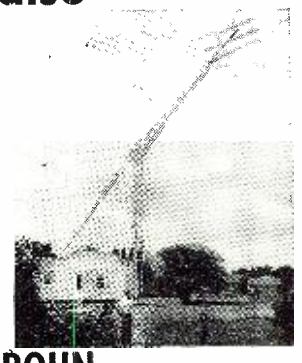
no. 30 tower

Heights up to 200′ or more when guyed

Self-supporting up to 60′

Sturdy communication or TV tower that "stands up" to *all* the stresses of weather and climatic conditions . . . will withstand heavy wind and ice loading. Heavy gauge tubular steel, electrically welded throughout. Weather resistant, non-corrosive *double* coating provides durable finish. All sections in 10′ lengths. Only 2-4 manhours required for installing 50′ tower!

also



ROHN Fold-over tower

For experimenters, TV service departments and retailers. Use this kit with regular Rohn tower sections. Simple and easy to use.

ROHN Telescoping Masts

Heavy-duty hot-dipped galvanized steel tubing and rigid joints give extraordinary strength. *Quick installation* . . . mast attached to base—antenna fixed, then mast hoisted quickly to desired height. Utilizes special clamp and guy ring arrangement. Flanged interior section; crimped exterior section gives mast stability that can't be beat. Complete with guy rings and necessary erection parts. In 20, 30, 40 and 50 ft. sizes. Bases and ground mounts available.

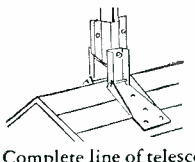
and a complete line of ROHN accessories —*all galvanized*

PEAK ROOF MOUNT

Heavy duty for quick, secure mounting of tower to top of peak roof. Flanges hinged, fastened to roof with 2 lag screws in each flange.

FLAT ROOF MOUNT

For all types flat surfaces. 3–1" solid steel projections permit first section of tower to be mounted directly on roof mount by inserting usual ⅜" bolts.

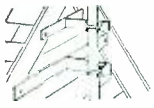


MAST BASES

Complete line of telescoping mast bases for every requirement, accommodating masts from 1"–2¼" diameter. Also available—drive-in mast bases.

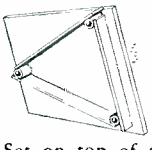
MAST 'N TV TUBING

Heavy-duty, hot-dipped galvanized steel tubing. Machined to perfection. Extra sturdy joints slotted for full, perfect coupling.



PEAK and WALL MOUNTS

For mounting of mast or pole to roof or wall. Heavy-duty steel. Variable sizes. Models for most every need.



DRIVE-IN BASE

Set on top of ground . . . 3–4′ drive rods driven through base into ground. First tower section secured to rods with single bolt in each leg. Instant erection.

SERVICE TABLE

Perfect answer for television servicing, display and storage. Truly one of the finest of its kind in economy price range.

ALSO AVAILABLE

Rotator posts for mounting rotator to tower; House Brackets; Guying Brackets; UHF Side Arm Mounts; Mounts for Additional Antennae on a Tower; Erection Fixtures; Guy Rings; Installation Accessories; and dozens of other items!

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Designed and Manufactured Exclusively by

ROHN *Manufacturing Company*

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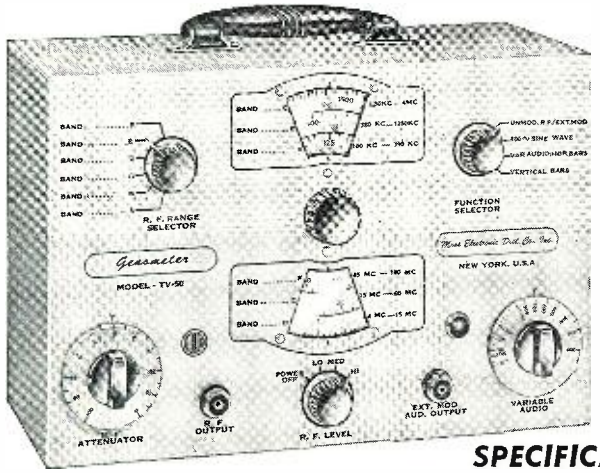
The Model TV-50 GENOMETER

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A. M. Radio F. M. Radio Amplifiers Black and White TV Color TV



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

SPECIFICATIONS:

R. F. SIGNAL GENERATOR:

The Model TV-50 Genometer provides *complete* coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics. Accuracy and stability are assured by use of permeability trimmed Hi-Q coils. R.F. is available *separately*, modulated by the fixed *400 cycle sine-wave* audio or modulated by the *variable* 300 cycle to 20,000 cycle variable audio. Provision has also been made for injection of any external modulating source.

VARIABLE AUDIO FREQUENCY GENERATOR:

In addition to a fixed 400 cycle sine-wave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal. This service is used for checking distortion in amplifiers, measuring amplifier gain, trouble shooting hearing aids, etc.

BAR GENERATOR:

This feature of the Model TV-50 Genometer will permit you to throw an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. A Bar Generator is acknowledged to provide the quickest and most efficient way of adjusting TV linearity controls. The Model TV-50 employs a recently improved Bar Generator circuit which assures stable never-shifting vertical and horizontal bars.

CROSS HATCH GENERATOR:

The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines *interlaced* to provide a stable cross-hatch effect. This service is used primarily for correct ion trap positioning and for adjustment of linearity.

DOT PATTERN GENERATOR *(For Color TV)*

Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for *proper color convergence*. When all controls and circuits are in proper alignment, the resulting pattern will consist of a sharp white dot pattern on a black background. One or more circuit or control deviations will result in a dot pattern out of convergence, with the blue, red and green dots in overlapping dot patterns.

MARKER GENERATOR:

The Model TV-50 includes *all* the most frequently needed marker points. Because of the ever-changing and ever-increasing number of such points required, we decided against using crystal holders. We instead adjust each marker point against precise laboratory standards. 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.)

The Model TV-50 comes absolutely complete with shielded leads and operating instructions. Only .....

$47.50 NET

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Try it for 10 days before you buy. If completely satisfied *then* send $11.50 and pay balance at rate of $6.00 per month for 6 months. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-117, 3849 Tenth Ave., New York 34, N.Y.

Please rush one Model TV-50. I agree to pay $11.50 within 10 days and to pay $6.00 per month thereafter. It is understood there will be no finance, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name .....

Address .....

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

Superior's new Model 670-A

SUPER METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers)
REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to +18 +14 to +38 +34 to +58

ADDED FEATURE:

Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40 NET

Superior's new Model TV-11

TUBE TESTER

SPECIFICATIONS:

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron, Miniatures, Sub-Miniatures, Novals, Sub-minars, Proximity fuse types, etc.
★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because *all elements are numbered according to pin-number in the RMA base numbering system,* the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus *it is impossible to damage a tube by inserting it in the wrong socket.*
★ Free-moving built-in roll chart provides complete data for all tubes.
★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.
★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

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

$47.50 NET

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

SUPERIOR'S NEW MODEL TV-40

C.R.T. TUBE TESTER

★ **A complete picture tube tester for little more than the price of a "make-shift" adapter!!**

The Model TV-40 is absolutely complete! Self-contained, including built-in power supply, it tests picture tubes in the only practical way to efficiently test such tubes; that is by the use of a separate instrument which is designed exclusively to test the ever increasing number of picture tubes!

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.

★ **Tests *all* magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!**

SPECIFICATIONS:

- 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.
- Tests for open elements.

Model TV-40 C.R.T. Tube Tester comes absolutely complete—nothing else to buy. Housed in round cornered, molded bakelite case. Only .....

$15.85 NET

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Try any of the above instruments for 10 days before you buy. If completely satisfied *then* send down payment and pay balance as indicated on coupon. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-117 3849 Tenth Ave., New York 34, N. Y.

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

Name.....

Address.....

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

☐ Model 670-A.....Total Price **$28.40** $7.40 within 10 days: Balance $3.50 monthly for 3 months.

☐ Model TV-11.....Total Price **$47.50** $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model TV-40.....Total Price **$15.85** $3.85 within 10 days. Balance $4.00 monthly for 3 months.

HAMILTON WINS 1954 EDISON AWARD

G-E's Third Annual Award goes to 35-year old Navy vet from La Mesa, Calif.

☆ ☆

CD Chief Val Peterson congratulates Benjamin S. Hamilton who receives the 1954 Edison Radio Amateur Award from J. M. Lang, electronic tube department manager of General Electric Co.

A 35-year-old Navy veteran of both World War II and Korea has been named winner of the Third Annual Edison Radio Amateur Award, sponsored by the Tube Department of *General Electric Company.*

Ben Hamilton, a teacher of industrial electronics at the San Diego City Junior College and Vocational School, devoted an average of 20 hours a week last year to setting up a system of civil defense radio communications networks for San Diego County, California. He thus provided his 750,000 neighbors with an active 200-man civil defense radio system that has been adjudged one of the best in the entire country.

Hamilton organized the amateurs, integrated them into the over-all CD group, and supervised technical communications surveys to see what type of equipment would best serve their needs.

In addition, he trains the personnel to man the equipment by holding classes from 7 to 9 p.m. each Tuesday and Thursday at the San Diego County CD headquarters.

In recognition of his unselfish contribution to his community, Mr. Hamilton was presented with a cup and an engraved watch at a dinner ceremony held recently in Washington, D. C.

Federal Civil Defense Administrator Val Peterson was the principal speaker at the banquet. He sent a special message to the nation's 120,000 licensed radio amateurs which was transmitted from the banquet table by Mr. Hamilton *via* MARS stations K4USA and K4AF in the Pentagon. -30-

Directing radio communications for civil defense in San Diego County was the outstanding public service that brought Hamilton his award. His unselfish sacrifice of his spare time provided his 750,000 neighbors with a top-notch radio system.

Another facet of Hamilton's service included training classes of CD workers in the Morse Code. Here he gives Jackie Fouchee tips on sending civil defense messages.

the **one** line that has **everything**

C·D·R ROTORS

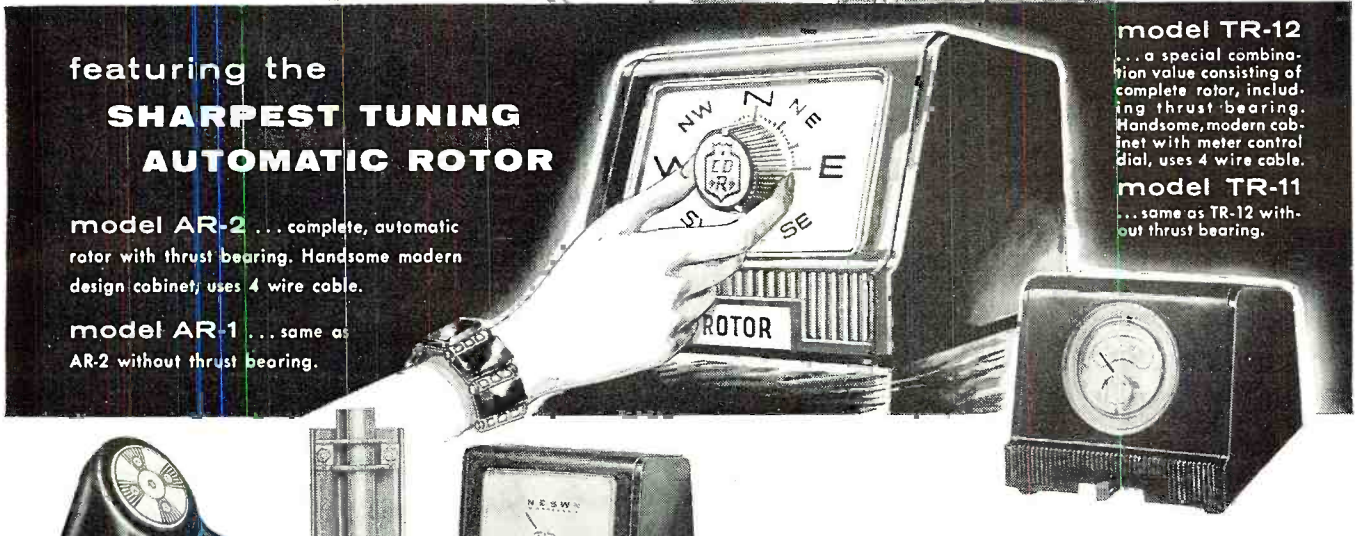
a model for every need

Powerful beyond any need!

featuring the
SHARPEST TUNING AUTOMATIC ROTOR

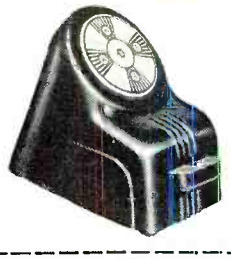
model AR-2 ... complete, automatic rotor with thrust bearing. Handsome modern design cabinet; uses 4 wire cable.

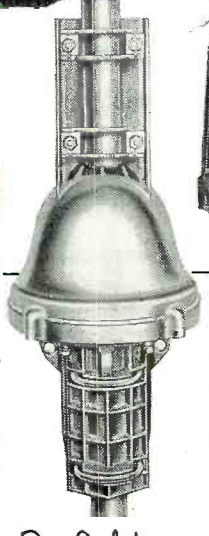
model AR-1 ... same as AR-2 without thrust bearing.

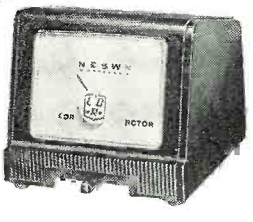


model TR-12 ... a special combination value consisting of complete rotor, including thrust bearing. Handsome, modern cabinet with meter control dial, uses 4 wire cable.

model TR-11 ... same as TR-12 without thrust bearing.







model TR-2 ... the heavy-duty rotor, with plastic cabinet featuring "Compass Control" illuminated perfect pattern dial, uses 8 wire cable.

model TR-4 ... the heavy-duty rotor complete with handsome, new, modern cabinet with METER control dial, uses 4 wire cable.

Here is the one COMPLETE line of rotors ... everything you need because there is a CDR rotor for every need! SIX skillfully engineered models ... ALL FIELD TESTED AND PROVEN by thousands and thousands of satisfied users from coast to coast.

Pre-Sold to millions every week on TV stations across the nation.

CORNELL-DUBILIER
SOUTH PLAINFIELD, N.J.

THE **RADIART** CORP.
CLEVELAND 13, OHIO

WHAT'S NEW IN RADIO

The products described in this column are for your convenience in keeping up-to-date on the new equipment being offered by manufacturers. For more complete information on any of these products, write direct to the company involved.

GEIGER COUNTER

The Radiac Company, Inc., 489 Fifth Avenue, New York 17, N. Y. is now offering a new Geiger counter specifically designed for uranium and thorium prospecting, the Model GC 235 "Prospectometer."

The new unit features a watertight directional probe containing a highly sensitive thin-walled Geiger tube. The

probe, which has a shield for beta-gamma discrimination, is connected to a five-foot cable to permit the easy investigation of holes, crevices, and other likely hot spots.

The watertight case of the unit is of drawn aluminum with rounded corners. Its tropicalized circuit assures maximum efficiency in all types of weather or climate. The design features a patented printed circuit and a stable electronic supply which operates off inexpensive, low-voltage batteries.

EAVE MOUNTS

Kenwood Engineering Co., Inc., Kenilworth, N. J. has introduced its line of eave mounts to the TV servicing industry.

This mount is easily secured to the hanging rafter or fascia board of the apex of the eave, clearing attic louvres and windows without loss of mast height. Only four lag screws are required for installation. U-bolt slots in the long lower member permit vertical alignment of the mast after the mount has been secured to the eave. A reinforcing step in the lower member foots the mast for easy orientation of the antenna. Offset feet on both the upper and lower brackets provides clearance for trim moldings and shingles.

The entire line will take masts up to

1½" in diameter and is made of heavy gauge, hop-dipped galvanized steel. A data sheet on these units is available from the company on request.

POWER RESISTORS

International Resistance Company, 401 North Broad Street, Philadelphia 8, Pa. is now offering two specially-designed "Resist-O-Cards" introducing its two new 7 watt and 10 watt wirewound power resistors.

Assortment #19 contains 20 selected popular values of Type PW7, including the frequently requested values of 3300 and 3900 ohms. Assortment #20 contains 20 selected values of Type PW10 including 3300, 3900, and 6000 ohm values. The resistors themselves are of a unique rectangular shape with the wirewound elements fully enclosed and sealed in ceramic. Sturdy axial leads are provided for easier handling and installation.

TV TEST INSTRUMENTS

Winston Electronics, Inc., 4312 Main Street, Philadelphia 27, Pa. has added two new items to its line of test equipment.

The first is the Model 810 flyback-yoke tester which provides "good-bad" tests by means of a special oscillating neon indicator driven by a d.c. amplifier which is said to make the indicator more sensitive than a meter. Separate calibrated positions are provided for continuity and shorted turn tests on iron core and air core transformers as well as yokes.

The second item is the Model 820 dynamic sweep circuit analyzer for both color and monochrome. It provides 60-cycle vertical saw-tooth, 15-kc. horizontal saw-tooth, and deflection transformer driver for both vertical and horizontal sweep circuit troubleshooting by speedy signal substitution.

Full technical details on either or both of these instruments are available from the company on request.

"UNATEST 51"

Baumbach Eng'r. & Research Co., 10147 Halbrent Ave., San Fernando,

California is now offering a new, low-priced radio and television tube tester which is simple to operate and requires no special training to master.

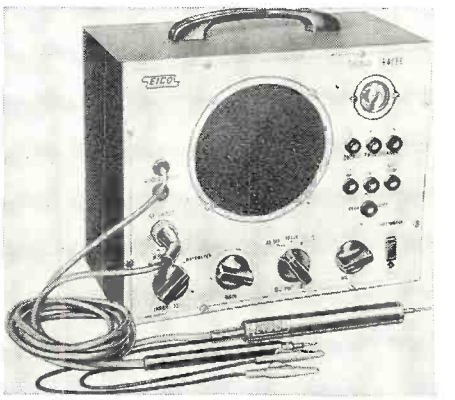
The tester will handle over 350 tube types. It is constructed with a heavy-

gauge metal chassis and a mahogany case, giving eye appeal and rugged life. It comes complete with instructions and a list of tubes that can be handled by the unit.

Full details on the "Unatest 51" are available from the company on request.

MULTI-SIGNAL TRACER

Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, N. Y. is now offering a deluxe multi-signal tracer which provides facilities for r.f., i.f., and audio signal tracing and troubleshooting in AM, FM, and TV sets.



Available in both kit and factory-wired form, the new *Eico* Model 147 has separate high-gain r.f. and low-gain audio input channels. In addition to the built-in 5" test speaker, a magic eye monitors both channels, for easier estimation of signal strength and gain-per-stage.

The unit comes complete with shielded r.f. demodulator probe and audio probe. For complete data on this instrument and other units in the company's line, write the firm direct.

CIRCUIT CHECKER

Tele-Diagnosis Co., 155 W. 72nd Street, New York, N. Y., is now offering its Model 143 "Trouble-Shooter" which has been designed to permit continuity, resistance, and voltage checks to be made at the pins of tubes in radio or TV sets when there is no direct access to the bottom of the tube sockets.

The tests can be made without removing the set from the cabinet. Circuit tracing is simplified in all cases where it is inconvenient to reach tube pins. Adapters plug into the sockets of the circuit under test and the tubes are plugged into the top of the adapters. A cable connects each adapter to the instrument. Two tubes may be checked simultaneously.

The instrument is available in two models, the #143 and the deluxe #160. Data sheets on either or both of these units are available on request.

"SILENT LISTENER"

Fenton Company, 15 Moore Street, New York 4, New York has developed a "silent listener" earpiece attachment especially for people who like to watch late shows or listen to the radio without disturbing others in the room.

Known as the "Adaphone," a 5-ohm

load takes the place of the voice coil when the loudspeaker is switched off, thus providing a "hearing aid" for the hard-of-hearing listener without picking up and amplifying background noises, also as a "silent listener" for the night owls.

The unit is provided with a 15-foot extension cord for comfortable placement away from the TV set. An additional earpiece set for simultaneous listening by two persons or an earphone embedded in a 12" x 9" x 2½" foam rubber pillow for listening while in bed, are also available at extra cost.

HEARING-AID TRANSISTORS

CBS-Hytron's Lowell, Mass. plant is now in production on a new transistor which has been designed especially for hearing-aid applications.

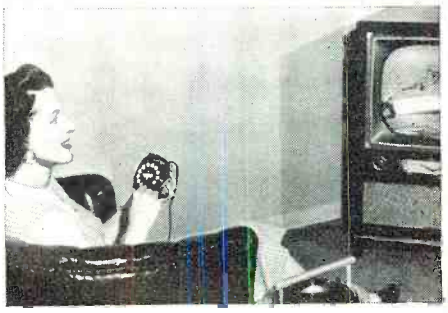
The new line, designated as the HA-1, HA-2, HA-3, HA-8, HA-9, and HA-10, is of the *p-n-p* junction type. They are hermetically sealed, are contamination-proof, light-proof, and humidity-proof. The 8, 9, and 10 units are miniaturized versions of the 1, 2, and 3 types, or .250" long as against .330" long for the latter type.

A data sheet giving full mechanical and electrical specifications on these new transistors is available from the company on request. Write the firm's Commercial Engineering Department at Danvers, Mass.

REMOTE TUNER

The Microtone Company, 5740 Wayzata Boulevard, Minneapolis 16, Minn. has developed a remote-controlled, automatic channel selector drive unit which permits the user to dial either u.h.f. or v.h.f. channels and to control the fine tuning remotely.

The heart of the unit is the "bean bag" mounted dial and fine tuning



lever switch which will operate at distances up to 30 feet. The manual control at the television receiver is not affected. A small bracket switch between the dial and a control knob mounts in the cabinet and permits the user to perform all functions necessary to tune the set with a fingertip touch.

The device uses a remote cable which measures ¼" in diameter. The unit itself is readily adaptable to any make of tuner whether turret or switch wafer type.

"WHIP FLEXOR"

The *Vaaro Division* of *Davis Electronics,* Box 1247, Burbank, California has developed a new "Whip Flexor"

(*Continued on page* 142)

McGEE'S OUTSTANDING VALUES FOR APRIL

MINIATURE BROADCASTING STATION FOR THE HOME

NEW 1955 MODEL WITH CRYSTAL MIKE $9.95

Sensational new model MCL-E3 miniature broadcasting station for microphone and phonograph. Can be received on any broadcast radio in the home. No wires to connect, tunes in just like a radio station. Has input jacks for crystal mike or record player. Complete with 12K8 and 70L7 tubes and instructions. Operates on 110 volts AC. Simple to operate; one control fades from microphone to record. Frequency can be adjusted so as not to interfere with local radio stations. Miniature broadcasting station, complete with crystal hand mike and instructions. Ship. wt. 4 lbs. Net price $9.95.

6" SESSIONS CLOCK-TIMER

With Plastic Cabinet $3.95

6" Sessions Clock-Timer in plastic case 7" x 9⅝" tall, 3" deep. Was intended for a kitchen clock radio. Lower part of case was used for a small radio chassis. Lower portion has a usable space of 6¾" x 4" high and 2⅜" deep with 3" diameter hole in front. Many ways this attractive clock and cabinet could be used, such as mounting a small bell below the clock for use as a kitchen clock and timer. Clock has sweep second hand and 15 amp. 125 volt switch to turn on appliances at any pre-set time. Case available in Ivory, Green or Yellow. Stock No. MCT-63, Sessions Clock-Timer with case of your color choice. Sale price only $3.95.

RC-600 REGENCY UHF CONVERTER $16.95

UHF converter SCOOP! Brand new RC-600, Regency UHF converters. Special sale price only $16.95. Regular dealers net was $37.46. All channel UHF, 14 thru 83. Only 100 to sell. Model RC-600. Ship. wt. 6 lbs. Special sale price only $16.95.

RMS VHF TV BOOSTER $4.95

Latest RMS TV booster for all VHF channels. Continuously variable for channels 2 thru 13. Variable gain control prevents overloading on powerful stations. Brown plastic case 4½" x 5½" x 5". Operates on 110 volt, 60 cycle AC. Ship. wt. 4 lbs. Model SP-6, RMS TV booster, special sale price only $4.95.

6-TUBE, 2-BAND RADIO KIT $14.95

6-18 MC 550-1650 KC

6 tube, 2 band AC-DC radio kit, complete with speaker and plastic cabinet. Popular with schools and colleges for training in radio. Receives broadcast and 6-18 mc shortwave. Full 2 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12K8, 2—12SK7, 12SQ7, 50L6 and 35Z5, diagram and instructions. Cabinet 13" x 6¾" x 6¼". Ship. wt. 12 lbs. Model ME6-2, Net $14.95.

78 RPM-AMPLIFIED RECORD PLAYER $8.95

3-TUBE AMPLIFIER—6x9" SPEAKER

3-SPEED RECORD PLAYER $10.95

78 RPM amplified player kit only $8.95. 3 speed amplified player kit, $10.95. Leatherette cabinet 9½" x 12" x 16½" high, made to set on floor. Completely wired 3 tube amplifier has separate tone and volume controls, 12BF6, 35W4 and 50B5 tubes. Heavy 6" x 9" speaker, pickup, motor and turntable. Cabinet is precut, no holes to drill. All you do is fasten the amplifier, speaker and motor in the cabinet. Only a few minutes required to assemble. Complete with simple, easy to follow instructions. 3 speed model has crystal pickup—with flip-over, 2 needle cartridge. Buy either of these kits at less than the cost of the parts. Shipping weight 15 lbs. Shipped via Express only.
No. CPR-78K, 78 RPM amplified player kit, $8.95.
No. CPR-437K, 3 speed amplified player kit, $10.95.

50-WATT BOOSTER AMPLIFIER

50-WATT BOOSTER AMP. $39.95

2-Mike Pre-Amp $12.95 Extra. Not a Kit, but a Manufactured Amp.

A sensational value. A 50 watt booster amplifier with push-pull, parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-2X pre-amplifier to allow the use of 2 microphones and one low level input. The amplifier has one input jack with 1 volt input giving 50 watts of audio. Amplifier has a 6 lb. potted case high fidelity output transformer with taps at 4-8-16-60 and 250 ohms. 225 mil power transformer and 5U4G rectifier. Includes tubes: 4—6L6, 7N7 and 5U4G. Two variable tone controls for master volume and bass boost tone control. Chassis size, 8" x 6½" x 14½". Model No. PA-55N. Ship. wt. 26 lbs. Sales price, $39.95. PR-2X, 2 mike input pre-amplifier plugs is directly to the PA55N 50 watt booster amplifier. Allows use of 2 microphones, either crystal or dynamic and one low level input. Furnished with 4 ft. connecting cable and plug for remote control of the 50 watt booster. Chassis size, 5¾" x 3½" x 2½". Model PR-2X, Sale price, $12.95.

10" PM SPEAKER AND LEATHERETTE BAFFLE

Now, buy a full 10" PM speaker with Alnico V magnet with our top quality 10" leatherette wall baffle, both for only $5.49. Baffle is finest lock joint construction with rounded corners, quality covering and plastic grill cloth. Stock No. 10RN, 10" speaker and baffle, $5.49 each, 2 for $10.00.

BOTH FOR $5.49

12" PM speaker with same quality 12" wall baffle, only $7.49 each, 2 for $15.00.

2 for $10.00

FAMOUS STANDARD COIL CASCODE TUNERS

TV-2000 series Standard Coil cascode tuners complete with 6J6 and 6BK7 or 6BQ7 tubes. Thousands of TV sets use this famous tuner. Tunes 12 channels (2 thru 13). For 21 mc I.F. circuit. This tuner will give 2 to 1 better reception than the old pentode type. Many servicemen replace all older tuners with this cascode model. Available with either 2⅞" or 4¼" shaft length. A tremendous purchase makes our low $12.95 price possible. Specify shaft length desired. Stock No. TV-2000-3. Sale price $12.95 each, 2 for $25.00.

SALE PRICE $12.95

2 FOR $25.00

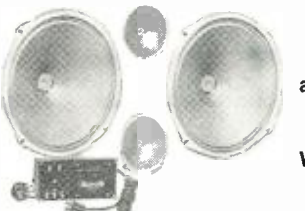
No. 3103-S, 41 mc Standard Coil cascode 12 channel tuner with 41 mc I.F. for intercarrier sound circuits. With 6BK7 and 6J6 tubes. 3⅛", 4½" or 6" shaft. Sale price, $12.95 ea., 2 for $25.00.
No. TV-4001-7, 41 mc Standard Coil cascode 12 channel tuner with 13th position for use with separate UHF tuner. 6¾" shaft. With tubes 6BQ7 and 6J6. Used in Sentinel, MW, Arvin, etc. Sale price, $12.95.

STANDARD COIL PENTODE TV TUNERS $9.95

SC-947 Standard Coil Pentode 12 channel tuner, as used by Emerson 650D, 655, etc. Fine tuning shaft insulated from ground. Filaments shunted with resistor for .6 amp drain. 2¼" shaft. With tubes 6BC5 and 6J6. Sale price, $9.95.
SC-948 Standard Coil Pentode 12 channel tuner with 6BC5 or 6AG5 and 6J6 tubes. Millions of TV sets now in use have this tuner. 1¾", 2⅞", 3", 4" or 5" shaft length. You can replace that old tuner cheaper than it can be repaired. Sale price, $9.95.

Matching knobs for Standard Coil tuners. Set No. SCK-2 for fine tuning and channel selector. Set VCK-2, matching volume and contrast knobs. Either set only 59c a pair.

25 WATT HI-FI SPEAKER SYSTEM $24.95 AND MAHOGANY SPEAKER CABINET $79.95



2-12" Woofers
2-5" Tweeters
Power Supply and L-C Cross-over Network

$24.95 WITH CABINET $79.95

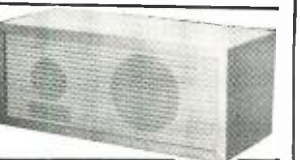
25 WATT HI-FI SPEAKER SYSTEM $24.95

25 watt, High-Fidelity Dynamic Speaker System, complete with 2000 cycle genuine inductance-capacitance cross-over network, two 12" woofer speakers, two 5" high frequency tweeter speakers and separate 110 volt AC power supply, less console baffle for only $24.95. Frequency response 20 to 18,000 cps. Both the woofers and the tweeters are fine quality dynamic speakers with fields excited to saturation by the power supply. Tweeters are specially made with cones designed to respond only to the high frequencies of the audio spectrum. The 2000 cycle cross-over network is of the high quality inductance-capacitance type which prevents frequencies below 2000 cps from entering the tweeters and eliminates frequencies above 2000 cps from the woofer circuit. The cross-over network system is simple to connect to any 4 or 8 ohm output of your high fidelity audio amplifier or radio. No. SP-12125CR, High Fidelity Dynamic Speaker System, Ship. wt. 15 lbs., Sale price, $24.95.
No. SPS-12125, High Fidelity Dynamic Speaker System, as described above, but less the 2000 cycle cross-over network and with a separate attenuator control. Sale price, $14.95.

SPEAKER SYSTEM INSTALLED IN CABINET $79.95

High Fidelity Speaker system installed in mahogany console speaker cabinet. A complete high fidelity speaker system contained in a beautiful hand rubbed mahogany console speaker cabinet. This ¾ door style speaker cabinet is 43" high, 31" wide and 23" deep. This cabinet was intended for a 24" TV set and cost over $100 to build. We have added a heavy laminated baffle, cut for the 4 speaker system and matching mahogany color plastic grill cloth that is acoustically correct for this speaker system. The baffle portion of this cabinet contains 9.4 cu. ft. of space. It could easily be made into a top quality bass reflex baffle with the addition of a back and the proper acoustical lining. Full shelf below speakers is 27" wide and has panel 4½" high ideal for installation of a high fidelity amplifier and preamplifier. Bottom section of the cabinet is cut for two 10" speakers which were used with the TV set. This space could easily be converted for a number of uses. Speaker system described above is shipped installed in cabinet. All wiring is done. Only two wires to connect to the output of your radio or amplifier. Model CSP-121CRM, High Fidelity Speaker System installed in mahogany console cabinet. Shipping wt. 105 lbs., Sale price, $79.95.
Model CSPS-121M, High Fidelity speaker system; less cross-over network, installed in mahogany console cabinet, Sale price, $69.95.

3 NEW 1955 8" HIGH FIDELITY SPEAKER SYSTEMS



IMPERIAL I $19.95

CONTAINS HEAVY DUTY 8" AND 5" ALNICO V PM SPEAKERS
RESPONSE 25 TO 14,000 CPS

IMPERIAL II

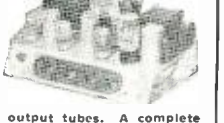
Contains 8", 6.8 oz. Oxford and 5" Oxford Response 20 to 14,000 cps. $24.95

IMPERIAL III

Contains 8", 6.8 oz. Oxford and 4401 University Tweeter Response 20 to 15,00 cps. $39.95

New 1955 model IMPERIAL HIGH FIDELITY 8" SPEAKER SYSTEMS BY McGEE. Here are three outstanding values in high fidelity speaker systems. Each one is housed in the same high quality leatherette covered plywood cabinet, Speakers are fully enclosed and cabinet has a back cover. The difference in price is due to the different speakers offered in each model. Cabinet dimensions are 10" x 10" x 24" long. Use in a book shelf or separately. All sides are covered with the exception of the back. May be used as an auxiliary TV speaker or with any high quality radio, amplifier or home music system. The Imperial will never be obsolete. You can add a 12" or 15" woofer in the future and use the Imperial for the middle range and high frequency speaker, to make a complete wide range, hi-fi speaker system.
IMPERIAL I, contains a 8" heavy duty Alnico V magnet PM and a 5" PM speaker. Frequency response, 25 to 14,000 cps. Net price, $19.95.
IMPERIAL II, contains a 8", 6.8 oz. magnet Oxford and a 5" Oxford PM speaker. Frequency response, 20 to 14,000 cps. Net price, $24.95.
IMPERIAL III, contains a 8", 6.8 oz. magnet Oxford PM speaker and University Model 4401 high frequency reproducer. Frequency response, 20 to 15,000 cps. Net price $39.95. Shipping weight 18 lb. on all models.

22 WATT HI-FI AMPLIFIER KIT COMPLETE WITH TUBES $29.95



8 Tubes—Push-Pull Output
ALL TRIODE CIRCUIT

22 watt, 8 tube High Fidelity amplifier kit with push-pull output tubes. A complete kit of parts to build this fine quality amplifier. Includes 3-7E5, 2-12AT7, and 2 Western Electric VT-52 (6A3) output tubes. All triode circuit minimizes harmonic distortion. Has inputs for Radio tuner, crystal or variable reluctance phono pickup and crystal or dynamic microphone. Output transformer matches 8 ohm voice coil. Will match any of the high fidelity speakers shown on this page. Twin electronic bass and treble tone controls, wide range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. Response 20 to 18,000 cps. This is the very best quality amplifier kit we make. 22 watt, 8 tube all triode amplifier kit, complete with all parts, tubes, diagram and instructions. Model 7XS, ship. wt., 25 lbs., Net price, $29.95.

TWO-TUBE SARKES-TARZIAN TV TUNER $8.95 WITH TUBES

New 2 tube Sarkes-Tarzian No. TT-3A, 12 channel TV tuner, 21-25 mc. Popular in many makes. Also, ideal for general replacement use. Has 6J6 and 6BC5 tubes. Used in CBS, Arvin, Crosley F17T0LBU, TOLH, TOLU, F21CDL8H, etc. Also, ideal for general replacement use. A good replacement for one tube tuners. 3⅛" shaft. No. TT-3A, Sale price, $8.95. Takes SCK-2 knob set described at left.

3 TUBE SARKES-TARZIAN, RCA, GEN'L. INST.

TV-53735, 3 tube Sarkes-Tarzian, 12 channel tuner, with 2-6AG5 and 6C4 tubes. 3" shaft. Used in Air King 700 series. Sale price, $7.95.
Type 3, 3 tube Sarkes-Tarzian 12 channel tuner with 6C4, 6BH6 and 6AG5 tubes. Use with separate sound or intercarrier. Has converter coil. 2⅞" shaft. Sale price, $7.95. Famous RCA 201E1, 13 channel tuner with 3-6J6 tubes. Brand new as used in RCA 630 chassis. Stock No. RCA-13P, Sale price, $7.95.
RCA 4P102, 12 channel printed circuit tuner used in Hallicrafters. With 6J6 and 6CB6 tubes. 6½" shaft. Sale price, $9.95.
GI-44 General Inst. 12 channel tuner with 6BC5, 6AG5 and 6J6 tubes. 5" shaft. 21 mc I.F. Sale price only $4.95.

TUNERS FOR EXPERIMENTERS, BUILDERS $2.95

Bargain priced tuners, less tubes for the builders and experimenters. Ideal for building a field strength meter, etc. Type 4 Sarkes-Tarzian, has screw driver slot fine tuning instead of concentric shaft, $2.95 less tubes.
RCA-13X, 3 tube RCA 201E1, removed from sets may need repair. $2.95 less tubes.
GI-13X, 3 tube Gen'l. Inst. 12 ch. tuner. Removed from sets, $2.95 less tubes.

