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RADIO & TELEVISION NEWS

**MAY
1955**

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World's Leading Electronics Magazine

IN THIS ISSUE

IT'S TIME FOR PORTABLES

**CAMPUS
CARRIER-CURRENT SYSTEM**

144-148 MC. HANDIE-TALKIE

TRANSISTOR PREAMP

**HOW GOOD ARE MODERN
TV SETS**

SHRINKING TV PICTURES

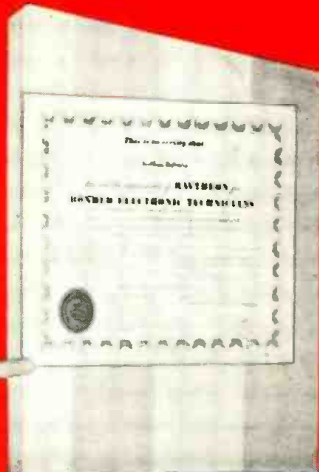
V.H.F.—U.H.F. TV GENERATOR

HI-FI SYSTEM SWITCHING

VARIABLE LOW-PASS FILTER

**AN R/C RECEIVER
FOR MODEL BOATS** →
(See Page 64)





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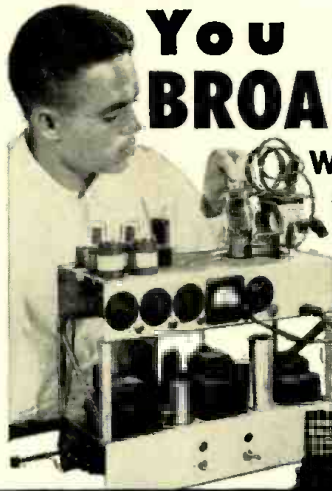
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BROADCASTING: Chief Technician, Chief Operator, Power Monitor, Recording Operator, Remote Control Operator. **SERVICING:** Home and Auto Radios, Television Receivers, FM Radios, P.A. Systems. **IN RADIO PLANTS:** Design Assistant, Technician, Tester, Serviceman, Service Manager. **SHIP AND HARBOR RADIO:** Chief Operator, Radio-Telephone Operator. **GOVERNMENT RADIO:** Operator in Army, Navy, Marine Corps, Forestry Service Dispatcher, Airways Radio Operator. **AVIATION RADIO:** Transmitter Technician, Receiver Technician, Airport Transmitter Operator. **TELEVISION:** Pick-up Operator, Television Technician, Remote Control Operator.

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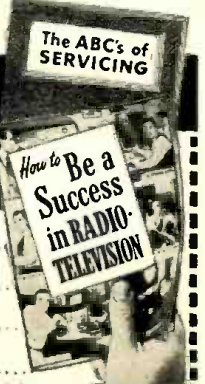
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COVER PHOTO: A reliable radio-control receiver adds to the pleasure of operating model planes and boats. With the advent of summer, try building the R/C receiver on page 84. (Ektachrome by J. Hilmanowski)

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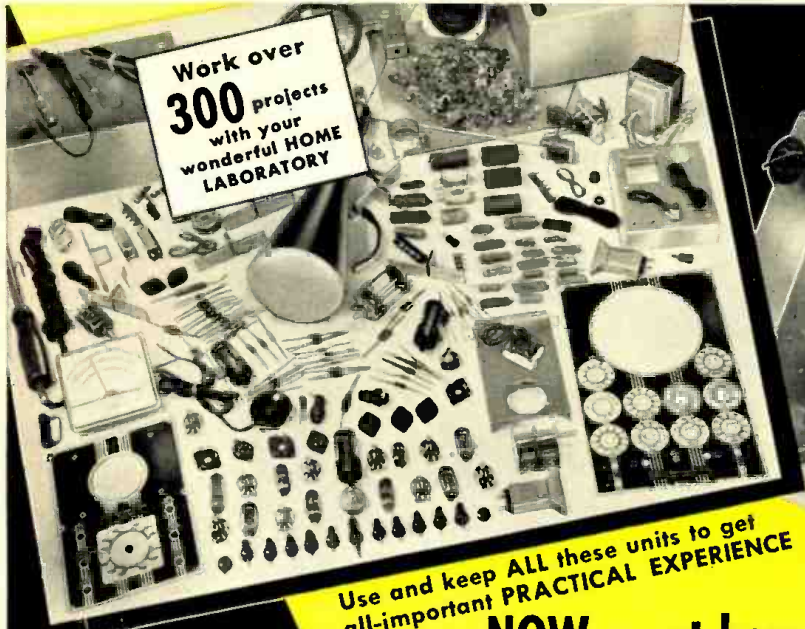


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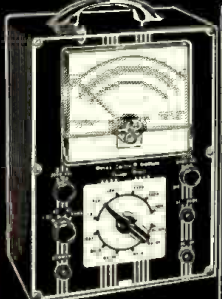
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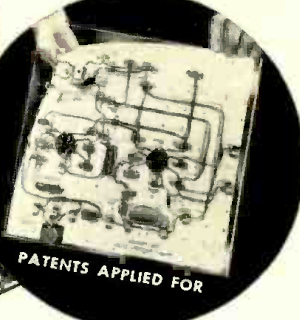
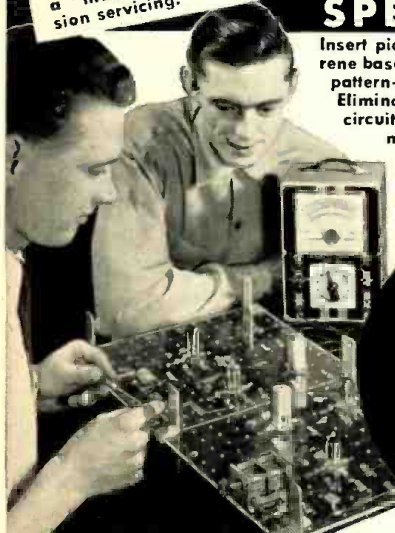
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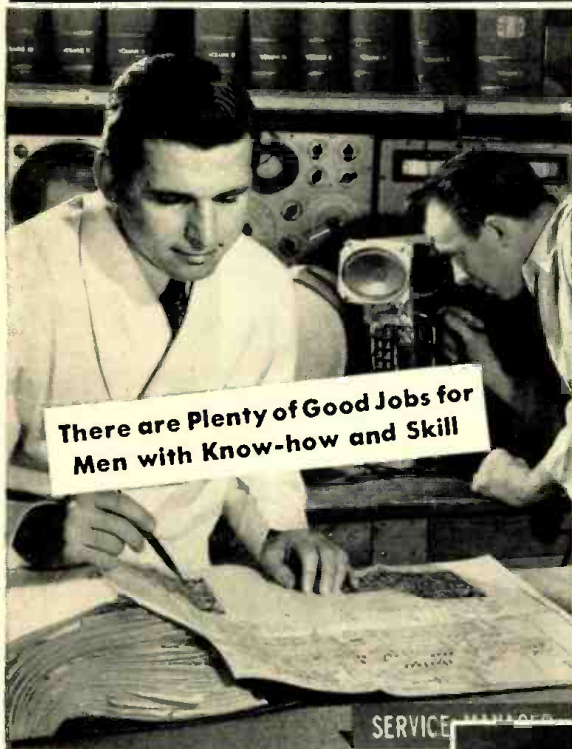
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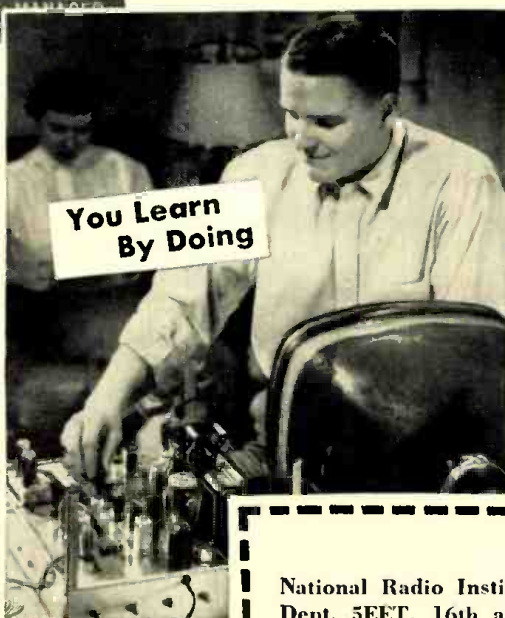
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For the RECORD.

BY THE EDITOR

TECHNOLOGICAL REVOLUTION

AMERICA has long been described as "the land of opportunity," and indeed it is. Today, more than at any other time in the history of radio, television, and electronics, are there numerous and promising opportunities for youth to enter the fastest-growing of all the world's major industries.