McGEE RADIO COMPANY

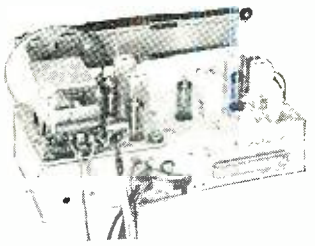
PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

OUR NEW ADDRESS IS
1901 McGEE St., KANSAS CITY, MISSOURI

CUSTOM RADIO CHASSIS-CHANGERS-HI-FI SP AKERS

17" TO 21" TELEVISION CABINETS—LESS THAN FACTORY COST!

SPECIAL PURCHASE SALE!



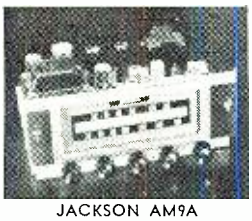
REAR VIEW

CROSLEY FM-AM TUNER

SALE PRICE $19.99

Model 362-2, 6 tube Crosley FM-AM tuner. Receives broadcast, 550 to 1600 kc and FM, 88 to 108 mc. Uses loop antenna for broadcast and has external antenna connections for FM antenna. Complete with tubes: 3—6BA6, 6BE6, 12AT7 and 6T8. Power to operate this chassis is to be picked up from your present audio amplifier or television set. (6.3 volt filament and 125 to 180 volts at 20 mils "B" voltage required.) Chassis size, 5½" deep, 10¾" long, 5⅜" high. Has illuminated slide rule dial 8½" long and 1½" high. 4 position switch on front of chassis selects FM, AM, TV or Phono. Input jack for variable reluctance pickup on back of chassis. One-half of the 6T8 is used as a pre-amplifier for the variable reluctance input. Chassis has no volume control. Audio is fed into your television or High Fidelity amplifier. These are new Crosley FM-AM tuners that cost the factory more than $20.00 to build. Model 362-2, shipping weight 9 lbs. Sale price $19.99. Complete with escutcheon, knobs, diagram, instructions and parts list.

Crosley 362-2VC, FM-AM tuner, same as above, but with volume control and power supply added to make a completely self-powered FM/AM tuner. Shipping weight 10 lbs. Sale price $24.99.



JACKSON AM9A

9-TUBE HI-FIDELITY

12 Watts Audio
Dual Tone Controls

$39.95 LESS SPEAKER

RECEIVES BROADCAST 550 TO 1650 K.C.

Jackson Model AM9A, 12 watt high fidelity audio amplifier and broadcast tuner combined, at less than you would normally pay for the amplifier alone. Push-pull 6V6 output. Frequency response from 30 to 15,000 cps. Inputs for crystal or G.E. variable reluctance pickup and crystal or dynamic microphone. Separate bass boost and treble tone controls. Radio-phono switch on front of chassis. Shielded output transformer matches 3.2 or 8 ohm speaker. Heavy duty 150 mil power transformer. 9½" illuminated slide rule dial with etched glass scale. 3 gang condenser with tuned R.F. stage and loop antenna. Receives broadcast 550 to 1650 kc. Size 13" long, 6" high and 9½" deep. Complete with tubes: 2-6BA6, 6AU6, 6BE6, 6SN7, 6AT6, 2-6V6 and 5Y3. Knobs, escutcheon, diagram and instructions included.

Model AM9A, Hi-Fi amplifier and tuner. Ship. wt. 9 lbs. Sale price, $39.95
Model AM9A with our CU-14Y 12" coaxial PM speaker, both for $49.95.
Model AM9A with our P15-CR 15" coaxial PM speaker, both for $59.95.

11-TUBE FM-AM HALLICRAFTERS

HALLICRAFTERS S-78A

Regular $89.50
McGEE'S SALE PRICE $69.95 LESS SPEAKER

★ HIGH FIDELITY
★ AUTOMATIC FREQUENCY CONTROL

Hallicrafters Model S-78A, 11 tube FM-AM superhet custom chassis. Size 7⅜" x 12½" x 11" deep. Complete with tubes, knobs, escutcheon, diagram and instructions. Receives broadcast 540 to 1700 kc, plus FM 88 to 108 mc. AFC holds FM stations in perfect tune. Output transformer matches 3.2 ohm or 500 ohm. High fidelity response, 50 to 14,000 cps. Bass boost tone control. A full 11 tube transformer powered chassis with push-pull 6K6 audio. This chassis found in $400 to $600 radio combinations. Has input for crystal phono pickup. Self-powered preamplifier necessary for G.E. variable reluctance cartridge, $3.95 extra.

S-78A Hallicrafter 11 tube FM-AM chassis. Ship. wt. 22 lbs. $69.95
S-78A Hallicrafter with our CU-14Y 12" coaxial PM speaker $79.95
S-78A Hallicrafter with our P15-CR 15" coaxial PM speaker $89.95

GARRARD—COLLARO—WEBCOR 3-SPEED RECORD CHANGERS

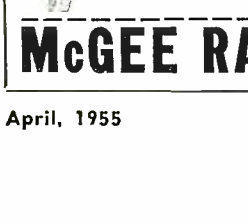
$65.00 LIST COLLARO 3/532 $38.95

Here are top values in modern up-to-date 3 speed automatic record changers. New Webcor model 114-43, 3 speed automatic changer with RPX-050 G.E. cartridge. Size, 13½" x 12". Ship. wt. 12 lbs. Sale price only $29.95.

Regular $65.00 list Collaro model 3/532, 3 speed automatic record changer made in England. Intermixes 10 and 12" records of same speed. Constant speed 4 pole motor and weighted turntable with molded rubber pallet. Compensating spring to shift weight of tone arm for LP and std. records. Plug-in head will hold any popular cartridge. 14¾" long, 12¼" wide and 4¾" above motor board, 2⅞" below. Available in grey, cream and gold hammertone. Ship. wt. 20 lbs. Regular net, $48.75. Special sale price, $38.95 less cartridge. Large 45 RPM spindle, $2.50 extra. 3/532 Collaro changer with G.E. Golden Treasure RPX-052 cartridge, $58.95.

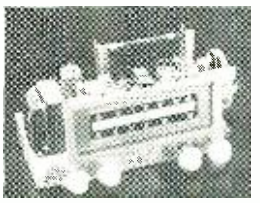
RC-80 Garrard "Triumph," 3 speed automatic changer. 13¼" wide, 15½" deep and 8" high. 2½" below motor board. Net price, less cartridge, $48.51. 45 RPM spindle $3.43 extra. RC-80 with G.E. RPX-052 Golden Treasure cartridge, Net $68.51. RC-80 with crystal flip-over cartridge, only $52.46.

RC-90 Garrard "Crown," 3 speed automatic changer. 13½" x 15½". 5¾" above motor board and 3⅞" below. Net price, less cartridge, $68.11. With crystal flip-over cartridge, $72.06. With G.E. RPX052 Golden Treasure, $88.11. 45 RPM spindle, $3.43 extra.

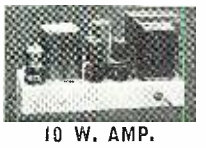


21" BLOND TV-RADIO-PHONO CABINET—SALE PRICE $49.95

Blond mahogany combination TV-Radio-Phono cabinet. Has full doors with panel cut for 20" or 21" TV chassis. Has space for radio chassis, record changer and record storage. Beautiful blonde finish with matching grill cloth and gold color hardware. TV compartment is 20½" high, 24¾" wide and 21¼" deep. Chassis was intended to mount on side. Radio changer space will hold changer 13¼" x 14" and radio chassis 8" high and 13" wide. Baffle cut for 12" speaker. Overall cabinet size, 38" high, 42½" wide and 24¼" deep. Ship. wt., 85 lbs. Stock No. DJB-21R, Sale price $49.95.



HI-FI FM-AM TUNER AND 10 WATT P.P. 6V6 AMPLIFIER

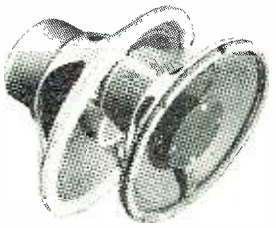


10 W. AMP.

BOTH FOR $49.95

9 TUBES-PLUS
2 RECTIFIERS
PHONO INPUT

New, high fidelity self-powered FM-AM tuner with 10 watt amplifier (Push-pull 6V6's) on separate chassis. All you need is a record changer and one of the speakers shown below, to have a complete home music system. 3 ft. cable connects tuner to amplifier. Tuner has input for crystal phono pickup. (If one of the changers with a G.E. variable reluctance cartridge is purchased, we will include the necessary pre-amp at no extra charge). Self-powered tuner has 6 tubes plus rectifier (12AT7, 6BE6, 2-6BA6, 6AT6, 6AL5 and 6X4). Amplifier has 3 tubes; 2-6V6's, 6SN7, plus rectifier. Full superhet circuit with AVC and 3 position tone control. 9" illuminated slide rule dial with gold color escutcheon and matching knobs. His "High-Q" ferrite stick loop antenna for AM and separate FM antenna. Radio FM, AM, phono selector switch, tone control, volume control-off-on switch are on the tuner chassis. High fidelity response, 50 to 17,500 cps. Receives broadcast 540 to 1600 kc and FM, 88 to 108 mc. Output transformer will match any of the speakers listed below. This high fidelity FM-AM tuner and 10 watt amplifier is comparable with competitive units selling for $100.00 and more. Stock No. FA9-2CR, tuner and amplifier complete with all tubes, knobs, instructions and diagram, Ship. wt., 22 lbs. Special sale price, only $49.95. CU-14Y, 12" coaxial PM speaker, $10.00 extra. P15-CR, 15" coaxial PM speaker, $20.00 extra, when ordered with tuner-amplifier. Collaro 3 532, 3 speed automatic intermix changer with crystal flip-over cartridge, $42.95 extra.



McGee's Famous 12 AND 15 INCH COAXIAL P.M. HIGH FIDELITY SPEAKERS

$12.95 — 12-Inch Model CU-14Y

$23.95 — 15-Inch Model P15-CR

Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.8 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price $12.95 each, two for $25.00.

Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 20 cps. and up to 17,500 cps. Full 21½ oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular $62.50 list speaker. Model P15-CR, McGee's Sale Price, $23.95.

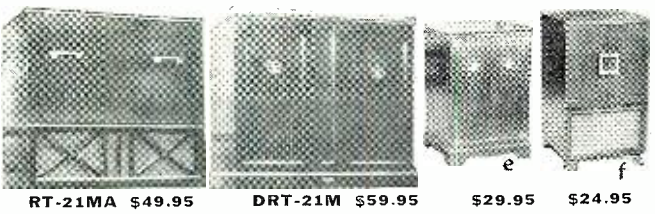
HIGH FIDELITY SPEAKERS

8" BLUE STREAK ..... $ 6.95
12" JENSEN P-12P $15.95
15" WOOFER $18.95

Model HF-8J, 8" "Blue Streak," High Fidelity wide range speaker. This one speaker properly baffled will give excellent response to both high and low frequencies and terrific response through the very important middle range. It has tone quality equal to many high priced imported speakers. Has 6.8 oz. Alnico V magnet with wide range curvelinear cone and 8 ohm voice coil. This speaker has a beautiful tone at low volume levels. 8 watts continuous with peaks up to 12 watts. Response essentially flat from 35 to 12,500 cps. Ideal for use with a woofer for a hi-fi speaker system. Perfect for high fidelity radios, amplifiers and professional music systems. Ship wt., 6 lbs, Model HF-8J, Sale price, $6.95.

Model P-12P, 12" Jensen Concert, High Fidelity wide range speaker. Has 14½ oz. Alnico V magnet with 1¼", 8 ohm voice coil. Heavy ribbed, easy moving molded cone. Will take 18 to 25 watts of audio. Ideal for P.A. systems as well as a mid-range speaker for high fidelity speaker system. Frequency response, 50 to 12,500 cps. Model P-12P, 12" Jensen Concert PM speaker, Ship. wt., 8 lbs. Sale Price $15.95.

Model SP-15P, 15" "Blue Streak" High Fidelity low frequency woofer speaker. This is an ideal woofer for a high fidelity speaker system. Use a cross-over network for best results. Has 21½ oz. Alnico V magnet, with 1¼", 8 ohm voice coil. Has free floating cone of one piece type construction. Will respond to frequencies down to 20 cps. and up to 10,000 cps. Takes 18 watts with peaks up to 25 watts. This speaker used with the 8" "Blue Streak" or both the 8" and 12" speakers described above makes a top quality high fidelity speaker system. Model SP-15P, 15" "Blue Streak" woofer speaker, Ship. wt., 12 lbs., Sale price, $18.95.



RT-21MA $49.95 — DRT-21M $59.95 — e $29.95 — f $24.95

21" Mahogany Television-Phono Cabinet

RT-21MA, Mahogany Television-Phono combination cabinet with half doors, for 20" and 21" TV chassis and record changer. 36½" high, 39¼" wide and 22" deep. Baffle cut for 12" speaker. TV compartment 21½" high, 21¼" wide and 19" deep. Will hold most 20" and 21" chassis. Changer shelf 15" x 16" with 9" height clearance. Ship. wt. 75 lbs. Sales price, only $49.95. 21" gold trim plastic safety shield and mask to fit cabinet, $6.95 extra. No. A13-9, ball bearing changer drawer slides, $1.39 pr., extra.

DeLuxe 21" Mahogany TV-Phono Cabinet

DRT-21M, Deluxe flame grain mahogany Television-Phono combination cabinet for 20" and 21" TV chassis and record changer. Beautiful full door style with matching front panels and piano finish. 37" high, 40½" wide and 22¼" deep. Baffle cut for 12" speaker. TV compartment 21½" high, 23½" wide and 19" deep. Will hold most 20" and 21" TV chassis. Changer shelf 15" x 17" with 9" height clearance. Ship. wt. 90 lbs. Stock No. DRT-21M, Sale price only $59.95. 21" mask and safety glass available at $6.95 extra. (Requires fitting to cabinet) No. A13-9, ball bearing changer drawer slides, $1.39 pr.

17" FULL DOOR $29.95

(e) No. AH-430. Mahogany with full doors. 36" h. 24" w. 21¾" deep. Chassis area 22" w. 17¾" h. 18¾" deep. Blank panel. Holds 17" TV easily. Baffle for 10" speaker. Ship. wt. 80 lbs. On sale at less than it cost a famous TV factory. Sale price $29.95.

17" ½ DOOR WALNUT $24.95

(f) No. AH-85A. Walnut with half doors. 36" h. 20¾" w. 21½" deep. Chassis area 19" w. 18¼" h. 18¾" deep. Blank panel. Will hold most 17" sets. Baffle cut for 10" speaker. Ship. wt. 65 lbs. An attractive well proportioned cabinet on sale at only $24.95.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY
SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

OUR NEW ADDRESS IS
1901 McGEE St., KANSAS CITY, MISSOURI

PORTABLE "NIGHT VIEWER"

Details on the new Curtiss-Wright unit which is designed especially for security applications and navigation work.

A PORTABLE viewer that permits vision in complete darkness for distances up to 12,000 feet has been introduced by *Curtiss-Wright Corporation* of Wood-Ridge, New Jersey.

Trade named the "Night Viewer," the new device is designed for use in navigation, security work on the part of police and customs guards, in police work, and industry where processes cannot be conducted in normal light. One such application would be in the manufacture of photo-sensitive materials.

The unit consists of an infrared radiator which projects a beam invisible to the human eye upon a selected object or location and a receiver which converts the reflected infrared image to rays visible to the viewer. These two units are synchronized for simultaneous focusing upon an object.

This equipment is also designed in such a way that it can be matched with an industrial television camera to permit monitoring, at a single place, of a series of such "Night Viewers."

One unique feature of this new device is that it operates on standard power line or a portable generator.

The system comprises a tripod-mounted transmitter, a receiver with telescope and remote controls mounted on a pedestal, and a power supply unit containing the amplifiers necessary for the operation of the selsyns and generators comprising the remote control circuit.

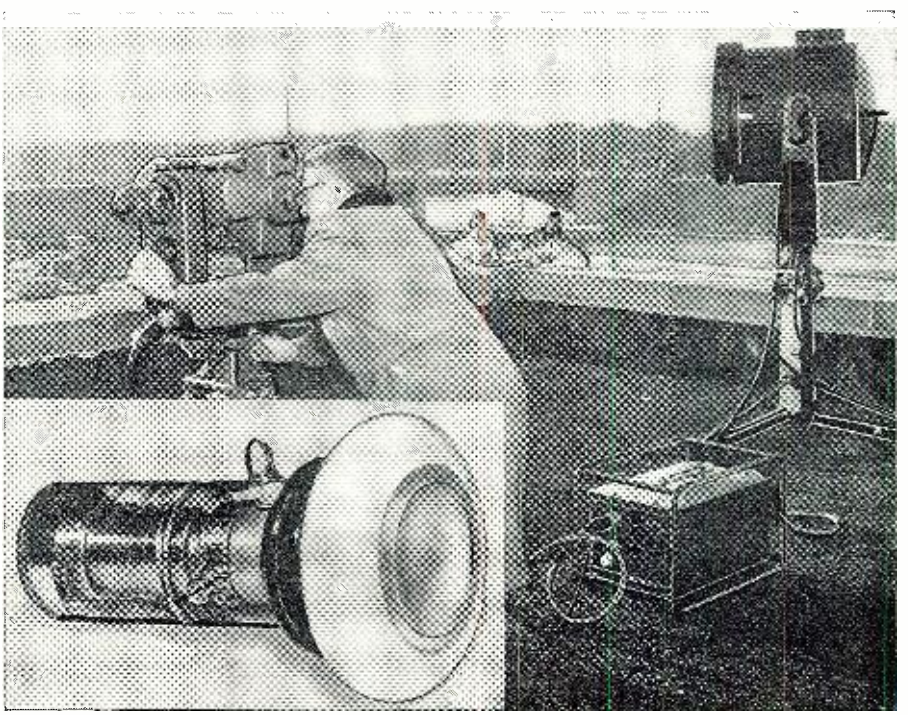
The transmitter is essentially a searchlight of 60 cm diameter mounted on a rugged tripod, equipped with a highly polished mirror and a 5 million candlepower tungsten lamp with an input of 1500 watts at 9 volts. The support frame contains the remote control receiving elements and motor generators for positioning the searchlight.

The receiver is an electronic image converter with an adjustable telescope of six times magnification so mounted on a pedestal as to be rotatable. The operating control switches for the triggering of the entire device as well as the selsyns are mounted on the receiver unit.

The power supply consists of a portable shockproof unit which can be plugged into any suitable 220 volt, 50-60 cycle main or to a mobile power supply of approximately 2 kw. All the necessary power for the entire device is supplied by this unit.

The equipment is in production at the present time at the company's plant in New Jersey. —30—

A plant security officer checks the "Night Viewer" equipment which permits vision in complete darkness for distances up to more than two miles. The unit consists of an infrared radiator which projects a beam, invisible to the human eye, upon a selected object or location and a receiver that converts the reflected infrared rays to a visible image. (Inset) The image converter tube used in the "Night Viewer."



Certified Record Revue

(*Continued from page 58*)

transients are fantastic. An immense variety of percussion is used in the "Toccata," and ranges from the tiniest, barely perceptible "tick" of snare and woodblock, to the sharp impact of vari-toned tympani and thunderous explosion of bass drum. I think this is far more effective, because of its actual musical content than the random percussion sounds in the earlier album. Unless my ears are deceiving me, the material excerpted from standard albums sounds better and cleaner here than in the originals. A case in point is the dance from "Capitol of the World." The foot-stomping, etc. of Roy Fitzell seems to have far more impact and greater dynamics. Perhaps it only appears to be better because of the absolutely flawless surfaces. This is the quietest LP I have yet encountered. The inclusion of some excellent notes on high fidelity by Charlie Fowler of "High Fidelity" magazine adds to the attractiveness of the album. The RIAA curve did not require adjustment in my set-up.

OLE! OLE! (MUSIC OF SPAIN)
Orquesta Zarzuela de Madrid conducted by Frederico Morreno Torroba. Decca DL9736. RIAA curve. Price $5.95.

I hardly knew what to expect from the title of this, but am pleased to report there is much interesting and highly listenable material on this disc. Torroba, as might be expected, is a master of tempi and style and he keeps everything moving along briskly. He is also a composer of considerable merit, and in fact, his "Danza Asturianas" is by far the best work on the disc. Other familiar and unfamiliar excerpts from zarzuelas, constitute the rest of the disc. All are light fare and will find many an appreciative ear. This is the best sounding record I have heard from *Decca*, with good clean strings and brass, and notable percussion. Try this for something a little different.

KAY-BALANCHINE
WESTERN SYMPHONY
THOMSON-CHRISTENSEN
FILLING STATION
New York City Ballet Orchestra conducted by Leon Barzin. Vox PL9050. NARTB curve. Price $5.95.

This is the first result of the new collaboration between *Vox* and the New York City Ballet. Two of the most popular modern ballets in the New York repertoire are given their LP debut in quite an auspicious manner. The scores are delightful and gay, "Filling Station" having had the honor of a TV appearance as proof of its mass appeal. This recording is the best-sounding ever issued by *Vox*. String tone is smooth and free from wiriness, brass is punchy and bright, percussion is quite weighty and clean. Little distortion was noted and frequency and dynamic range was expansive. Excellent acoustic treatment made for a very "live" sound. A "must" for balletomanes.

HAYDN
CONCERTO FOR TRUMPET
CONCERTO FOR HARPSICHORD IN D
Vienna State Opera Orchestra with George Eskdale, trumpet, and Erna Heiller, harpsichord, conducted by Franz Litschauer. Vanguard VRS-454. NARTB curve. Price $5.95.

Another superb recording from that enterprising small company, *Vanguard*. The trumpet concerto will be welcomed by those hi-fi fans who remember the notable earlier effort on the *Haydn Society* label. George Eskdale

is, of course, one of the great trumpet virtuosi of our time. While there may be some who prefer the easier style of Wobitsch on the earlier disc, I prefer the brilliance of tone, the beautifully modulated phrasing, and the superb articulation of the Eskdale trumpet. Couple this with the splendid sound *Vanguard* affords him and this outweighs the advantages of the *Society* recording.

The harpsichord concerto has a very fine artist in Heiller, and if she has less lustre than the great Landowska, she has no competition in the sound department. It is to *Vanguard's* credit that the harpsichord is recorded in its proper perspective. No microphone inside the instrument here! The orchestra is larger than the harpsichord in sound, as it should be. Both concerti are very wide range, and with good dynamics. Virtually no "trumpet blast" distortion was present, and pre-echo was also minimal. You can't go wrong on this one. The NARTB curve did not require adjustment. Moderately quiet surfaces.

L'ANTHOLOGIE SONORE (VOL. 2)
Haydn Society AS-B, NARTB curve. Price $29.75 (five discs).

This is the second volume in the monumental "Anthologie Sonore" and one that I find personally of great interest. Admittedly this is pretty dry stuff for the hi-fi fan, but for the serious music lover, it's a veritable gold mine. The beginnings of music have a particular fascination and the wealth of material on early vocal styles covered in this volume, will enrich anyone's understanding of latter day works. The recordings themselves are as varied in quality as is possible to imagine. Some of the sound is quite modern and acceptable in quality, some is quite restricted in range and dynamics, obviously quite dated. One work was a Grand Prix du Disque winner back in 1935! Still others betray their 78 rpm origin by high surface noise. All in all, considering the nature of the material, the sound will not in any case negate its value. It would be hard to imagine a musicologist without this on his reference shelf, or a school library denied its advantages. Hats off, to the *Haydn Society* for a tremendous and courageous undertaking!

DUBOIS
THE SEVEN LAST WORDS OF CHRIST
The Boston Chorale and soloists, Reginald Foort, organ, conducted by Willis Page. Cook 1094. RIAA curve. Price $5.95.

This recording has been around for some time, but I never caught up with it until recently. Of all the things *Cook* has done on records, this is positively the best. The work is an exceptionally beautiful one, quite dramatic in concept. The soloists are all top-notch and the choral work is superb. Add an impressive dynamic range and ultra "live" acoustics for good measure. The *piece de resistance* for the hi-fi fans is the throbbing thunder of 32 foot organ pipes. *Cook* claims 16 cycles is actually on the record! I'm inclined to believe him from the evidence of "feeling" as well as hearing. At any rate, this will test your speaker's low frequency response as nothing else has ever done before! Good sound . . . good music. This warrants your attention.

THE CONFEDERACY
Columbia SL220. NARTB curve. Price $10.00.

Shucks, podner, I just had to review this one! Y'see, mah wife is an Atlanta gal, suh! Suiting words to action, Ah slipped outen' mah union suit and shrugged on my grey flannel sack coat and sot me down t'listen' a spell. Well I liked what I heard. Seriously, this is an ambitious project *Columbia* has

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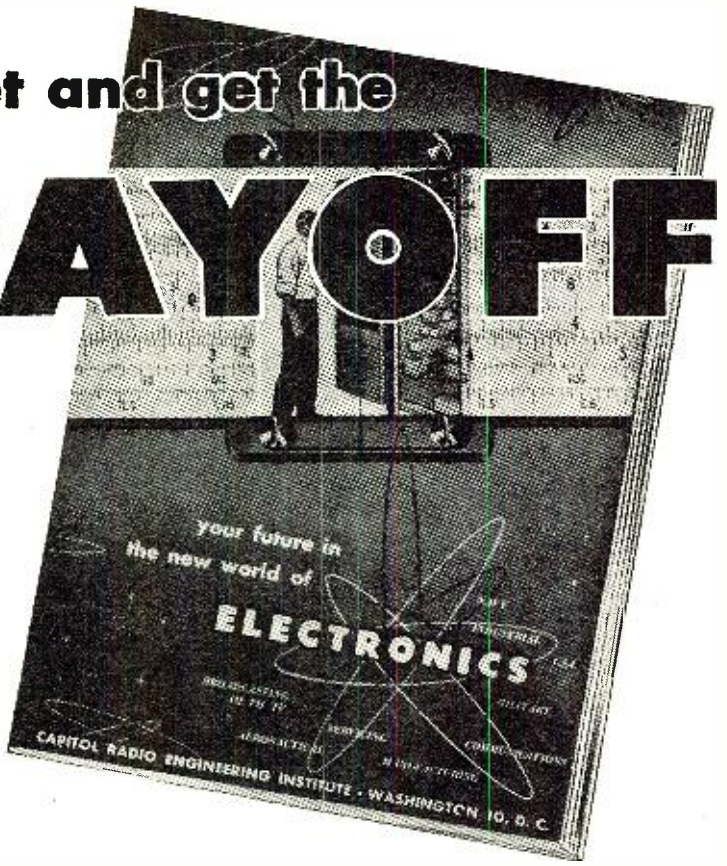

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fostered, and one which comes off very successfully. The triumph may be somewhat more literary than musical, however. The attractive grey and gold album with the Stars and Bars proudly displayed on the cover is full of stories, articles, photographs, and other memorabilia about the Confederacy. A thoroughgoing job of research has evidently been done to insure authenticity. The music consists of songs that were popular during the War, which frankly I don't find too stimulating, along with a lively Grand March, and a stirring real ding-dong version of the immortal Dixieland, replete with Rebel yells! Sound quality is quite good, with particularly splendid acoustics. I should mention that a descendent of General Lee, reads Lee's Farewell to the Army of Northern Virginia, accompanied by muffled drums. The voice is soft . . . perhaps a little tired, with an odd nostalgia that is highly effective. I predict there won't be a dry eye in the South during this section! It even got to me, and I'm just a damyankee!

ROSSINI-RESPHIGHI
LA BOUTIQUE FANTASQUE
WORKS BY MENDELSSOHN, COUNOD, DELIBES

Philharmonia Orchestra conducted by Robert Irving. Victor LBC-1080. RIAA curve. Price $2.98.

Every now and then, *Victor* puts out a record in their low-priced *Bluebird* series, and one wonders how it got there. This "Fantasque" has everything to offer . . . superb sound, excellent orchestra, and a conductor who outguns his more luminous competitors. Irving has been around the ballet for a long time and this experience is invaluable in works like this. His sense of balance, of timing, his light-handed treatment of the score is perfection, and this is the version of choice. The three other trifles on the disc by the composers listed, are well-handled but are hardly worth mention. The sound quality is far above the usual *Bluebird* standard. Good clean strings are coupled with brilliant brass and exceptional percussion. The Ansermet-*London* version has still better sound, but Irving has the edge in performance. A matter of taste here. The RIAA curve was better with a little bass boost. Quiet surfaces in my copy.

GIAN CARLO MENOTTI
AMELIA AL BALLO

Chorus and Orchestra of La Scala with Margherita Carosio, soprano, Rolando Panerai, baritone, and Giacinto Prandelli, tenor, conducted by Nino Sanzogno. Angel 135140. RIAA curve. Price $4.98.

Angel scores a notable first with this recording of Menotti's first opera. To many people, this is considered his best opera, although it is hardly fair to judge any work in so short a passage of time. Strangely enough, although the composer was fortunate in having a Metropolitan production of "Amelia" in 1938, it was not until 1954 that his opera was presented in the land of his birth at La Scala. This recording was made at that time and is sung in the original Italian. The story plot is a familiar one, but aided by the enchanting music which Menotti wrote, it seems less hackneyed. The work is comfortable and everywhere shines the melodic gifts of Menotti. The music has been likened to Puccini, and with its fresh and universal appeal, this would appear to be a valid appraisal.

The production here is splendid. The cast is well chosen and we are once again indebted to Carosio for her magnificent voice. She is as effective in this role as she was in the recent "Elixir of Love." Panerai does nobly as the Husband, as does Prandelli as the Lover. The other roles are capably sung. Sanzogno is unknown to me, but evidently knows his way with the score. (Since Menotti was in attendance, it would be unlikely for the conductor to be anything but well prepared.) The sound is in the best *Angel* opera tradition, which is to say very good indeed. Voices were well projected, good balance was maintained, and the acoustic treatment was exemplary. A little pre-echo was the only mar in the album. If you enjoyed the "Medium" and the "Consul," you will be captivated by the charming "Amelia." Curve and surfaces were OK.

TCHAIKOVSKY
SYMPHONY #4

Philharmonia Orchestra conducted by Herbert von Karajan. Angel 35099. RIAA curve. Price $4.98.

SYMPHONY #5

Philharmonia Orchestra conducted by Herbert von Karajan. Angel 35055. RIAA curve. Price $4.98.

This is version 16 for the 4th symphony and 17 for the 5th symphony. I wonder will they never cease? Von Karajan has formidable competition in both works. He comes off better than most, but his readings cannot be called definitive. A little too much "tempi-tampering" and a lack of cohesion are his undoing. Some people may like the urgency with which he imbues the works, but I prefer the more leisurely approach. On the credit side, von Karajan elicits some of the most beautiful sounds ever heard in a Tchaikovsky work. His superb orchestra responds magnificently to his demands for sumptuous tone. From a purely orchestral viewpoint, these readings have no peer. The sound is typical *Angel* . . . ultra-smooth strings, fluent woodwinds, noble sounding horns and bright trumpets, percussion solid, but not spectacular. If you are a von Karajan fan you will not find these disappointing. For others, a listen to a few other versions should decide for you whether you want the smooth naturalness of the *Angel* sound or the more detailed, brighter, and more exciting sound in competing discs. Strictly a matter of taste. The RIAA curve was better with a little bass boost. Beautiful surfaces.

RACHMANINOFF
SYMPHONY #2

Pittsburgh Symphony Orchestra conducted by William Steinberg. Capitol P8293. RIAA curve. Price $5.95.

One of four discs issued by *Capitol* to celebrate the third anniversary of its association with the Pittsburgh Symphony, this is just about the finest thing they have done. From every conceivable aspect, this recording is superior to the three previous issues. If you remember the excellence of the Ormandy-*Columbia* version, you'll realize this is a large statement. Steinberg essays a much slower pace in his reading, than does Ormandy, and I for one prefer this treatment. Steinberg emphasizes the essential lyric quality of the work, yet the scherzo and finale have the needed strength and vigor. His handling of dynamics is much superior to the Ormandy, and his ritards less theatrical. Soundwise, this is a fabulous disc. The strings are virtually edgeless and the celli and contrabass are particularly impressive. Sweet-sounding woodwinds, brass of unusually bright timbre, and authoritative percussion add their merits. The noiseless surfaces allow a very wide dynamic range. The acoustic treatment makes for a "big-hall" type of sound, very appropriate in a romantic work. However, I am bound to say that I would have preferred a little less reverb, to achieve a smidgin' more detail. This is but a minor annoyance. Certainly, this is one of the most beautiful symphonies ever written. Sooner or later, the

"pop" boys will figure out how to steal some of the glorious melody of the third movement. It would be an immediate "hit." If you are not familiar with this work, get it by all means. If you don't like what you hear on first listen, I'll eat a copy of it in Macy's window! The RIAA curve was OK.

SAINT SAENS
SAMSON AND DELILAH (EXCERPTS)
NBC Symphony Orchestra conducted by Leopold Stokowski, with Rise Stevens, Jan Peerce, Robert Merrill, The Robert Shaw Chorale.

WOW! If this were only complete! Unhappily it is not and may never be. But we can be grateful at least for what we have. An absolutely sensational record from all aspects. Dr. Stokowski's performance is white-hot, as is Miss Stevens vocal characterization of the sultry temptress. Jan Peerce can only be described as magnificent as Samson and Robert Merrill and the Shaw chorale add their excellence to the proceedings. The love duet has never sounded better and Samson's final declamation is terrifying in its impact! The sound is tremendous. Every nuance and shading of the voices are perfectly projected. The thunderstorm at the end of the love duet is productive of some stentorian tympani and bass drum blasts and when Samson pulls down the pillars of the temple in the finale, look out for your speaker! Huge drum blasts, great clanging gongs and crashing cymbals, combine with the cries and screams of the people in the temple to chill your blood! Great frequency and dynamic range throughout the disc, virtually no distortion. An outstanding recording, highly recommended.

STRAUSS, JOHANN, JR.; JOSEF
WINE, WOMEN, AND SONG MARCHES, POLKAS, ETC.
Vienna State Opera Orchestra conducted by Anton Paulik. Vanguard VRS-457. RIAA curve. Price $5.95.

As spritely a collection of Strauss waltzes, polkas, etc. as ever graced a turntable. The familiar bubbly music is in the best Viennese tradition, and the performances are exemplary. Soundwise, it is another example of *Vanguard's* fine recording technique. Strings, brass and especially percussion, is magnificent. This disc will undoubtedly find use as demonstration material. RIAA curve OK and quiet, too!

RACHMANINOFF
RHAPSODY ON A THEME OF PAGANINI
DOHNANYI
VARIATIONS ON A NURSERY SONG
London Philharmonic Orchestra conducted by Sir Adrian Boult with Julius Katchen, pianist. London LL1018. RIAA curve. Price $3.98.

More Rachmaninoff, and in this case, a recording that was badly needed. None of the five preceding versions could honestly be called hi-fi in sound and this disc is welcome from that aspect alone. Performance-wise, outside of Rachmaninoff himself on a *Victor* "Treasury" series, Katchen outguns his competition. His reading is well modeled, technically fluent and he shows a marked sensitivity for balance and feeling. The sound is a veritable *tour-de-force*. Crisp clean-lined piano tone, lean and free flowing when needed, sharp and percussive on demand. Recorded fairly close-to, which is OK for the repertoire involved, there is never a hint of wow or flutter. Sir Adrian and his beloved LPO furnish a sympathetic accompaniment and the whole is enrobed in sound of wide frequency and dynamic range. The Dohnanyi work is a highly amusing satire. The piece

opens with hugh orchestral sonorities, and builds to a great pompous climax. Then, full of naivete, the simple one-finger piano enters with the familiar nursery tune! Dohnanyi then leads you through some exceedingly clever and amusing variations to the final climax. Plenty of zesty material for the hi-fi fan in both works and some rewarding music for the uninitiate. Unreservedly recommended. The RIAA curve did not need adjustment.

BALAKIREV
THAMAR
LIADOV
ORCHESTRA MUSIC

L'Orchestre de la Suisse Romande conducted by Ernest Ansermet. London LL-1068. RIAA curve. Price $3.98.

This recording stirred up quite a ruckus at the New York Audio Fair. A quick listen to "Thamar," or Liadov's "Baba-Yaga," and you'll understand why. This is typical Russian music of the nationalist school, with some orientalism thrown in for good measure. No great philosophic concepts here, just good entertainment. In fact the record could stand on the merits of its sound more than anything else. Of course there is plenty to stir the heart of the hi-finatic, most notable of which are some great brass sounds and enormous bass drum blasts. Another good demonstration disc and another good job from the always dependable Ernest Ansermet. The RIAA curve did not require adjustment.

Jazz Corner

BORDERLINE

The Mel Powell Trio. Vanguard VRS-8501. NARTB curve. Price $5.95.