It is unfortunate, we feel, that in this age of technological achievement and progress that so few teen-agers are encouraged at school level to examine the tremendous possibilities in the fields of science—particularly electronics. Educators are failing to encourage these teen-agers in things technical, but are devoting their efforts in educating youth to study other arts which, in the future, do not possess the practical advantages of an expanding industry.

Our country was known many years ago for its craftsmen. Today it is comparatively rare to find one skilled in things mechanical which, by comparison, are more profitable as a vocation than numerous other arts commonly taught in our high schools. In spite of the tremendous growth of electronics, its opportunities apparently are overlooked by the educators. This, in spite of the fact that today electronics is and will continue to be the fastest-growing industry of our times. It takes no crystal gazer to realize that the electronics industry will probably more than double its growth within the next ten years.

Recently, your editor visited his local high-school at a regular P.T.A. meeting to see the "end products" of various classes—including the arts. Instructors, without exception, took great pride in displaying pottery, glassware, oil and water-color paintings, cartoons, pen and ink sketching, etc., to name but a few. But nowhere could we find evidence of any scientific instruction like electronics that offered a real opportunity for future employment for the average student. We don't mean to imply that no opportunities exist in the other arts. But compared to electronics, they are indeed most limited. We feel that the educators are failing miserably to foresee and to analyze the great opportunities presented by the fastest growing of all the world's major industries—electronics.

Our government has recognized the weakness of our educational system in its failure to supply potential scientists and engineers for its vast defense system, and even without the opportunities for a bright future in military electronics there also remains a vacuum of talent in all of the scientific fields. Our industry is said to have only 25% of essential technical know-how, and points with alarm to our potential enemy and its progress in scientific educational development. Electronics, as an industry, has expanded at a rate that almost defies comprehension. To many it is still a magical term.

It's the old story of the three blind men and the elephant. The one who felt the trunk described it as an animal built like a tree; the one who patted its side thought of it as built like a door; and the one who grabbed the tail said it resembled a snake.

It could hardly be otherwise. Electronics is today a highly complex industry because of the many miracles that it can perform in the home, in industry, and in commerce. Youth does not realize, for example, that the entertainment end of the industry comprises but a fraction of its over-all productivity and application. The field of industrial electronics, as one example, will some day reach proportions that may dwarf either military or entertainment electronics.

Our friends in Canada have made tremendous progress in electronics during the past few years. Interest has been reflected in our own growth across the border. We talked to many visitors to the recent IRE convention in New York and, without exception, these Canadian engineers wholeheartedly agreed that equal opportunities exist in the Canadian electronics industry for new blood. Hi-fi is booming, we are told.

As you read this editorial, I will be in Toronto to visit their 2nd annual Audio Show and to later report on our observations of Canada's expanding electronics industry.

Numerous opportunities are available to youth in the field of electronics, but he cannot possibly seize upon these opportunities unless he is first encouraged at school level and, accordingly, to understand and consider its advantages. And it is logical to assume, we think, that if the educators would encourage and teach electronics subjects that they would make an outstanding contribution in the prevention of juvenile delinquency. This is so because electronics, compared with other fields of endeavor, is able to offer not only a lucrative *vocation* but, of equal importance, has its well-known *avocations* including the hobbies of amateur radio, high-fidelity, model control, and a host of other interesting pastimes.

Here we think is a very real opportunity for educators to use a bit of common sense in designing a curriculum that would serve a positive purpose—one that would result in future security for millions of teen-agers.

We would like every teen-age boy in high-school to read the following from a recent speech by W. Benton Harrison, of Sylvania Electric Products Inc., in which he states: ". . . from the standpoint of sales and revenues, the electronics industry is today virtually a \$9,000,000,000 industry. In the three-year period, 1958-60, total sales will come close to \$14,000,000,000 a year. And, ten years from now, in 1964, we are positive we will be justified in calling electronics an industry with sales and revenues totaling over \$20,000,000,000 a year. . . ."

"I repeat, today electronics is a \$9,000,000,000 industry; by 1960 it will be a \$15,000,000,000 industry; and by 1964 it will be a \$20,000,000,000 industry. That means that within a decade it will have more than doubled its present size. It is extremely difficult to envision any other major industry that will grow that fast between now and 1965."

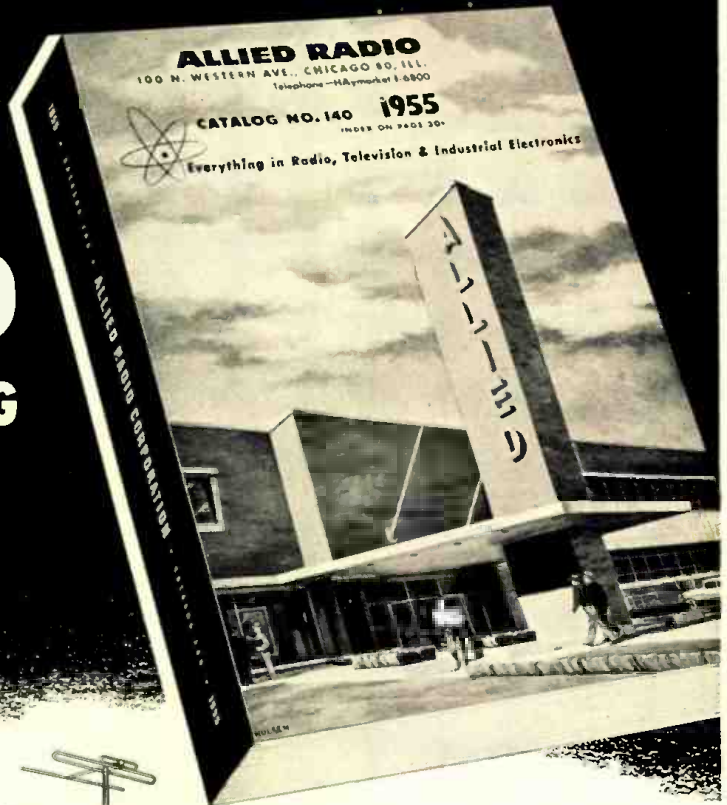
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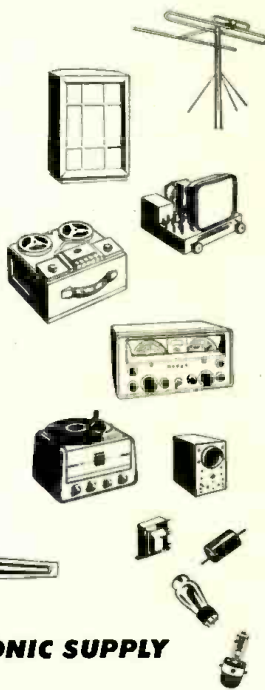
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(the 220 and 240
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The 220 and 240 are engineered to maximize performance. By comparison they are without equal . . .

The **220** and **240** are
Lighter—5 $\frac{1}{2}$ grams
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The **220** and **240** have
Highest Output—30 millivolts/10cm/sec.
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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 . . .

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



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MY FREE LESSON MAY CHANGE YOUR ENTIRE LIFE

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— No previous experience necessary. You learn by practicing with the professional equipment I send you. Many of my graduates now have good paying technician jobs with such firms as RCA, NBC-TV, Dumont TV and numerous other TV Studios and plants.

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Combination Voltmeter-Ammeter-Ohmmeter

Super-Het Radio Receiver

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Public Address System

C-W Telephone Transmitter

Radio Television Training Association

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Licensed by the State of New York • Approved for Veteran Training

May, 1955

Just by clipping the coupon below and sending it to me today, you can open up a whole new future for yourself in America's fastest-growing field — Radio-Television-Electronics.

The very day I receive your coupon I will send to you Free a Sample Lesson and my New 36-page Book showing you "How to Make Money in Television, Radio, Electronics" by STUDYING AT HOME IN YOUR SPARE TIME.

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If you think I was exaggerating when I said, "My Free Lesson May Change Your Entire Life," just see what some of my graduates say about my training —

"RTTA training gave me the skill and know-how to do the work I love best and enjoy better things in life."
Harold Gimlen
Flint, Michigan

"If it had not been for you, your instructors and the school, I never would have had this opportunity."
J. A. Irwin
Radio-TV Repairman
Coburg, Ont., Canada

"I know I would not have achieved this progress if it weren't for the help and guidance from RTTA."
Edward Breault
Chief Radar Operator
National Guard
Central Falls, R. I.