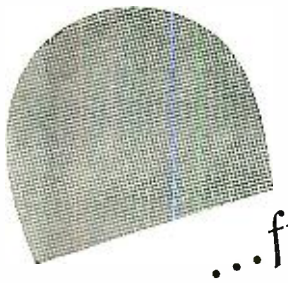
Another jazz record worthy of your attention. *Vanguard* teams up an *Altec* and a *Telefunken* mike to record the piano, sax, and drums of the Mel Powell trio and with sensational results. This is close-up recording at its best. The sax has a very live "breathy" sound, the piano is flawlessly reproduced with superb transients and the traps are ultra-clean, with great authority and impact. Frequency response is exceptionally wide and distortion is non-existent. This is music in the "cool" school, and as such is largely improvisatory. Powell works his amazing art on such stalwarts as "What's New," "Avalon," etc. and the result is always interesting and highly listenable. If all jazz were as well recorded as this disc, there would be a great many more jazz fans in this world! Try this for a treat of transients! The NARTB curve did not require adjustment.

Tape Review

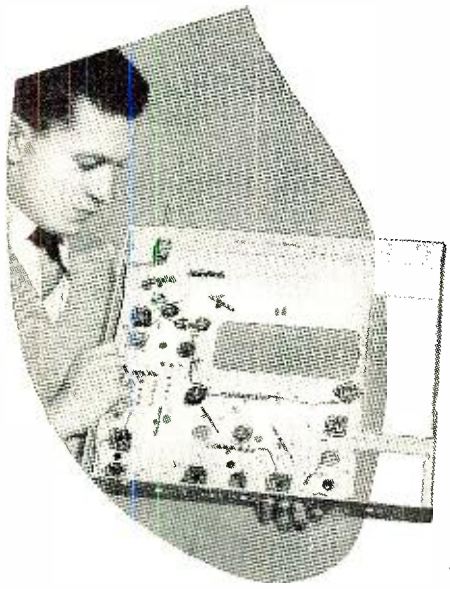
STRAUSS, RICHARD
ALSO SPRACH ZARATHUSTRA

Chicago Symphony Orchestra conducted by Fritz Reiner. Victor TCS-1. 7" reel, 7½ ips, stacked stereophonic heads. Price $14.95.

I had a hard time getting this first *Victor* stereophonic tape, but finally got a copy through the courtesy of Mr. Sam Goody. Believe me, the results are well worth the effort! This work was given a very good recording on the disc, but this is so far superior, that comparison is ridiculous. This particular tape was made for reproduction through stacked heads, so I used channels one and three of an *Ampex* three-channel unit. The same tape is also available for the *Magnecord* type of staggered heads. Right from the very beginning, where the great groaning contrabassi are heard, the magic of stereophonic sound makes an astounding difference. Where the sound on the disc is merely good, here it is a glowing living "presence." Standing between the two speakers you could easily discern di-

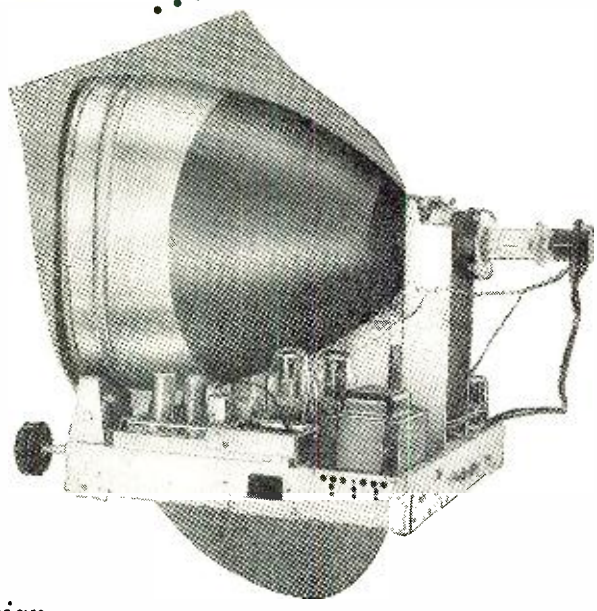


...from start



...and step by step

...to finish



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rection for individual instruments and choirs. If you think strings are nice and clean on monaural tape, wait 'til you hear them stereophonically! The brightness remains, but the smoothness is uncanny. French horns, always a difficult instrument to record, are reproduced with soaring, effortless ease. Percussion is at last in its proper perspective and the clarity and impact is startling.

The microphones in this recording were placed 21 feet apart. In my humble opinion, this is a little extreme. I have recorded stereophonically in Orchestra Hall in Chicago, and for reproduction in the average good-sized living room have found 8-10 feet to be optimum. This allows better detail in the "hole in the middle," especially with the woodwinds which are usually at that place. A check with one of my own recordings proved this to be true. However, this is very minor, the over-all sound being so magnificent as to beggar description. In spite of the fact that I was using heads with reduced gap areas, the signal-to-noise ratio was excellent with very little tape hiss. As has been noted in the previous disc review, Mr. Reiner's performance is all that one could desire and the orchestra is magnificent. Expensive, yes . . . but so is a couple of good seats at the Hall. This is the next best thing and you can play it anytime you choose, with assurance that the performance will always be good, and the sound breathtaking from your vantage point. If you have the remotest opportunity to hear this tape, seek it out and you will be rewarded by the hi-fi thrill of your life. —30—

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A COURSE in code and radio theory for Novices and Technicians is being offered without charge as a public service by the Quarter Century Wireless Association in cooperation with The Hallicrafters Corporation and Allied Radio Corp. of Chicago.

Classes are being offered at Allied headquarters, 100 N. Western Ave. in Chicago every Monday and Thursday from 7 to 9 p.m. Classes will continue through May 26th and resume in the fall. —30—

TAPE TRICKS WITH YOUR HOME RECORDER

By MICHAEL KAPP
Technical Director, Kapp Records Inc.

MANY home recordists have discovered through advertisements and sundry articles that commercial editing equipment, available at a nominal cost, can transform the home tape library from a hodge-podge into a carefully-compiled, commercial-free collection of valuable tapes.

Often overlooked as a valuable "accessory" to the editing gear is the tape machine itself. The erase head (the first head the tape passes over in travelling forward to the takeup reel) can be used with excellent results for creating a precise period of dead tape between selections, or can be used to eliminate any extraneous matter before the actual start, or after the end of the show without cutting the tape.

The method consists of carefully cueing the tape to the desired spot at the playback head of the machine and then marking that spot on the back of the tape with a china-marking pencil. (Fig. 1) If it is desired to erase the material after that spot on the tape, the tape should then be moved backward by hand until the mark on the tape is over the erase head. (Fig. 2) By starting the machine in the forward record mode, everything on the tape after the mark will be eliminated, and a clean "out" cue effected, providing the tape has been marked and cued properly. By following the same process with but one exception, the beginning of a tape may be wiped up to a desired spot. The marking and cueing back to the erase head remain the same, but the tape is now lifted from any contact with the drive capstan. The machine is then placed in the record mode, and the feed reel is held by the operator, and then moved backward by hand over the erase head until a sufficient amount of erased tape preceeds the show.

It is suggested that these processes be practiced on a spare reel of recorded tape so that the operator may compensate for the individual differences of his machine.

There is no worse feeling for the recordist than putting a tape labelled with one title on his machine, only to find that he has accidently erased that tape or the tape was put in the wrong box. Despite care used when labelling tape and box, these mixups can occur. One solution to this problem is having the recordist put a spoken introduction on the tape before recording a show. By announcing the name of the show, date recorded, and the settings on his equipment, the chance of accidental erasure is eliminated, for if the operator is ever in doubt about what is on a particular tape, all he need do is listen to the first few seconds of the tape.

Aside from the help offered by this system, the noting on tape of the setting used will help the home recordist establish certain standard record settings by being able to compare the quality of his tapes at the various settings. —30—

Fig. 1. Operator marking the back of the tape with a china marking pencil after cueing up tape to the playback head. Note that white leader tape has been used instead of standard recording tape in the photo for better contrast with the head.

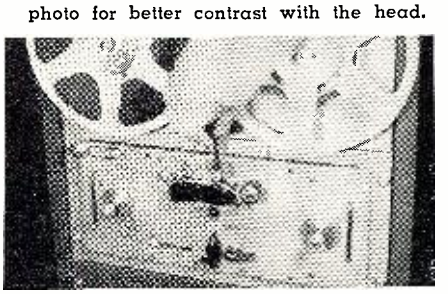
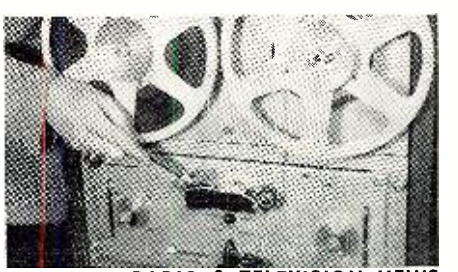


Fig. 2. Pencil points to the spot on the back of the tape which has been moved back directly over the erase head prior to putting the machine in the record mode. Again white leader tape is used so that it will show up against black head assembly.



Recorded "Echo"

(*Continued from page* 63)

its amplifier. On the other end of the wire attach a plug which will fit your amplifier's microphone input. Keep the wire short to avoid hum pickup.

If your machine already is equipped with the additional head you may connect it to the amplifier in either of two ways. You can detach the wires from the tape machine to the playback head, then attach the head to the auxiliary amplifier as described in the preceding paragraph. Or, you can wire from the tape machine's playback amplifier output to the auxiliary amplifier's input. With the second method it may be necessary to insert a transformer or resistor in the wire between the tape machine and amplifier to cut down the volume and prevent distortion.

Now to the circuits for the artificial brilliance effects. They are based on electrical feedback with time delay. The sound for echo is fed through an amplifier, recorded, picked up on the extra tape playback head, and fed back into a second channel of the original amplifier. Both the original sound and the recorded-played-back sound are heard in the loudspeaker. Thus, as the original sound picked up by the microphone is heard in the loudspeaker it is also being recorded. The tape takes a fraction of a second to travel from the recording head to the pickup head. When this delayed sound is fed into the amplifier it is heard in the speaker and also is re-recorded, but with diminished volume. As the sounds thus "chase their tails" the total effect reminds one of the acoustical conditions in a large stone hall.

Examine Fig. 1. Notice that the microphone feeds the vocal music to the public address amplifier's microphone channel one. The signal from the amplifier output is heard in the loudspeaker. The same signal is supplied to the tape recorder by a wire from the amplifier output to the tape machine input. (On many machines the proper input is marked "radio." Do not use the microphone input.) The tape machine is operated on "record." The output of the extra head is fed to the amplifier's microphone channel two, where it mixes with the original sound to form the final effect.

Channel two's volume control will control the amount of feedback or "echo." The time-delay involved is set by varying the space between the recording head and the playback pickup. The greater the distance the longer the delay. The speed of the machine would affect this too. Slower tape speed means longer delay. A speed of 7½ inches-per-second is suggested for heads spaced one to two inches apart.

If sufficient volume cannot be obtained from the extra head working into a microphone channel, a preamplifier can be inserted between the head and the amplifier.

Experiment will show the best uses

for this effect. In performance before a live audience the rules regarding any public address system use will apply. Too much loudspeaker volume will cause a wailing feedback. Keep the microphone fairly close to the sound source. To expand the apparent size of a small chorus, place the microphone in front of the entire group. The group will sound "larger" and in a seemingly larger auditorium. For a solo voice rising out of the choir place the microphone close to the soloist, letting the remainder of the voices be heard naturally without amplification or echo. The same applies to a narrator with chorus or orchestra. Dramatic and orchestral effects may be accomplished in a similar manner.

Although this article has dealt with "live" performances, the same technique can be used for recordings. The same tape used in producing the effect will contain a recording of it. You'll find many uses for this setup in adding a bit of spice to musical and dramatic productions. —30—

VERMONT QSO PARTY

THE Tri-County Amateur Radio Club of Brattleboro, Vermont is sponsoring its fourth "Vermont QSO Party" during the 24-hour period Saturday, April 9 at 6 p.m. (EST) to Sunday, April 10 at 6 p.m. (EST).

According to the group there is no time limit and no power restrictions. For Vermont stations one point per contact will be allowed with the total multiplied by the number of states, U. S. possessions, Canadian provinces, and foreign countries worked during the contest period. Outside stations will be credited with 5 points for each Vermont station worked multiplied by the number of counties in Vermont worked during the contest period.

Credit for contacts with the same station on another band will be given this year in order to promote activity on the higher frequency bands.

A certificate will be awarded to the highest scoring station in each state, U. S. possession, Canadian province, and foreign country, as well as each Vermont county.

Logs and scores must be postmarked not later than May 10th. Send them to Tri-County Amateur Radio Club, % Ray N. Flood, W1FPS, 2 Marlboro Ave., Brattleboro, Vermont. —30—

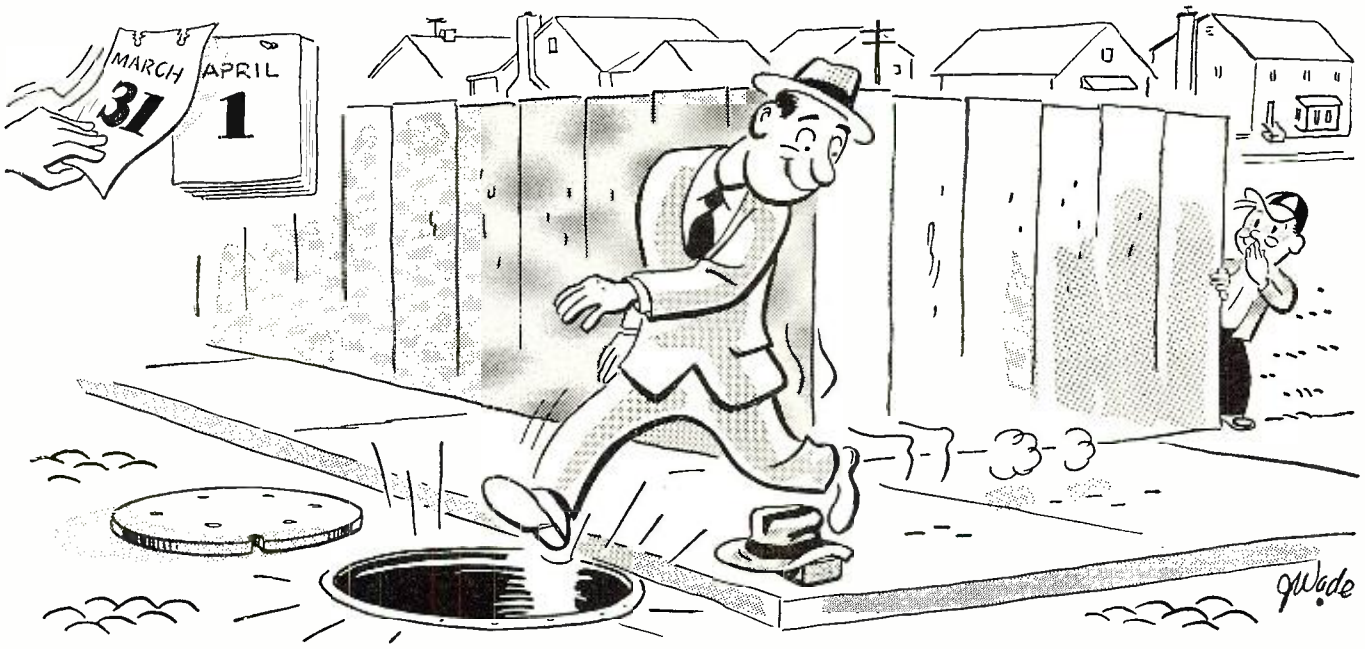
"OLD TIMERS NITE"

THE Tenth Annual Old Timers' Nite Round-up and Banquet will be held on Saturday evening, April 23rd in the Grand Ballroom of the Stacy-Trent Hotel, West State Street at Willow in downtown Trenton, New Jersey.

This annual stag event is sponsored by the Delaware Valley Radio Association.

Awards will be given to attendees submitting the oldest amateur and commercial licenses. A special award will go to the "Grand OM" whose radio operating experiences date back to the earliest days of wireless.

Tickets are by reservation only and may be obtained from Ed G. Raser, W2ZI, 315 Beechwood Ave., Trenton 8, N. J., before April 18th. Tickets are $5.00 a head with late comers being assessed $6.00. —30—



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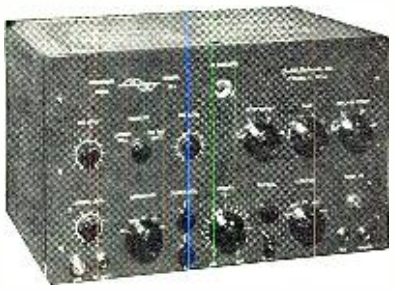

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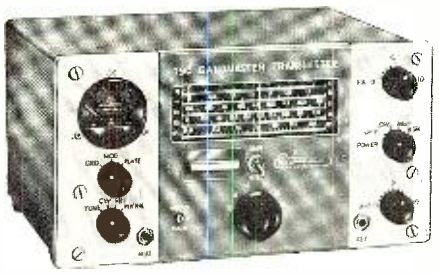

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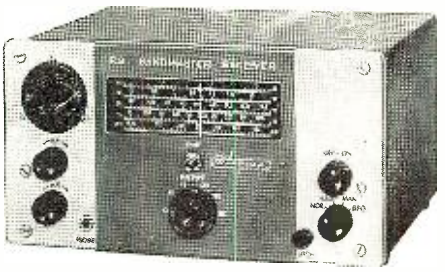

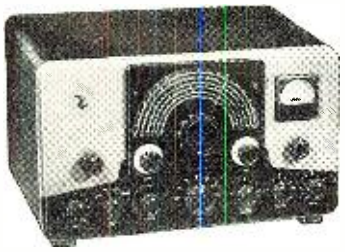

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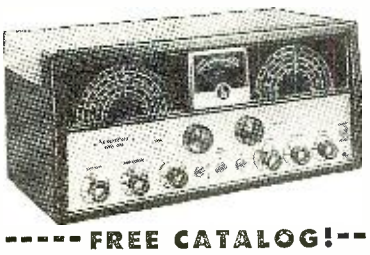

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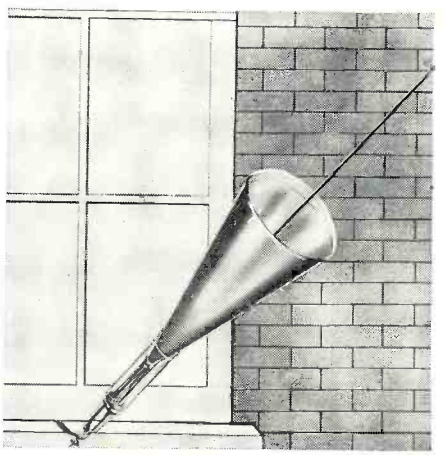
THE G-LINE ANTENNA LEAD-IN

By **LEONARD LIEBERMAN**

Unique transmission line featuring low losses over long lengths at u.h.f. is excellent for fringe areas.



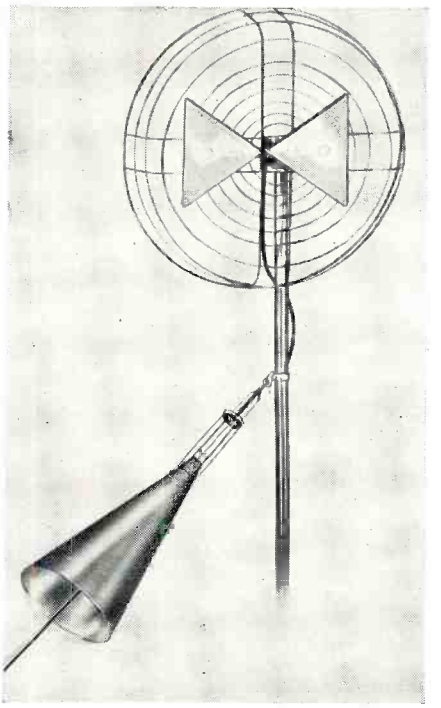


Fig. 1. View of the launchers used at the antenna and house end of the "G-Line." The wire itself is strung directly from the antenna to the house entrance of the lead-in wire; the launcher sends the received signal down the wire in the method peculiar to this type transmission line.

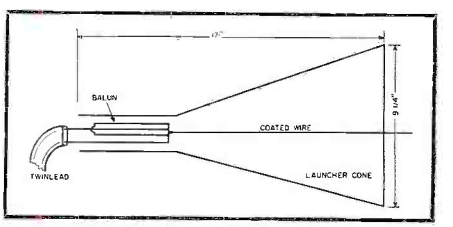


Fig. 2. Details of the launcher cone.

AN UNUSUAL type of antenna lead-in which may be found useful for difficult u.h.f. installations is called "G-Line," after its inventor, Dr. G. Goubau. It is shown in Fig. 1. This new lead-in works on the surface-wave transmission principle.

It is well known that a single wire in air which has a voltage impressed on it will radiate energy. This, of course, is basic transmitting antenna theory. Dr. Goubau, in an effort to develop a simple super-high-frequency wave guide, found that when a single wire is coated with a dielectric material, some interesting things occur. The first of these is that the wire becomes nonradiating. As a result, virtually all the energy impressed at one end of the wire is recovered at the other end.

The second result noted is that as against the 72-ohm impedance of a coaxial cable of the same size, the impedance of the "G-Line" is approximately 300 ohms. This gives a better match to most antennas which are designed with a 300-ohm output impedance.

Another result is that since there is only one wire in the system, as compared to two in the twin-lead lead-in, the wire loss is half that of the twin-lead. A further benefit comes from the fact that just as the wire does not radiate, conversely, it cannot pick up external noises as might come from faulty electric motors, car ignitions, etc.

To understand why these conditions prevail, let us examine the structure of the unit. If we consider the *inner surface* of the dielectric coating on the wire as one side of a capacitor and the *outer surface* as the other side, the amount of radiation would be a function of the leakage current through the dielectric. If the material has a good dielectric constant, this leakage is small and the radiation field is small. It has been found that this field can be kept within one-quarter wavelength from the center conductor.

The construction of the line makes it virtually unaffected by rain or layers of soot. In all two-wire systems, these installation bugaboos create low-impedance paths between the two lines. This is true to a greater or lesser extent of *all* two-wire systems. In the "G-Line," all that occurs is that the dielectric is increased with a very small increase in the loss resulting from additional dielectric currents. This effect is hardly measurable with laboratory-type equipment.

To develop the proper wave transmission along the line, special "launchers" are required. These launchers are hollow cones. The large diameter of the cone is determined by the desired size of the field around the wire and by the lowest operating frequency. (It might be noted that these launchers, because of the last-named requirement, also act as high-pass filters aiding the set in the rejection of interfering signals below the u.h.f. band.)

The launchers (Fig. 2) are 17 inches long and 9¼ inches in diameter at the large opening. A nonconducting cone is attached over this opening to keep the launcher weatherproof. The dielectric-covered wire is connected to a "balun" (*bal*ance-to-*un*balance transformer). This balun has a flat standing-wave ratio over the entire u.h.f. band. The other end of the balun is connected to the short 300-ohm lead from the antenna, or the 300-ohm lead into the building.

The loss caused by the two launchers and the two baluns is approximately one db total and is constant over the entire u.h.f. band. The loss in the wire is 1 db per hundred feet. The dry loss in the best of the two-line systems is 1.9 db per hundred feet. Some elementary arithmetic shows that for runs over 125 feet with dry lines, the total loss of the "G-Line" becomes progressively smaller than the loss in the best two-wire system. When the comparison is made with new ribbon line of the type usually used, the "G-Line" is more efficient even for runs as short as 90 feet when dry and 30 feet when wet.

These facts indicate the potential of the "G-Line" in fringe reception areas. At u.h.f., one of the limiting factors on the antenna tower height or distance from the house is the loss in the lead-in wire. This loss makes it inadvisable to take advantage of sturdy trees or a hill which might be more than a very short distance away.

With the "G-Line," it is possible to run the line from a point 300 to 500 feet from the house without any more loss than would be sustained with 100 feet of currently-used wire. Since the line is made with #14 AWG wire covered with .060" of polyethylene, it can be strung for as far as 500 feet without requiring any supports. If it is desired, the line can be supported by nylon string (such as used in fishing line) as long as the wire isn't bent more than 30° at any point. The launchers and wire are connected as shown in Fig. 1. The wire, itself, should be kept at least one foot from the house or the ground.

One particular application of this transmission line is in installations where the house is "shadowed" by a hill or obstruction. This line allows the planting of the antenna mast at any convenient high location.

"G-Line" is presently being manufactured and marketed by the *David Bogen Company, Inc.*, of New York City, under license from *Surface Conduction Inc.* —30—

TRACKING ERRORS IN PHONOGRAPH SYSTEMS

By **T. A. BENHAM** and **PAUL CRAIG**
Haverford College

A summary of the important factors involved in the design and mounting of pickup arms for best results.

THE problem of needle pressure and resonance has received much attention in the literature of sound reproduction. A related problem which has received far less attention is that of needle tracking error. It has not been widely realized just how much may be done to minimize this source of distortion and record wear. Tracking error is defined as deviation from perpendicularity between a line through the pickup cartridge and a radius drawn to the needle point from the record center. In recording, this error does not arise, for a lathe is used to transport the cutting stylus, which insures the correct angle at all times. However, playback is generally accomplished with a pivoted arm which must track the record from a single point.

The result of the finite length of the pickup arm is that error is introduced, and the needle is not at all times perpendicular. This error has a number of detrimental effects. In magnetic type cartridges a push-pull action is generally used to obtain cancellation of even harmonic distortion. When tracking is imperfect, a force is exerted to displace the needle from its normal rest position even when no groove modulation is present. Thus the needle is forced closer to one pole piece than the other, so cartridge output is greater for displacements in one direction than in the other, resulting in even harmonic distortion. In non push-pull cartridges the needle is forced to operate in a region other than that in which it was designed to operate, so that the damping blocks have a continuous extra force in one direction.

Another disadvantage of tracking error is needle wear. Since more force is exerted on one side of the needle than the other, wear is uneven, and its life will be proportionately reduced. Further, if tracking error changes while the record is played, wear is distributed about the point of the needle, making the life that much shorter. Thus, if error varies from +10° at the outer radius of the record to −5° at the inner radius, wear is distributed along 15° of the needle.

In designing a pickup arm there are three dimensions which must be taken into account, neglecting the actual pivoting mechanism. Two of these are under the control of the manufacturer, and the third must be determined by the user. The first two are the length of the arm and the amount of offset, or head angle, of the cartridge mounted in the arm. The head angle is usually introduced by building a curved arm, or by mounting the cartridge at an angle on the head of the arm.

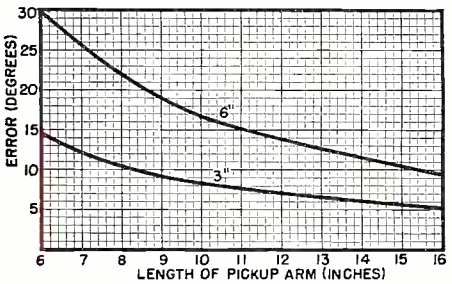
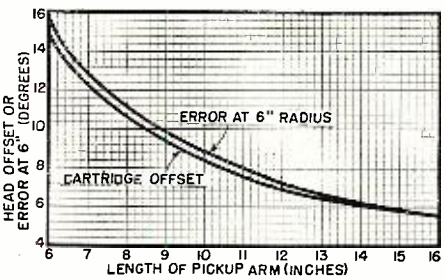


Fig. 1. Straight arm error at 3" and 6" with the needle passing over the center.

The third factor is the amount of overhang of the needle over the turntable spindle when the arm is mounted. This factor is extremely delicate, and must be determined for each individual arm if tracking error is to be reduced to a minimum. We must reach a compromise between obtaining the smallest possible amount of error, and allowing the arm to overhang so far that excessive force is applied to the needle from this alone. To make mounting as simple as possible several graphs have been drawn from which the best mounting for a given arm can be found at a glance.

Fig. 1 shows the error of various length arms at 3" and 6" radii if the needle passes over the center. Even with an arm as long as 10" the error at the outside of a 12" record is almost

Fig. 2. The "cartridge offset" curve shows head offset in degrees required for zero tracking error at 3" radius for various arm lengths. The curve "error" at 6" radius shows error in degrees that would then occur at various arm lengths. The needle passes over the center of the record.



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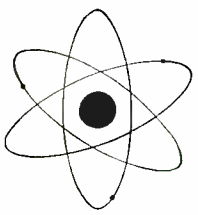

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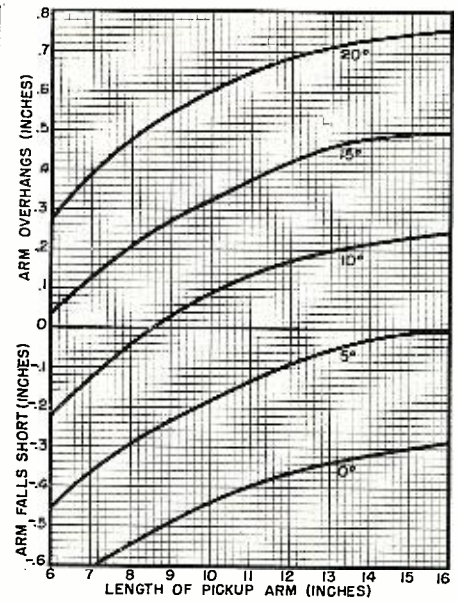


Fig. 3. Assuming zero tracking error at 3" radius, curves show desired position of needle point in relation to center of record. The curves 0-20 degrees refer to the various head offsets. Refer to text.

17 degrees. Fig. 2 shows how much we can reduce this by simply turning the cartridge in the end of the arm. The error has been removed at a 3" radius, where it does the most harm. Now with a 10" arm with about a 8.5 degree head angle the error is approximately 9 degrees at the outside of a 12" record. Fig. 3 shows how much overhang (position of needle in relation to center

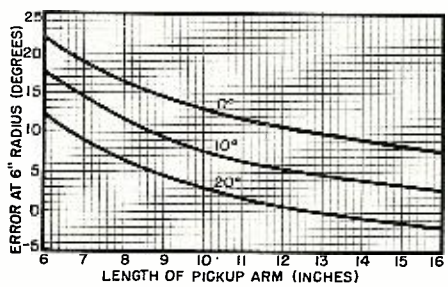


Fig. 4. Tracking error at 6" radius for various head angles with overhang set for a zero error at a 3" radius. See article.

of record) is necessary with various pickups to remove all error at a 3" radius. With our 10" arm and a 15 degree offset angle only .33" overhang is necessary. This dimension must be determined very accurately, for only a few hundredths of an inch can make a difference of several degrees tracking error.

Fig. 5. Optimum head angle and head offset for zero tracking error at 3" and 6" radii.

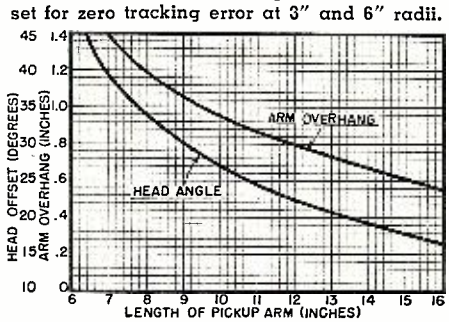


Fig. 4 shows the error at 6" for various head angles, when the overhang is adjusted for no error at three inches. For designing the best pickup of some particular length Fig. 5 shows the best head angle and amount of overhang in order to have no error at all at 3" and 6". For a given pickup, where the length and head angle cannot be changed, Fig. 3 would be used to find the proper amount of overhang. —30—

ION TRAP MAGNETS

By GEORGE RULFFS, JR., W2CJY

MAGNETS from discarded bar-type ion traps should be salvaged to make a bench tool for collecting loose steel filings and chips resulting from metal work on a chassis.

Cement a magnet from one of these traps into a Bakelite or polystyrene tubing of correct diameter and convenient length. Ordinary household cement will do nicely.

Should the magnet be larger than the tubing's inside diameter, file away some of the tubing for a snug fit. If the tubing inside diameter is too large, the bar may be wedged into place with scrap pieces of poly plus a generous application of cement. Both ends of the tubing may be treated this way to make a double-ended tool.

This gadget will also hold and start small steel nuts in hard-to-reach places. —30—

SMALL COAX, LARGE PLUGS

By E. J. GAUSS, WØEOS

HAVE you ever tried to use connectors designed for large cable with coax of smaller diameter? If you have, perhaps you will be interested in the way this problem was handled by one experimenter who achieved a weather-tight joint in addition to strengthening the junction against wear.

The more common types of "UHF 83" plugs do not fit common coax having a diameter of .245". Such plugs are designed for cable with an o.d. of .405".

For one application it was desirable to use RG-59/U (o.d. of .245") with large connectors. Commercial adapters were not available at the time. The connector was to be used outdoors and had to be weather-tight. It was found that ¼" i.d. rubber tubing, commonly used with Bunsen burners could be used as an adapter.

A 2" piece of the tubing was clipped over the end of the cable. The cable was then stripped and soldered to the connector in the conventional way. The rubber tube has an o.d. of about ⅜" and increases the diameter of the cable so that it makes a snug, weather-tight fit. In addition, the rubber tubing strengthens the cable and prevents wear near the connector.

Although this method works quite well for most applications, it is not recommended for exacting work as a slight impedance discontinuity is produced. —30—

How small coax is adapted for use with large connectors by means of rubber tubing.

THE TWIN SUPPLY

By J. J. HOEFER, WØIIJ, and G. GORDON, JR.

A unique power supply which uses junk-box parts and offers some unusual features for the home experimenter.

PROBABLY one of the most commendable attributes of the radio amateur is his ability to stretch the use of his junk box, thereby saving himself a few pennies.

The ideas presented in this article save the cost of a high-voltage transformer in an oscilloscope power supply by utilizing some already on hand. In addition, other uses can be made of the somewhat unusual voltage multiplier circuit shown in Fig. 1.

It will be noted that one side of the output of the high-voltage supply is grounded, and further study will show the circuit to be a voltage multiplier in series with a half-wave rectifier. Simultaneously, a low voltage is obtained from the same transformer.

The low-voltage supply is conventional and no more will be said of it. Let us examine the operation of the high voltage supply.

C_1 is charged through V_1 to approximately e, the peak voltage of one-half the secondary, with the polarity as shown. C_2 is charged through V_2 to a value of $3e$, the peak secondary voltage plus the voltage on C_1. C_3 is then charged to a value of $4e$, the peak voltage of one-half the secondary plus the voltage on C_2.

As the output is taken across C_3, this represents a voltage of four times the peak voltage across one-half the secondary. Thus, for a 250—0—250 transformer, e equals 350 volts, and we may expect approximately 1400 volts d.c. out.

The capacitors should have a working voltage rating in this case as follows: C_1-350 volts, C_2-1200 volts, C_3, 1500 volts. The peak inverse voltage rating of the rectifiers should be: V_1-700 volts, V_2-1400 volts, V_3-700. Most vacuum rectifiers have a peak inverse voltage rating in excess of 700 volts; types 5U4, 5V4, 5Y3, etc. have a rating of 1400 volts or higher.

The output voltage will be negative with respect to ground. If the rectifiers are all reversed, the output will be positive. Separate filament transformers should be used for V_2 and V_3 to keep from exceeding the cathode-filament voltage rating.

Another circuit, shown in Fig. 2A, will give a greater voltage out for the same number of components. In this case C_1 will charge to $2e$, the peak voltage of the full secondary, through V_1. C_2 charges through V_2 to a value of $4e$, the peak secondary voltage plus the voltage on C_1. C_3, across which the output is taken, will charge to $5e$, the peak voltage of one-half the secondary plus the voltage on C_2.

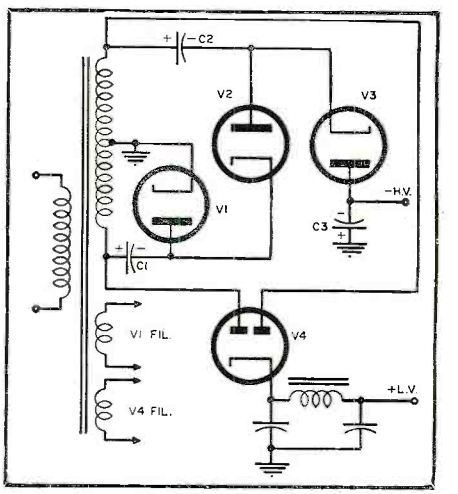


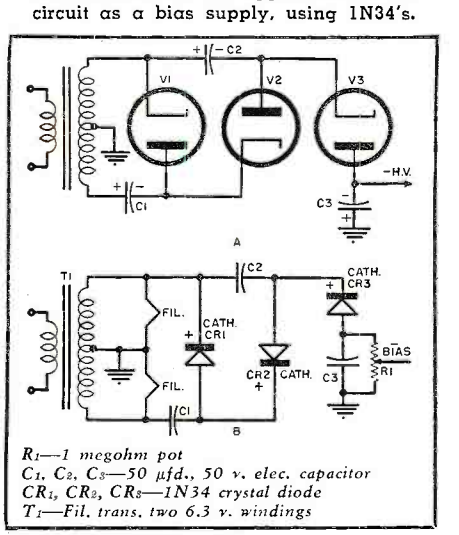
Fig. 1. Schematic of the twin power supply. See text on the values of component parts.

Thus, an output voltage of five times the peak voltage of one-half the secondary is obtained. For a 250—0—250 transformer, a d.c. output of 1750 volts can be obtained.

Voltage ratings of the capacitors are now: C_1-700 volts, C_2-1500 volts, C_3-2000 volts. Peak inverse voltage ratings on the rectifiers should be: V_1-1400 volts, V_2-1400 volts-V_3-700 volts.