These letters and many more like them are in my files. The TV Boom that brought good opportunities to these RTTA graduates is still on with no sign of letting up. Don't let opportunity pass you by. Write today for your Sample Lesson, new 36-page book, TV Job Opportunities List, and 48-state list of future TV stations — ALL FREE!

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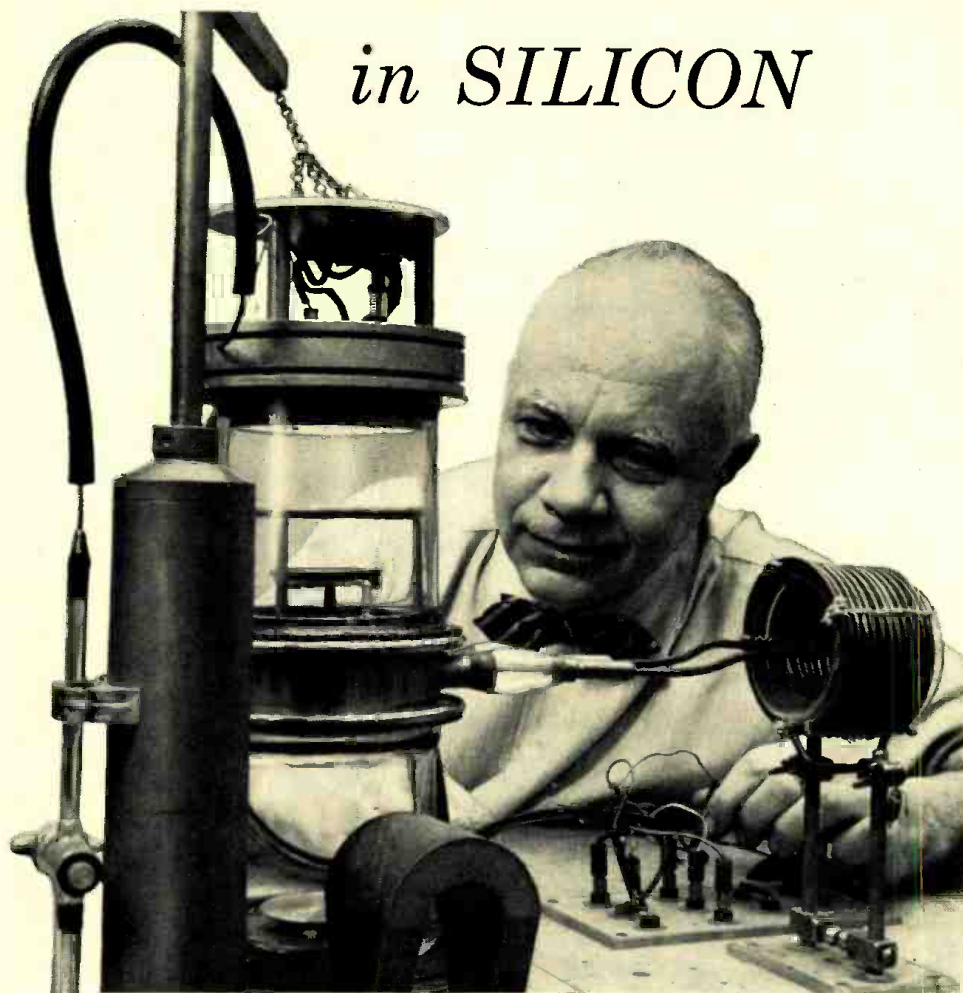
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in SILICON

One example of junction technology at Bell Laboratories. Here a junction is produced on the surface of silicon by bombardment with alpha particles. Bombardment enhances silicon's performance at very high frequencies.



One day in the 'thirties a revolutionary adventure began for Bell scientists. They were testing an experimental silicon crystal they had grown to make microwave detectors.

Intriguingly, they found that one end of the crystal conducted by means of positive charges, the other end with negative. Positive and negative regions met in a mysterious barrier, or junction, that rectified, and was sensitive to light. It was something entirely new . . . with challenging possibilities.

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producibile junctions. Thus, junction technology came into being, and the 20th Century had a new horizon in electronics.

This technology has already produced at Bell Telephone Laboratories the versatile junction transistor (useful in amplifiers and switches); the silicon alloy diode (surpassingly efficient in electronic switching for computers); and the Bell Solar Battery which turns sunshine directly into useful amounts of electric current.

This is one of many adventures in science which make up the day-to-day work at Bell Laboratories . . . aimed at keeping America's telephone service the world's best.



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



Another Great Instrument in Philco's Complete Line of Test Equipment



MODEL 7300

PHILCO®

Precision Alignment Generator

for Better Television and FM Radio Service

Speed up work on the bench or in the field . . . handle jobs more efficiently and make more profits! Every service man needs the Philco Precision Alignment Generator. A portable unit, versatile in application, it gives fast, accurate information for better TV and FM Servicing.

All necessary signals for servicing FM and TV receivers are supplied by this compact instrument. Intermediate frequencies and channel frequencies are covered in two ranges by the sweep generator. Three ranges, from 3.2 MC to 260 MC may be tuned in with the Marker Generator, and this function can be used to supply marker pips for use with the sweep generator or as an AM generator with 400 cycle modulation.

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Portable or for use
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IMPROVE THE
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a NEW **FINCO**[®]

MODEL

F-4

(PAT. PEND.)

with exclusive

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 con-
ceived 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."**

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**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!**

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THIS TIME BE SURE
with
PEERLESS
Quality
Transformers



For military requirements, insist on Peerless transformers for **QUALITY** design and **QUALITY** manufacture that insures constant **QUALITY** control.

Grade for grade, class for class, Peerless transformers exceed the MIL-T-27 requirements.

Peerless quality is **ECONOMICAL, UNIFORM, DEPENDABLE.**

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Spot Radio News

★ Presenting latest information on the Radio Industry.

By RADIO & TELEVISION NEWS'
WASHINGTON EDITOR

THE TANGLED V.H.F.-U.H.F. situation received another encyclopedic review a few weeks ago; this time from the Republican member of the Senate Interstate and Foreign Commerce Committee, Robert F. Jones, serving as special counsel to the group. Like the Plotkin (representing the Democratic faction) edict, this essay was also extremely critical of dozens of decisions that have been made by the Commission and industry.

Reviewing the ultra-high problem, Jones said that it does not appear "... practical that the television industry and the public would accept any plan to drop v.h.f."

The former FCC member viewed past actions of his colleagues as serving to accentuate, rather than alleviating "... the economic and operational difficulties of u.h.f. telecasting, as compared with v.h.f. ..."

Noting that the Commission has permitted satellite operation of high-band stations by low-band operators, he said that if these older stations, now located in the larger markets of the nation, use their new satellites to extend their service areas "... then indeed u.h.f. individual operators will have a further economic hurdle thrown in their paths to compete with v.h.f. stations for the sale of their broadcast time."

The pending proposal, to double maximum antenna heights (1000 to 2000 feet), would in the former Commissioner's opinion further lessen the chances for successful u.h.f. operation. As a matter of fact, he said, any "... increase in antenna height of the proposed magnitude would substantially increase the size of the v.h.f. service area, and act as a halter to successful operation of any u.h.f. station."

Pointing out the future of the high bands lies in economics, Jones said that no amount of "... dogged determination on the part of Congress will repeal the economic facts upon which it must rise or fall."

Hitting the allocation plan as the core of the trouble, the Washington attorney said that v.h.f. operators simply had too much time to build up their systems and as a result promote the purchase of too many millions of low-band sets. And even after the freeze went, he added, only low-power u.h.f. stations appeared, and so the march to v.h.f. continued.

"No amount of wishful thinking or executive fiat will remove these differences ... until there is a circulation of u.h.f. receivers," declared the Senate's counsel.

Continuing his withering attack against the Commission, Jones said that during the freeze, the FCC found a means of "... mitigating the effect of interference by offsetting the carriers of each adjacent-co-channel station, and it established new interference curves, based upon new desired-to-undesired signal ratios. However, it (the FCC) used the new technique (offset carrier and the new interference information) to overcome every difficulty of the v.h.f. channel (frequency) characteristics (attainable immediately), and then it fixed unrealistic values for u.h.f. channels which could not be exploited competitively by u.h.f. operators immediately or in the foreseeable future."

In conclusion, the members of the investigating committee were told that no sentiment "... on the part of Congress or the Commission in behalf of u.h.f. will repeal the law of economics operating in our private enterprise system ... V.h.f., by virtue of its early start, has moved into the larger markets and saturated such markets and surrounding rural areas with v.h.f.-only receiving sets ... It follows that the larger concentrated masses of population now and hereafter will need only v.h.f.-only sets and that the unit costs will always favor v.h.f.-only sets and work against any mass production to cut costs on all-channel receivers."

THE WONDROUS DEVELOPMENT of the nation's electronic experts received a dramatic unveiling a short while ago, during a gala open house for two labs of the Bureau of Standards in Washington.

In a talk before distinguished guests, the director of the bureau, Dr. Allen V. Astin, described and demonstrated an ingenious device for x-ray televising of the interior of an engine. Highly-penetrating radiation from a betatron, in combination with a technique recently developed at the Bureau for converting high-energy x-rays into visual images, were used. The audience saw clearly a moving piston, piston rod, and other parts in the televised x-ray image of the engine; a one



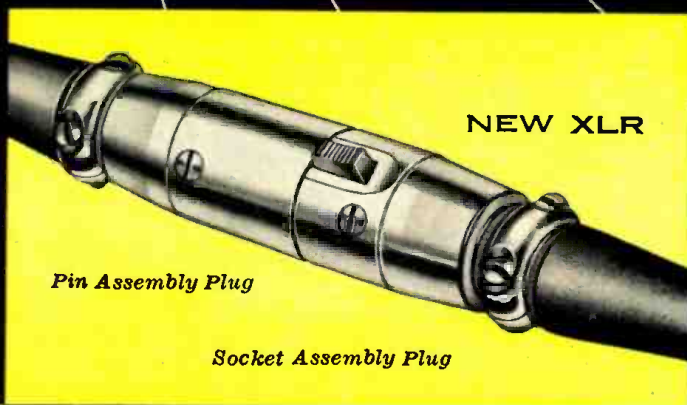
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XLR is the designation of Cannon's all new audio cord connector . . . the most modern addition to the long line of distinguished Cannon Connectors featured on all top-quality microphones. It's really quiet, too!

New resilient insulator and specialized construction of socket contact assembly protects against disagreeable mechanical interference . . . noise problems encountered with many other type connectors when their cables are moved, pulled or subjected to shock.

Features streamline design, bright nickel finish, integral cable clamp, neoprene cable relief, and the time-tested Latch-Lock that Cannon pioneered on the first audio connectors. Available with three 15-amp. or four 10-amp. contacts. Available in panel receptacle type, providing same continuous characteristics.

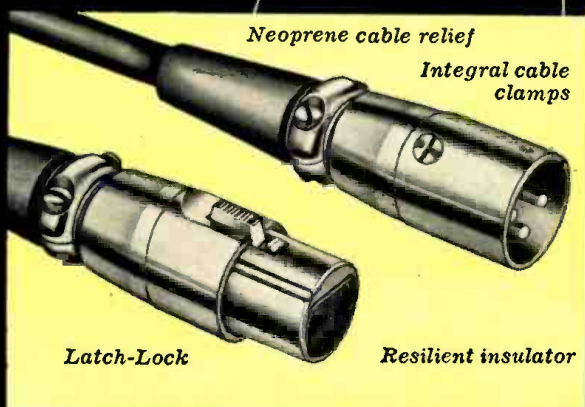
Available from distributors everywhere, or from the factory in production quantities.



NEW XLR

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Neoprene cable relief

Integral cable clamps

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Resilient insulator

first in connectors

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Please refer to Dept. 145

Factories in Los Angeles; East Haven; Toronto, Canada; London, England. Representatives in all principal cities. Distributors everywhere.

PERMOFLUX ANNOUNCES

The NEW

Largo-12

Big brother to the famous "Largo 8"



New, complete two-way speaker system —
with all the time-tested, proven features of the "Largo 8"
plus:

- More powerful Super Royal 12" Speaker
- New, larger, back-loaded horn enclosure
- Full 20-watt power-handling capacity
- Smooth peak-free response . . . 30 to 16,000 cycles

Combined with: • Scientifically matched 32KTR Super Tweeter • Slanted speaker panel for proper sound focusing
• High-frequency balance control • Horn loading of back wave thru unique cabinet base. The Largo 12 is precision-constructed of beautiful ¾" Mahogany or Korina Blonde cabinet woods. Impedance, 8 ohms.
Size: 23½" H, 27½" W, 15½" D.

Audiophile NET.....\$149.50
(Also available in Walnut at slightly higher price.)

H.T.P.

The Largo 12 is available under the exclusive Permoflux insured Home Trial Plan (H.T.P.). Try it in the comfort and quiet of your own home for 15 days—with your own records and associated equipment. For a limited time only, each H.T.P. participant will receive—absolutely FREE—the new Permoflux "Maestro" speaker-Headset Control Box (\$10.00 value). Also available under H.T.P.: the Diminutive (\$49.50); the Largo 8 (\$99.75).

Only Permoflux gives you all the features you should have in a 2-way high-fidelity speaker system. See and hear the Largo 12 and other Permoflux systems at your hi-fi dealer today. Also ask him about H.T.P.—or write:

Permoflux CORPORATION

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West Coast Plant • 4101 San Fernando Road • Glendale 4, California
Canadian Licensee • Campbell Manufacturing Co., Ltd., Toronto, Canada

cylinder affair. By means of this technique, it is said that it should be possible to televise the internal operation of a wide range of mechanisms, such as automotive and aircraft engines, pumps and so on.

Because of their greater penetrating power and lower scattering, high-energy x-rays from betatrons and synchrotrons produce sharper images than do lower-energy x-rays, allowing observation of greater detail and detection of more minute flaws in metallic equipment.

The new system makes use of an instrument called a pattern amplifier, which acts as an x-ray intensifier, continuously detecting, amplifying, and displaying low-intensity x-ray images. The major component of the amplifier is a converter; a large cylindrical, thallium-activated sodium iodide crystal, which converts x-ray images into optical images. When bombarded with an x-ray beam, the crystal emits visible light. If the flat faces of the crystal are perpendicular to the x-ray beam, a visible replica of the x-ray image may be observed along the beam axis. When the pattern amplifier is used in conjunction with a high-intensity, high-energy x-ray source such as the synchrotron, it can continuously display images of parts hidden by as much as eighteen inches of steel or seven and a half feet of concrete. The visual image may be detected in several ways. It may be observed directly by eye, photographed with an ordinary camera, or observed with a remotely-controlled television camera.

Discussing the Bureau's radio range, Dr. Astin said that they are working with the Air Force and Navy Bureau of Aeronautics to set up a recalibration center to insure the reliability and efficiency of electronic equipment in military aircraft. At this center, working standards, used in maintaining general equipment will be periodically recalibrated.

Also on demonstration was a three-color brightness standard, covering the reds, greens, and blues, used for the TV industry system.

In addition, high-speed electronic computers and supersonic speed measurement devices were also demonstrated.

A RESOLUTION to amend House rules to permit broadcasting and televising of committee proceedings received quite a heated hearing during a recent session of the House Rules Committee.

Favoring open telecasting, Congressman Donald Jackson of California said that in his opinion TV was a major medium of information, and eventually public pressure will demand that Congress permit televising of perhaps all of its activities. Chiding his colleagues who insist on acting before the cameras, the Congressman said that such performances could well show up the ego of the Representatives and possibly affect their popularity and re-election.

(Continued on page 140)

NEW



Here are wire wound power resistors designed for today's servicing requirements. New, rectangular design is more compact. Famous IRC element is sealed in ceramic case for complete insulation and protection. Axial leads are easily soldered and speed replacement. Clear, permanent markings give full identification.

- 2 SIZES—PW-7 seven watts; PW-10 ten watts.
- COST LESS—new, low price for IRC Power Resistors.
- FULL POWER—Conservative ratings permit continuous operation at full power.
- NEW VALUES—in keeping with today's needs.

WIRE WOUND POWER RESISTORS *in handy Resist-O-Card Assortments*



IRC Resist-O-Cards are easier to buy, stack and use. Values are printed on each card—you always know what you have, and you always have what you need. Assortments are based on popular usage.

- ASSORTMENT # 19—Twenty 7 watt resistors. Dealer Price \$6.20
- ASSORTMENT # 20—Twenty 10 watt resistors. Dealer Price \$6.60
- ORDER NOW—From your IRC Distributor

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MODEL 10B EXCITER KIT. 10 watts peak output. Net \$129.50.
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Wired and tested. Net \$249.50.

Trade-in talk is not idle chatter when it concerns Walter's "Surprise" allowances on used (factory-built) test and communication equipment. Here's the real low down. You save money...lots of money. And that's the kind of plain talk any one with an eye for a bargain can understand. Better, wire, write, phone or use the handy coupon—right now!