Like any voltage multiplier, fewer or more sections may be used, and various voltages may be obtained. The circuit of Fig. 1 can be made to give voltages of $2e$, $4e$, $6e$, and that of Fig. 2A to give voltages of $3e$, $5e$, $7e$, for example. A large selection of high voltages of either polarity can be de-

Fig. 2. (A) Revised circuit of Fig. 1 which provides greater output voltage. See text for parts values. (B) Application of the circuit as a bias supply, using 1N34's.



R_1—1 megohm pot
C_1, C_2, C_3—50 μfd., 50 v. elec. capacitor
CR_1, CR_2, CR_3—1N34 crystal diode
T_1—Fil. trans, two 6.3 v. windings

LAFAYETTE'S SPECTACULAR MONEY SAVERS

- Brand new fully automatic 3 speed record changer
- Dual turn-over cartridge with dual styli
- Automatic shut-off after last record

SALE! Webcor 26.50

3 SPEED AUTOMATIC RECORD CHANGER Buy at Lafayette's LOW SALE PRICE

You'll find this famous Webcor Diskchanger not only in Webcor Fonografs but in radio phonograph combinations of other famous manufacturers. This is truly supreme excellence in record changing. Not only does it play all 3 speeds and all sizes of records, but it plays up to four hours automatically . . . then shuts itself off after the last record has played. The Webcor Diskchanger was designed for swift, silent record changing; smooth, accurate turntable speeds; and gentle treatment of your precious records. To obtain these qualities, Webcor has included such outstanding features as the: Balanced Tone Arm, Electrostatically Flocked (super-soft) turntable, and a powerful 4 pole motor. Shpg. Wt. 16 lbs.

PK-49 ..... Singly, ea. **26.50**

WEBCOR WITH G.E. CARTRIDGE

STOCK NO. PK-46 Same as above but with G.E. RPX-050 Triple-play cartridge. List Price, $51.75 ..... NET **29.50**

Lafayette Greatest Tape Buy Ever!

$1.89 per roll plus postage (C.O.D.'s accepted)

1200 FT. REEL Genuine Plastic Base RECORDING TAPE Shpg. Wt. 14 oz.

LAFAYETTE made a terrific deal with one of the leading manufacturers of recording tape to supply us with their regular tape which sells for almost twice our price. WE GUARANTEE ABSOLUTE SATISFACTION OR YOUR MONEY BACK. The finest, professional-quality recording tape obtainable. Highest performance for thousands of playings. Red Oxide Base in a smooth, uniform coating; greater signal strength; with maximum fidelity; uniform frequency response from 40-15,000 cps.

In lots of 10 rolls - 1.75 ea

Masco CASCADIAN TV BOOSTER

Reg. Price ~~$42.50~~

SALE 9.95

Biggest Booster Buy Ever!

Famous Masco Cascode Booster!!

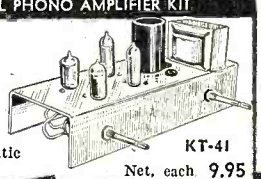
- Three tuned circuits—cascode!
- Golden Grid 6BZ7 Plus 6J6 Plus rectifier!
- 35 db gain (56 times!) average on all channels!

A sensational new tunable VHF booster utilizing a special low-noise circuit. Employs the new Golden Grid 6BZ7 tube so well known for its use in cascode circuits. Field pioneer and specifically designed for new low noise-high gain front ends. Brings superior reception to older type receivers. Single knob control for utmost simplicity of operation. Signal strength is increased at least 56 times—35 db!—average on all channels. Rack and pinion permeability for precision stability. Automatically switched on and off by TV set. Uses cross-neutralized 6J6 and 6BZ7 tubes for maximum gain and bandwidth. U/L approved. For 110 volts AC. Wt. 5 lbs.

Masco TVB-53 in lots of 3, Net **9.45** Singly, ea. **9.95**

HI-FI PUSH PULL PHONO AMPLIFIER KIT

Hi-quality 4 tube push-pull phono amplifier kit. Plenty of power — low distortion. 2-35C5, 1-12AX7, 1-35W4. Inverse feedback circuit. Separate tone and volume controls. Complete with tubes—output transformer—pictorial and schematic diagrams.



KT-41

Net, each **9.95**

SALE ASTATIC UHF CONVERTER

channels 14 thru 83

In Lots of 3.... **13.95**

Singly, each..... **14.45**

Below manufacturer's cost! Continuous vernier tuning—14 thru 83. Operates into TV receiver channels 2-3-4-5 and 6! Two-stage preselector. Fully shielded spiral inductance tuner reduces oscillator radiation. Uses 6AF4 or 6T4 and 1N82 crystal diode. High sensitivity—low noise performance!

ASTATIC UHF— Singly, each..... **14.45**

In lots of 3, each..... **13.95**

TV POWER TRANSFORMER

Exact replacement for Admiral 80C25-1. Plate volts 730V C.T. at 200 ma. and 215V at 65 ma. Rectifier 5V. at 3A. Filament—6.3V at 10A. and 6.3V at 2.5A. Useful general replacement.

TR-60—Lots of 3, each..... **4.50**

Singly, each..... **4.95**

FAMOUS ALARM-TIMER SWITCH

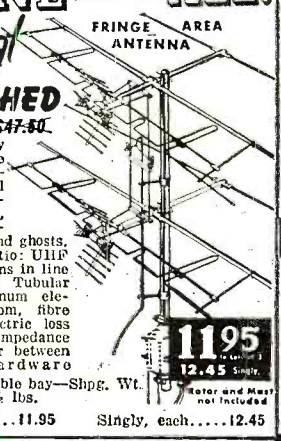
- BUZZ ALARM
- SLEEP SWITCH
- AUTOMATICALLY TURNS ON RADIOS, ETC.

We've done it again. We bought up the overstock of an equipment manufacturer to bring you this automatic 4-button timer at a giveaway price. Turns on radios, TV sets, toasters, etc. at any preset time within 12 hour period. Built-in SPST switch handles up to 15 amp 115 volts. Has sleep switch so you can go to sleep to music—it will automatically shut off radio at preset time up to 90 minutes. And it also tells time. Radium dial. For 110-120V 60 cycle. Shpg. Wt. 1½ lbs.

MS-105 ..... Net **5.70**

UHF VHF FM ALLIANCE TRI-CEPTOR ONE ANTENNA for ALL!

Sensational SMASHED REGULAR PRICE ~~$47.50~~



A new revolutionary design with monolobe highly directional pattern that covers all channels 2-83. Features great power, minimizing or eliminating interference and ghosts, high front-to-back ratio: UHF and VHF lobe patterns in line off front of antenna. Tubular built seamed aluminum elements, seamless boom, fibre glass and low dielectric loss insulation, zero loss impedance matching transformer between antennas. All hardware mounted. TC-2—Double bay—Shpg. Wt. 12½ lbs.

Net—Lots of 3, ea.... 11.95 Singly, each..... 12.45

REAR SEAT AUTO SPEAKER KIT

A HEAVY DUTY 6" x 9" PM KIT B

A complete kit for adding another speaker in the rear of your car. You get a 6"x9" PM speaker with a 2.15 oz. Alnico V magnet; a CRL PK300 three position switch so you can select either speaker alone or both together, dial plate with mounting bracket, knob and hardware; a plastic grille (illustration A) (your choice of brown, grey or silver), wire and wiring instructions. Simple to install. Shpg. Wt. 4 lbs.

SK-36 ..... Net 4.50

DELUXE 6" x 9" KIT

SK-37, with chrome plated metal grill (Fig. B). Shpg. Wt. 5 lbs. ..... Net 5.75

5" Tweeter AND Crossover Network

7.95

A specially designed 5" Tweeter and Crossover Network that will assure high frequency response when used with any speaker you now possess. You can now make your present speaker into a 2-way speaker system increasing the high frequency range up to 15,000 cycles. Diagram included. Shpg. Wt. 5 lbs.

STOCK NO. SY-14 ..... Net **7.95**

MINIATURE CRYSTAL MICROPHONE

Here's a typical Lafayette special for the experimenter, student or dealer. An extremely sensitive and small crystal microphone used in hearing aids and other small apparatus. Can be used as lapel mike—miniature transmitter mike for concealed locations, etc. Its size and performance gives it joint versatility. Brand new. Size only 1⅜" Diam. x 5/16" deep. Imported to save you money.

MS-108 ..... Net **1.95**

BINOCULARS NEVER BEFORE AT THIS PRICE

IMPORTED DIRECT

Prism-Coated Lenses

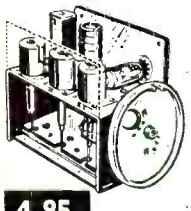
- All-Metal Construction
- Individual Focus
- Leather Case & Straps

F-105, 8 x 30 with case....NET 18.25
F-15, 7 x 35 with case....NET 19.95
F-103, 7 x 50 with case....NET 21.95
F-104, 12 x 50 with case....NET 32.50

} with order, Add 10% Fed. Tax

SALE! RADIO RECEPTOR UHF CAVITUNER

Complete with 6 AF4, 6BZ7 and IN82



4.95

Tunes all UHF channels 14-82. Most advanced engineering, three cavities, two used as bandpass pre-selector, one controlling local oscillator. Features frequency stability, uniformly broad bandwidth, high selectivity, low noise, high gain. Completely shielded. Ideal for building convertors, etc. Size 3½" H x 4¾" W x 4⅜" D. Shpg. Wt. 4½ lbs.

TL-26...Lots of 3, ea. **4.45**

Singly, ea. **4.95**

DUAL STYLUS — TRIPLE PLAY

11.95

DIAMOND and SAPPHIRE

(LP) (78)

LIST ~~$31.00~~

Replacement for All G.E. RPX-050 Triple-Play Cartridges!

Stock No. PK-29 Net **11.95**

WESTERN ELECTRIC HEARING AID

Brand new, in original Western Electric's jeweler's case. Supplied with receiver, receiver cord, battery cord and plug (less batteries). Money back guarantee. Act now while they last! Uses Burgess XX30E PI and 8B batteries at $1.68 per set.

Reg. Price ~~185.00~~

Our Price **$14.95**

FREE send for it RADIO CATALOG

GET LAFAYETTE'S NEW CATALOG PACKED WITH THE LARGEST SELECTION OF QUALITY ELECTRONICS EQUIPMENT AT BARGAIN PRICES.

Lafayette Radio

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Include postage with order.

veloped with any transformer, and still have a low-voltage supply!

In actual operating tests these circuits give outputs which are very close to calculated values. For scope supplies, the ripple will be satisfactory when all capacitors are .5 microfarad.

Another application of this circuit is for a bias supply, using 1N34 crystal diodes in the circuit of Fig. 2B. The transformer makes use of two 6.3 volt windings, with filament power also taken from both windings. There is considerable leeway in the matter of filament transformers. Two transformers can be used, a unit with two windings can be employed, or a regular power transformer having two filament windings could be used after the high voltage windings are taped for safety's sake. Output voltage is approximately 45 volts maximum. The capacitors should be 50 microfarads for good filtering and be rated at 50 volts. A combination of a 6.3 volt and a 5 volt winding can also be used for slightly less output. Proper phasing of the windings is necessary, and reversal of the leads of one winding may be needed. —30—

IMPROVED 10-METER SIGNAL

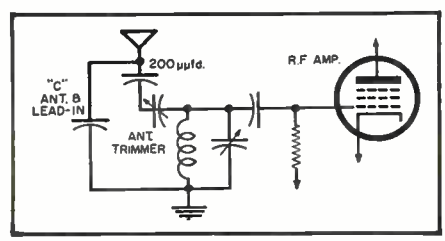
By G. R. ANGLADO

WHEN a 10-meter whip antenna is used for receiving 10-meter band signals on an auto set, a great loss of signal strength usually occurs. The antenna is usually mounted on the rear bumper and connected to the receiver with coaxial cable. This decrease of sensitivity is caused by the shunt capacitance of the lead-in and it is impossible in most cases to peak the signal from the whip with the antenna trimmer on the set.

The auto set is designed so that the antenna trimmer can adjust the total stray capacitance across the tuned coil to the value that permits the circuit to track properly. The range of the trimmer is selected to compensate for nominal values of antenna and lead-in capacitance resulting from using a standard automobile broadcast antenna and 3 or 4 feet of lead-in. When a longer antenna is used, a dozen or more feet of coaxial cable increases the stray capacitance values to a point where the antenna trimmer cannot compensate for them.

This makes it impossible to resonate the antenna circuit of the receiver, causing a loss of sensitivity. It is possible to compensate for the added stray capacitance by simply connecting a capacitor of 200-μμfd. in series with the lead-in at the receiver's input terminal. The added capacitor will reduce the lead-in capacitance because it is in series with it. —30—

Circuit showing the antenna-to-ground capacitance "C lead-in" and "C-ant." in series with antenna trimmer across antenna coil.



International Short-Wave

(*Continued from page 70*)

announced is "HJLV." Also *announces* "HJLA," 950 kc., "HJLV," 93 mc. (FM), all 10 kw. (Churchill, Va.) *Radio Libertad,* Medellin, noted from 2340 to 0028 sign-off on *measured* 5.979. (Parsons, Pa.)

Cuba—Radio Salas, 9.026A, Havana, broadcasting *to Cubans abroad,* closes 0500 with Cuban National Anthem. (Garrigo, Cuba) Havana, 9.710A, noted at excellent level closing 0530A. (Chamberlayne, Va.) COBL, 9.670A, Havana, noted in clear 1800-2000, then has QRM from Madrid, 9.363AV. (Diaz, Ind.) COCQ, 9.670A, Havana, is very strong level around 0100; verifies by QSL card *by return mail* from Circuito CMQ, Habana, Cuba. (Kelly, Mass.)

Czechoslovakia—"The Voice of Peace," 9.504, Prague, noted with news 1215A. (Sutton, Ohio; Pearce, England) Heard on 9.550 at 0030 and on 7.255 at 0400 *(by now may be 0300 instead)* with *English* for North America; answers listeners' letters *Mon.* 003A. (Young, N. Y.; Marsh, Pa.; Cencer, Mich.; Weaver, Va., others) Heard on 6.115A with music 1840, identified in French 1900.

Dutch New Guinea—RONG, 6.145A, Hollandia, noted opening 0930; world news in Dutch 0945; carrier of VOA, Okinawa, *starts 0510 and ends readability of Radio Hollandia;* closedown is probably 1040A. (Balbi, Calif.) Heard on 4.745A at 0930-1040 sign-on and sign-off, respectively; may be parallel 6.145A; often has both man, woman announcers; following opening, usually has sacred singing with organ accompaniment, then news in Dutch, and popular and classical recordings until closedown; at times is as high as S9 in signal strength; QRN, at times also some QRM. Announces *"Outzender Radio Hollandia."* (Saylor, Va.)

Ecuador—HCJB, 6.048A (*listed* 6.050) noted again parallel 9.745A at good level 0700-0815 sign-off in *English Tue.-Sat.,* inclusive. (Balbi, Calif.) Heard ending *English* 0405A on 11.915, excellent signal in Va. (Chamberlayne) *Radio Iris,* 6.215A, Esmeraldas, noted 0200-0315 in Spanish. (Pozo G., Cuba)

France—Paris-Inter, 6.200, noted from *after* 0700 to 0900; news in French 0815; 7.220 heard *after* 0800, but *is "cut to pieces" by ham QRM:* is *not* then parallel with 6.200. (Balbi, Calif.) Paris, 6.045, announced parallel 7.255, 9.625 (*not* heard), noted 0630-0700; news 0645, fairly good level in Ohio. (Sutton) Paris, 15.240, strong with *American tunes* 1742. (Bromley, Ont.)

Germany—RIAS, 6.006, Berlin, noted 0725 with organ music; news in German by man 0730; S9 level; music 0740; *jammed* by 0750; *incidentally, at that time, "continuous" jamming was noted from 6.085 through 6.110!* (Cox, Dela.) *"Voice of Germany,"* 5.980, Cologne, noted with news to North America 0230-0240, then music to 0300. (Sutton, Lennon, Ohio, others) Has *DX session* in German and *English* every *second Monday* of the month at 1100, 9.640, 11.795, 15.275; at 1500, 1830 on 7.290, 9.640, 11.795; at 2230, 5.980, 7.290, 9.630; on *second Tuesday* at 0200 *(in North American beam)* on 5.980,

(*Continued on page 134*)

TURRET SOCKET PROBLEM

BY CAPT. ROY E. PAFENBERG

HOW often have you had a tough wiring or assembly job where even a shoe horn would not work? Perhaps the answer was a turret socket, but none were available or those available were not just right for the job on hand.

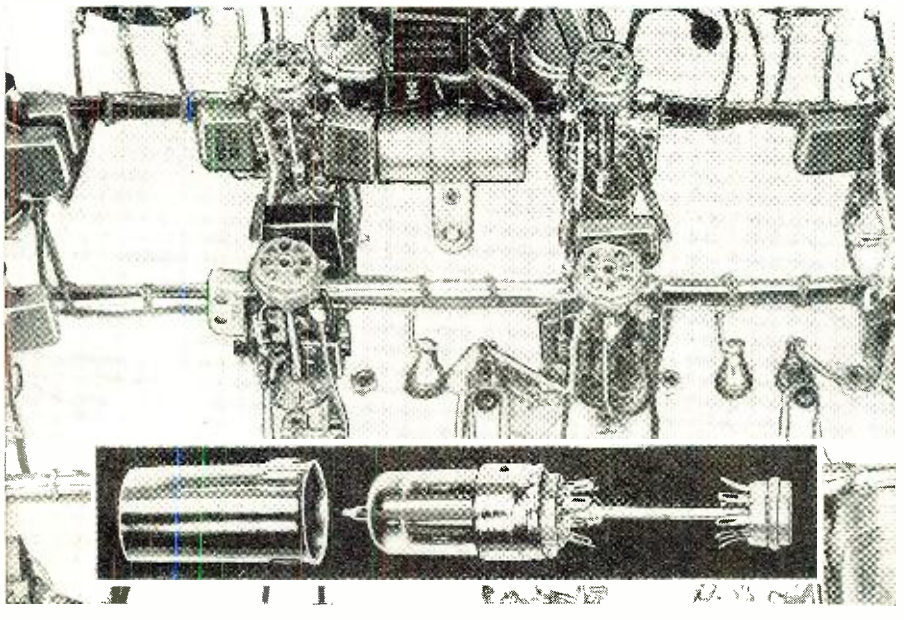
Well, there is an easy answer to the problem. All you need is a 7- or 9-pin tube socket with center shield and another socket of the same type, either 7- or 9-pin, depending on the number of parts to be mounted.

To assemble the turret, snip off the mounting shell from one of the sockets. Then, take a short piece of number 10 or 12 solid copper wire of such a length as to space the two sockets the desired distance. Insert the wire in the center shields and solder as shown in the inset photo below, grounding the center pin of the tube socket.

That's all there is to it! Just look at photo and imagine those parts spread all over the chassis if point to point wiring had been used. There is no doubt about it, turret wiring has its advantages.

—30—

Construction project in which turret sockets were used to provide a compact and inexpensive assembly. (Inset) Details on using tube sockets to make the turret.



7.290, 9.735. (Radio Sweden) Heard on 15.275 with news 1130-1135; *announced* 11.795, 9.640 as in parallel. (Bates, Okinawa) *Bayerischer Rundfunk,* 6.160, heard in German 0600, fair level in N. Z. (Hardwick)

Greece—A *new* Greek station in Athens operates on 6.075A, audible in France 1900 at good level. (ISWC, London) *Radio Athens,* 9.607, noted with French 1730; *English* 1745-1800 closedown. (Hardyman, Ohio, others) Larissa, 6.745A, fine level recently 0430-0700 sign-off; all-native program, but played some Spanish recordings. (Saylor, Virginia)

Guatemala—TGCQ, *Radio Central,* appears to have *moved* from 9.705A to 6.408A where is good level 0300A, but with CWQRN. (Niblack, Ind.) TGQA, *Radio Nacional,* has *moved* from 6.638 to 6.708A, good from tune-in 0030 to 0500 sign-off; all-Spanish. (Saylor, Va.)

Haiti—4VEH, *announced* 9.639 (*measured* 9.640), has been *testing* recently with a vertical antenna; *will experiment with several "V-beam" antennas this spring—on different frequencies and beamed in different directions.* (Saylor, Va.)

Hong-Kong—ZBW3, 9.525, Victoria, noted around 1200 but soon faded out. (Hickman, Idaho) Noted with news 1100, very weak signal in Ohio. (Hardyman)

India—AIR, 3.980, opens in French 1945, weak, CWQRM; good parallel on 6.290; fair on 7.065; is good opening 0730 in *English* on 11.640A, news 0735. (Hardwick, N. Z.) AIR, 9.755, Delhi, weak 0230-0245 with man reading news, then went into native language. (Cox, Dela.) Noted with news 0230 on 7.285A, parallel 11.960A. (Hardwick) Heard on 5.990 with news 1530-1545. (Crocket, Calif.) Noted opening to West Indies 2330 on 11.850 with flute-like interval signal, strong level in Ind. (Marutz)

Indo-China—Radio France-Asie, Saigon, is being heard in Australia on 9.695A at 1200. (Radio Australia) Noted on 9.775 (*moved* from 9.765) with news in French 1115, closing 1130. (Balbi, Calif.) Heard with news 1000 on 15.420. (Sanderson, Australia) *"La Voix de Vietnam,"* 9.625, Saigon, heard with *English Lesson* 1140, fair level; the 7.263A outlet had separate program (in native) then, heard closing 1130A. (Balbi)

Iraq—Radio Baghdad, 11.702 (measured by Ferguson, N. C., recently), noted 0500 with Arabic program of music, news. (Sanderson, Australia) Noted on 3.297 at 1900 with news in Arabic; at 1915 had Arabic music to closedown with National Anthem 2000; *seems to no longer have English 1915.* (Pearce, England) Heard in Sweden on 11.702 around 1545. (DX-Club Tellus, Sweden)

Israel—"Voice of Zion" relay from Jerusalem noted over Tel Aviv, 9.008, beginning 2115 with news, S9 in N. H. (Parker, Hermann) Received QSL card, looks like *new* design. (Lubell, N. Y.) *Also sends form letter verification.* (Hartle, Pa.) Noted with news 2015. (Parsons, Pa.; Gay, Calif.; Krepper, N. J.) Has *Hebrew Lesson* for French listeners at 2100, *Mon., Wed.;* for *English* listeners at 2145, *Mon., Tue.* (Austrian DX-Club)

Italy—Rome, 15.320, noted with *English* 1530-1600, news 1645. (Sutton, Ohio) Heard on 7.300A at 0230-0240, QSA5, R9 in Italian. (Pozo G., Cuba) Noted parallel on 9.575A and 15.320 at 2255 asking for reports to Italian Broadcasting and TV System, P. O. Box 320, Milan, Italy. (O'Brien, N. Y.) When this was compiled, Rome was still noted with *English* to North America daily 0015A-0040A on 6.210, 9.575A, good level on both channels. (Saylor, Va.; McCabe, Md., others) And 2100-2145A. Cox, Dela., notes Rome's *Home Service* on 9.420 at 2104 in Italian, occasional classical music, good level, but with heavy CWQRM.

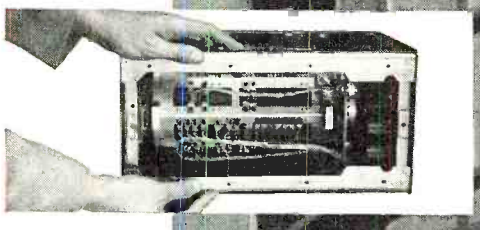
Ivory Coast—Radio Abidjan, 4.945, fair 2000 when woman identified in French, then

SCANNING A NEW HORIZON

Hughes, pioneer developer of airborne digital computers, and leader in radar fire control, now enters the field of ground radar and data processing systems.

Important new programs are under way in the Radar Research and Development Division for the development of ground radar and data processing networks. In these projects, Hughes engineers are drawing on their extensive experience in the successful development of radar fire control systems and airborne computers.

The data gathering for these ground networks will be performed by very high power radar using advanced high-speed scanning techniques developed by Hughes under sponsorship of the U. S. Navy. The processing, transmission, and correlation of the great mass of data involved will be handled by large-scale digital systems. This equipment must be designed to meet stringent tactical requirements for reliability and maintainability.



Shown here is a new magnetic drum memory for the Hughes airborne digital computer. Many of the techniques it employs will be used in the ground radar data processing systems.

Here are some of the types of work included:

TRANSISTOR CIRCUITS
DIGITAL CIRCUITS
MAGNETIC DRUM AND CORE MEMORIES
LOGICAL DESIGN
PROGRAMMING
ADVANCED RADAR TECHNIQUES

Engineers and Physicists

Application of the techniques, special knowledges and individual talents indicated here is creating positions at all levels in the Ground Systems Department. Engineers and physicists with experience in the fields listed, or those with exceptional ability in these directions, are invited to consider joining our Staff.

Scientific and Engineering Staff

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

had piano music; dance music noted 2100-2138A when closed with "La Marseillaise." Also noted with dance music, excellent signal, 0650-0700. (Cox, Dela.) *Verifies promptly.*

Japan—New channel of 3.620 noted 0800 parallel JKI, 4.910, JKJ, 7.285, with NHK programs; however, these outlets have *English news* 0955-1000 sign-off on *weekdays only.* (Balbi, Calif.)

Lebanon—Radio Beirut, 8.036A, noted 2000-2015 with popular instrumentals and Latin-American vocals, some CWQRM; another day at 1814 with Arabic vocals by man. (Cox, Dela.) Noted with two time pips at 2100, then had Arabic to closedown 2135A, poor level and with QRM. (Niblack, Ind.) Has *"English Hour"* 1500-1600. (Pearce, England)

Liberia—A *new* short-wave station is under construction in Monrovia, owned by Sudan Interior Mission, which already has ELWA, on medium-wave 710 kc., in operation; power of the short-wave outlet will be 10 kw. and broadcasts at first will be for listeners in Liberia, Nigeria. (*Nattugglan,* Sweden) ELBC, 6.022A, Monrovia, closes 2345A. (Saylor, Va.)

Malaya—BFEBS, 9.690, Singapore, opens 0915 to Indonesia; at 1100 has Chinese; at 1600 BBC news relay parallel 7.120, signing off 1635. (Balbi, Calif.) Strong on 11.820 with BBC news relay 1300. (Cox, Dela.) At 1030 with relay of BBC's *General Overseas Service.* (Rosenauer, Calif.) Noted at good level *Sun.* on 11.955 at 1400 with BBC's *"Radio Newsreel"* feature. (Sutton, Ohio) *Radio Malaya,* 4.780 and 6.135, Singapore, noted 1100, weak to fair; the 4.820 outlet is fair with church service—relayed by Kuala Lumpur, 6.025—heard at 1100. (Balbi, Calif.)

Mexico—Radio Mil, XEOI, 6.010, Mexico City, good level around 0500, usually with popular and classical music. Spanish comments; requests reports by letter or postcard —to Radio Mil, Ayuntamiento 101, Mexico City, Mexico, D.F.; heard closing 0710. *Radio Morelia,* XEKW, 6.030, good level 0000A; has Spanish and American music with news and commercials in Spanish. (Diaz, Ind.) XEOI noted on a *Fri.* 0415-0420 with *English* (probably recorded) and Spanish—discussed popular records and artists. (Niblack, Ind.) XEUW, 6.020, Vera Cruz, good signal around 2100 with *English* comments, music. (Diaz, Ind.) XEHH, 11.880, Mexico City, powerful level around 1600 and *after* 2100. (Behr, Ont.) XEBR, 11.820, Hermosillo, noted 2245 at good level with music, Spanish announcements. (McGerald, Conn.)

Monaco—Radio Monte Carlo, 7.349, parallel 6.035 (*not* heard), noted *Mon.* with *English* (religious session, *"The Hour of Revival"*) 2205-2305A closedown; announced *English* for *Mon., Wed., Thur.* at that hour. (Sutton, Ohio; Roemer, Ky., others)

New Zealand—ZL3, 11.780, Wellington, excellent with light music 0530, parallel with 11.830, weaker. (Cox, Dela.) ZL7, 6.080, good signal with musical session around 0945, but QRM bad from unmodulated carrier which *cuts readability to about 50 per-cent.* (Rosenauer, Calif.) Good 0815 with drama, but with QRM; parallel then with ZL18, 9.520, poor level; latter peaks around 0930. (Zahner, Md.)

Nigeria—Lagos, 4.800, weak to fair 2000 with BBC news relay, good level by 2100 when had music. (Cox, Dela.) And closing 2200A with "God Save the Queen." (Hardyman, Ohio; Mahajewski, N. Y.; Starry, Pa., others) Has news *weekdays* 2145. (Bromley, Ont.) *North Regional Service* of *Radio Nigeria,* 3.326, Kaduna, noted 0545A-0645A at poor to good level, with program summary, native chanting (prior to 0600), then BBC news relay; morning worship service 0610; native music 0630; has considerable CWQRM and some QRM from CHU, Dominion Observatory time-signal station, Ottawa, Ont., Canada on 3.330A. (Morris, Ohio) *Reception reports will be welcomed* by the Chief Engineer, Broadcasting House, Lagos, Nigeria; *verification is by letter;* regional programs originate in Kaduna, Enugu, Ibadan; mobile recording units are in the regional towns and at Lagos, programs are recorded and then relayed to the stations; *work will commence shortly on a high-powered transmitter at Ibadan (West Region).* (Foster, Ill.)

North Korea—Radio Pyongyang noted on *new* 4.545, parallel 6.250, opening 0755; *no English; signal much weaker on* 4.545 than on 6.250. (Balbi, Calif.) Heard in Japan on 6.250 in parallel with 4.530A, 2.872, with Japanese-language sessions 1230-1300. (JSWC)

Pakistan—Radio Pakistan, 7.010, Karachi, fair level 1815 with native music, CWQRM; closed with identification in *English* 2045, then few bars of music. Heard on 15.135, excellent when tuned 1326, with native musical program; woman identified in *English* 1329, and station closed. (PRB23, Brazil, was in clear on that channel *after* 1330A closedown of *Radio Pakistan.*) Karachi noted over the 7.010 outlet with news 1445-1500 now. (Sutton, Ohio) Heard on 6.235 at strong level 2009 with classical music, parallel 7.010; *"Pakistan Calling"* 2015. (Cox, Dela.) Noted with news 1445-1500 on 3.955; on 11.725 with news 0200-0215, music. (Hardwick, N. Z.) Heard on 11.885 at 2015 with news, music in *Home Service;* with news 0030 on 11.850; on 11.940A at 1200 with news, music. (Sanderson, Australia)

Panama—Radio Atlantico, 9.505, Colon, HOLA, QSA5, R8-9 in Spanish 1815-1845. (Pozo G., Cuba) Noted with news by man 2130-2135, followed with *"Voice of Prophecy,"* in *English.* (Cox, Dela.) HP5K, 6.005A. Colon, weak to fair 0353-0400 with musical program in Spanish; QRM'd *RIAS,* Berlin, heard well *after* 0400 there. HP5J, 9.607, Panama City, weak with Spanish session 2145, with QRM from XERQ, 9.610, Mexico; heard to 2200. HOJA, 9.645, Chitre, *"Radio Provincias,"* poor level with Spanish music 2145-2200, with QRM from TIFC, 9.647, Costa Rica. (Cox)

Peru—OAX4R (*some sources list call OAX4*), 9.562A, Lima, *Radio Nacional de Peru,* noted with news 0400. (Kellogg, La.; Mainwaring, N. Y.; Brooks, Kans.; Esser, Pa.; Buehler, Ohio, others) OAX4K, 9.522A, Lima, *Radio Central,* good signal 0100 tune-in to 0400 sign-off. (Saylor, Va.)

Philippines—DZH2, 9.640, Manila, noted in Melbourne from 1030 relaying programs of medium-wave DZRH. (Radio Australia) DZH7, 9.730, FEBC, Manila, noted 1040 at good level with religious program in *English.* (Rosenauer, Calif.) Can be heard in Virginia *some days* around 0930-1200 fade-out; news 1000. (Saylor) Noted in Idaho opening 0930, good signal level. (McDaniel) Has a second 10 kw. *Collins* transmitter on order from U.S.A.—to operate in 19- or 25-m. band upon delivery. (Radio Australia)

Poland—Radio Warsaw, 6.195, noted with *English* 1900 at fair level, parallel 7.145, weak and with CWQRM; weak 0630 on 7.125, CWQRM. (Hardwick, N. Z.) Heard with news to North America 0030 on 6.025. (Parsons, Pa.) Noted on that channel with Polish 2155; a recent letter from the Director of *Radio Warsaw* said "We are especially interested in your comments on the content of our programs." (Winch, Calif.) Heard at strong level on 7.205 at 0650-0700 sign-off in *English.* (Machajewski, N. Y.) Noted on 5.955A with *English* 0630, weak, CWQRM. (Hardwick)

Portuguese Guinea — Etersvep, Sweden, says CQM4, Bissau, is now on *new* channel of 7.937. *Look for this one around 2000-2100.*

Puerto Rico—Test transmission for circuit adjustment purposes noted from the *Radio Corporation of Puerto Rico* station in the 31-m. band around 2234 (Young, N. Y., others)

Roumania—Radio Bucharest, 6 210, noted with news, commentary, music 0430-0500. (Anderson, W. Va.; Sutton, Ohio) Still *lists English* for North America daily 0300-0330, 0430-0500 on 9.570, 6.210. (Dexter, Iowa, others) Heard over 6.210 at excellent level 1937 when identified in *English*, then had *"Listeners' Mailbox"* session; 9.252 outlet noted 2100, parallel 9.570, with interval signal, then language session. (Cox, Dela.) Heard with *English* 1930 on 9.570, poor level in Idaho. (McDaniel)

Surinam — PAC, 15.405A, Paramaribo, logged 2214-2245 with popular music. (Shear, Iowa) Heard lately on 4.750A at 2300-2400, some CWQRM. (Mathieu, Mass.) Commercial phone station noted on 9.45A *testing* around 0100-000. (Edwards, Kans.)

Sweden—Radio Sweden, 9.620, Stockholm, noted in *English* to North America 0030-0100. (Parsons, Pa.) Goes into Swedish 0100, then S9. (Jarvis, Va.) Has *English* again 0200-0245A. (Grant, Mass.) Widely reported by West Coast listeners with *English* beamed there 1600-1615 on 9.535.

Switzerland—Berne's *Home Service* has been noted *irregularly after* 2100 to 2230 sign-off over HER4, 9.535. (Balbi, Calif.) This outlet noted at excellent level 0428 tune-in with news for Western North America. (Chamberlayne, Va.) Heard to Eastern North America 0130-0315, to Western North America 0415-0500 over HER2, 6.055, HER3, 6.1665, HER4, 9.535. (Young, N. Y.; Lennon, Ohio, others) Beam to Great Britain-Ireland noted closing 2030 over HER2, 6.055, Berne, fair level in N. Y. (Smith) Widely reported in USA parallel over 9.665 (*best*)

Taiwan (Formosa) — "Voice of Free China," Taipeh, has news 0305-0320 to North America over BED6, 11.736, BED4, 11.920; 0735-0750 for Europe, same channels. (Hardwick, N. Z., others) *Home Service* noted on 9.775, parallel 9.755, at 1200. (Balbi) A *new* channel has been heard, very strong on Okinawa, on *measured* 3.2195, closing 1530; *according to announcement*, is scheduled 2230-0200, 0355-0700, 0930-1530. BEC38, Taipeh, *Police Broadcasting Station*, 5.960, noted daily in Japan 0400-0600; 3.370, formerly parallel, *is no longer operating*. (JSWC)

Tangier—WTAN has *moved* from 7.175 to 7.125 *to avoid jamming; wants reports; recently added new programs Sun.* 2100-2130 and *Tue.* 2130-2200; has broadcast on 6.025 *daily* 1300-1330. (Pearce, England)

Thailand—HSK9, 11.670, Bangkok, *Radio Thailand*, is noted in Melbourne at excellent strength during the *English* session 1030-1125A. (Radio Australia) Good in *Thai* transmission 1300-1400A or later. (Arthurs, Pa., others) Identifies in *English* 1300A, 1400A. (Sutton, Ohio, others) Sent nice QSL card. (Cox, Dela.)

Turkey—Radio Ankara's TAP, 9.465 *(at times may vary)*, noted 2100 with news for Western Europe and Britain; good level but with considerable QSB and teletype-CWQRM. (Chamberlayne, Va., others) And parallel over TAS, 7.285, to 2145A close-down. (Esser, Pa.; Buehler, Ohio, others) Has *"Mailbag"* session now *Sun.* 2130. TAV, 17.825, excellent level opening with music 1300, followed by news by man. (Cox, Dela.) TAT, 9.515, noted to North America 2315-2400, but usually is weak to inaudible in Ill. (Kleinhenz) Reported by many other ISW Dept. monitors.

USI (Indonesia)—An Indonesian, 5.990A, opens 0900 with clock striking 5 p.m.; has Western songs and other music to 0935, then is in native; at 1000 news in native; mentions "Djakarta" often; must be a *new*

transmitter; signal fair to good. (Balbi, Calif.) YDF6, 9.710, Djakarta, noted with news, commentary, music 1430-1530. (Sutton, Ohio; Peterson, Texas; Gay, Calif., others) Has news 0615. (Saylor, Va., others) Balbi, Calif., notes that the *listed* 9.710 channel lately has been, instead, on 9.715, and is now used to India, opening 1615, parallel with YDF, 6.045; has French 1700-1800 when fades out. Hardwick, N. Z., confirms that these channels are also now in use for *English* to Europe 1900-2000; also noted by Pearce, England. Balbi also hears YDB3, 7.270, Djakarta, in French 1530-1630 sign-off, fair signal but with lots of ham QRM. Saylor, Va., notes YDQ3, 9.552A, Makassar, Celebes, fair level 1230-1310 sign-off; *signal has improved greatly recently.* A QSL lists *Home Service* transmitter YDB4, Djakarta, as now on 3.935. (Hardwick, N. Z.) A station on 5.060, believed Jogjakarta. noted at good level 1400-1430 when has clock chimes and news in Indonesian to 1445. (Rosenauer, Calif.)

USSR—Baku, 4.956A, fair level with classical music 2025, native language; noted an unidentified *Home Service* transmitter on 4.940A, parallel Baku; Erivan, 4.740; Moscow, 5.920; Samarkand, 5.450; clock strikes 12 midnight at 2100; Baku then signs off, but others remain on the air. Uzuho, Sakhalinsk, 5.060A, noted 0915 with man and woman in *Home Service*, weak level, parallel on 3.965 at strong level; gong at 0520; also found parallel on *unlisted* 6.120 which was strong signal.

When this was compiled, *Radio Moscow announced* these frequencies as in use to North America *(English)* at 0230—9.830, 9.660, 9.570, 9.550, 7.350, 7.290, 7.260, 7.250, 7.240, 7.230, 7.200, 7.170, 7.150, 7.130, 6.240, 6.070. (Kahan, Calif.) *Some of these, of course, are satellite relays, actually. By this time may have changed from some of these channels to summer frequencies.* Has *"Moscow Mailbag"* session *Sun., Mon.* at 0200. (Himber, Calif.) *Radio Moscow,* 11.885A, noted 1415-1445 in *English* to Southeast Asia; then with Hindustani.

Vatican—HVJ is noted in Melbourne at 1230 on 9.646, slightly better parallel over 11.685, with programs in Italian, Spanish. (Radio Australia) Has *English daily* 1500 on 7.280, 9.646, 11.685, 15.120, and 1815 on 6.190, 7.280, 9.6646, 11.685; on *Tue.* (especially for India, Pakistan, Ceylon) 1600 on 9.646, 11.685. (Gasparik, Vatican Radio Correspondent, Cleveland, Ohio)

Venezuela—Ondas del Lago, 4.805A. Maracaibo, good level in Spanish around 0330. (Dexter, Iowa) YVSC, 9.640A, Radio Nacional, noted 2245-2330 with music; *on Mon. has local news in English* 2300-2330, QSA4, R7 in Ohio. (Sutton) YVLK, 4.970, Caracas, *Radio Rumbos,* noted in *English ("Supper Club"* session) 2300A-2400A. (Mann, Minn.) *Some reporters say this is not every day.*

Zanzibar—Nattugglan, Sweden, says *Radio Zanzibar* is heard on 4.795A at 1400-1500. The 1955 Edition of *WRH* lists this channel on that schedule *weekdays* in Kiswahili. Says has *English* music *every last Tue. of month* 1430-1500. Identifies in Kiswahili with *"Hii ni Sauti ya Unguja;"* in Arabic, *"Haatha Saut Zinjibar,"* and in *English, "This is Zanzibar calling."* Has "national" music *weekdays* 1445-1500, chiefly Arabic. Transmissions open with the anthem of His Highness, the Sultan of Zanzibar. Verifies by letter from Information Office, P.O. Box 344, Zanzibar.

* * *

Last-Minute Flashes

The *Winward Islands Broadcasting Service* noted on 3.395A closing around 0109; man gave schedule as 2200-0100; seems to have been dedicated or inaugurated by Princess Margaret of Britain during her recent visit to the West Indies. (Ferguson, N. C.)

WIN-TRONIX

LOW COST TV TEST INSTRUMENTS

NEW

Buy Now for BL. & WH. Service —and be ready for COLOR

COMPATIBLE FOR COLOR and BLACK AND WHITE

CHECK THESE FEATURES!

- ✓ *COMPATIBLE ADVANCED DESIGN* PREVENTS OBSOLESCENCE.
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FOR COLOR OR BLACK & WHITE

WHITE-DOT and LINEARITY GENERATOR

▶ **COLOR CONVERGENCE** — A must on every color service call — gives large and small white dots.

▶ **BLACK & WHITE** — Linearity & picture size adjustments.

Model 160 **$79.95**

Model 150 **$49.95**

PATENT PENDING

RAINBOW GENERATOR

This Color Pattern Generator produces New Linear Phase Sweep for faster color TV servicing.

▶ **APPLICATIONS:**

- All chroma circuit tests.
- Color demod. phase alignment.
- Color gain adjustments.
- Matrix test and alignment.
- 3.58 mc traps and coils.

SWEEP CIRCUIT ANALYZER

NEW! *The complete sweep circuit* tester — takes the guesswork out of sweep circuit troubleshooting.

▶ **TWO INSTRUMENTS IN ONE**

1. Horizontal and vertical sawtooth for signal substitution. (15KC and 60 CPS.)
2. Complete flyback and yoke testers.

Model 820 **$59.95**

FOR COLOR OR BLACK & WHITE

FLYBACK and YOKE TESTER

NEW! Sensitive circuit checks one *turn shorts* in yokes *as well as* xfmrs.

- ▶ Oscillating neon indicator *more sensitive than a meter.*
- ▶ Advanced design also tests color yokes and xfmrs.
- ▶ Saves time with fast test of —
  - Flyback transformers
  - Deflection yokes
  - Bypass and electrolytic condensers
  - Continuity of coils, xfmrs

Moael 810 **$29.95**

FOR COLOR OR BLACK & WHITE

COMPATIBLE FIELD STRENGTH METER

VHF and UHF

NEW! *Here is the FSM that won't be made obsolete by color TV!*

For good antenna installations (color or bl. & wh.) **YOU NEED:**

1. Microvolt testing
2. Bandwidth testing

FEATURES:

- ▶ Tests for color performance on antenna installations.
- ▶ Tests for bandwidth for better bl. & wh. pictures.
- ▶ Reads microvolts *directly* on 5 scales.
- ▶ Channels 2-13; extra coils available for UHF channels.

Model 330 **$129.95**

FOR COLOR OR BLACK & WHITE

COMPATIBLE CRYSTAL CALIBRATOR

NEW! Crystal controlled generator and crystal tester

FOR:

- ▶ Color and bl. & wh. servicing
- ▶ Labs and factories
- ▶ Amateurs and experimenters

FEATURES:

- ▶ Accurate 3.579545MC color subcarrier standard, *factory calibrated* (crystal supplied).
- ▶ Three external crystals* and a crystal switch permit quick selection of precise frequencies.

APPLICATIONS:

- 3.579545MC color oscillator alignment.
- Crystal tester.
- RF and IF marker and calibrator.*
- Color TV 3.58MC generator.
- Microsecond time marker for scopes.*

Model 120 **$59.95**

FOR COLOR OR BLACK & WHITE

*These Crystals available extra

WINSTON E ECTRONICS, INC. Dept. RT-455 4312 Main St., Philadelphia 27, Pa.

Gilfer Associates, Box 239, Grand Central Station, New York 17, New York, is now making immediate delivery of the 1955 Edition of *World Radio-Television Handbook,* considered a "must" for the SWL. Price is $2, *postpaid.*

Radio Maroc, Rabat, French Morocco, is now on *measured* 6.089. (Mercier, France, *via WRH) Revised spring* schedules for Radio Japan, Tokyo, are 0500-0600, 0700-0800, 9.695, 11.725; 0900-1000, 11.725, 15.135; 1030-1230, 7.180, 9.695; 1245-1345, 1400-1500, 1500-1600, 1615-1715, 1730-1830, 9.695, 11.725; 1900-2000, 7.180, 9.695; 2300-2400, 9.675, 11.705. *(WRH) Soon may have special beam for listeners in Eastern North America, according to advice direct from station officials.* (Perkins, Ill.)

Radio Sarawak has *changed* frequency from 4.860A to 5.052A; now is scheduled 0900-1445 *(Sun.* also 0430-0530); *English* 0930-1000, 1300-1400 (and *Sun.* 0430-0530). *(WRH) Radio Cairo,* 9.475, noted lately in Arabic 0035-0100 when announced in Spanish and had *program to South America (new)* to around 0129. (Ferguson, N. C.) *Radio Pakistan,* 6.235, Karachi, noted opening 0155, news 0200; YDF7, 11.770, Djakarta, USI (Indonesia), heard at *dictation speed in native language* 0815-0900. (Balbi, Calif.)

According to announcement, HI2T, 9.737A, Ciudad Trujillo, Dominican Republic, *now uses 100 kw.* (Diaz, Ind.) Sutton, Ohio, flashes that OAX4Z, 6.082, *Radio Nacional de Peru,* Lima, now has news 1800-1815, good level.

4VEH, Haiti, may test soon in the 49 m. band *(probably 6.175 at first).* (Saylor, Va.) Watch for this one around 1400-1500. Advance notice may be given over "regular" 9.640 channel.

Radio Andorra, now on 5.978A, seems to have extended schedule, at least some days; heard with time pips and gong 0100. (Cox, Dela.) At present, *Radio Peking's* 11.300 is good level in West Virginia around 0000-0100 or later; should have news on this channel 0300; in many parts of the country should be audible as early as 2200. *Radio Cadena Oriental,* COKG, 8.950A, Santiago, was off the air for several months, reason unknown; however, has just been "found" on *new* 9.750A on full schedule of 1200-0430; says now is broadcasting from studios in Havana; has comments in *English* just before close-down. (Diaz, Ind.)

Radio Rumbos, YVLK, 4.970, Caracas, noted on Mon., Fri. with news 0445-0458A; English at that time is not daily. (Sutton, Ohio) A station heard on 6.400A with oriental language, closing 1945, is believed to be the Technical University of Istanbul, Turkey. (Cox, Dela.) Balbi, Calif., flashes that *Radio France-Asie,* Saigon, Indo-China, has lately been noted on 9.710 with all-French session 1030-1230; *best after* 1100. *Radio*

ELECTRONICS HITS THE ROAD

By HENRY C. SUTER

THE men who guide the destinies of Leonard D. Allen, Inc. of Syracuse, N. Y., have long sought an effective way of displaying the various lines that they represent in the component, accessory, hi-fi, and phonograph fields.

In addition, since the firm is also New York State representative for the *V-M Corporation,* they were seeking a sure-fire means of displaying that firm's line to distributors and dealers.

The answer to both of these problems was found in the adoption of a trailer—a veritable showroom on wheels!

The trailer is equipped with a series of counters and shelves designed to display the merchandise most effectively. In addition, there is a comfortable "order taking" corner for the convenience of the salesmen and customers. The very nature of the electronics industry —with new products pouring out of the laboratories and off the production lines —makes it imperative that the customers be kept abreast of these new developments with as little delay as possible. The trailer permits the rapid coverage of the firm's sales territory.

The trailer also serves as a booth at state fairs and can make the rounds speedily and economically.

According to Mr. Allen, one of the prime assets of the trailer is the fact that there are no telephones, clerks, or customers to interrupt a sale.

Furthermore, he adds, "We have been very gratified with the results that we have obtained with our display unit since it was designed to take the distributor away from the interruptions that are normally encountered in our contacts with them. We are now able to have the distributor in the trailer where he can concentrate on the advantage of the products shown.

"It has meant additional volume for us and furthermore has made it possible to better train their salesmen and countermen in the salient features of these products. We feel that the future of this type of selling is positive since we are in a position now to actually demonstrate the models of phonographs, high-fidelity equipment, TV antennas, and many other allied components. We are proud to say that we have been a pioneer of sorts in a type of sales that will reach all of our customers to both their advantage and ours."

This firm's enthusiastic support of this new sales technique appears to be justified on the basis of cold cash and increased acceptance on the part of its distributors. —30—

The Leonard D. Allen, Inc.'s "showroom on wheels" offers many unique advantages.

Athens definitely is using new 7.142 for French 1730, *English* 1745-1800 closedown. (*WRH*) CE1200, Santiago, Chile, noted back on measured 12.000. (Ferguson, N. C.)

Via airmail, we learn that Andrée Thomasson, a co-editor of *Nattugglan* (*"The Night Owl"*), house organ of the Scandinavian DX-Club, has been named the Swedish DX Champion, and was to receive a week's trip to Rome; has been DX-ing for 15 years, has 125 countries verified, and uses an *AGA-A*, Swedish-made receiver. Stig Dahlberg, editor of *Nattugglan*, took third spot in the competition and was awarded a *Hallicrafters* S38-C receiver. (Dahlberg, Sweden)

A novel session from SBC, Berne, Switzerland, is the "Penny A Song" broadcast; this request program has been placed at the service of the International Red Cross, Geneva; now, each request must be accompanied by a receipt for a donation "to your national Red Cross organization, or the amount may be sent direct to SBC by postal check, IRC, money order, or in some other 'international' form; do not send bank notes or coin." (Pettersson, Sweden) "Penny A Song" is featured Sat. 0245 in the North American beam —over 6.055, 6.165, 9.535. (Balbi, Calif.)

Bennett, N. J., co-short-wave editor of NNRC, and Cox, Dela., report picking up a *test* transmission from the Leeward Islands on 3.395A and 5.980A at 0058-0106; man identified at 0101, 0104, merely saying was from the Leeward Islands; then had tone signal and signed off; no anthem; strong on 3.395, while 5.980 was heard through heavy QRM. This may be *Radio Montserrat*, listed by *WRH* as on 3.255 with Home Service in *English* Sun. only 1300-1330. On the other hand, may be same station reported as first "Last-Minute Flash" herein, from Ferguson, N. C., who understood announcement to say is located in the Winward Islands.

Vienna, Austria, *Radio Oesterreich*, is testing over a *new* 5 kw. transmitter to Europe in German, *English*, French at 0700-0900, 1900-2200, with relay of the *Second Home Program* 0910-1900; frequency not given but most likely is in the 49-, 41-, or 31-m. band at present. (Radio Australia; *WRH*) "Regular" short-wave channels of *Radio Oesterreich*, as listed by the 1955 Edition of *WRH*, are: OEI21, 6.155; OEI24, 11.785; OEI22, 7.245; OEI32, 9.505; OEI33, 9.615; OEI23, 9.665; OEI30, 5.985; EI31, 7.135; OEI34, 9.645; OEI35, 11.775, and OEI36, 11.935.

Recent *alterations* to *Radio Australia* schedules include for Pacific Islands, South, and South East Asia 0255-0945 *(Fri., Sat.* from 2315), 1000-1359, 15.320; 1000-1145, 7.215; 1400-1500, 1629-1730, 9.580; 0900-1359, 9.580, to Forces in Japan, Korea; 0600-0645, 9.500, French for Tahiti, Europe; 2000-2300, 15.320, to Mid-Pacific Islands. (Radio Australia)

"Heard All-Pacific" and "Broadcast Heard All-Continents" are additional (junior) awards being offered by the International DX League, Box 56, Kyoto Central Post Office, Japan. Write to the club for details. —30—

EDITOR'S NOTE: *"International Short-Wave" has been a monthly department of RADIO & TELEVISION NEWS for many years. Because short-wave listening, as a hobby, has been somewhat replaced by ever-increasing "graduation" to Novice amateur activity, your editors feel that this coverage can be better served in its sister publication, POPULAR ELECTRONICS. Short-wave topics of international interest, will henceforth be published monthly in POPULAR ELECTRONICS magazine. All correspondence concerning short-wave schedules, etc. should be addressed to the Short-Wave Editor, POPULAR ELECTRONICS, 366 Madison Ave., New York 17, New York.*

What's New in Radio

(*Continued from page* 109)

which is designed to keep the mobile receiving antenna, or whip, in perpendicular position while the car is in motion.

The problem of signal fading caused by the swaying of the lower section of the mobile antenna is met by eliminating the base spring and utilizing the "Whip Flexor" above the rigidly mounted loading coil. The new unit is also designed to permit the whip to be brought down in a horizontal plane for storage in a garage or for passing through low, thickly wooded areas, etc.

Additional information on this device is available from the company.

CERAMICS FOR COLOR TV

The "Hi-Q" Division of *Aerovox Corporation,* Olean, N. Y. has developed a new heavy-duty ribbed-case type of ceramic capacitor which is designed to meet the higher operating voltages of color TV receivers.

The special ribbed construction provides an extra-long "creepage path" in a relatively small size. Rated at a working voltage of 30 kv. or a test voltage of 50 kv. for one minute, the new "Cartwheel" is incased in a cast insulating material, completely and permanently sealed in one operation.

The company will supply full specifications upon letterhead request.

82-CHANNEL TUNER

Anchor Radio Corp., 2215 S. St. Louis Ave., Chicago 23, Illinois has designed a new 82-channel TV tuner, the TV901.

The new tuner is a single unit no larger than the average v.h.f. tuner and is operated without complicated drives or knobs. Channel segments to suit local TV station requirements are snapped into the easily accessible turret and may be arranged in any desired order.

The segments consist of simple circuits which are factory tuned and need no further adjustment in the field. All channels, 2 to 83, are priced the same. If required, as many as 12 channels may be inserted.

WIDE-BAND SCOPE

The Supply Division of *National Radio Institute,* 16th & You Streets, N.W., Washington 9, D. C. has announced the availability of an inexpensive oscilloscope which incorporates several laboratory-quality features.

Designed especially for the TV service technician, the instrument may also be used for industrial applications where square-wave and pulse-type signals must be observed.

Vertical amplifier response is flat from 10 cycles to 4.5 mc. (± 3 db). The four-step frequency-compensated vertical attenuator is calibrated for direct peak-to-peak voltage measurement. Sensitivity is .014 volt (r.m.s.) per inch of deflection. Linear sweep range is 10 cycles to 100 kc. The average

vertical amplifier input impedance is 2 megohms and 25 μμfd. The instrument also offers positive and negative sync and incorporates a voltage-regulated power supply.

A four-probe accessory kit is available at extra cost for use with this instrument. The company will forward literature on this scope upon request.

"3-PI" TVI FILTER

Federal Electronics, Federal Electronics Building, Rockville Centre. N. Y. is in production on a new TVI filter which has been tradenamed the "3-Pi."

The unit features a precision-engineered printed circuit designed to effectively suppress TV interference caused by auto ignition systems, diathermy, x-ray equipment, neon signs, amateur radio transmitters, electrical appliances, and similar devices. The unit is mounted within a durable transparent polystyrene plastic case.

According to the company, the 0 to 54 mc. attenuation of the unit is in excess of 46 db.

CRT TESTER

Authorized Manufacturers Service Co., Inc., 919 Wyckoff Ave., Brooklyn, N. Y. is currently in production on a lightweight, portable cathode-ray tube tester, the Model 101.

The unit is designed to provide a positive test indication for emission and continuity within 90 seconds. All phases of potential trouble and breakdown are indicated on the front panel of the instrument. A turn of a dial

and the pressing of a button provides either neon or meter indication.

The tester measures 8" x 9" x 3" and weighs only 5½ pounds. The company will provide complete specifications on request.

TWO-WAY PORTABLE RADIO

Industrial Radio Corp., 428 N. Parkside Ave., Chicago 44, Illinois is now offering its Model A "Pak-Fone" which may be operated on its own self-contained batteries, from a 115 volt a.c. source, or from a 6-volt storage battery.

The new unit is designed for use in Civil Defense, fire and police applications, forestry services, engineering and heavy construction applications, etc. The unit carries both FCC and FCDA designations.

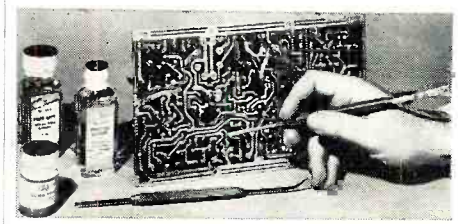
The "Pak-Fone" may be operated as a central control station when powered

by 115 volt a.c., as a mobile unit when powered by an auto battery, or as a completely portable station using its self-contained batteries.

Complete information may be obtained from the manufacturer.

PC REPAIR KIT

General Cement Mfg. Co., 919 Taylor Avenue, Rockford, Illinois has introduced a new printed circuit repair



kit which is said to meet all printed circuit servicing needs on virtually all TV sets using that circuitry.

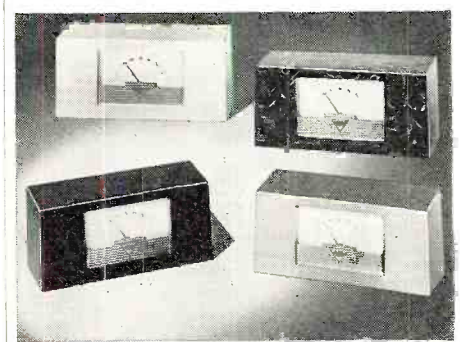
Developed in conjunction with one of the country's foremost set manufacturers, the kit includes the necessary silver print material and silicone resin for protecting the silver coating, plus the special tools that have been designed to expedite this type of work. Full instructions are included in the kit.

Further information on this kit is available from parts distributors or from the company itself.

ROTATOR CONTROL CASES

Trio Manufacturing Company, Griggsville, Illinois has recently announced a novel plan which enables the dealer or jobber to carry a complete stock of its new "Aristocrat" rotator control cases in all four of the new colors.

The cases are now available separately in cartons of four cases (one of each color) at a nominal cost. Besides



having extra cases on hand to provide for breakage, the purchaser has a choice of colors to match and the "works" can be changed in a moment since there are no knobs or switches to remove in exchanging cases.

Complete information on this new plan is available from the company.

PANEL INSTRUMENTS

Phaostron Company, 151 Pasadena Avenue, South Pasadena, California is now offering an extensive line of panel instruments, ranging in size from 2½" to 6".

All of the units in the line are designed to conform to applicable MIL and JAN specifications, all are housed

METERS:

WESTON AC AMMETER:

(Pictured) In portable leather case, with Test Leads, 2½", 0-15 AC and 0-3 AC Scale..... **$5.95**

DC AMMETER HOYT: In portable metal case, with Test Leads, 4½", Fan, Mirrored Scale 0-15 ADC.....$4.95
0-3 RF AMMETER IS-128: 2½" Rd....NEW: 2.95
0-500 MICROAMMETER: TRIPLET, 2½" Sq.. 4.95
0-5 MA DC WESTINGHOUSE: 2½" Sq..... 3.95
DB METER: 10 to Plus 6—G. E.—3½" Rd.... 4.95
TS-291/U VOLTOHMMETER.....NEW: 7.95
0-8 Amp RF w/Thermocouple IS-89; 2½" Rd... 4.95
0-15 AC-DC—2½" Rd.; IS-122..... 4.95
0-500 MA DC—2½" Rd.; IS-22..... 4.95

RECEIVER—TRANSMITTER:

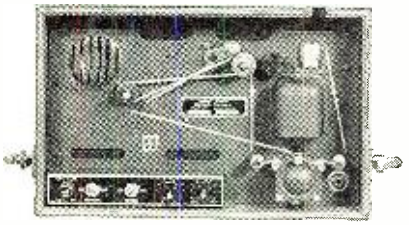
BC-229/429—RECEIVER TRF—With 3 Plug in Coils for Freq. 201 to 398; 2500-7700 KC; Six Tubes: 1/37—1/38—3/39. Size: 16" x 8" x 7". With Schematic. Price. USED: **$6.95**

BC-230 TRANSMITTER—Voice modulated, with 5 Plug in Coils for Freq. 2500 to 7700 KC. Four Tubes: 2/10y—2/45 & 0-1.5 RF Meter. Size: 13" x 8" x 7". With Schematic. Price.....USED: **$8.95**

PLUGS to fit BC-229 or BC-230.....Each: 75¢
CONTROL BOX F/BC-229 or BC-230..Ea.: 75¢
TUNING KNOBS F/BC-229 or BC-429..Ea.: 65¢
COILS F/Rec. 201-398; 2500-4150; 4150-7700. Each: $1.75
COILS F/Trans.—2500-3200; 3200-4000; 4000-5000; 5000-6210; 6210-7700 KC.Ea. Coil: $1.50
SET of 5 Coils.....$5.00

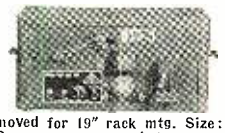
TG-34A KEYER

NEW—$16.95



TG-34A KEYER—115 or 230 V. @ 50 to 60 cycles—an automatic unit for reproducing audible code practice signals previously recorded in ink on paper tape. By use of the self contained speaker, the unit will provide code practice signals to one or more persons—or provide a keying oscillator for use with a hand key. Unit is compact, in portable carrying case, and complete with tubes, photo cell, and operating manual. Size: 10-9/16" x 10½" x 15-13/16". Shipping weight: 45 lbs. NEW—While They Last— ONLY **$16.95**

TG-10 Keyer:



Same function as TG-34A (described below) only larger — using 2/6N7 — 2/6L6 — 2/6SJ7 — 1/5U4G Tubes and 1/923 Photo Cell. Housed in standard Metal Cabinet, can be removed for 19" rack mtg. Size: 11" H x 24" W x 18½" D. PRICE—USED, TESTED.....Only: **$17.95**

TRANSFORMERS—115 V. 60 CYCLE PRI.:

600 VCT/100 MA—6.3 V/5 A.; 5 V/3 A. $4.95
650 VCT/50 MA—6.3 V/2.5 A; 6.3 V/.6 (Rect. 6x5) 1.95
350 VCT/40 MA—6.3 V/2.4 A; 6.3 V/.6 (Rect. 6x5) 1.75
2500 V/.015 A; 2.5 V/1.75 A; 6.3 V/.6A..... 5.95
1890 V/12.6 MA Tapped 2.5 V. 2 A. 5.95
1100 V/80 MA.; 7.5 VCT/3.25 A. 5.95
5 Volt CT-25 A; 10.000 V. Ins. Open Frame.....$7.95
9 Volt CT—35 Amp, Tapped 4.5 V..... 7.95
12 Volt—Two separate windings—4 Amp each.... 5.95
28 Volt 8 Amp Tapped 4 Volt..... 5.95
5 V/2 A; 5 V/2 A; 5 V/2 A; & 5 V/6 A. 2.95
600-0-600VAC—200 MA. 12.5 V. 2 A.; 12.5 V. @ 2 A.; 5 V. @ 3 A.—#H-108—Price..... 8.95
250-0-250 VAC—50 MA. 24 V. 1 A.; and 6.3 V. 1 A. #H-109—Price..... 3.95

CURRENT TRANSFORMER—Ratio 150 to 5; 25 to 60 cycle. West. Style 81R691.....$8.95
CONSTANT VOLTAGE REGULATOR—115 Volt 60 cycle, 80 VA. Sola #30726.....$12.95

Choke 12.5 Hy/100 MA. $1.95
Choke 12Hy/250 MA., 180 Ohm..... 4.95
Choke 15 Hy/165 MA., 125 Ohm..... 1.95
Choke 5 Hy/150 MA., 85 Ohm..... 1.50

SOUND POWERED HEAD AND CHEST SET

Navy Type—No Batteries Required—Ideal for TV Antenna Installations and many other uses. 20 Ft. Cord. Used Tested: ..... **$3.95** EA.

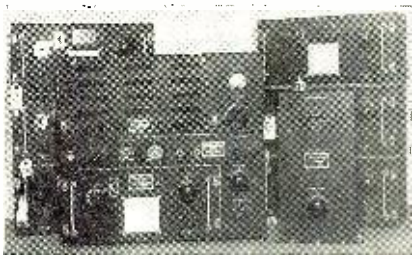
TS-10 Handset

Sound Powered. Used, Tested: **$3.95**

DUAL IFF RECEIVER $5.95

BC-966—Two separate receivers in one—160 to 211 MC with 13 Tubes: 7/6SH7, 3/6H6, 3/7193—voltage regulator, relays, etc., less dynamotor. (UNUSED)

BC-375 TRANSMITTER And TUNING UNITS



BC-375 100 Watt TRANSMITTER—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—Price.....USED: **$29.95**

TUNING UNITS For BC-375 & BC-191:

	NEW:	USED:
TU-5—1.5 MC to 3MC	$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...Each:		2.75

ANTENNA MATCHER

VARIABLE inductance Tuner with Calibrated Veneer Lock Dial, 100 Watt Cap. (shown upper right of BC-375 picture above). Size: 7½" x 3½".....USED: $9.95
UNIT with 0-8 RF Meter and Panel.USED: $12.95

MOTORS:

24 VDC REVERSIBLE MOTOR—3.7 RPM, 40 lb. Torque. Motor Size: 5½" x 4 1/32" x 3 5/16". Shaft Size: 21/32" x 5/16". Also operates 24 VAC. Philco No. 441-1008 .....Price: $5.95

27 VDC GEAR HEAD MOTOR—960 RPM; 1/75 HP; 1.75 A. Size: 5" x 3". Shaft: ¼" x 5/8". Air Assoc. #EE120M1.....Price: $7.95

27.5 VDC GEAR HEAD MOTOR—324-1 Ratio; 4050 RPM; Right Angle Drive Motor—Size: 5" x 3½". Shaft Size: 5/16" x ¾". Bodine Type #V-10R.....Price: $7.95

24 V. GENEVA LOC ACTUATOR MOTOR ASS'Y—1/25 HP.; 15000 RPM, w/Gear Head & Limit Switches. Motor Size: 5½" x 3½"; Angle Drive Shaft: ¼" x ½". Bendix #LM-106524. Price: $7.95

27 VDC MOTOR—1.5 A.; 1/50 HP.; 3000 RPM Shunt Motor. Motor Size: 3" x 2¼". Shaft: 5/16" x ¾". Oster #D8-1 or WEVS-5876. Price: $2.95

27.5 VDC MOTOR—1/100 HP.; 7000 RPM; Motor Size: 3" x 1¾"; Shaft: ¼" x ¾". Oster #C2BP-1A .....Price: $2.95

27.5 PERMANENT MAGNET ALNICO FIELD MOTOR—.03 A.; 10000 RPM; Size: 1" x 1⅛" x 2". Shaft: ⅛" x ½". Delco #5068571. Price: $7.95

110 VDC 1/70 HP. 1550 RPM. Motor size: 4" x 2½", Shaft size: 1" x 3/16". Redmond #157.....$4.95

6 VDC 1/20 HP. 4000 RPM. Motor size: 5" x 3", Shaft size: ¾" x ¼".....Price: $4.95

12 VDC 1/30 HP. 4500 RPM. Motor size: 3" x 2½", Shaft size: 1" x 3/16". Delco #5047520.....$4.95

A.C. INDUCTION MOTOR—115 Volts 60 cycles 1.9 RPM—Torque Oz. In. 75: Watts—9: with variable Multiple Disc Coder Wheel and Micro Switch mounted on Bracket Assy. Holtzer Cabot Motor Type RWC 2505 .....$9.95

GEARED HEAD MOTOR—Heavy Duty, 24 VDC 8 Amp. 2½ lb. Torque: 100/200 RPM. Shaft size: 5/16" x 1". Right Angle Drive.....$8.95

BC-455 RECEIVER $4.95
6 to 9 MC. Used w/Tubes

R-27/ARC-5 RECEIVER $3.00
6 to 9 MC. Used, Less Tubes

COAXIAL CABLE & CONNECTORS

CD-1071 CORD—With PL-259 Plugs each end. 50 ohm coax 2 Ft. long. Prices: 59¢ Each—Or in Lots of 10 @ 50¢ Ea.
PL-259—Plug. Ea. End & 32"—RG-54/U—58 ohm.50¢
SO-239 Chassis Conn. f/PL-259 (Removed)..3 for $1.00
UG-21/U—Plug ea. end & 32"—RG-11/U—75 ohm.50¢
UG-22/U—With 4" Coaxial Cable.....50¢
COAXIAL CABLE: Price Per Ft. 100 500 1000
RG-8/U 51.5 Ohm (Special)..... .07 .06½ .06
RG-34 71 Ohms—145 Ft. Length.....$15.00 Per Lgth.

BLOWERS:

115 VAC 60 CYCLE SINGLE TYPE—100 CFM; 2¼" intake; 2" outlet. Complete Size: 5" x 6". No. 1C939..... **$8.95**

115 VAC 60 CYCLE DUAL TYPE—200 CFM; 4" intake; 2" Dis. Each Side. Complete Size: 8" x 6". No. 1C880..... **$13.95**

115 VAC 60 cycle COMPACT TYPE—108 CFM: Motor built inside squirrel cage; 4½" intake; 3⅜" x 3" Dis. Complete size: 4¼" W x8⅜" H x 8⅛" D—No. 2C067 ..... **$14.50**

115 VAC 60 cycle FLANGE TYPE—140 CFM: 3½" intake; 2½" Dis. Complete size 7½" W x 7¼" H x 6¾" D—No. 1C807 ..... **$13.95**

115 VAC 60 cycle FLANGE TWIN—275 CFM: 4½" intake; 3¼" x 3" Dis. Complete size: 11¾" W x 8⅜" H x 8-1/16" D— No. 2C069 ..... **$21.95**

115 Volt 400 cycle—10 CFM. Eastern Air Devices Motor J31A—7200 RPM; 1/100 HP. L-R #2 Blower Assy. Overall Size: 4½" x 3½". No. 3110..... **$5.95**

6VDC SINGLE—100 CFM—No. 6100.....$4.95
6 VDC FLANGE—150 CFM—No. 6150.....$6.95
12 VDC SINGLE—10 CFM—Min.—No. 1210.....$7.95
24 VDC SINGLE—10 CFM—Min.—No. 2410.....$5.95
24 VDC DUAL—20 CFM—Min —No. 2420 .....$7.95
12/24 VDC-AC Cast Aluminum Blower—100 CFM: 3" intake; 2" outlet. Shunt Motor 4" x 2" 3000 RPM @ 24 VDC **$5.95**

CLASSIFIED ITEMS:

BC-212G Amplifier 2/6C5	Tubes—N: $8.95	..U: $1.95
BC-216A Amplifier 6F7 & 39/44 Tubes		.U: 1.95
BC-347 Amplifier 1/6F8G Tube—N:	$3.95	..U: 1.95
BC-357 Marker Beacon Receiver		.U: 4.95
BC-367 Amplifier 2/6V6GT Tubes—N:	$4.95	..U: 3.95
BC-453 Receiver 190 to 550 KC		.U: 14.95
BC-455 Receiver 6 to 9 MC		.U: 4.95
BC-459 Transmitter 7 to 9 MC		.U: 8.95
BC-463 Transmitter & Modulator 67 to 74 MC.		U: 16.95
BC-605 Amplifier 2/1619 Tubes		.U: 3.95
BC-620 FM Transceiver 20 to 28 MC		.U: 24.95
BC-645 Transceiver—Converts 420 to 500 MC.		N: 24.95
BC-654 Transceiver 3800 to 5800 KC		.U: 34.95
BC-709 Amplifier Batt. Op. 1 Tube—N:	$3.95	; U: 1.95
BC-745 Transceiver 3 to 6 MC		.U: 14.95
BC-745 Transceiver Chassis Only		.N: 5.95
BC-791 Code Tape Recorder		.U: 4.95
BC-1206 Receiver 200 to 400 KC—Less Tubes.		.U: 6.95
R-25/ARC-5 Recvr. 1.5 to 3 MC—Less Tubes		U: 9.95
R-27/ARC-5 Recvr. 6 to 9 MC—Less Tubes.		.U: 3.00
R-1/ARR-1 Receiver—Converts 2 or 6 Meters.		.N: 3.95
RT-7/APN-1 Altimeter		.N: $19.95—U: 9.95
RT-34/APS-13 Transcvr—Complete less tubes		U: 3.95
BD-72 Switchboard —Portable—12 Line		.U: 39.95
FL-8A Range Filter—$1.49; FL-5 Filter		..U: 1.00
TS-9 Carbon Hndset—U: $3.95; TS-13 Hndset		U: 6.95
TS-10 Soundpwrd Handset or Head&Chest Set.		U: 3.95

TUNING SHAFTS F/Various Receivers. Specify Type & Minimum Length. Price Per Ft.....15¢
TUNING KNOBS—Splined For Various Receivers—Specify Type Receiver.....Ea. 65¢

SYMBOLS: N: Means NEW—LN: Means LIKE NEW —U: Means USED

DYNAMOTORS:

INPUT VOLTS:	OUTPUT: VOLTS:	MA.	STOCK No.	PRICES: USED:	NEW:
14 VDC	230	90	DM-21	$6.95	
14	330	150	BD-87	3.95	$5.95
14	250	50	DM-25	6.95	8.95
14	1000	350	BD-77	14.95	20.95
14	500	500	BD-500		12.95
14	600	300	BD-86		12.95
14	1030	260			
	515	215	DM-42	8.95	12.95
28	1000	350	PE-73	8.95	
12 or 24	500	50	USA/0515		4.95
12 or 24	275	110	USA/0516		4.95
12	230	90	PE-133	4.95	6.95
14 VDC	375	150	BD-83	3.95	4.95

ANTENNA EQUIPMENT

MAST BASES—INSULATED:

MP-22 BASE — (Illustrated) Ins. spring action: direction of bracket can be raised or lowered easily **$2.95**

MP-S-33 BASE—Insulated type with heavy coil spring and 5" dia. Ins. Requires 2" hole for mounting. Weight: 9 lbs..... **$5.95**

MP-37 BASE—Insulated type with heavy coil spring. 7" dia. insulator; requires 1⅜" hole for mounting. Weight: Approx. 10 lbs. **$8.95**

MAST SECTIONS FOR ABOVE BASES:

Tubular steel, copper coated, painted in 3 ft. sections, screw-in type. MS-53 can be used to make any length with MS-52-51-50-49 for taper. Any section .....@ 50¢ Each
Larger Diameter Section: MS-54.....75¢

Address Dept. RN • $5.00 Order Minimum, & 25% Deposit on C.O.D.'s. • Prices are F.O.B., Lima, Ohio

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in cases with anti-magnetic shielding, and provide insulated zero adjustments. The design is such as to provide environment free operation anywhere in the world. All of the instruments are calibrated to within ±1% of full-scale deflection with controlled, certified standards.