JOHNSON VIKING KILOWATT POWER AMPLIFIER for CW, AM and SSB. With tubes, wired and tested. Net \$1595.00.

Accessory desk top and right or left hand pedestal. Net \$123.50.



BARKER AND WILLIAMSON TRANSMITTER. Model 5100S. Modified for use with 515B exciter. Net \$467.50.

B & W SINGLE SIDEBAND EXCITER. Model 515B. Net \$279.50.

HALLICRAFTERS SX-96. Less speaker. Net \$249.95.



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Rush "Surprise" Trade-In Offer on my _____
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 Rush copy of latest Catalog.

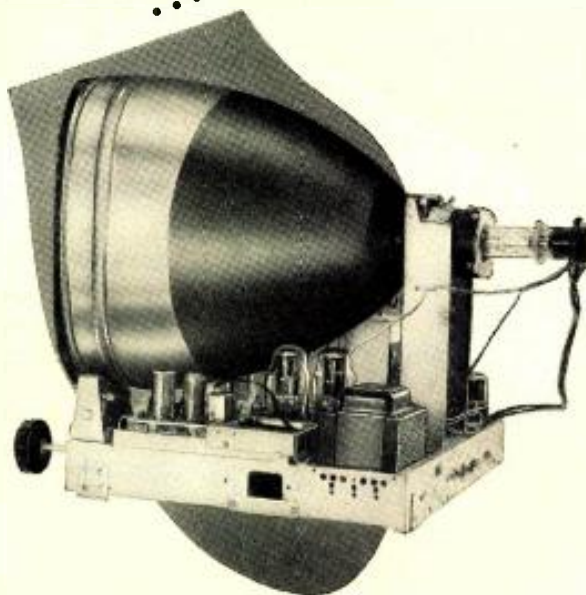
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...from start



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Now . . . RCA INSTITUTES offers modern TV KIT with Comprehensive Television Servicing Course

START to build with a TV Kit developed by one of America's foremost radio-tv schools—RCA Institutes. LEARN with simple step-by-step instruction how to build a modern, large-screen receiver. TEST each stage, as you build, and see how it works. Learn how "trouble-shooting" is applied. FINISH your Home Study Course ready and able to service all make and model sets!

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The RCA Institutes' TV Kit utilizes up-to-date circuits including:

- *Synchro-Guide horizontal automatic frequency control circuit.*
- *Horizontal magnetic reaction scanning.*
- *Latest deflection circuits.*
- *FM sound discriminator.*
- *High-gain, low-noise cascode tuner.*

Join the many thousands who have been successfully trained by RCA Institutes for a good job (or business of their own) in television servicing.

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 With no obligation on my part, please send me a copy of your booklet on the TV Servicing Home Study Course and Kit. I understand no salesman will call.

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Now you CAN afford the beauty of HIGH FIDELITY!

A COMPLETE HIGH FIDELITY SYSTEM

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In Mahogany or Blonde
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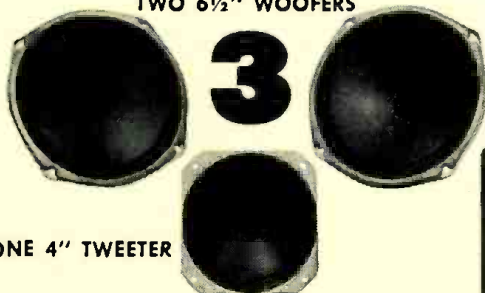
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**3-SPEAKER
PUSH PULL BEAM POWER
AUDIO AMPLIFIER**

makes any record player, changer, tuner, microphone, etc. into a SUPERB HIGH FIDELITY SYSTEM with performance equal to equipment costing \$150 to \$200!

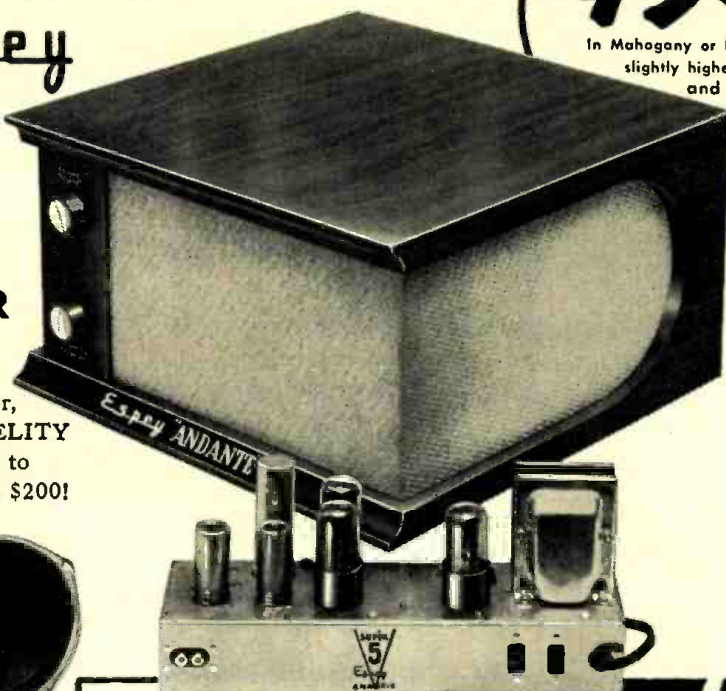
TWO 6½" WOOFERS



ONE 4" TWEETER

Only ESPEY PIONEER ENGINEERING could make possible the "ANDANTE". . .

Since 1927 Espey has been a world leader in the design and manufacture of electronic and audio equipment of the highest precision. Espey engineers have long concentrated on the problem of attaining high-fidelity reproduction at a price within the reach of all—have finally developed the astonishing SUPER V-5 AUDIO CHASSIS.



Look at all these almost-unbelievable quality features!

- PRECISION 5-TUBE AC-OPERATED PUSH-PULL BEAM POWER AMPLIFIER with power transformer.
- TUBE COMPLEMENT: 6X5GT, 12A7, 12AX7, 2-6K6GT
- AUDIO DEGENERATION CIRCUITRY: special inverse feedback provides minimum distortion.
- AUDIO OUTPUT: 5 watts, wide range.
- OUTPUT CIRCUIT: special output transformer with crossover network for high frequency channel speaker.
- TWO SEPARATE LOW-FREQUENCY SPEAKERS: 6½-inch, side-mounted.
- ONE SEPARATE HIGH-FREQUENCY SPEAKER: 4-inch, front-mounted.
- HIGH-FIDELITY VOLUME CONTROL: automatic frequency-compensated circuitry maintains proper amount of compensation for "high" and "low" at every volume level.
- FREQUENCY RESPONSE CONTROL: enables user to adjust tone response to individual requirement of "high" and "low".
- COMPLETE UNIT AUDIO RESPONSE: 40-15,000 cps.
- CAN BE USED WITH ANY STANDARD RECORD PLAYER (RCA, Webster, VM, Columbia, etc., as well as any Tape Recorder, Tuner, Microphone, etc.)
- TWO INPUT JACKS TAKE EITHER A CRYSTAL OR MAGNETIC CARTRIDGE.
- DUAL AC OUTLET for other electrical appliances such as lamps, etc.
- CHOICE OF BEAUTIFUL FURNITURE FINISH: Mahogany or Blonde — hand-rubbed, high luster.
- COMPACT SIZE: only 8½" high x 15½" wide x 15½" deep. Shipping weight 22 lbs.
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CUSTOM BUILDERS!
READY FOR MOUNTING ANYWHERE!
SUPER V-5 ESPEY CHASSIS
complete with **\$39.95** NET
3 SPEAKERS
slightly higher South and West
already baffled, plus escutcheon and knobs, LESS CABINET

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“I WANT THE TUBES WITH THE GOOD HOUSEKEEPING GUARANTY SEAL!”

“TV and radio tubes are mysterious things to me, but that Good Housekeeping Seal is a tried and true friend. I trust any product that has earned it. So when you replace tubes in *my* sets, be sure they're CBS tubes . . . *the tubes with the Good Housekeeping Guaranty Seal.*”



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- 1** It's a *woman* you talk to on most service calls.
- 2** CBS is addressing its national advertising especially to women.
- 3** 53% of *all women* are influenced in their purchases by the Good Housekeeping Guaranty Seal.
- 4** CBS tubes have that Seal.

Use CBS tubes . . . the tubes in which women have confidence.



Millions will see or hear about CBS tubes on TV and radio . . . and in national magazines throughout 1955.

GET YOUR NEW CBS Tube SALES PROMOTION KIT

Ask your CBS tube distributor for special offer . . . or mail \$2.00 direct for complete Kit.