Complete specifications on the various types of panel instruments currently available are included in a series of data sheets available from the company.

DELAY CABLE FOR COLOR

Columbia Technical Corporation, 5 E. 57th Street, New York 22, N. Y. is currently marketing a new delay cable, the Type HH-4000.

The new component is an ultra-high impedance compact delay element which opens new design possibilities in amplifier circuits because of the higher possible gain and higher available voltage output from a given tube.

According to the company, the use of the delay lines in advanced color TV receiver models makes it possible to eliminate one stage in the conventional two-stage video amplifier.

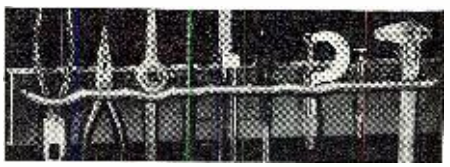
The cable has a nominal characteristic impedance of 4000 ohms and a time delay of 1 microsecond per foot. The attenuation for a delay of 1 μsec. is .2 db at 1 mc., 1.2 db at 4 mc., and 3 db at 6 mc., resulting in a bandwidth (3 db down) of 6.2 mc.

Complete specifications on this delay cable are available from the company.

TOOL HOLDER

Of interest to service technicians as well as home builders and experimenters is the new tool holder being introduced by *Searle of Chicago,* 216 W. Jackson Blvd., Chicago 6, Illinois.

Tradenamed the "Grip-R," the unit will hold drill bits of any size, pliers, screwdrivers, probes, etc., with or



without a handle, without magnetizing the tools. Sliding ring clips make the holding spaces adjustable. Spring tension holds tools securely. Any tool can be easily inserted or removed with one hand. —30—

DIRECTORY OF COMPANIES ISSUING PRE-RECORDED TAPE

MUSIC

A-V Tape Libraries, Inc.
730 Fifth Avenue
New York 19, New York
Symphonic and popular music, educational, language tapes.

Audiosphere
Livingston, N. J.
Classical and semi-classical, monaural and binaural.

Tape-Toons
Box 397
Smithtown, N. Y.
Organ recordings of popular tune classics.

Hack Swain Productions
P. O. Box No. 2834
Sarasota, Florida
"Musikon" tapes, popular and semi-classical selections—organ, electric piano, multi-track. Also Dixieland jazz and "custom" tapes with person's name.

Webcor
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Choral, chamber music, symphonic, and popular selections.

RCA Victor
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Celestial
Morrison Studios
2128 Westlake Avenue
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Dance and popular music; also square dancing.

Livingston Electronic Corporation
Livingston, N. J.
Jazz and opera, tapes of output of five disc independents.

Tru-Fidelity Tapes
Paducah, Ky.
Johnny Mack at Hammond organ. Novelty tunes.

Tempo Tapes
8540 Sunset Blvd.
Hollywood 46, Calif.
Popular and dance tunes.

Web Music Publishing Co.
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Background organ music for the home.

Console Recordings, Inc.
1652 W. 100th Place
Chicago, Illinois
Taped popular music.

Omega Tapes
International Pacific Recording Corp.
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Hollywood 46, California
Symphonic, classical.

Storyville Records
Magnetic Sound Recording Co.
Des Moines, Iowa
Semi-popular and popular.

SPECIAL, EDUCATIONAL, RELIGIOUS

Folkways Records
117 West 46th Street
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Folk music from the Folkways catalogue, and other educational selections.

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1818 M. Street, Northwest
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German, French, Italian language teaching tapes. Also drama and poetry.

Spiritual Recordings, Unlimited
1425 N. W. 39th Street
Oklahoma City 3, Okla.
Tapes of spiritual leaders of our time. Non-profit organization.

Fort Orange Distributing Co.
904 Broadway
Albany, New York
Has catalogue of "Tapes for Teaching" selections.

Charles G. Reigner Library of Recorded Sermons and Worship Services
Union Theological Seminary
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Great sermons of past and present by leading theologians and several actors. Catalogue sent on request.

EMC Recording Company
P. O. Box 3387
St. Paul 1, Minnesota
Living Language Library — educational tapes in many fields.

Phonotapes, Inc.
853 Ninth Avenue
New York, New York
Poetry, drama, and other literary readings.

Courtesy Minnesota Mining & Mfg. Co.

Double Troubles

(*Continued from page 55*)

vertical section and the incorrect positioning was simply caused by an incorrectly adjusted centering lever on the focus magnet ring.

The picture had good stability despite the snow, which eliminated the video i.f. stages as the trouble source, since a lowering of gain would also affect stability. The a.g.c. system also showed evidences of functioning properly since the picture had fairly good contrast as well as the stability aforementioned. The antenna system was checked and found to be all right. The trouble was finally localized to a defective 6BZ7 tube in the cascode r.f. amplifier section of the tuner. This tube had an abnormally high noise level but still provided fairly good amplification.

The snow which appears on the screen of a picture tube actually does not originate outside of the receiver but is produced by the amplified tube noises which exist in the first r.f. amplifier stage and others to a lesser degree. When the tube is defective, or if the signal is weak, the signal-to-noise ratio is poor.

Some tube noises are always present but, in a normal signal area, the high signal-to-noise ratio minimizes the tendency for the tube noises to ride through the video stages and appear at the grid of the picture tube. Some radio frequency amplifier tubes have a greater inherent noise factor than others and in weak signal areas it is advisable to try several tubes to find one which produces less snow effect. In a strong signal area slight differences in the noise levels of various tubes will not be noticeable unless the tube is defective and has a noise level which is abnormal.

The foregoing represent examples where a primary trouble is accompanied by a secondary symptom. A secondary symptom in most instances might escape notice because it is overshadowed by the more evident primary symptom. These illustrations serve to point out the need for a more careful analysis of the symptoms so that defects other than the primary one can also be corrected during a service call to the customer's home or when the set is brought in for bench servicing.

On occasion, three or four troubles may be evident and all should be corrected even though some of the troubles may be so minor that the customer would not notice them and hence would not complain. A correction of such factors as linearity, focus, definition, and a slight hum from the speaker even though the service call was initiated because of picture pull or keystoning, will result in a more professional job and ultimately greater customer satisfaction. It is a mark of professional distinction to do a thorough job and the results are always rewarded by increased business and an enhanced reputation.

—30—

New Turret Tuner

(*Continued from page 43*)

ment. One, giving the greater range, is the slug-tuned oscillator coil, L_7. The second adjustment is the fine-tuning control mounted on a concentric shaft; the same type as used in previous models.

Before discussing the u.h.f. operation of this tuner, a few features used in the cascode version should be mentioned. In most cascode models, the u.h.f. crystal clips are located at the number 1 terminal of the coil board rather than at the number 9 and 11 terminals. In Fig. 5, both locations are shown, but in actual practice only one is used.

Cascode tuners use a 6J6 or its series-heater version, the 5J6, as combination mixer and local oscillator. The circuitry is practically the same as in earlier turret tuners.

U.H.F. Operation

The new turret tuner described in this article has the facilities for receiving any u.h.f. station by means of a simply-installed adapter segment. A typical u.h.f. segment for the new tuner is shown in Fig. 6. Note that it consists of two portions. The u.h.f. portion at the right connects to spring clip terminals 1, 2, 3, and 4, in Fig. 5, and constitutes the r.f. bandpass and the mixer network. The u.h.f. signal appears between terminals 2 and 3, and the mixer crystal mounted at the top of the tuner chassis mixes the incoming u.h.f. signal with a harmonic of the local oscillator to produce a v.h.f. signal which is applied across terminals 3 and 4.

The v.h.f. coils mounted on the coil form at the left of the conversion strip of Fig. 6 are tuned to the unused v.h.f. channel which serves as i.f. for the

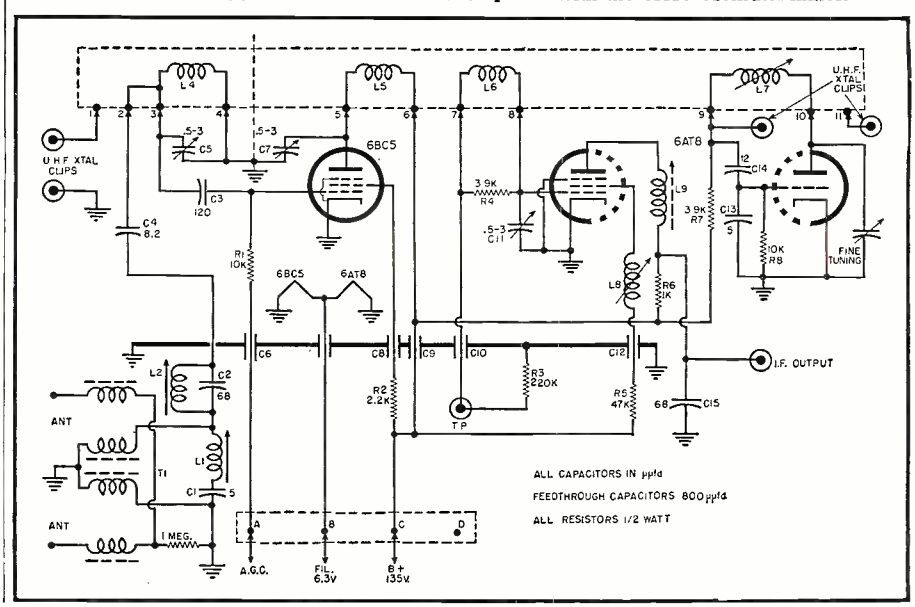
Fig. 6. A u.h.f. coil strip used with the new turret tuner. The crystal shown is used to generate a u.h.f. oscillator signal as a harmonic of the v.h.f. one.

u.h.f. first mixing process. The crystal diode shown in Fig. 6 serves as harmonic generator and produces the necessary u.h.f. oscillator frequency which is coupled through a small wire loop to the u.h.f. mixer crystal circuit. In some models of the new turret tuner this harmonic generator crystal as well as the mixer crystal are mounted above the chassis and serve for all u.h.f. channels.

When purchasing a u.h.f. adapter segment for any of the new turret tuners the same information is required as for the previous models. The u.h.f. channel and an unused v.h.f. channel as well as the exact model turret tuner must be known to obtain the correct u.h.f. adapter segment. Adjustment of the u.h.f. segment consists of oscillator tuning and the insertion of the mixer crystal into the clips provided at the top of the tuner chassis. In most instances, the u.h.f.-r.f. circuit and the v.h.f. section of the adapter strip will not need any touch up whatever and only the oscillator tuning slug will be adjusted, after warm-up, for best picture and sound.

In conclusion, the main improvements of the new *Standard Coil* turret tuner include the new 300-ohm balanced input coil which maintains good impedance match over all v.h.f. channels, and the use of a single coil segment instead of the two previously used for each channel. Part of the drum assembly doubles as r.f. shield and as

Fig. 5. Complete schematic diagram of the new turret tuner showing a v.h.f. coil strip in place. Two positions in the circuit are shown for the u.h.f. crystal clips although in actual practice only one position is used. An alternative tuner model uses a cascode circuit for the r.f. amplifier with the 6AT8 oscillator-mixer.



spring retained disc for the coil segments. The new arrangement permits removing each coil segment without a screwdriver.

For u.h.f. operation, the new tuner can again be supplied with adapter coil segments. As an economy measure, a single mixer crystal is used for all u.h.f. segments, mounted from the top of the tuner chassis. And finally, a simpler and more logical layout of the chassis aids in troubleshooting. —30—

"TALKING BOOK" FOR HAMS

THE Division for the Blind of the Library of Congress, Washington, D. C. has just published "The Radio Amateur's Novice License, Questions and Answers," in talking book form.

This volume will be made available to registered blind readers through the twenty-eight regional circulating libraries which regularly distribute such material.

This recorded book provides a source of information and means of access to an interesting and worthwhile hobby to the many persons without sight in this country who have time on their hands.

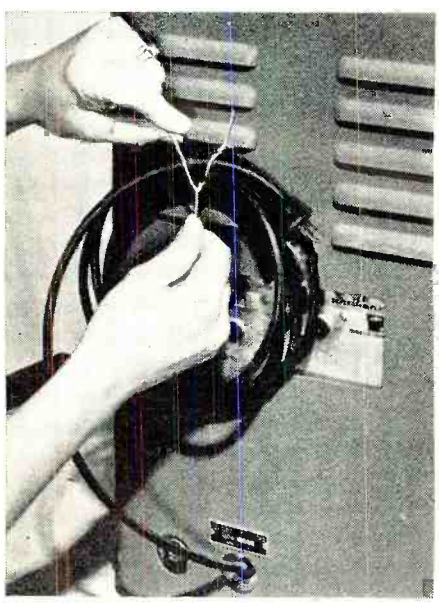
We would appreciate it if our readers would call this service to the attention of any blind people they know or any organization leaders who work with the sightless through Boy and Girl Scout Troops, public and private institutions for the blind, "sight-saving" classes in public schools, etc. as well as ham clubs desiring civic projects. —30—

LINE CORD HOLDER

By HUGH LINEBACK
Oklahoma A & M College

DANGLING line cords are a nuisance, particularly when a piece of equipment is to be carried about. The cords can be kept out of the way when not in use simply by attaching a scrap of wire to the case of the instrument and using it to hold the cord. Fasten the wire through ventilating holes, or under a screw in the cabinet. —30—

Avoid dangling cords on your portable gear by making a cord holder of scrap wire.



Hunting Harmonics

(*Continued from page 51*)

carries an antenna of less than 25-feet height, with something around 18-feet being most popular. *This means the radiation resistance will be in the neighborhood of 1 ohm.*

It follows that if the loss resistance in the circuit is also 1 ohm, exactly 50% of the very expensively-generated transmitter power goes up in smoke. Now, there are already losses which exceed that figure in the usual installation. So the design of a wavetrap must be such that it will not add too much more, or the station might as well stay off the air.

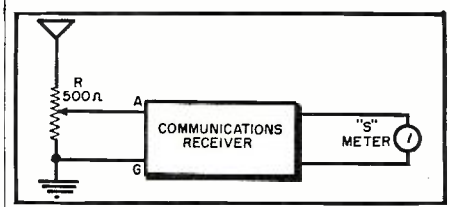


Fig. 2. Method of checking harmonic emission by using a communications receiver equipped with S-meter. See article for details.

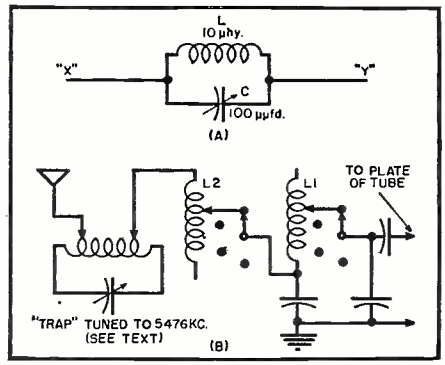
Fig. 3A shows the circuit of the most-commonly-used trap arrangement. When *L* and *C* are resonant to the harmonic frequency, they offer maximum impedance to the flow of harmonic current from "X" to "Y." The impedance will depend upon circuit *"Q,"* or the ratio of reactance to resistance. Satisfactory trapping thus depends a great deal upon the quality of the coil.

Not all coils are as good as they look. The safest way to make a selection is with a *"Q"* meter. A kit job is perfectly adequate for this work, or, even more inexpensively, direct *"Q"* readings may be obtained with *"Q* Box." *

In the absence of instruments, a fair coil selection may be made by using

* Robberson, Elbert: "Q-Box," CQ, April, 1954, page 44.

Fig. 3. (A) One commonly-used trap arrangement where L and C are resonant to the harmonic frequency. (B) Another trapping arrangement whereby trap is loaded by both transmitter and antenna permitting tapping across a portion of coil. This helps preserve trap "Q" and removes some coil resistance from transmitting circuit, resulting in lower fundamental loss.



the coil with the least extraneous matter in its field, the largest conductor (#10 wire or heavier, or copper tubing), and with a length-to-diameter ratio of 1:1. To resonate at 5476 kc., within the tuning range of a 100-$\mu\mu$fd. variable capacitor, an inductance of 10-μhy. is required. A coil of these characteristics may be built specially. The author found that 15 turns of *B & W* #3905 coil stock filled the bill, while presenting a loss resistance of less than 1 ohm to signal currents. A self-supporting coil of copper tubing with the same inductance would be better yet, due to its lower resistance.

It is possible to obtain a fair approximation of trap operation by placing one in the antenna circuit of a receiver. Disregarding impedance matching, it can be seen that tuning the trap to the frequency to be rejected will reduce signal strength from 6 to more than 9 S points, or 36 to over 54 db. Now, a db is a db whether it is measured at the transmitting or the receiving end, so it should theoretically be possible to drop our unwanted harmonic the same degree, simply by putting the trap in the transmitting-antenna lead.

However, the trap is "loaded" by both the transmitter and the antenna, so tapping across only a portion of the coil, as shown in Fig. 3B, will help preserve trap *"Q"* and at the same time remove some of the coil resistance from the transmitting circuit, resulting in less loss of the fundamental. These taps, as well as trap tuning, can then be adjusted to bring about the desired degree of harmonic attenuation. It will also be necessary to touch up the transmitter-antenna tuning, to counteract the small inductive reactance introduced by the trap at signal frequency.

Making the fair assumption that a properly-adjusted transmitter should put out less than 5% second-harmonic power (amounting to approximately 13-db reduction), the trap is only required to drop the harmonic by 27-db more. This is no tremendous feat, just as the FCC says.

The trap circuit should be installed inside a non-ferrous shield or metal cabinet, so the harmonic current it has trapped doesn't get scattered again. Leave plenty of clearance around the coil (inches, that is) to preserve as much *"Q"* as possible, and ground the box with a short, heavy lead.

Then look about the boat to make sure there isn't any wire hanging around with an electrical length that would encourage shock excitation. The critical length would be around 43 feet for a wire grounded at the bottom (such as a shroud) or 85 feet for a "floating" wire, such as a halyard.

With a trap, such as described, on a transmitter with the smallest common antenna it should be possible to obtain more than the required attenuation, and probably knock the harmonic all the way off the air without lowering desired signal volume enough to make any great difference to the ear. And if the vessel has a good antenna system to begin with, there should be no loss worth mentioning. —30—

Manufacturers' Literature

The bulletins reviewed in this section are for your convenience; unless otherwise indicated they are available to all our readers. For prompt attention write directly to the manufacturer for literature described.

ENCLOSURE BROCHURE

Altec Lansing Corporation, 9356 Santa Monica Boulevard, Beverly Hills, California or 161 Sixth Avenue, New York 13, N. Y. has compiled an 8-page brochure for audiophiles on the subject of loudspeaker enclosures.

The publication discusses the advantages and disadvantages of the many types of enclosures for high-fidelity loudspeakers. Frequency response curves which may be expected from different cabinet types are reproduced to illustrate the characteristics of different enclosure designs.

The literature also contains complete information on the design and construction of bass reflex enclosures and detailed drawings for the construction of a corner enclosure.

The company's dealers will supply copies of the publication or it may be obtained from the company direct.

"VARIAC" BULLETIN

General Radio Company, 275 Massachusetts Avenue, Cambridge 39, Mass. has just published a 16-page catalogue covering its continuously adjustable autotransformer, the "Variac."

Bulletin N contains photographs of the various units in the line plus complete electrical and physical specifications. A condensed table of all pertinent data is included on the back of the catalogue to facilitate ordering the desired autotransformer.

TAPE GLOSSARY

A glossary of tape recording terms for the amateur recording fan has been prepared by the manufacturers of *"Scotch"* brand magnetic tape.

The 8-page, mimeographed publication contains easy-to-understand definitions of 57 basic words and phrases commonly used in the tape-recording field.

This new publication is available without charge from Dept. M5-12 of *Minnesota Mining and Manufacturing Co.,* 900 Fauquier St., St. Paul 6, Minn.

TAPE RECORDER DIRECTORY

Audio Devices, Inc., 444 Madison Avenue, New York 22, New York has published a compact but comprehensive tape recorder directory which is available without charge as long as the supply lasts.

The 20-page publication lists, in chart form, quick facts on the magnetic tape recorders manufactured by some 36 companies. Each unit is pictured and described briefly. A recording time chart for various tape speeds and reel sizes is also included. Four pages are devoted to *Audio Devices'* line of tape recording accessories and tape offerings.

ASA PUBLICATION

American Standards Association, 70 E. 45th Street, New York 17, N. Y. has released copies of the proceedings of its Fifth National Conference on Standards.

The volume, "Standards for a Strong America" contains 40 papers (100 pages) on a wide range of subjects including color TV, purchasing, quality control, architecture, safety, international electrical standards, company standardization, agricultural, forecasts by technical and business paper editors, etc.

Copies of this report are available from the Association for $3.00 a volume.

MINIATURE TRANSFORMERS

Microtran Company, 84-11 Rockaway Beach Boulevard, Rockaway Beach 93, N. Y. has just issued a 12-page catalogue covering its line of miniature transformers.

The compact publication gives detailed specifications on hundreds of miniature transformers designed for applications in guided missiles, transistor circuitry, radio paging, airborne applications, etc. The units are available in hermetically sealed, molded, encapsulated, or impregnated construction.

For a copy of the new catalogue, make your request on your business letterhead.

PRECISION WIREWOUNDS

Shallcross Mfg. Co., Collingdale, Pa. has recently published an engineering bulletin describing its line of .10- to 2-watt "Akra-Ohm" ceramic-bobbin precision wirewound resistors from .1 ohm to 1000 megohms, 75 to 2000 volts.

Engineering Bulletin L-35 describes in detail the various forms in which the resistors are available. The bulletin is available on letterhead request as is a copy of the firm's Bulletin L-30 covering encapsulated precision wirewounds meeting MIL-R-93A specifications.

CRYSTAL DIODE DATA

The second edition of *CBS-Hytron's* "Reference Guide for Crystal Diodes" is now available at the company's distributors.

The new guide lists 185 types of diodes, gives all the basic data concerning them, and includes 18 dimensional diagrams. Because diode types are constantly multiplying, it was necessary to revise a previous edition.

CERAMIC CAPACITOR DATA

The "Hi-Q" Division of *Aerovox Corporation,* New Bedford, Mass., has issued a comprehensive 24-page booklet covering its line of ceramic capacitors.

The publication includes an introduction and then provides pertinent data on standard tubular and disc ceramics, temperature compensating types, JAN and RETMA types, bypass-coupling units, high-voltage capacitors of the cartwheel, tubular and disc types, and feed-throughs and stand-offs.

Of interest to engineers, this publication is available from the distributor division of the firm.

MAGNETIC TAPE BOOKLET

The seven questions recording engineers have asked most frequently about the company's *"Scotch"* brand "Extra Play" magnetic tape No. 190 have been answered in a new, 8-page booklet recently released by *Minnesota Mining and Manufacturing Co.,* 900 Fauquier Street, St. Paul 6, Minn.

Discussed in the two-color, 5½"x 10¾" booklet are such points as playing time, tape strength, reel sizes, recorder settings, and performance characteristics.

When writing for a copy, please specify the "190" booklet.

AUDIO REFERENCE GUIDE

Leonard Radio, Inc., 69 Cortlandt Street, New York 7, New York, has just issued a 160-page catalogue which contains all essential details on the latest model high-fidelity components released by leading manufacturers.

In addition to picturing the various components, complete electrical and mechanical specifications are provided. An 18-page introduction contains valuable information on the selection and assembling of home sound systems.

Dept. PR-9 of the company will forward a copy of this publication upon request.

SHIELDED WIRE AND CABLE

A new illustrated bulletin on shielded wire and cable for microphone and sound system use is now available from *Whitney Blake Company,* New Haven 14, Conn.

The new publication, Bulletin SW-1, describes the firm's new microphone cables with semi-conducting textile shield as well as the conventional type with braided copper shield. The company's new speech input and sound system cables are also included.

Copies of this 8-page publication are available without charge on request.

COLOR-CODE CHART

A new plastic wall chart is now being offered by the Electronic Components Division of *Stackpole Carbon Company,* St. Marys, Pa., to design engineers, electronics purchasing departments, radio-TV service technicians, and other users of fixed composition resistors and capacitors.

One side of the 8"x11" chart lists the company's ½-, 1-, and 2-watt standard fixed composition resistors in all 269 RETMA preferred values from 10 ohms to 22 megohms, with tolerances of ± 5%, ± 10%, and ± 20%. The other side, printed in different colors for easy identification, lists the 46

RETMA values for the company's fixed composition capacitors from .10 μμfd. to 10 μμfd., also in tolerances of ± 5%, ± 10%, and ± 20%.

A copy of this chart is available from the company on letterhead request.

NBS PUBLICATION

The National Bureau of Standards has published a 39-page booklet entitled "Cheyenne Mountain Tropospheric Propagation Experiments" which is available from the Government Printing Office, Washington 25, D. C., for 30 cents in cash.

The NBS Circular 554 describes the Bureau's Central Radio Propagation Laboratory's facilities atop Cheyenne Mountain, Colorado, and gives some sample results of the tropospheric propagation research carried out using these facilities.

WIRE CATALOGUE

The *Columbia Wire & Supply Company,* 2850 Irving Park Road, Chicago 18, Illinois, is now offering copies of a supplement to its catalogue No. 104 which will be forwarded without charge upon written request.

Among illustrated items appearing in the publication are the company's "Permaline" TV transmission line, "Permaline" rotor cables, "Permaline" intercom and telephone wire for outdoor use, a new hook-up wire display, new connectors, cords, cables, etc.

LOUDSPEAKER BULLETIN

Jensen Manufacturing Company, 6601 S. Laramie Ave., Chicago 38, Ill., has issued a new manufacturers' bulletin which describes its new miniature loudspeaker.

Bulletin No. 1001 provides full details on the new P275-Y speaker which was designed for transistor radio receiver and other subminiature applications.

Manufacturers may obtain a copy of this bulletin for use by their purchasing agents and design engineers. —30—

Reference-Shift Modulator

(*Continued from page 47*)

According to the results obtained with the class K modulator and reference-shift modulator, and according to the testimony of Bill Orr in his bias-shift story, an efficiency of about 50 per-cent can be obtained with any of these circuits. However, if the modulator is overdriven so that its output flattens at the positive and negative peaks, the resulting waveform inherently contains more power than a corresponding sine wave, and the efficiency of the modulator can therefore exceed 50 per-cent. This peak flattening also results in a kind of high-level clipping which increases the average modulation level.

The fly in the Vaseline is the fact that a waveform distorted by clipping contains harmonics which broaden an AM signal. Therefore if the reference-shift modulator (or any other modulator employing high-level clipping) is used to modulate a medium- or high-power transmitter which might disturb neighboring stations, a high-level, low-pass filter should be used.

Scope patterns obtained with the reference-shift modulator and tests conducted on the air indicated that the audio quality is beyond reproach.

Design Considerations

None of the circuit values in the reference-shift modulator is critical and placement of components on the chassis is not critical.

The speech amplifier employs three cascaded triode amplifiers and provides sufficient gain for use with a crystal microphone. The cathode V_{2A} was left unbypassed in the hope that the resulting degeneration would reduce any distortion which might occur at maximum speech-amplifier output. If more gain is required, however, this cathode may be bypassed.

The plate-voltage decoupling network consisting of R_7 and C_4 is necessary only if the same power supply is used for both modulator and speech-amplifier plate voltage.

The 807 will easily modulate any power input to the final up to 60 watts, although it can probably do better. A class K 807, for example, does a fair job of modulating 90 watts. At any rate, a given tube in the reference-shift modulator will safely modulate another tube of the same type operated at maximum power input.

Several different power tetrodes were tried as the modulator. The first tube tried was 6L6, which proved to have the wrong E_g-I_p characteristics for use as a reference-shift modulator. The 1614, a "souped-up" version of the 6L6, was also unsatisfactory.

A 6V6 worked fairly well with a plate voltage of about 375 volts and a maximum plate current of 70 ma. A 6V6 will modulate 25 watts.

An 807 also worked and proved to be the ideal choice for a wide range of

power levels. It was used to modulate an 807 final amplifier operated at power inputs from 20 to 70 watts and at plate voltages from 350 to 700 volts.

The coupling choke, CH_1, should have an inductance of at least 5 hy., and its resistance should be as low as possible, although neither value is especially critical. The choke should be capable of carrying the final amplifier plate current plus the maximum modulator plate current.

In Fig. 3, the values shown for components in the final amplifier are not necessarily correct for all operating conditions. The voltage rating of the plate-circuit bypass capacitor need be only twice the plate voltage used; and the exact value of the screen dropping resistor will depend not only on the plate voltage and power input but on the loading of the final.

Note that the value of the final screen bypass capacitor is only 500 $\mu\mu$fd. It was found that the lower the value of this capacitor the less distortion is introduced in the final. This may not be true of any final amplifier, but in general the screen bypass capacitor should be as small as possible consistent with stable operation.

Several methods may be employed to couple the modulator to the final. In the circuit of Fig. 3, a common power supply is used for the modulator and final amplifier. Sometimes, however, it is desirable to modulate a c. w. rig whose power supply can handle only the final amplifier. In this case, the parallel-feed system circuit shown in Fig. 2 should be used. Two chokes, coupled by a capacitor, are used, one in the modulator plate circuit and the other in the final plate circuit. By this means separate power supplies can be used for the modulator and final. With this system the modulator and final plate voltages should be about equal for a high modulation level. Incidentally, the cost of two 10-hy., 100-ma. chokes is not much more than the cost of one 5-hy., 200-ma. choke.

A modulation transformer can of course be used to couple the modulator to the final. However, modulation transformers are usually more expensive than equivalent chokes, and if you have a modulation transformer you are possibly as well off with a push-pull class AB_1 modulator.

Perhaps the author is unduly enthusiastic about the reference-shift modulator as a means of eliminating the need for modulation transformers in low-power rigs, but then perhaps the enthusiasm is justified. It is also hoped that the reference-shift system can be applied with equal success to high-power transmitters. The author wishes to thank Henry Keen and Bill Orr without whose help and inspiration the reference-shift modulator would not have been possible.

REFERENCES

1. Hileman, Dale: "Class K Modulator," *CQ, October 1953.*
2. Orr, William, I.: "The Bias-Shift Modulator," *CQ, April 1954.*

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Electronic Lock

(*Continued from page 53*)

even be used to sound a central station alarm at the same time that the local alarm buzzer is sounded.

Providing Stand-by Power: In most installations, it is necessary to provide for emergency operation of the lock even if there should be a general power failure. This may be accomplished quite easily by using the circuit arrangement shown in Fig. 6.

The original circuit (Fig. 2) is broken at points "X" and "Y" and T_1 connected as shown in Fig. 6. Two additional parts are required, a d.p.d.t. 117-volt relay (RL_3) and a 6-volt storage battery or dry cell source. If a storage battery is used, it may be desirable to add a "trickle" charger.

Sometimes it will be necessary to replace RL_2 with an a.c.-d.c. relay. The time delay relay, RL_1, will work equally well on both a.c. and d.c.

In operation, RL_3 will automatically switch the combination lock circuit from line to battery operation in event of a power failure, and back again to line operation when power is restored.

Construction Hints

Construction of the basic combination lock circuit is simple and straightforward. The average technician should have little or no difficulty in assembling and wiring a similar unit. Standard parts are used throughout.

Neither parts layout nor lead dress is critical. However, there are two special points of interest,

First, the time delay relay RL_1 is a standard "plug-in" unit. The time delay period depends on the relay chosen. If the relay specified in the parts list is used, a delay of 10 seconds is obtained. In order to facilitate changing the time delay, a standard octal socket is wired for RL_1. Then, to change the time delay interval, it is only necessary to plug in a relay having the time delay desired.

Secondly, R_1 should be chosen experimentally to match the alarm relay (RL_2) used. This resistor should be large enough so that RL_2 does not close accidentally, even when line surges occur, yet small enough so the relay holds once it is closed. This will provide a "latching relay" action without the need for a special relay.

Installation

The actual installation of the electronic combination lock in a specific

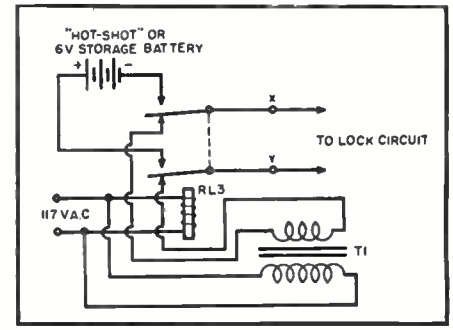


Fig. 6. Diagram shows how stand-by power from a 6v. battery can be obtained should regular 117-volt power source fail.

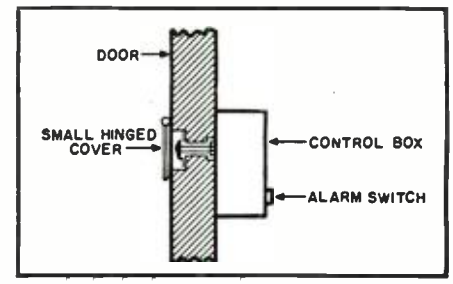


Fig. 7. How alarm is mounted on door.

location is so much of a "custom" job that only general suggestions may be given. One type of installation is shown in Figs. 5 and 7.

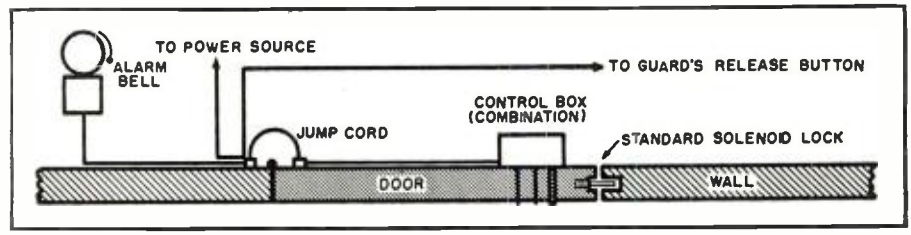
In general, the "control box" containing the switches, relays, and wiring, will be mounted behind or to one side of the door to the protected area. The dial switch shafts are left long and project through the wall or door. Such an arrangement will make it impossible for a potential intruder to reach the control box proper.

The *"Alarm Release"* switch (S_2) may be mounted either on the control box or in a hidden location. The *"Guard's Release"* switch (S_2) may be mounted either at the guard's table or at the receptionist's desk. The alarm bell or buzzer is generally mounted outside the protected area in a tamperproof case or cabinet.

If the control box is mounted on a door, a standard flexible "jump cord" is required. See Fig. 5.

In general, the electronic combination lock will be used to protect the entrance door to a closed working area, such as a laboratory, drafting or engineering office, or a classified file room. However, it may be used equally well to protect a storage area, such as a warehouse, store room, or vault. In the latter type of installation, the *"Guard's Release"* switch may either be omitted or used as an emergency

Fig. 5. The details of the actual installation of the electronic combination lock.



lock release switch, in case a worker is accidentally trapped in the area.

In any case, the lock is only effective where all entrances to the area, including windows, air-conditioning vents, skylights, and fire doors, are adequately protected by a good intrusion or burglar alarm system.

Once the lock is installed and checked out, a "standard operating procedure" should be set up. Specific individuals should be entrusted with the combination and charged with the responsibility of "opening" and "closing" the protected area each day.

In many cases, the "opening" procedure will be as follows:

The individual responsible for "opening" the area will arrive ahead of the other workers. He sets the combination and waits until the time delay expires and the latch releases (or the solenoid pulls the bolt open). He then opens the door and switches the *"Alarm Release"* switch to its "off" position. After this he resets the combination dials to their normal "off" positions and turns the *"Alarm Release"* switch back "on".

If the area is normally left "wide open" during working hours, he simply leaves the door open. If the area is to be kept "closed," he closes the door, locking it, and admits later arrivals by pressing the *"Guard's Release"* switch.

The same, or another, individual should be responsible for seeing that the lock is set up at the end of the working period.