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 • CBS-Columbia • CBS International • and CBS-Hytron

May, 1955

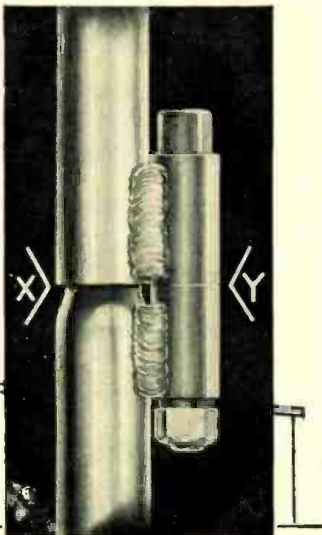
23

A TOWER OF STRENGTH

- Safe in gales up to 80 m.p.h. without ugly, hazardous guy wires
- Free-standing to 50 feet high
- No rusting, ripping or weakened holes
- Big, safe, steel gird-around ties
- Easy installation and dismantling
- Sturdy, safe . . . on roof or ground
- Thick, baked-on-steel aluminum finish

Kuehne*

TELEVISION TOWERS



Exclusive! LATERAL LOAD-BEARING JOINTS

No dangerous rust. Arrow "X" shows open-joint section. Moisture cannot get in tubing to cause interior rust.

No hazardous holes. Arrow "Y" shows lateral load bearers lifetime welded to side of each section leg with twin 1 1/8" fillets. Sections are bolted vertically. Bear 100% of load! No load on joints.

No horizontal bolts to tear through. Nothing stronger or safer. Only Kuehne has it!

KUEHNE MFG. CO.
TV TOWER DIVISION
MATTOON, ILLINOIS

* Say "Kee Nee"

For catalog sheets, see your "Kee Nee" Man or write direct.

Within the INDUSTRY

JOHN K. McDONOUGH, until recently manager of *Sylvania's* radio and television division, has joined *General Instrument Corporation* as vice-president of its *F. W. Sickles Division* and director of sales for both the subsidiary and the parent company.



In his new post, Mr. McDonough will cover the sales of all products made at the company's six plants, i.e., TV tuners, black-and-white and color TV deflection components, variable capacitors, auto radio tuners, and coils.

He was associated with *Sylvania* for more than ten years and has a wide knowledge of the radio and TV industry, both civilian and military.

DON G. MITCHELL, chairman of the board, has been elected president of *Sylvania Electric Products Inc.* to fill the vacancy caused by the recent death of **H. WARD ZIMMER**. . . **W. WALTER JABLON** has been appointed sales manager of *Radio City Products Co., Inc.*, and its affiliate, *Reiner Electronics Co.*. . . *Alpha Wire Corporation* has named **JACK KIRSCHBAUM** to the post of distributor sales manager.

. . . **EUGENE H. RIETZKE**, president of *Capitol Radio Engineering Institute*, was one of ten industry and government leaders to receive a Marconi Memorial Gold Medal awarded by the Veteran Wireless Operators Association. He was cited for his "outstanding contributions in the fields of technical education and electronics in all its phases" . . . **JOHN G. THOMPSON** has been named plant manager of *Heppner Manufacturing Co.* of Round Lake, Ill. . . **CHARLES JACKSON PAN-NILL**, former president of *Radiomarine Corporation of America* and *RCA Institutes, Inc.*, who retired in 1947 after nearly half a century in radio communications, died recently in New York. He was 75 . . . *Andrew Antenna Corporation, Ltd.* of Whitby, Ontario, has named **RICHARD P. MATTHEWS** to the post of director of sales and engineering . . . **LEONARD F. CRAMER**, vice-president of *Avco Manufacturing Corporation* and general manager of radio and television for its *Crosley Division*, has resigned his post. His future plans have not been announced . . . **RICHARD F. GOETZEN**, sales manager of *Fidelitone* and *Permo Point Divisions* of *Permo, Inc.*, passed away recently . . . **IRVING GREENE** has resigned his post as vice-president of *Asco Sound Corporation* and joined *University Loudspeakers, Inc.* as advertising and sales

promotion manager . . . **HARVEY FINKEL** has joined *JFD Manufacturing Company, Inc.* as general production manager. He is the seventh son of **JULIUS FINKEL** to join the firm . . . **SAM F. ARN** has been named engineering sales manager of the technical products division of *Packard-Bell Company*. . . *Rola Company, Inc.* of Cleveland, has appointed **JOHN ADAMS** to the post of sales manager . . . **NELSON P. MARSHALL** has been appointed general sales manager for *Sola Electric Co.* of Chicago . . . *National Company, Inc.* has named **EUGENE F. GRANT** to the post of director of engineering. The firm also announced the appointment of **ROBERT J. MURRAY** as manager of its service department . . . **CHARLES BUTCHER** has been promoted to the post of manager of the Newburyport, Mass. plant of *CBS-Hytron*. . . **JAMES M. BENNAN**, president and chairman of the board of the *Jefferson Electric Company*, was killed recently in an automobile accident. He was 44. His brother, **EDWARD J. BENNAN**, has been elected president to succeed him while **LOUIS J. CROSS** was named chairman of the board by the directors . . . **CHARLES H. GRIFFITH** and **JOHN M. ZIMMERMAN** have been elected vice-presidents of *International Resistance Company* by the board of directors . . . *C.G.S. Laboratories, Inc.* has named **MELVIN L. JACKSON** a vice-president of the firm . . . **NATHAN CHIRELSTEIN**, chairman of the board of *Allied Electric Products, Inc.* and its division *Shelden Electric Co.*, passed away recently at the age of 55 . . . **LOUIS G. PACENT, JR.**, works manager of *Emerson Radio and Phonograph Corporation*, has been elected vice-president in charge of manufacturing for the firm . . . **FRANK J. HEALY**, a vice-president of *Sylvania*, has been elected a director of the company. He has been with the firm for 38 years.

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DOUGLAS C. LYNCH, formerly executive vice-president of *Brush Electronics Company* of Cleveland, has been named president of the company.



He joined the company in 1952, having previously been head of the international operations of the *Crosley Division* of *Avco Manufacturing Corporation*, and later a senior staff executive of *Willys-Overland Motors, Inc.* He holds a degree in mechanical engineering from *Tri-State College*. From 1937 to 1947 he was associated with *Westinghouse* in a number of engi-

RADIO & TELEVISION NEWS

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

GOOD JOBS AWAIT THE TRAINED RADIO-TV TECHNICIAN

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

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

EARN WHILE YOU LEARN

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



Signal Generator



T. R. F. Receiver

Audio Oscillator

National Schools Training is All-Embracing

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

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

TELEVISION TRAINING

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



MASTER ALL PHASES!

Get Master Shop-Method Home Training from an Established Practical Resident School with its own Training with almost 50 Years of Successful Experience in Training Ambitious Men.
We Bring National Schools To You!



Shops, Laboratories, Studios — almost 50 Years of Successful Experience in Training Ambitious Men.



Superheterodyne Receiver

You also receive this Multitester

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.

APPROVED FOR VETERANS AND NON-VETERANS
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Both Resident and Home Study Courses Offered!



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Check here if interested ONLY in Resident Training at Los Angeles. VETERANS: Give Date of Discharge _____

The DYNAMŪ Story

IS TOLD BY OUR CUSTOMERS

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"... DYNAMŪ head produced significantly less hum and tape hiss..."

"... For the first time my tapes sound as good as my best records through my Hi Fi System..."

"... Could extend useful frequency response 15 kc or more..."

"... No audible distortion such as may be discerned during peaks of a phonograph recording..."

"... No noise is detectable except with ear right against the speaker..."

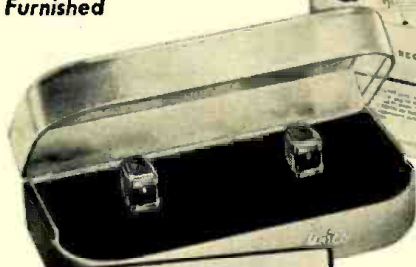
"... A phonograph record transferred to tape and played back is indistinguishable from the original..."

"... It was a 'cinch' to convert my tape recorder with your well illustrated folders..."

"... Can't tell the difference at 7.5" with DYNAMŪ and 15" with my professional recorder..."

**STANDARD GUARANTEE
ON MATERIALS
AND WORKMANSHIP**

**Illustrated Step-By-
Step Instructions
Furnished**



**The Great Names
in HI FI Distribution
Have DYNAMŪ for you**
Ask your favorite
dealer or write:

"DO IT YOURSELF"

Or Factory Authorized
Installation



**DYNAMŪ CONVERSION
KITS**

**FOR YOUR PENTRON • REVERE
RCA • WILCOX GAY • KNIGHT
CONCERTONE • OTHERS**

DYNAMŪ DATA

● DIRECT magnetronic drive as in finest professional studio equipments.

● 1½/10,000 of an inch gap formed of pure electrolytic copper for highest efficiency and long life. The finest and narrowest gap ever available on any head.

● RECORD and REPRODUCE gaps a straight line from end to end within 2 wave lengths of light for exact reproduction quality from one recorder to another with lowest intermodulation distortion.

● Distortion—typical head: 100 cycles— .6% at 15db below tape saturation. 800 cycles— .35% as above.

neering, sales, and management positions, finally as assistant general manager of *Westinghouse International*.

Brush, a unit of the *Clevite Corporation*, manufactures electronic instruments, magnetic recording heads, and piezoelectric crystals.

HUGO COHN has been elected president of *Radio Receptor Company, Inc.*, succeeding Ludwig Arnson who is retiring from the post he has held for the past 31 years. Mr. Arnson will continue to serve the company as a director and consultant.



Mr. Cohn, who formerly held the post of executive vice-president, has been an officer of the company since its founding in 1922.

The firm manufactures electronic equipment for communications, radar, and navigational applications and also produces selenium rectifiers, germanium diodes, transistors, and dielectric heating equipment.

SANGAMO ELECTRIC COMPANY of Springfield, Ill., has acquired the assets of **GOTHARD MANUFACTURING COMPANY**, also of Springfield, which will henceforth operate under the name of **SANGAMO GENERATORS, INC.**

TOPP INDUSTRIES, INC. has purchased the assets and acquired the services of key technical personnel for the full line of potentiometers of **STANDARD ELECTRONIC MANUFACTURING COMPANY** of Culver City, California... A community operations division has been formed by **JERROLD ELECTRONICS CORP.** of Philadelphia to handle all phases of community television installations and equipment...

AIRCRAFT RADIO CORPORATION has purchased **ORION INDUSTRIES, INC.** of Richmond, Va., in a move to broaden its airborne communication and navigation equipment line... **BECKMAN INSTRUMENTS, INC.** of Fullerton, California, has acquired **SPECIALIZED INSTRUMENTS CORP.** and **SPINCO SERVICE CO.**, both of Belmont, California...

BERLANT ASSOCIATES has been integrated into the group of companies controlled by **AMERICAN ELECTRONICS, INC.** This was accomplished by the merger of **BERLANT** and **ELECTROFLOW CORPORATION**, one of the **AMERICAN ELECTRONICS** subsidiaries. The two new subsidiaries will operate under the name of **BERLANT INSTRUMENTS**...

BARRY CORPORATION of Watertown, Mass., has changed its name to **BARRY CONTROLS, INCORPORATED** as being more descriptive of its output... **ASSOCIATED MISSILE PRODUCTS CORPORATION** has been organized in Pomona, California. Its 51,000 square foot plant is located at 2709 North Garey Ave... Edward Robinson, former sales manager for **ESPEY**, has organized a sales representative firm, **ROBINSON ASSOCIATES**, with headquarters at 1058 2nd

(Continued on page 72)

**DYNAMŪ MAGNETRONICS CORPORATION, Div. of the
Maico Bldg., Minneapolis, Minn.**

Maico Co. Inc.



NEW!

Sylvania Technical Manual

—the most complete, up-to-date, tube reference available

- Streamline, loose-leaf format makes it easy to use.
- Supplement service keeps you up-to-date month by month.

The new 10th edition of Sylvania's Technical Manual has been brought up to date completely to include the latest receiving tubes, picture tubes, and special-purpose tubes. More pages, more tubes, more features; yet because of its versatile format it's still the handiest, comprehensive manual to use.

Manual owners receive newly released tube data in loose-leaf form regularly so it can be inserted in the manual.

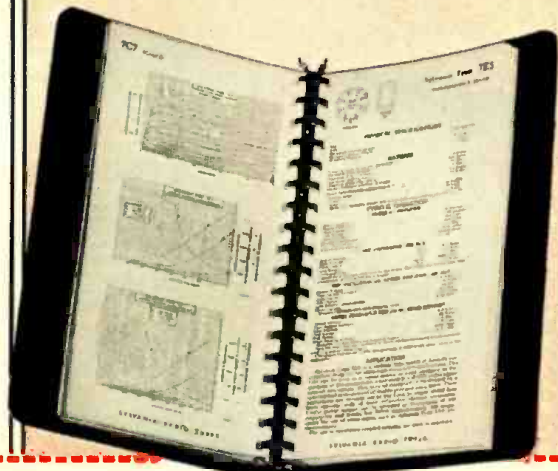
Your copy of the 10th edition of the Sylvania Technical Data Book is available at your Sylvania Distributor —or you can act right now and mail the coupon below.

Lists over 1000 tube types including:

- series-string television types
- color television receiving types
- complete picture-tube listing
- new special-purpose tubes

plus:

- complete characteristic curves on all important types
- tube tester settings for 184 most popular tubes
- new Crystal Diode Chart
- new special-purpose tube chart
- new Resistance-Coupled Amplifier Data.



SYLVANIA

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1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., St. Catherine Street, Montreal, P. Q.

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Sylvania Electric Products Inc.
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check money order for \$2.00 is enclosed. Please send the 10th Edition of Sylvania Technical Data.

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LIGHTING • RADIO • ELECTRONICS •

TELEVISION • ATOMIC ENERGY

May, 1955

27

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 **LOW-EST-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-sembed" and non-assembled, the "MAVERICKS" are, without doubt, today's most sensational antenna-buy.



"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



100%
aluminum

"MAVERICK 300"

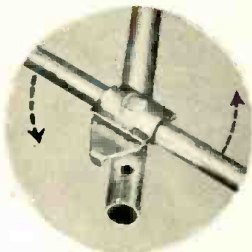
12 different models

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"*

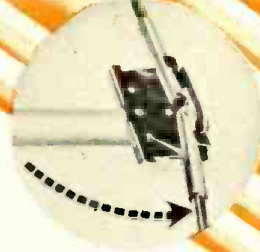
No hardware, no tools, no tightening—pops open, ready for the mast!



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.
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WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

Write for complete technical literature

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G-C RADIO-TV SERVICE CEMENT
Famed high grade adhesive.
No. 30-2 NET \$0.39



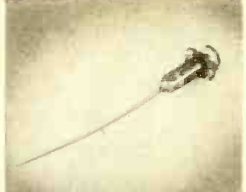
G-C CEMENT SAMPLER KIT
Includes 7 different cements.
No. 345 NET \$4.95



G-C SILICONE COMPOUND
Permanent waterproof material.
No. 8100 NET \$0.99



G-C ELECTRONIC CONTACT CLEANER
All-purpose contact cleaner.
No. 210-2 NET \$0.33



G-C LONG-REACH LUBRICATOR
For hard-to-reach places.
No. 8690 NET \$0.48



G-C RUF-KOAT WRINKLE VARNISH
Black, Gray, Brown (specify).
No. 60-2 NET \$0.39



G-C DIAL LITE COLOR KIT
Kit of 5 colors and solvent.
No. 66-6 NET \$0.72



G-C GENERAL SKRATCH STIK
Removes wood scratches.
No. 909 NET \$0.30



G-C TV-RADIO DIAL CABLES
Best nylon cord in 25-ft. lengths.
No. 75-25 NET \$0.84



G-C DIAL POINTER KIT
Box of 25 assorted pointers.
No. 6805 NET \$3.30



G-C SHIELDED PICK-UP WIRE
Assorted wire lengths.
No. 1738-E NET \$0.27



G-C ASSORTED SPAGHETTI KIT
Kit of 26 lengths of spaghetti.
No. 550 NET \$0.30



G-C NEEDLE-POINT PRODS
Brass chucks, 6" test prods.
No. 7701 NET \$0.30

GENERAL



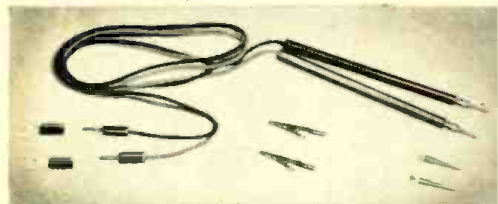
CEMENT

Ask For These
RADIO-TV SERVICE AIDS

... at Your Jobber



G-C SPRAY DE-OX-ID
Cleaner for radio, TV controls.
No. 19-6 NET \$2.97



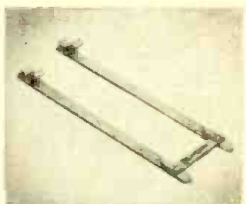
G-C UNIVERSAL TYPE TEST LEADS
Heavy duty 6000 V. leads 50" long, 6" handles, solderless tips.
No. 8463 NET \$1.80