In addition, it is considered good practice for the lock and alarm system to receive a periodic test. An incorrect combination is deliberately set and the system "put through its paces." In critical installations, the test may be a daily affair. —30—

ION TRAP MAGNET

By H. LEEPER

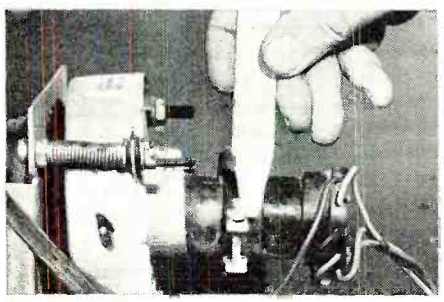
ION trap magnets sometimes become jarred out of position or otherwise require adjustment.

The type shown has a thumb screw to tighten the mounting strap while others are held around the neck of the tube with a coiled spring.

The magnet is moved slightly backward or forward, or rotated for maximum brightness of the picture tube, with no shadows at the picture edges.

A final adjustment may be required of the trap, after checking and moving the focus shaft, at normal viewing brightness. —30—

Check for correct location of trap magnet.



Loudspeaker Distortion

(*Continued from page* 50)

tative damping factor of +30, or about 40 db harder than is possible with a low positive damping factor as attained by *negative* current feedback. In fact it is reasonable to assume that if high damping (positive current feedback) will decrease speaker distortion then low damping (negative current feedback) will increase it. Theoretical considerations and actual tests bear this out. A tabulation of the effects of ultimate damping and low damping on various characteristics of the speaker system is given in Table 1. Fig 4 is a simplified explanation of low damping as contrasted with ultimate damping.

The "variable damping factor control" for the first time enables the listener to determine for himself the damping factor which will result in optimum performance of his speaker system. Being continuously variable, it will allow the precise adjustment required to attain ultimate damping. Inasmuch as the voice coil resistance may have a value between 1 and 8 ohms, the continuously variable feature is essential.

Non-technically stated, the control shows itself best when set to give ultimate damping. The decreased low frequency distortion reduces "listener fatigue" and allows you to actually listen to music continuously for hours-on-end and still find it easy on your ears.

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1. Olson, H. F.: "Elements of Acoustical Engineering," D. Van Nostrand Co., Second Edition. Chapter 6.14, 1947
2. Tanner, R. L.: "Improving Loudspeaker Response with Motional Feedback," Electronics, March, 1951
3. Wilkins, C. A.: "Variable Damping Factor Control," Audio, September, 1954

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A BROKEN CIRCUIT

By A. L. ALBRIGHT

A TABLE MODEL radio receiver using a printed wiring board was found to be dead as far as the signal was concerned. Testing tubes and voltages revealed nothing unusual, and the oscillator was operating. All circuit components tested well and close visual inspection failed to reveal any fault. The set seemed to be perfect, except that signal tracing indicated that the i.f. signal was not getting through.

Accidentally, the Masonite board on which the circuit was printed was flexed. Lo and behold, there was a break of the signal circuit just ahead of the second detector. The ohmmeter indicated continuity across this break until the board was flexed.

The soldering gun and a very small amount of solder was used to mend this break and the set was back in operating condition.

Apparently the set had fallen to the floor and while the cabinet had not been damaged, the printed wiring board had cracked. Maybe we need flexible printed circuits! —30—

NEW AUDIO EQUIPMENT

MAGNETIC CARTRIDGES

Fairchild Recording Equipment Company, 154th Street and 7th Avenue, Whitestone, N. Y. is now offering a new line of magnetic cartridges, the Series 220.

Based on the high-compliance moving coil principle, the new cartridge has high compliance and vastly improved characteristics. Frequency response is flat to 17,000 cps with a very gradual roll-off. A 4 to 6 db increase in signal level simplifies installation in any hi-fi system. Models are available for either microgroove or 78 rpm records.

TAPE RECORDER-PLAYBACKS

Magnecord, Inc., 225 W. Ohio Street, Chicago 10, Illinois has introduced a new recorder-playback unit which meets professional specifications and is designed primarily for the small studio or laboratory installation.

Frequency response is in excess of 15,000 cps. Cathode follower output

permits long runs from the recorder without danger of noise. High impedance microphone and unbalanced bridge inputs handle ordinary requirements and with use of optional input transformers and low input microphone, balanced bridge inputs are included to provide additional flexibility. Solenoid-operated differential band brakes provide simpler, more positive braking than is usually available. The unit also has unusually low flutter and wow characteristics.

This recorder measures 19" long by 12¼" high by 8½" deep. The weight is 50 pounds. The amplifier is 19" by 5¼" by 8½" and weighs 15 pounds.

SONOTONE CARTRIDGE

A new single-needle, high-fidelity ceramic cartridge, the 1P, has been announced by *Sonotone Corporation,* Elmsford, N. Y.

The unit features high compliance and an extended frequency response.

It is available in two versions—one for microgroove 33's and 45's and the other for standard groove 78's.

The 1P does not require equalizers nor preamplifiers and is unaffected by moisture or temperature. Because of its small size, it will fit into an unusually large number of tone arms.

STROBOSCOPIC TURNTABLE

A new type of turntable, designed for broadcast and home high-fidelity installations, has been introduced by *Hermon Hosmer Scott, Inc.,* 385 Putnam Avenue, Cambridge 39, Mass.

The Type 710-A provides push-button selection of 33⅓, 45, and 78 rpm speeds. Each speed is adjustable by ± 5% to allow matching the pitch of

an accompanying musical instrument. The built-in expanded scale optical stroboscope, with electronic peak pulsing for extreme clarity, insures precision speed adjustment even while a record is being played, according to the company.

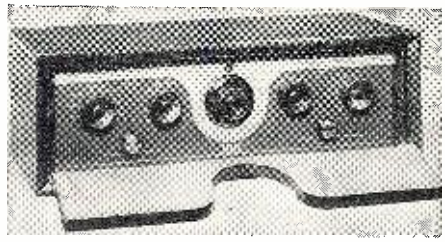
Special mechanical design reduces motor rumble by more than 60 db below the recording level. Wow and flutter have been reduced to less than .1%, well below audibility and virtually unmeasurable.

The turntable board can be mounted directly to a cabinet without additional vibration isolation or an accessory mahogany base is available if cabinet mounting is not desired. A free technical bulletin on the Type 710-A is available on request.

ALTEC AMPLIFIER

Altec Lansing Corporation, 161 Sixth Avenue, New York 13, N. Y. has previewed the newest preamplifier control unit and power amplifier in its line, the A-440A.

The new unit has two low-level and three high-level inputs with individual



gain controls, selection for either conventional volume or loudness control, choice of 25 recording characteristics, separate wide-range bass and treble controls, and a special tape monitoring facility.

The A-440A is housed in a furniture-

type cabinet with a hinged door that hides all controls except the "on-off-volume" control. With the door open, all controls are accessible and the inside of the door contains complete information for the selection of the proper recording characteristic.

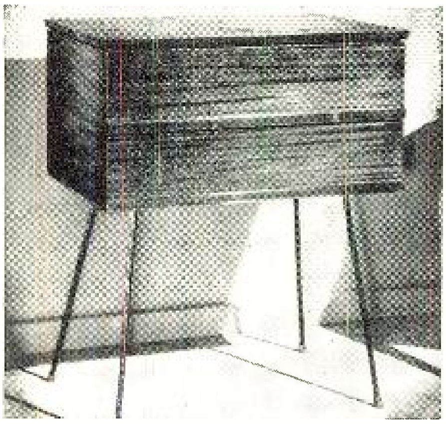
NEW CABINET LINE

Regency, a division of *I.D.E.A., Inc.,* 7900 Pendleton Pike, Indianapolis 25, Ind., has introduced a new line of cabinets designed especially for people who lack space to make custom installations or who live in rented homes where its is impractical to make permanent installations.

Three cabinets are currently available in the line. The Model TM is a table model which has pre-cut and predrilled panels. It is designed to be used with the *Regency* HF 80 or HF 150 amplifiers.

The Model TMC is designed to accommodate the HF 80 or HF 150 amplifier or the AF 220 tuner with any standard record changer. It is available with optional wrought iron legs which converts it to a consolette model.

The most versatile of the line is the Model CTC which is adaptable to any *Regency* amplifier or tuner and any standard record changer. All of the



cabinets come in mahogany or blonde oak wood veneer. Other finishes or woods are available on special order.

MATCHING TRANSFORMERS

Electronic Communication Equipment Co., 1249 W. Loyola Ave., Chicago 26, Illinois, has developed a new series of line-to-speaker matching transformers for commercial sound systems using 70-volt distribution techniques.

Three sizes are available for feeding individual loudspeakers or banks of loudspeakers requiring up to 5, 15, or 50 watts. Transformers are available for indoor or outdoor applications. The outdoor types, being hermetically sealed, require no additional weather protection.

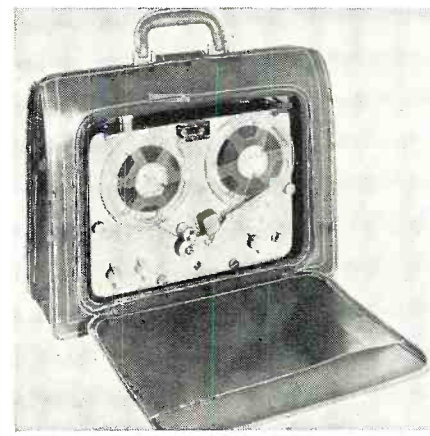
Information on this new 70-volt line-to-speaker matching transformer series is available from the company.

COMPACT RECORDER

Amplifier Corp. of America, 398 Broadway, New York 13, N. Y. is in

production on a battery-operated magnetic tape recorder that is housed in an average-sized leather briefcase.

The new "Secret Recorder" is designed for all kinds of investigative

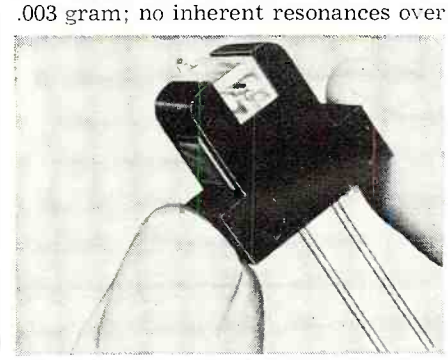


work and may be opened, carried, or put down without showing the recorder in operation.

The unit weighs only 11¾ pounds and measures 16" long, 12½" tall, and 4½" wide. It is extremely simple to operate. After the volume control has been preset, no further adjustments are needed. The recorder provides continuous rcording for 1½ hours at a tape speed of 1⅞ ips using long-play ¼" magnetic tape. A 5" reel of this tape will hold three hours of dual-track recorded material. The recorder incorporates a built-in preamplifier for earphone playback. The output can be fed into any external amplifier with speaker for greater playback volume.

ELECTRODYNAMIC CARTRIDGE

Electro-Sonic Laboratories, Inc., Long Island City, N. Y., is in production on a new electrodynamic cartridge which is said to offer smooth response from 20 cycles to above 20 kc.; less than 1% intermodulation distortion; a minimum compliance of 4.43 x10^{-6} dyne/cm.^{2}; an equivalent mass of .003 gram; no inherent resonances over



the entire audio range; and good dynamic range and transient response.

The new cartridge is readily adaptable to changers and professional arms and is available, with diamond or sapphire stylii, at audio dealers throughout the country.

FM TUNER TIMER

Browning Laboratories, Winchester, Mass., is now offering a new timer unit for use with that firm's line of "Brownie" tuners. A *G-E* "Telechron"

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Type	Price	Type	Price	Type	Price
OZ4M	.65	6AU5GT	.82	7C6	.59
1AX2	.62	6AU6	.46	7F7	.79
1B3GT	.73	6AV5GT	.83	7H7	.59
1E7	.29	6AV6	.40	7N7	.69
1H4	.30	6AX4GT	.65	7Q7	.66
1LA6	.69	6BA6	.49	7Y4	.69
1LH4	.69	6BC5	.54	12A4	.60
1LN5	.59	6BC7	.82	12AL5	.37
1R5	.62	6BE6	.51	12AT6	.41
1S5	.51	6BG6G	1.25	12AT7	.72
1U4	.57	6BH6	.53	12AU6	.46
1U5	.50	6BJ6	.49	12AU7	.60
1X2A	.68	6BK5	.80	12AV6	.39
3A3	.80	6BK7	.80	12AV7	.73
3AL5	.42	6BL7GT	.91	12AX4	.67
3AU6	.46	6BN6	.74	12AX7	.63
3BC5	.54	6BQ6GT	.98	12B4	.60
3BN6	.74	6BQ7	.90	12BA6	.49
3CB6	.54	6BZ7	.90	12BE6	.51
3Q4	.59	6C4	.40	12BF6	.39
3Q5GT	.69	6CB6	.54	12BH7	.63
3S4	.58	6CD6	1.11	12BY7	.65
3V4	.58	6CF6	.64	12CU6	.98
4BQ7	.90	6CS6	.51	12SA7GT	.65
4BZ7	.96	6H6GT	.41	12SJ7M	.67
5AW4	.59	6J5GT	.48	12SK7GT	.63
5J6	.64	6J6	.52	12SL7GT	.57
5T4	.79	6K6GT	.45	12SN7GT	.59
5U4G	.55	6L6	.84	12SQ7GT	.56
5U8	.78	6Q7	.45	12V6GT	.46
5V4	.71	6S4	.48	12X4	.38
5Y3GT	.37	6SA7GT	.55	14A7	.63
6AB4	.46	6SH7GT	.49	14B6	.63
6AC7M	.86	6SJ7GT	.50	14H7	.79
6AF4	.90	6SK7GT	.53	19BG6	1.39
6AG5	.56	6SL7GT	.67	19T8	.69
6AG7M	.99	6SN7GT	.59	25AV5GT	.83
6AH4	.67	6SQ7GT	.46	25BQ6GT	.98
6AH6	.73	6T4	.99	25L6GT	.51
6AK5	.75	6T8	.80	35B5	.52
6AK6	.59	6U8	.78	35C5	.51
6AL5	.42	6V6GT	.50	35L6GT	.51
6AM8	.78	6V8	.86	35W4	.47
6AN8	.78	6W4GT	.47	35Y4	.54
6AQ5	.50	6W6GT	.57	35Z3	.59
6AQ6	.46	6X4	.37	35Z5GT	.47
6AQ7	.70	6X5GT	.37	50A5	.55
6AR5	.45	6X8	.75	50B5	.52
6AS5	.50	7A7	.69	50C5	.51
6AS6	1.49	7A8	.68	50L6GT	.61
6AT6	.41	7B7	.49	80	.43
6AU4GT	.68	7C5	.69	117Z3	.45

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WHAT THE PROGRESSIVE RADIO "EDU-KIT" OFFERS YOU

Our Kit is designed to train Radio Technicians, with the basic facts of Radio Theory and Construction Practice expressed simply and clearly. You will gain a knowledge of basic Radio Principles involved in Radio Reception, Radio Transmission and Audio Amplification.

You will learn how to identify Radio Symbols and Diagrams; how to build radios, using regular radio circuit schematics; how to mount various radio parts; how to wire and solder in a professional manner. You will learn how to service and trouble-shoot radios. You will learn code. You will receive training for F.C.C. Novice License. You will learn High-Fidelity.

In brief, you will receive a practical basic education in Radio, worth many times the small Price you pay.

THE KIT FOR EVERYONE

The Progressive Radio "Edu-Kit" was specifically prepared for any person who has a desire to learn Radio. The Kit has been used successfully by young and old in all parts of the world. It is not necessary that you have even the slightest background in science or radio.

The Progressive Radio "Edu-Kit" is used by many Radio Schools and Clubs in this country and abroad. It is used by Armed Forces Personnel and Veterans throughout the world.

The Progressive Radio "Edu-Kit" requires no instructor. All instructions are included. All parts are individually boxed, and identified by name, illustration and diagram. Every step involved in building these sets is carefully explained. You cannot make a mistake.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" comes complete with instructions. These instructions are arranged in a clear, simple and progressive manner. The theory of Radio Transmission, Radio Reception, Audio Amplification and servicing by Signal Tracing is clearly explained. Every part is identified by illustration and diagram. You will learn the function and theory of every part used.

The Progressive Radio "Edu-Kit" uses the principle of "Learn by Doing." Therefore you will build radios, perform jobs, and conduct experiments to illustrate the principles which you learn. These radios are designed in a modern manner, according to the best principles of present-day educational practice. You begin by building a simple radio. The next set that you build is slightly more advanced. Gradually, in a progressive manner, you will find yourself constructing still more advanced multi-tube radio sets, and doing work like a Professional Radio Technician. Altogether you will build fifteen radio circuits, including Receivers, Transmitter, Code Oscillator and Signal Tracer. These sets operate on 105-125 V. AC/DC. An Adaptor for 210-250 V. AC/DC operation is available.

THE PROGRESSIVE RADIO "EDU-KIT" IS COMPLETE

You will receive every part necessary to build 15 different radio sets. Our "Edu-Kit" contains tubes, tube sockets, chassis, variable condenser, electrolytic condenser, paper condensers, resistors, line cord, selenium rectifier, tie strips, coils, hardware, tubing, etc.

Every part that you need is included. These parts are individually packaged, so that you can easily identify every item. A soldering iron is included, as well as an Electrical and Radio Tester. Complete, easy-to-follow instructions are provided. All parts are guaranteed, brand new, carefully selected and matched.

In addition, the "Edu-Kit" now contains lessons for servicing with the Progressive Signal Tracer, F.C.C. instructions, quizzes, High-Fidelity instructions.

TROUBLE-SHOOTING LESSONS

Trouble-shooting and servicing are included. You will be taught to recognize and repair troubles. You will build and learn to operate a professional Signal Tracer. You receive an Electrical and Radio Tester, and learn to use it for radio repairs. While you are learning in this practical way, you will be able to do many a repair job for your neighbors and friends, and charge fees which will far exceed the small cost of the "Edu-Kit." Here is your opportunity to learn radio quickly and easily, and have others pay for it.

FREE EXTRAS

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Progressive "Edu-Kits" Inc., 497 Union Ave., Brooklyn 11, N.Y.

MAIL TODAY. BUILD 15 RADIOS AT HOME WITH THE PROGRESSIVE RADIO "EDU-KIT".

MAIL TODAY—Order shipped same day received.
30-Day Money-Back Guarantee. Include ALL FREE EXTRAS

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- ☐ Send "Edu-Kit" Postpaid. I enclose full payment of $20.95 (Outside U.S.A.).
- ☐ 210-250 V. Adapter for "Edu-Kit"—$2.50.
- ☐ Send "Edu-Kit" C.O.D. I will pay $19.95 plus postage (U.S.A. only).
- ☐ I wish additional information describing "Edu-Kit". No Obligation.
- ☐ Send me FREE Radio-TV Servicing Literature. No Obligation.

Name .....

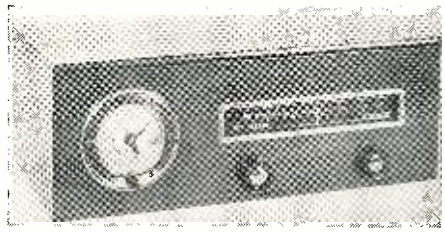
Address .....

.....

PROGRESSIVE "EDU-KITS" INC.
497 UNION AVE. Room 40E, Progressive Bldg. BROOKLYN 11, N. Y.
On shipment to a New York City address, add 30¢ sales tax.

clock-timer unit installed in a cabinet complete with three-way a.c. outlet makes it possible to preset the tuner to automatically turn a complete high-fidelity system on or off.

The new unit, Model CL, is available in either blonde or mahogany finishes. The "Brownie" tuner can be inserted in the cabinet using just a screwdriver.



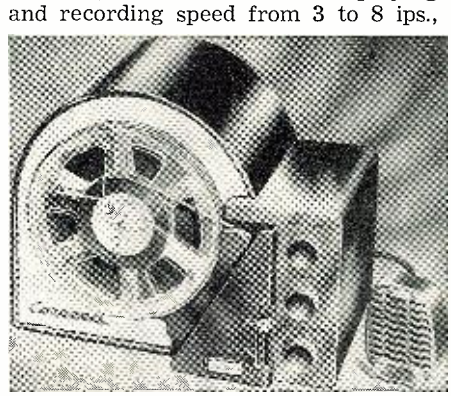
The timer units are available with or without the companion FM tuner. A free descriptive booklet is available from the company on request.

NEW-DESIGN RECORDER

Tape Recorders Incorporated, 1501 W. Congress St., Chicago 7, Illinois, is now offering a two-speed, dual-track magnetic tape recorder of radically new design.

Known as the "Tri-Fy Carousel," the unit is a continuous-play recorder which is designed to accommodate all reels up to 10½", mounted coaxially in a vertical position, and will play up to 8 continuous hours before repeating itself automatically and endlessly while the set is in operation.

A finger-tip control varies playing and recording speed from 3 to 8 ips.,



and provides perfect pitch control for speech and voice training. Other features include high-speed differential 2-way wind, 8" speaker, and all-triode amplifier.

A data sheet giving complete specifications is available on request.

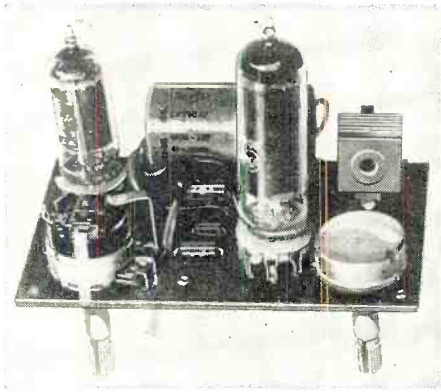
PC AMPLIFIER ASSEMBLY

Photocircuits Corporation, Glen Cove, New York is now offering a low-cost, compact printed-wire audio amplifier assembly which is designed to be used as an amplifier alone or incorporated into equipment as a subassembly.

Measuring only 2½" wide x 4⅛" long x 1¾" deep, exclusive of control shafts, this two-stage unit produces up to 2 watts output, sufficient for many audio applications.

The amplifier is complete, including volume and tone controls, except for

an output transformer which is usually mounted on the speaker. Frequency response is flat to 8000 cycles.



Input voltage requirements are .2 volt. A 12AT6 is used as a voltage amplifier driving a 50B5 power output tube. The power supply for the amplifier uses a selenium rectifier.

P.A.-SOUND CABLE

Belden Manufacturing Company, Chicago, Ill., has announced a newly designed p.a. and sound system cable which offers improved efficiency and economy of installation, according to the manufacturer.

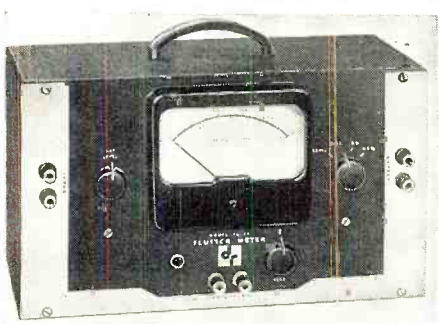
The No. 8790 is a balanced twisted pair which features a new spiral wrapped tinned copper shield. The spiral is easily unwrapped, twisted, and soldered.

The color-coded twisted pair provides line balance and eliminates crosstalk. It has a smooth surface and measures just .225" o.d.

FLUTTER AND WOW METER

D&R Limited, 402 East Gutierrez St., Santa Barbara, California is now marketing a new portable flutter and wow meter, the Model FL-3B.

Designed to measure flutter and wow at 3 kc. in tape, film, wire, and disc recording and reproducing equipment, the instrument features an internal 3 kc. oscillator which eliminates the need for additional equipment to initiate a measuring signal. The stability of this oscillator is factory-adjusted to a secondary frequency standard. The unit will give full limiting with an input signal of .4 volt



r.m.s., thus permitting measurements to be taken from a standard 0 dbm program line.

The company will supply complete specifications on the Model FL-3B upon request. —30—

RADIO-TV Service Industry News

AS REPORTED BY THE
TELEVISION TECHNICIANS LECTURE BUREAU

THE two things that are uppermost in the minds of the operators of service businesses today are: (1), how to maintain an adequate volume of business, and (2), how to reduce operating costs.

Maintaining an adequate volume of business is, of course, a never-ending problem. Old customers have a habit of slipping away and it takes a continual promotion to add a percentage of the new customers as "regulars."

The service businesses that handle dealer service are, of course, in the best position to maintain an adequate volume of business. They get complete records of the customers who buy from their dealer accounts. Each purchaser of a TV set is a potential buyer of approximately two and one-half service calls per year. The experienced TV service operator tries to keep all of these calls for himself by maintaining contacts with these set owners, by mail. Many service businesses that handle dealer service do not advertise in the telephone directory or other conventional advertising channels. They use their advertising funds to keep their names before the customers whose warranty contracts they have handled, using mailing pieces that have a good customer relations slant.

Theoretically, when a service business builds a mailing list of one thousand known owners of TV sets, that list will represent a potential market for 2500 service calls per year. This would figure out to be about 48 calls per week on an average. Using generally accepted national figures, 42 of these service jobs would be completed in the home and six sets would be pulled to the shop each week for service. If proper service charges are made and the business is well managed, this theoretical potential would support the shop owner (provided he is a good bench technician), a field service technician, and a combination office girl and telephone operator. If the shop owner organizes his time properly, he will be able to maintain his dealer contacts, handle some of the field service calls on rush days, and supervise the work of his technician and his office girl. By maintaining his dealer contacts, the new service referrals would more than offset the normal attrition that takes place among the regular customers of any business. Actually, the customer list should grow steadily so that in the course of time, more technical help will be added.

Customer Relations

The important factor in the growth of such a business is the ability to maintain good relations with its customers. This includes the constant use of good customer relations practices in the day-to-day contacts with them. It also requires the maintaining of liaison with customers during the periods between service calls.

Service businesses that have been built through the handling of dealer service usually use one or more of three methods for maintaining good customer relations by mail and keeping their customers conscious of the service company. With a variety of forms, contacts are maintained by the regular use of:

1. A letter or card mailed the day after each service call, thanking the customer and reminding her that if anything about the service was not satisfactory to be sure to call the service manager about it.

2. Letters or cards mailed to the complete customer list at regular intervals to keep the service company's name before them.

3. "We've missed you" type of letter sent to customers who have not called for service in eight or ten months, or in some cases, a year. The time interval employed varies with companies.

These programs have proven very successful for the service shops that use them regularly. If the office work and record systems are well organized, all three plans can be carried out as a part of the normal routine of the business.

It is preferable to use a printed letter or card as a follow-up after each service call. These can be addressed each morning by the office girl or bookkeeper. A conventional item used by large service companies is a printed "Thank You" card with a postage-paid, return mailing card attached. Typical copy on these cards reads like this:

"We wish to sincerely thank you for calling us in to service and thoroughly check your television set.

"We want to be sure the work is entirely satisfactory and that your set is working properly.

"Because professional men never take ethical service for granted, and because our business is based on a long record of satisfied customers, would you kindly check the postage paid reply card attached and drop it in the mail at your convenience?"

The reply card should be devised to make it easy for the customer to check the following:

"Your technician . . .

Repaired my television set to my satisfaction

Did not repair the set to my satisfaction

He was courteous

He was not courteous"

A few lines are provided for the customer's suggestions, comments, and questions. Finally, three lines are provided and marked: "Name", "Address" "Telephone."

A general mailing can best be done if customer's names are maintained on mailing plates. Since there are several inexpensive addressing systems on the market, the small cost of a mailing plate is a good investment when considered in the light of its potential return in service income. Each name placed on the list is a known TV set owner who is a potential purchaser of at least $20.00 worth of service each year.

It requires some method of quickly identifying the date of the last service job on each account to economically handle the follow-up letters to dormant accounts. This is not a difficult project if the plan for it is incorporated in the paper control system used by the service business. However, it is time consuming if all service records must be examined at intervals to determine the names of the customers who have not called for service in a long time.

The cost of using these methods for maintaining the business of old customers is less than the cost-per-customer for advertising and promotion carried out in the normal way. The main thing is to build up a large enough list of known TV set owners that under the normal operation of the law of averages will keep a regular flow of set owners calling.

C.O.D. Business

Service businesses that are being built on C.O.D. business developed through advertising have a harder job of maintaining a consistent volume of business. The customers who call purely on the basis of what they have read in an ad are those who have been abandoned by the dealers who sold them their sets or have drifted away from the service shop that originally handled their work. If the selection was inspired by a special price mentioned in the ad the chances are the customer will prove to be one of those who is impossible to please.

Men who are building businesses on

the basis of fair dealing with their customers and adequate charges for their labor, occasionally feel the full blast of customer idiosyncrasies when they try some kind of a free gimmick to promote business. For instance, one service operator got involved in a special promotion in which coupons were distributed that entitled the holder to a free service call the next time his TV set needed service. However, the coupon clearly stated that only the service charge was free, and the coupon holder would have to pay for the tubes or parts necessary to perform the service. It was a perfectly legitimate promotion in which the coupon holder actually saved the normal five-dollar service charge made for a home call in the area where the deal was promoted.

However, the service operator soon discovered that the coupon holders did not read the coupon which stated clearly "Service Charges Only Free—Standard Charges for Parts and Tubes Needed to Complete Service." The coupon holders expected everything free and complained bitterly when they found they had to pay for tubes and parts. Some even threatened to call the Better Business Bureau and complain about the plan as a racket despite the fact that all conditions were clearly stated on the coupons and in all promotions in connection with them.

As one service shop owner expressed it: "We have fringe and submarginal customers just as there are fringe and submarginal technicians. They always try to get something for nothing. In most of the cases we have checked where set owners were gypped by some service technician, we found that the customer was just asking for it when he tried to get something for nothing."

The service shop that operates entirely on business promoted through advertising is seriously affected by the seasonal swings in business. However, it is possible to fill in the gaps in service income through inexpensive promotions based on local needs and conditions.

Those who operate two- and three-men shops say they find that house-to-house distribution of flyers and other service promotion pieces is more effective and economical than other methods of advertising. It provides a concentration of the promotion in a selected area. No mailing list is necessary, of course, and there is no addressing cost involved. In areas checked by your editors, the house-to-house distribution was handled by high school students who were contacted through the employment counsellor of the local high school.

Methods for promoting business vary widely, of course, in relation to the size of the service company and are governed by their basic methods of operation. Larger companies use specially-prepared promotional campaigns designed for maximum effectiveness in the areas where they operate. But

whether large or small, new business promotion is as necessary today in the successful operation of a service business as competent technical know-how to repair sets.

Operating Costs

One of the classic stories of the early days of TV was that of the radio service shop owner who jumped into television without any planning. During his first year he worked hard to do ten-thousand dollars worth of business. At the end of the year he discovered to his disgust, that he had spent eleven-thousand dollars to do that ten-thousand dollars worth of business.

It is comparatively easy to do a lot of business and lose money doing it. Management is what spells the difference between making money and losing money in business. Men who manage their businesses are constantly concerned with what it is costing them to do business.

In an electronic service business it is necessary to have a steady flow of customers to buy the service and the replacement parts it has to sell. That means it is necessary to advertise and promote the business constantly. This raises a natural question: What percentage of the gross income of a service business should be allocated to advertising and sales promotion?

Then there is the cost of transportation necessary to carry on a normal or average TV service business. Autos and trucks are expensive and the cost of operating and maintaining them is no small item in the conduct of a service business. The service business must not only pay the cost of operating and maintaining this equipment, but it must make enough money to buy new vehicles at regular intervals.

New tube types and an ever-growing list of replacement components require constant additions to the basic inventory if the technician does not want to lose a large part of his productive time in trips to his jobber for needed tubes and parts. As the inventory grows, possible loss from stock obsolescence grows with it. Parts and tubes that gather dust on the shelves are a dead loss to a service business, yet money had to be earned to pay for them.

The number of test instruments needed in a service shop has kept step with the advancing technology of the industry. These instruments eventually wear out or become obsolete and they must be replaced out of service income.

Add to these the various and sundry expenses that are involved in the operation of any business, large or small, and it all adds up as part of the deadweight known as "overhead" that every business must carry. Of course, there is rent, light, heat, telephone, wages, taxes, and a host of other expenses a business must carry and which the business must earn before the owner can rightly start calling the income his own.

The wide variety of businesses engaged in electronic service presents a substantial problem in preparing percentage figures that would be applicable across the board. In studying management requirements and cost factors in the operation of service businesses, your editors have reached the conclusion that there are four basic businesses in relation to size, each of which require percentage tables to meet their individual needs. In general, these four categories in size are: (a) One-man service operations; (b) Two- to five-men businesses; (c) Six- to ten-men businesses; (d) Businesses that employ more than ten men.

In appraising the survival problems in a one-man service business, it is necessary to define the type of business involved. It is also necessary to differentiate between businesses as to the type of electronic service handled. For instance, a one-man shop specializing in radio and phono service where the customers are in the habit of bringing sets to the shop will have an entirely different set of expense ratios than the individual who handles television service in homes and uses a telephone answering service to handle his calls. The cost of transportation would be no factor in the operation of the radio service shop, whereas it would be a major item to the television service technician. On the other hand, the TV technician could operate out of a location where rent was a minimum item but the radio shop would have to be located in a good traffic location for customers to bring in their sets.

Another type of business that is common in TV service is that operated by a good TV technician with his wife as active partner. This type of business, however, would have to be classified as a two-man service operation.

As a service to the industry, your editors are undertaking a survey to develop factual information on the costs of operating service businesses and, percentage-wise, how these costs are spread over the various elements that are involved in the operation of a service business. The four different size categories of service businesses will be handled separately.

Readers of RADIO & TELEVISION NEWS who wish to participate in this survey may obtain a Survey Form by sending a stamped and addressed envelope to TTLB Special Services Department, P. O. Box 1321, Indianapolis, Indiana. The survey will not require you to divulge your business income in dollars. It will provide for the needed information in percentages. Those who participate will receive a brochure covering operating cost percentages in all four of the categories at the conclusion of the survey. —30—

HOW TO TIME YOUR TAPES

THE length of recording and playing time you get on your recorder depends upon a couple of things. One important factor is the length of tape used. "Scotch" brand magnetic tape and most of the other tapes come in set standard lengths—150, 300, 600, and 1200 foot lengths are most common for home recorders. Professional machines and some of the new high-fidelity recorders can take tapes of longer lengths which are also available. The longer the length, the longer the recording time.

To meet the demand for more playing time on a reel of tape, there are now thinner, long-play tapes which give 50 per-cent extra tape and playing time on a standard reel. These extend the limits of many home type recorders which could not accommodate larger reel sizes. They come in lengths starting at 900 feet and going up to 7200 for the largest professional reels.

The other determining factors in tape playing time are in the type of recorder you use—the playing time it offers—and whether it has a full track or half track record head. Some of the tape recorders most commonly used run at 3¾ inches-per-second, others at 7½ inches-per-second, and some combine both speeds. Professional machines are apt to use the 15 inch speed and some even go up to 30 inches. The faster the speed, the less recording time will you get on the same length of tape.

A full track recorder records the whole width of the tape, making it easy to edit and splice recordings without losing any part of the recorded portion.

If your machine has a half track record-playback head, the tape can be recorded on one half its width at a time. This allows you to get double the playing time of your recorder at any speed by reversing the reel.

For an easy handy reference, the accompanying table lists all standard lengths of tape, both regular and "Extra-Play," and states how much recording and playing time can be gotten on them at various standard speeds.

This information and chart were supplied through the courtesy of Minnesota Mining & Mfg. Co., makers of "Scotch" recording tape. —30—

REEL SIZE (in.)	TAPE LGTH. (feet)	UNINTERRUPTED RECORDING TIME* FOR VARIOUS TAPE SPEEDS AND TAPE LENGTHS (TAPE SPEED—inches per second)						DUAL TRACK TIME	
		15/16 ips	1⅞ ips	3¾ ips	7½ ips	15 ips	30 ips	3¾ ips	7½ ips
3	150	½ hour	15 min.	7½ min.	3¾ min.	.....	.....	15 min.	7½ min.
4	300	1 hour	30 min.	15 min.	7½ min.	3¾ min.	1⅞ min.	30 min.	15 min.
5	600	2 hours	1 hour	30 min.	15 min.	7½ min.	3¾ min.	1 hour	30 min.
5	900**	3 hours	90 min.	45 min.	22½ min.	11¼ min.	5⅝ min.	1½ hour	45 min.
7	1200	4 hours	2 hours	1 hour	30 min.	15 min.	7½ min.	2 hours	1 hour
7	1800**	6 hours	3 hours	90 min.	45 min.	22½ min.	11¼ min.	3 hours	1½ hrs.
10½	2400	8 hours	4 hours	2 hours	1 hour	30 min.	15 min.	4 hours	2 hours
10½	3600**	12 hours	6 hours	3 hours	90 min.	45 min.	22½ min.	6 hours	3 hours
14	4800	16 hours	8 hours	4 hours	2 hours	1 hour	30 min.	.....	.....
14	7200**	24 hours	12 hours	6 hours	3 hours	90 min.	45 min.	.....	.....

*Single track only. For dual track recording, double the time.
**"Scotch" brand "Extra-Play" magnetic tape No. 190.

Technical BOOKS

"TV MANUFACTURERS' RECEIVER TROUBLE CURES" edited by Milton S. Snitzer. Published by *John F. Rider Publisher, Inc.*, New York. 114 pages. Price $1.80. Paper bound. Vol. 6.

This newest volume covers *Admiral, Aimcee, Arvin, Bendix, Cadillac, Capehart, CBS-Columbia, Conrac, Crosley, Du Mont, Emerson,* and *Firestone* television receivers and carries the troubleshooting hints supplied by the manufacturers on their particular sets.

All types of servicing hints are included from removing and cleaning safety glass to replacing transformers. The material is presented in concise form and specific recommendations are made for all replacements required.

Like previous volumes, this compact handbook is designed to be carried in the service kit or kept on the bench bookshelf.

* * *

"THE RADIO AMATEUR'S HANDBOOK" by ARRL Staff. Published by the American Radio Relay League, Hartford, Conn. 768 pages including catalogue section. Price $3.00. Thirty-Second Edition.

The very fact that this *is* the Thirty-Second Edition of the amateurs' "bible" is its own endorsement. Year after year this publication has provided comprehensive and authoritative information on all phases of amateur operating practices and equipment.

The 1955 Edition contains revised vacuum tube tables and base diagrams. Two full pages listing 67 new tube types have been added to the miniature-tube section alone. Further additions include 26 crystal diodes, 19 rectifiers, 17 transistors, and 32 other types.

The chapters on v.h.f., high-frequency transmitters, etc. have been revised, increased in scope, and improved to reflect the most recent developments in these fields.

In addition to the amateur fraternity, this handbook is an excellent reference work for home study, classroom work, and as an all-around source book.

* * *

"TELEVISION FOR RADIOMEN" by Edward M. Noll. Published by *The Macmillan Company,* New York. 770 pages. Price $10.00. Revised Edition.

During the years since the author's original text appeared, things have been happening in the television field at a tremendous rate! The service technician is as aware of this growth as the engineer in the laboratory and is often staggered by the vast amount of information he is expected to have at his fingertips to cope with his everyday servicing jobs.

This new edition has been brought completely up to date. New chapters on u.h.f., color television, and transistors have been added in line with the devel-

opments in the field. The section on u.h.f., for instance, includes detailed data on antennas, converters, installation, u.h.f. test equipment, and specific instructions for obtaining the strongest possible u.h.f. signal. The transistor treatment deals with the function of the component, the major types of transistors, and typical transistor circuitry.

A "second book" is included covering color television, theory and practice. This second book follows the main section and is a complete entity, having its own page numbering and separate set of diagrams and explanatory material.

Service technicians, students, and engineers will all find this book of special value. As a reference work and practical day-to-day handbook, this book would be hard to beat.

* * *

"RADIO RECEIVER SERVICING" by John T. Frye. Published by *Howard W. Sams & Co., Inc.,* Indianapolis. 186 pages. Price $2.50. Paper bound.

Despite the reams of material on the subject of television, radio is far from its deathbed. Last year millions of radio receivers were sold to the public indicating that there is still an active interest in AM and FM programming. Most homes now boast two or more radio receivers and portables are part of the "standard equipment" of most teenagers.

All of this means a healthy source of income for service technicians and those who overlook this pleasant means of making a livelihood are making a mistake, according to the author of this book.

Readers will immediately recognize the author as the writer of "Mac's Radio Service Shop" which appears monthly in this magazine. The same relaxed, unhurried style that has made this feature so popular with our readers characterizes Mr. Frye's newest book. The book is progressive in that the author covers the most-often-encountered troubles first and then advances to the rarer and less familiar circuit faults.

The text material is thoroughly practical and all the procedures described are those which the author has used during the quarter of a century in which he has been actively engaged in service work. The book contains none of that high-flown theoretical material that so often detracts from the value of handbooks for service technicians. The reader can use every bit of the material included in this little book to help him become a confident and skilled service technician.

* * *

"INTRODUCTION TO UHF CIRCUITS AND COMPONENTS" by Milton S. Kiver. Published by *D. Van Nostrand Company, Inc.,* New York. 403 pages. Price $7.50.

This is another of Mr. Kiver's lucid expositions and covers all phases of u.h.f. circuitry of interest to technicians, amateurs, students, and engineers.

The author discusses u.h.f. television, microwave relay stations, u.h.f. receivers and transmitters, resnatron and traveling-wave tubes, klystrons and magnetrons. In addition the text discusses transmission lines, wave guides, u.h.f. antennas, and measurements with emphasis on practical applications.

As was the case with the author's previous books, this work avoids, insofar as is possible, the purely mathematical and theoretical approach. The material presented is as practical as possible so that the reader may derive maximum benefit from his studies.

Self-testing questions are included at the end of each chapter as a check on the reader's grasp of the subject matter. The use of hundreds of photographs and circuit diagrams serves to enhance and clarify the text material if such enhancement and clarification is required.

Mr. Kiver is still batting 1.000 percent with this book and those of our readers who have been following his articles in this magazine will find this material on u.h.f. just as helpful and worthwhile.

* * *

"SINGLE SIDEBAND FOR THE RADIO AMATEUR" compiled by the ARRL staff. Published by American Radio Relay League, Hartford, Conn. 174 pages plus catalogue section. Price $1.50. Paper bound.

This is a compilation of material which originally appeared in *QST* in the form of articles. Thirty authorities in the field of single-sideband transmission and reception are represented in this slim volume.

The text material covers a discussion of this technique, the construction of SSB equipment, the construction and adjustment of SSB exciters, amplifiers, receivers, and accessory gear.

Where the articles included in this compilation made their appearance some time ago, the text material and circuitry have been revised to bring them up to date and in line with present-day SSB techniques.

Radio amateurs will welcome this valuable addition to their reference libraries since it represents, between a pair of covers, most of the current thought on the subject. —30—

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ERRATUM

The price of the 3-speaker hi-fi Model HT-225 tape recorder in the G.L. Electronics, Inc. ad (page 155, February 1955 issue) should have been $168.75 instead of $139.50 as quoted.

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Rate 50c per word. Minimum 10 words

RADIO ENGINEERING

COMPLETE radio, electronics theory & practice; television; broadcasting; servicing; aviation, marine, police radio. 12 or 18 months. Catalog. Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

FOR SALE

SCINTILLATION Crystals. Sodium Iodide, Thallium activated hermetically sealed tested. 1"x1" $75, 1½"x1" $120. 1¾"x2" $250. Shelby Instrument, 1701 Magnolia, Long Beach, Calif.

TUBES—70% to 90% Discount. Government, manufacturers, jobbers, etc. surplus. Guaranteed 1 year. Free catalog on request. Cadillac Trading, Dept. AD, 231-07 Linden Blvd., Jamaica 11, N. Y.

TV TRADE-In sets. Philco, R.C.A., Emerson, others. List available. 10"—$17. 12" to 17"—$20 up. Washtek Service Co., Dept. R, 1501 Boston Road, Bronx, N. Y.

ALUMINUM Tubing, Angle and Channel, Plain and Perforated Sheet. Willard Radcliff, Fostoria, Ohio.

FREE: Get our monthly electronic lists. Dick Rose, Everett, Wash.

FOR Sale—Geiger counter Kits $38.50. Geiger Counter & Scintillator Diagrams $1.00. Free Catalog. "R. F. Chambers," 13833 San Antonio Dr., Norwalk, Calif.

WALKIE-Talkie. Build a real wireless two-way portable radiophone for less than $10.00. Plans 50¢. Springfield Enterprises, Box 54-H4, Springfield Gardens 13, New York.

FIDELITY Unlimited—Built By Service and Quality. Authorized Distributors of the finest Hi-Fidelity Tuners—Speakers—Amplifiers—Turntables—Etc. Full Line. Audio Consulation Service For "Best Buys." Shipment Prepaid and Insured. Top Allowance for used Equipment. Visit our showroom or Write Today Answer Via Airmail. To our customers throughout the U. S., Thanks. Fidelity Unlimited, 63-03 39th Ave., Dept. RN, Woodside 77, N. Y.

DIAGRAMS for repairing radios $1.00. Television $2.00. Give make, model. Diagram Service Box 672-RN, Hartford 1, Conn.

TV-FM antennas. All types including UHF. Mounts, Accessories. Lowest prices. Wholesale Supply Co., Dept. H, Lunenburg, Mass.

TELEVISIONS. Working. $30 up. W1API, 1420 South Randolph, Arlington 4, Virginia.

TV Sets $17.00. Tubes 29¢. Jones, 1115 Rambler, Pottstown, Pa.

DIAGRAMS—Radio $1.00; record changers, recorders $1.25. Television with service data $2.00. Where model unknown, give part numbers. Kramer's Radio Service, Dept. S53, 36 Columbus Ave., New York 23, N. Y.

TAPE Recorders, Tapes, Accessories. Unusual Values. Dressner, Box 66R, Peter Stuyvesant Station, N. Y. 9.

TUBES and equipment bought, sold, and exchanged. For action and a fair deal write B. N. Gensler, W2LNI, 136F Liberty, N. Y. 6, N. Y.

HI-FIDELITY Bargains—Band new, factory packed Collaro RC-54, Dual sapphires, 45 spindle—$38.75. Fenton (English) Hi-Fidelity Basic 7½ IPS tape recorder with three 4-pole motors, push button controls and head—$49.85. All Items Prepaid. Tuners, Amplifiers, Speakers, Baffles, Turntables, etc. All Low Priced, New, Prepaid—Write Today. Fidelity Unlimited, 63-03 39th Ave., Woodside 77, N. Y.

RESISTORS, condensers, micas, electrolytics, chokes, etc., thousands of latest pigtail types, new, some leads cut & formed. Eleven pounds for $9.00. Prepaid. Cagan Sales, Box 1152, Rochester, New York.

MANUFACTURERS' Surplus—Build your own Electronic Organ from these basic units: 60 note triple stacked shunt keying mechanisms, octave wired isolating resistor to each palladium contract. Three types available: Great 16', 8', 4'; Swell 8', 4', 2⅔'; Single Manual 16', 8', 4', including 12 pedal bass notes. $10.00 each. Tone generator sub-assemblies consisting of 21 400V. and 600V. capacitors and 15 resistors. $.50 each. Special linear movement swell controls in 60 steps, 100K resistance $5.00 each. Radio & Television News, Box 545.

WANTED

AN/APR-4, AN/APR-9, other "APR-," "ARR-," "TS-," ARC-1, ARC-3, ART-13, everything surplus; Tubes. Manuals. Laboratory equipment. Describe, price in first letter. Engineering Associates, 434 Patterson Rd., Dayton 9, Ohio.

WANTED: Type R19/TRC-1 Receivers. Box 543, Radio & Television News.

WILL Buy All. Art-13/type T-47A $225.00 Art-13/type T-47 $150.00. BC-788C Altimeter Receiver, $150.00. R5/ARN7 Radio Compass $160.00. ARC-3 Complete $185.00. BC-348 Rec'r Modified $35. BC-348 Rec'r unmodified $50. ARC-1 Radio $150.00. BC-312 Rec'r $40.00. BC-342 Rec'r $50.00. Ship Via Express C.O.D., Subject to inspection to: H. Finnegan, 49-57 Washington Ave., Little Ferry, New Jersey.

REWARD! Large manufacturer has national electronic jobber distribution. Wants new products, ideas. (Radio-TV service aids, TV antennas; indoor, outdoor, UHF, VHF, combinations). Liberal purchase or royalty for good item. Mail brief product resume. Personal contact later. Radio & Television News, Box 546.

WANTED—ART-13 transmitters, parts, and components, DY-12 and DY-17 dynamotors, CU-25, etc. Also ARC-1 and ARN-7 material. Advise price condition first letter. Florida Aircraft Radio & Marine, Inc., P.O. Box 205, International Airport Branch, Miami 48, Florida.

WESTERN Electric-Type 728B-12" Speakers—State Price. Thomas R. Schreiner, 666 East Utica Street, Buffalo 11, New York.

HELP WANTED

TELEVISION Jobs—Names and addresses of companies to contact. $1.00. Fitzgerald, Dept. A-14, 815 Countryside Drive, Wheaton, Illinois.

INSTRUCTORS, well-versed in Radio and Television. Send complete resume of education and experience to Educational Director, Electronics Institute, Inc., 21 Henry Street, Detroit 1, Michigan.

CORRESPONDENCE COURSES

USED correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Ala.

MISCELLANEOUS

ALL makes speakers repaired. Amprite Speaker Service, 70 Vesey St., New York City 7.

RECORDISTS! Exchange talking and musical tapes internationally! Box 1404-G, San Francisco 1.

TEST Equipment Repaired and Calibrated by Factory staff. All makes. Superior, Simpson, Triplett, etc. Free estimate. Our nineteenth year. Douglas Instrument Laboratory, 176 Norfolk Avenue, Boston 19, Mass.

COLOR Television from Standard TV using color wheel. simple converter. Details, Colordaptor, 3471 Ramona, Palo Alto, Calif.

CORRECTION

Due to an oversight, the prices carried in the E. F. Johnson Company advertisement on page 138 of the March issue of Radio and Television News were not labeled "complete kit prices only."

When you order by mail . . .

please print your name and address clearly, be specific in your order, enclose proper amount, allow ample time for delivery.

"TAB"
THAT'S A BUY

VARIABLE VOLTAGE XFMRS
SUPERIOR-GR-STACO-UTC

0-132V 1.2SA ..... $ 7.99
0-135V 3A 11.25
Cased 0-135V 7.5A 20.70
Uncased 0-135V 7.5A ... 16.20
Cased 0-270V 3A 23.40
Uncased 0-270V 3A $18.00
Cased 0-135V 15A 41.98
Cased 0-270V 9A 41.98
SIX OR MORE 10% DISC

MONTHLY BARGAINS
C.D. Condenser BT14/.012/ 2500OWVDC..$4.98; 3/$12
Pentode. Output Xfmr to V.C. ..... for $3
IF Trans. 456KC. 49c; 6/$2
HS30 Cord CD 620R: 12/$5
Planetary Drive 5:1 & 1 to 1 ..... $2.49
Brach MCD4 Neon Arrestor ..... 3/$1.00
Isol. Transformer VS 110 to 220 or 440/ 150 watt ..... $4; 2/$7
Globar T2FD/350 ohm/500W RF Asst.. $2

NEW OIL CONDENSERS
1.3 MFD/2400WVDC ...$1; 4/$3
1.5 MFD/3000WVDC ...$2; 3/$5
25 MFD/1000WVDC...$8; 6/$36
26 MFD/1000WVDC...$8; 6/$36
48 MFD/1000WVDC..$11; 2/$18
0.25 MFD/1200WVDC.30c; 20/$3
0.38 MFD/2400WVDC..... 29c; 25/$3
Write for Complete Listing & Qty. Price

HI CURRENT POWER SUPPLIES GTD*
Variable 0-28VDC, Completely Built, Full Wave Selenium Rectifier, Transformer, Variac, Volt & Amp Meters, Switch, Terminals & Fuse. In Hvy Dty Steel Cabinet. Std 115V 60 Cy Input. 110 & 220 Vt. 3 phase to order. *One year.

Stock Number	Continuous Rating	With Meters
T28V5A	0-28 WVDC at 5Amp	$45
T28V5ACC	5Amp (1% Ripple)	$69
T28V12A	0-28 VDC at 12Amp	$99
T28V/12ACC	12Amp (1% Ripple)	$139
T28V24A†	0-28 VDC at 24Amp	$135
T28V/24ACC†	24Amp (1% Ripple)	$195
T28V50A†	0-28 VDC at 50Amp	$260
T28V/50ACC†	50Amp (1% Ripple)	$370
T28V100A†	0-28 VDC at 100Amp	$469
T28V/100ACC†	100Amp (1% Ripple)	$650

NEW! LOW PRICED HI CURRENT BASIC SUPPLIES
Consisting of Transformer & Full Wave Bridge Rectifier mfd & wired with no frills. Ready to deliver Constant DC power.

Stock Number	Continuous Rating	Basic
B28V/5A	0-28 WVDC at 5Amp	$35
B28V/5ACC	5Amp (1% Ripple)	$49
B28V/12A	0-28 VDC at 12Amp	$75
B28V/12ACC	12Amp (1% Ripple)	$109
B28V/24A	0-28 VDC at 24Amp	$110
B28V/24ACC	24Amp (1% Ripple)	$159
B28V/50A	0-28 VDC at 50Amp	$205
B28V/50ACC	50Amp (1% Ripple)	$339
B28V/100A	0-28 VDC at 100Amp	$395
B28V/100ACC	100Amp (1% Ripple)	$499

HEAVY DUTY BATTERY "FAST" CHARGER RECTIFIER
13-0-13V (CT) 100 Amp Fan Cooled or 34 Amp Air Cooled. Repl'mt 6V Booster Charger. Model CR16 $10.3/$27. 16-0-16V (CT) Fan Cooled. For 12V/60A and 6V/100A Booster Charger. Model CR30 $11; 3/$30

Convert Your 6 V "Fast" Chgr to 12V/50A As Well As 6V/100A Use
Details & Rectifier....$22.00 ea; 3/$60
BCT-2/1A 2V Battery "TR" Chgr...$3.98
BCT-6-12/2A 6&12V Batt."TR" Chgr.$7.98

NOW POWER YOUR GOV'T SURPLUS
Rec'rs & Transmitters From the Set Power Pack or Dynamotor. From 115 or 230 VAC.
B28V/5A for ARC5, BC312, 342, 348 $35
B28V/24A for BC654 or BC375..... $79.95
B12V/50A for BC191 ..... $110
B28V/100A for ART13 ..... $395

NEW RECTIFIER CHOKES
CH1/1AMP/0.1HY/1.4R/3± $3.95
CH2/2AMP/0.1HY/.67R/3± $5.95
CH07/5AMP/.07HY/.6R 10± $7.95
CH01/12AMP/.01HY/.1R/12± $14.95
CH004/24AMP/.004HY/.025R/20± .. $29.95
CH001/50A HIPERSIL Core $54.00
CH0035/70A/.0035 Hys/.0096R $66

NEW RECTIFIER XFMRS
Primary 115V 60 Cyc
Sec. at 18-15-9-0-9-15-18V

5 Amp ..... $8.65; 2/$15.75
12 Amp ..... $16.65; 2/$29.95
24 Amp* ..... $35.75; 2/$69.95
50 Amp* ..... $59.00; 2/$112
100 Amp* ..... $108.00; 2/$210
18 Volt only 2 Amps $1.98
*Dual Primary 115 & 230 Volt.

NEW "TABTRON" SELENIUM BRIDGE RECTIFIERS DATED & YR GTD
We mfg. Power Rectifiers to your specs. From 1 Amp up to and above 1000 Amps. Following List. Full Wave Bridge.

Curr. Cont.	18/14 Volts	36/28 Volts	72/56 Volts	130/100 Volts
1AMP	$1.35	$2.35	$4.50	$8.35
2AMP	2.00	2.75	5.90	10.30
3AMP	2.95	4.15	7.90	12.90
4AMP	3.50	7.35	14.35	25.00
6AMP	4.25	8.75	17.50	32.80
10AMP	6.30	12.15	24.80	41.50
12AMP	7.90	15.75	29.75	45.75
20AMP	13.05	25.05	48.75	78.50
24AMP	16.05	31.95	57.65	85.00
30AMP	19.50	37.60	71.05	110.00
36AMP	23.75	47.75	86.95	135.00
50AMP	31.00	61.50	105.75	175.00

RECTIFIER & TRANSFORMER COMBO
115V/60 Cy Inputs
Up to 14VDC at 12 Amps..... $19.98
Up to 28VDC at 5 Amps..... $15.65
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Up to 28 VDC at 24 Amps*..... $59.98
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*Transformer has 115 & 230 V Primary.

VARIABLE DC POWER SUPPLY
Full Wave Rectification. 6000 Mfd filter condenser, fused. 6.3V or 12.6V at 2 amp. operates 115V/60cy.
Model 2DCF.... $12.98
As above except 5-Amp
Model 5DCF.... $29.95
Model 5DCF ACC/5amp/1% Ripple. $32.50

• 1ST QUALITY • NO ELECTRICAL OR MECHANICAL REJECTS •
• HICKOCK MU TESTED 1 YR. GTD. • FULL RETMA WARRANTY •

TUBES

TUBE ORDERS OVER $20, WITH FULL PAYMENT, PREPAID TO YOU IN U.S.A. To Get This Deal, Mention 4RN5

0A2	.74	1C7	.49	1T5	.98	2K39	160.00	5AN8	1.05	6AR5	.79	6SA7	.67	12SR7	.46	701A	1.95	5608A	3.10	CRYSTAL DIODES	
0A2WA	4.15	1C21	3.69	1U4	.52	2K4S	75.05	5AW4	1.37	6AR6	2.74	6SC7	.74	14A7	.89	703A	1.48	5638	9.99	1N21	.32
0A3	.98	1D5	.69	1U5	.54	2V3	2.90	5AX4	1.22	6AS7	3.48			14N7	1.09	705A	.98	5641	6.59	1N21A	1.48
0B2	.74	1D7	.49	1V2	.68	2X2A	1.15	5AZ4	.54	6AT6	.42	6SF5	.68	FG17	3.01	710A	1.68	5656	9.98	1N21B	2.02
0B2WA	4.15	1D21	3.49	1X2A	.88	3A4	.48	5C22	29.57	6AU4	.97	6SG7	.62	19BG6	1.98	715A	1.51			1N22	.95
0C3	.88			2A3	1.27			5CG7	1.98			6SH7	.62	24A	.92	717A	.46	5663	1.06	1N23	1.48
0D3	.78	1E5	.69	2A6	1.49	3A5	.86	5J29	10.09	6AU6	.48	6SK7	.62	25BQ6	1.30	721A	.98	5670	2.24	1N23A	1.78
0Z4	.50	1E7	.49	2C21	.75	3A8	1.50	SR4GY	.96	6AV6	.48	6SN7	.59	25L6	.46			5672	1.27	1N34A	.88
1A3	.85	1F4	.49	2C26A	.49	3B4	2.70	5T4	1.48	6AW6	1.09	6SQ7	.56	25W4	.75	723A/B	17.98	5676	1.05	1N34	.45
1A6	.75	1G4	.69	2C34	.40	3B7	.56	5U4G	.54	6AX4	.81	6T4	1.35	25Z5	.75	724B	.96	5678	1.05	1N35	1.55
		1G6	.69			3B24	1.51			6B4	1.12	6V6GT	.56			725A	8.94	5692	6.48		
1A7	.96	1H4	.49	2C36	25.09	3B24	2.55			6B5	1.18	6W4	.38	35B5	.54	750TH	99.99	5693	5.49	1N38	1.55
1AB5	.45	1H5	.72	2C39A	16.90	3B26	3.55	5V4	.89	6B8	.64	7A4	.78	35L6	.69	750TL	32.55	5697	3.70	1N38A	1.29
1AD4	3.95	1H6	.69	2C40	7.22	3C6	1.19	5X4	.78	6BA7	.95			35Z4	.64	801A	.45	5732	3.94	1N39	4.51
1AE4	3.75	1J6	.79	2C43	9.09	3C22	65.09	5Y3	.42	6BE6	.75	7AG7	.79	45Z5	.89	803	1.79	5744	2.39	1N45	1.04
1AG4	1.07	1L4	.48	2C53	11.50	3C24	3.98	5Z3	.81	6BE7	.74	7B6	.72	45Z5	.89	807	1.19	5749	1.72	1N48	.47
1AH4	1.07			2D21	.80			6A3	1.29	6BG6	2.69	7C5	.54	50A5	.72	808	2.62	5802	6.70	1N54	.78
1AX2	.97	1L6	1.11	2E5	.92	3C33	9.99	6A8	.98	6BH6	.68	7C33	69.57	50C5	.54	811A	3.89	5812	2.99	1N55	.89
1B3	.79	1LA4	1.01	2E22	1.89	3D6	.48	6A87	.78	6BK5	.95	7E6	.54	HY69	5.49			5814	1.28	1N63	2.49
1B5	.49	1LA6	1.01	2E24	2.48	3D21A	7.99	6AC5	1.19	6BL7	1.19	7F7	.82	71A	.98	812A	3.85	5829	4.75	1N64	.69
1B22	1.68	1LE3	.99	2E26	5.78	3D22	16.35			6BN6	1.19	7J7	1.35	83V	1.22	814	2.48	5840	5.05	1N70	2.98
		1LN5	.78			3E29	9.09	6AC7	.68	6BQ6	.98	7Q7	1.06			830B	.99	5841	4.30		
1B23	4.11	1N5	.95	2E30	2.58	3J31	85.50	6AD7	1.47	6BZ7	1.27	7V7	1.06	100TH	7.94	833A	45.19	5875	2.05	C'RAY TUBES	
1B26	1.79	1P5	.78	2E42	1.49	3K22	275.00	6AF4	1.35	6CB6	.58	10Y	.40	117N6	1.97	865	.48	5881	2.70	3AP1	6.11
1B35A	6.90	1P21	33.00	2J21A	9.51	3LF4	1.17	6AG5	.71	6CD6	1.58			117Z6	1.09	866A	1.25	5910	.74	3AP1A	14.25
1B37A	8.75	1P28	9.50	2J22	8.95	3Q4	.46	6AH4	.87	6CF6	1.25	12A6	.48	152TH	27.99	872A	1.29			3DP1A	4.81
1B38	38.50	1P29	2.99	2J30	50.50	3Q5	.68	6AH6	1.88	6CG6	2.25	12AC7	1.19	201A	.98	874	.62	5932	5.00	3EP1	4.71
1B40	3.99			2J32	15.09			6AK5	1.19	6CL6	1.09	12AL5	.54	250TH	35.00	902A	5.05	5965	2.51	3FP7A	6.91
1B41	3.99	1P36	8.49	2J38	17.55	354	.46	6AK5	.62	6CS6	2.65	12AT7	.62	250TL	10.11	914A	93.45	6005	2.80	3GP1	1.91
1B46	1.88	1P39	1.69	2J42	99.50	3V4	.79	6AL5	.48	6DE5	1.09	12AU7	.58	304TH	10.98			6080	5.95	3HP7	3.91
1B51	7.60	1P42	10.97	2J55	45.09	4B23	16.98	6AL7	1.22	6F4	2.79	12AV7	.95	304TL	10.98	927	1.36	6099	1.55	5AP1	2.21
1B63A	42.50	1Q5	1.19	2J61	19.55	4B32	10.50					12AX7	.78	394A	1.96	955	.65	6101	6.45	5CP1A	14.49
		1Q26	69.00			4C25	5.98			6F6	.76	12BA6	.69	WL417A	8.48	956	.81	6119	6.45		
1B68	16.99	1R4	.96	2J62	6.65	4C35	15.05	6AM8	1.27	6G6	.92	12BE6	.62	450TH	75.49	973	16.98	6121	9.00	5CP7A	9.55
1B85	7.49	1R5	.58	2K22	15.07	4D21	18.99	6AN6	3.19	6J6	.58	12BH7	.99	450TL	76.95	1005	.56	6143	6.45	5HP1	3.91
1B88	4.99	1S4	.88	2K25	15.09	4E27	12.55	6AQ5	.52	6K6	.61			502AX	2.05	1090	2.98	6201	3.99	5JP7A	39.00
1C5	.89	1S5	.66	2K28	29.50	4J32	49.55	6AQ6	.98	6L6	1.98	12BZ7	1.05	503AX	1.30	1612	1.98			5LP1	3.91
1C6	.49	1T4	.68	2K33A	165.00	4J30	99.55	6AQ7	1.29	6S4	.99	12DQ6	.98	532DX	2.50	1619	.34	6369	24.95	5LP2	27.50
												12J5	.48	532DX	2.50	1625	.44	6393	24.95	5MP1	4.00
												12K8	.48	538DX	.98	1633	.98	8005	4.95	5SP7	100.00
												12L6	.70	541DX	2.50			8012	1.09	5UP1	15.05
												12SA7	.64	543DX	.99	1644	.99	8013	4.91	7BP1	8.65
												12SC7	.78	544DX	2.50	2050	.98	9001	.88	7BP7	6.50
												12SG7	.91			2051	.68	9002	.96		
												12SL7	.62	571AX	4.45	2C51	4.69	9003	.98	9LP7	2.98
												12SN7	.54	HY615	.46	5516	5.51	9004	.28	12DP7A	Q
												12SQ7	.54	WL676	34.98	5545	34.55	9006	.24	12GP1	49.98

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Kit consists of: Fully shielded **TRANSFORMER PRI 115V/60 cy sec 140V/30MA/6.3V/1A.** **SELENIUM RECTIFIER FILTER CONDS. 50MFD/300 VDC.** All For Only. **$2.25**
GET YOURS NOW!. Order in Lots of 3; $1.98

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2V/20AH Willard PLUS 2V Vibrator ..... "TAB" $2.98
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6V/6AH Batt. w/acid* $2.98
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10 Way Wrench w/1001 uses. Fits 95% all sizes Sq & Hex Head nuts & bolts. ¼" to 9/16". RUST PROOF. Gld Prkprod (Postpaid U.S.A.)....Special 98c; 6/$5

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Finest Swedish Steel. Genuine Saudvick Grade—24 to 30" long. Cross Cut 10.98 Reg....$3.95
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Write Us Your Needs—Complete Line.

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Weston VU-20 to +5/Sq. 3"/301 ..... $15.98

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AY1 Autosyn ..... 2/$3.98
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PRECISION RESISTORS
W.E.—IRC—Wilkor
1% Accuracy Gtd.
Special 35¢ ea.
10 of One Value.....ea. **25c**
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10 Asst'd Values $3
Write for Complete Listing

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Resistors, 100½ & 1W/95c; 6/85c
Tube Sockets, 20 Asst'd., 85c; 6/75c
Ceramicon Cond., 25 Asst'd. 85c; 6/75c
VitwwRes., 15 Asst'd.. $1.45; 6/$1.25
Rotary Sw, 12 Asst'd., 95c; 6/85c
Knobs, 10 Asst'd. 98c; 6/89c

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Finest Tape
$, $, $ Back Gtd.
Precision Coated & slit, Gtd Splice Free, Quality Controlled. Plastic Base. Gtd Constant Output. Freq 7½ IPS 40 to 15,000 cys (Oxide Wnd In).
Sold Singly. **$1.80** Twelve Lot Special.....ea. **$1.58**

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106 Watt Sec. Photoflash
Includes transf condensers two 525MFD/450V/Total 103W/Secds. Resistors, capacitors, rectifiers, flash tube in indicating flash gun, guide = nickel on Kodachrome. Does Not Incl. Batteries. AC only $33.98
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Electronic Flash Handbook ckt. data...50c

FOTOFLASH & STROBE LAMPS

"TAB" No.	Replaces	W-Sec. Max	Each
TLW	FA 104/FT118	150	$ 5.98
THI	AMGLO 5804X	100	10.98
23ST	GE FT 210	200	9.98
THVA	GYVL, 4330	200	9.98
V4X4	X400	200	10.98
TLX	DX & FA10Q	150	9.00
TDX	DXC/250-350	150	10.00
353GTQ	FT 503	2000	49.98

Trigger Coil for LO&HI Volt Flash $1.47
Write for "TAB" Flash Tube Data....50¢

HI-FI AMPLIFIER KIT
Model/TAB20 Ultra-linear Williamson Type Amplifier. Rated; 20 Watt. Freq. 12-56KC/10 Watt. 8-80KC. 5 Watt (+, -) IDB. DIST; 0.25% OUTPUT; 6, 8, 16 ohm. INPUT; Hi-impedance. Finest quality components, full detailed inst. 115V 60cy. Shpg. wt. 27 lbs.
"TAB" SPECIAL $49.95
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230 TO 115 AUTOFORMERS
For 220-240V/50-60 cy in. To 110-120V or step-up. With Cord, Plug and Receptacle.
TPA050/50W $2.55
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TPA200/200W $5.75
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TPA300/300W $7.25; TPA500/500W $8.25
TPA750/750W $11.75
Model TPA1000/1000W/1KW..... $16.95
Model TPA1500/1500W/1.5KW.... $22.50
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$100 Order Take 10% Disc.

4MFD/1200VDC or 10MFD/600VDC (or ass't'd) Lots of 12; $1.50, Singly $1.79

NEW VARIABLE 6 & 12 VOLT/12A
DC Power Supply Completely Built (Not a Kit)
MODEL T612V12AC..... **$29.95**
BATTERY ELIMINATOR, CHARGER, MODEL RR, PLATER, AIRCRAFT, MARINE & Any DC Reg. Contains F.W. xtra size Selenium Rectifier 5"x6" plates, Hvy. duty Transformer. Volt & Amp Meters. Switches. Circuit Breaker, Fuse, Capacitor, Vari Pwr. Control, Cord & Plug. Designed for continuous service & up to 20 Amps. intermittent overload. Housed in Hvy. duty Black crackle finish Steel Cabinet.
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CLAMP LAMP Adj., w/Bulb & Refl. Only. $1.59 ea., 7 for $10

HI-FI SPEAKERS
Inbuilt Network. 2 wires needed for HF & LF Response. Famous Hi-Fi Speaker. 15" Coaxial PM & 5" Tweeter, 25 watt/20-17500 cy Model P25CO $19.85
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"TAB" SPECIAL!!
BLOWER TURBINE TYPE, 50 CFM 28VACDC, Excell for 4x6imac Tubes & others. Compact Dia. 3" Self Lub. Bearings, cont. service. Rugged design. Only $4.98
With 115VAC Xfmr..$5.98; Lots 3/$15

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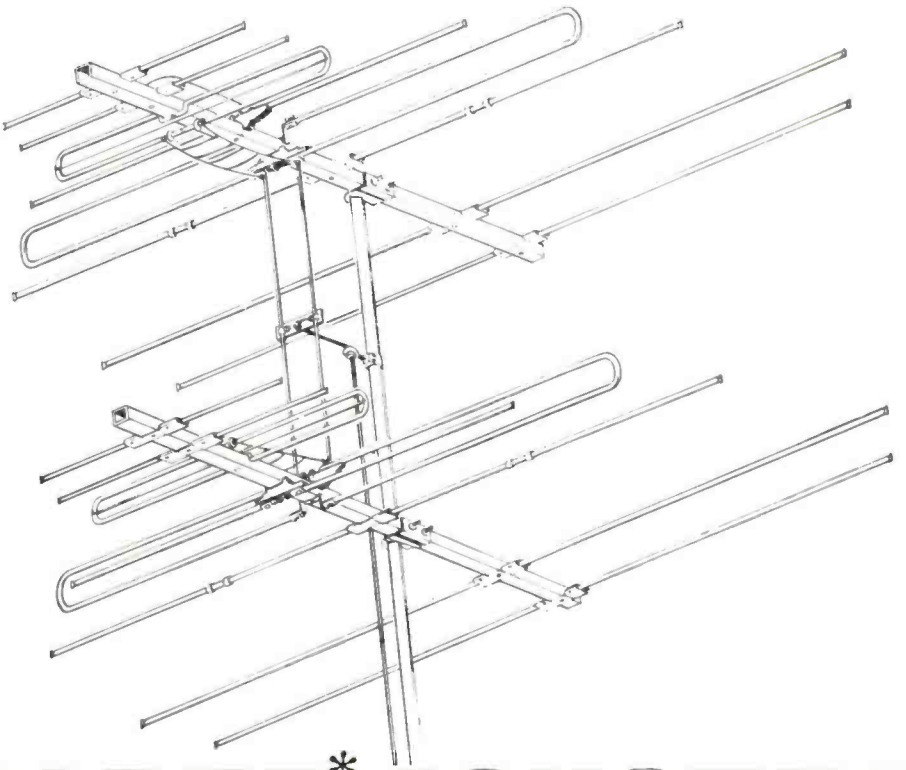
150 field tests have proved to WARD jobbers:

* Good VHF picture at as far as 200 miles on several channels
* Excellent results at 100 miles
* Good results in areas where no other antenna was able to bring in a picture
* More compact—25%-75% less stacking distance
* Channel 2-13 response as much as 40% better than any comparable antenna
* Unique superior snap-lock bracket
* Original WARD design all aluminum supplemented spring pressure bracket —eliminates possibility of intermittent contact

TRY ONE—you'll find why the Invader is superseding all fringe and super-fringe antennas.

WARD Model TVS 356 2 bay and stacking harness $39.95 list

WARD Model TVS 357 4 bay stacking kit (feed harness only) $3.95



THE INVADER* CONQUERS

sweeps all other fringe and super-fringe antennas before it

*an original WARD design

flat type Uni-plane Yagi for fringe area VHF and primary signal area UHF.

*Documental testimonials in our files

WARD Products Corp., Cleveland 15, Ohio

THERE IS NO SUBSTITUTE

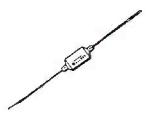
All FP Capacitors are Mallory. There are imitations, but no substitutes. Only Mallory FP Capacitors have these features . . . developed by Mallory and accepted for years as the industry's standard of performance by manufacturers and service men:

- Genuine fabricated plate anode
- 85° C. temperature rating
- Long life on the shelf and in service
- High ripple current capacity
- Simple, speedy twist-prong mounting

Don't settle for anything less than the best. Always specify Mallory FP Capacitors by *brand*. They outperform all others . . . yet cost no more.

BE SURE TO USE . . .

Mallory Plascaps® . . . plastic tubular replacements with permanently secured leads . . . won't short out or open prematurely.



Subminiature Silverlytic* Capacitors . . . only 3/8" long and 7/32" in diameter . . . ideal for transistor and other miniature low-voltage circuits.

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