G-C FIBRELOID SHIMS
Kit contains 20 fibreloid shims.
No. 702 NET \$0.39



G-C HARDWARE ASSORTMENT
Approx. 1,000 screws, nuts, etc.
No. 6064 NET \$1.08



G-C TELEVISION SAF-T-RACK
Sturdy, safe chassis repair.
No. 8045 NET \$3.27



G-C SPEEDEX WIRE STRIPPER
Automatic, delayed action return.
No. 766 NET \$4.95



G-C YOKE COIL EXTENSION
Service picture tube in set.
No. 8847 NET \$2.70



G-C TYPE II PIN CUSHION
Reduces fuzzy pin cushion effect.
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G-C POLARIZED TV LINE PLUGS
For all UHF and VHF lines.
No. 8596 NET \$0.36



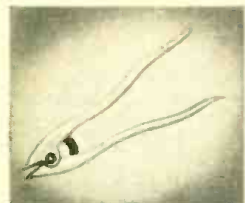
G-C TV KNOB SPRING-WEDGE KIT
100 assorted TV knob springs.
No. 8858 NET \$2.10



G-C ADJUST-A-LOOP ANTENNA
Eliminates bulky loop antennas.
No. 8866 NET \$0.60



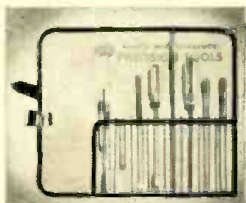
G-C SOLDERLESS TERMINALS
Handy lugs for 300-ohm TV lines.
No. 8633-C NET \$2.19



G-C TV STAND-OFF TOOL
Open and close TV stand-offs.
No. 8450 NET \$0.75



G-C SHAFT COUPLINGS, EXTENSIONS, REDUCERS
Accurately machined brass fittings. Use minimum space.
No. 6701 1/4" to 1/2" coupling NET \$0.12



G-C STD. TV ALIGNMENT KIT
Kit contains 9 essential TV tools.
No. 8455 NET \$4.59

FREE! Postcard brings your big G-C Catalog.



Ask Your Jobber for the



SPECIALS OF THE MONTH

ALL THREE REGULARLY \$1.05
YOUR COST THIS MONTH ONLY . . 69c!



BUY ALL THREE AND . . . SAVE 36c ON THESE HANDY G-C CHEMICALS!

G-C RADIO-TV SERVICE CEMENT	2-oz. bottle	NET \$0.65
G-C RADIO-TV SERVICE SOLVENT	2-oz. bottle	NET \$0.55
G-C ELECTRONIC CONTACT CLEANER	2-oz. bottle	NET \$0.55



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DELCO RADIO...

One of the Largest Makers
of High Quality

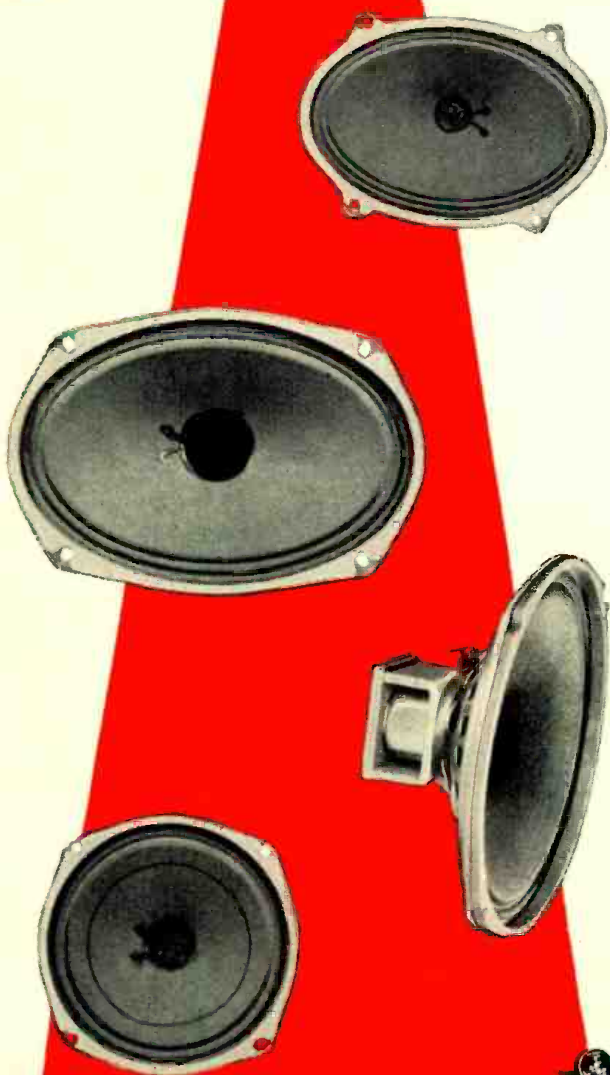
SPEAKERS

for Home and Auto Radios,
Phonographs and Television

Product of combined Delco Radio and General Motors engineering skills, manufactured in plants devoted exclusively to electronic parts, the Delco speaker line embraces 14 standard models for home and auto radios, phonographs, and television—plus the model 8007, a superior Hi-Fi dual-purpose speaker for replacement in AM, FM, TV and phonograph sets, and for use with custom-built high-fidelity audio systems. It's plain to see that here's the speaker line to fill your needs...products of uniformly fine design and construction, *all* of them competitively priced!

Standard Speaker Features: Designed and built to R.E.T.M.A. standards; cones uniform in response over operating frequency range; fully dustproofed with drawn brass magnet covers and felted cones; Alnico-V magnets; heavily plated metal parts.

Model 8007 Hi-Fi Speaker Features: Size 8"; 50 to 12,500 CPS frequency range; Alnico-V magnet; 10-watt power rating; 4.1 input impedance; $1\frac{3}{16}$ " voice coil.



DELCO RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA

A GENERAL MOTORS PRODUCT  A UNITED MOTORS LINE

DISTRIBUTED BY ELECTRONICS DISTRIBUTORS EVERYWHERE

Order these quality products of a volume electronics manufacturer through your UMS Electronic Parts Distributor today.

LAFAYETTE'S SPECTACULAR MONEY SAVERS



SALE!
26⁵⁰

Webcor
3 SPEED AUTOMATIC
RECORD CHANGER
Buy at Lafayette's
LOW SALE PRICE

- Brand new fully automatic 3 speed record changer
- Dual turn-over cartridge with dual styli
- Automatic shut-off after last record

You'll find this famous Webcor Diskchanger not only in Webcor Fonographs 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, 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**

Greatest Tape Buy Ever!



1200 FT. REEL
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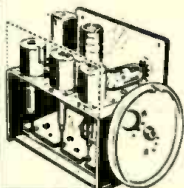
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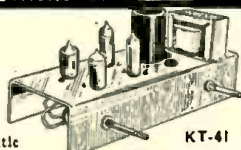
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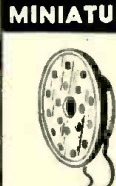


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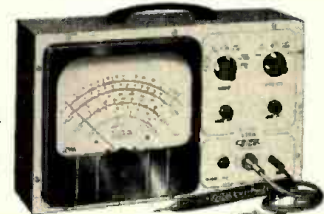
- ★ Measures directly p-p voltage of complex and sine waves: 0-4, 14, 42, 140, 420, 1400, 4200 volts p-p.
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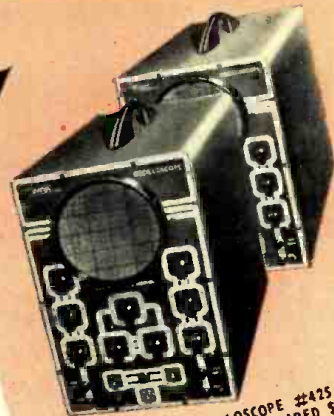
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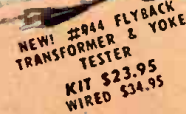
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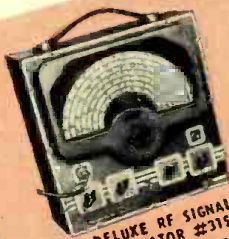
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CAMPUS CARRIER-CURRENT SYSTEM

By PHILIP J. KISER
Purdue University



Fig. 1. Author on duty in Announcing studio. Note remote control box for mike near right hand. (Right) Control console with Fisher AM-FM tuner and Heath amplifier at left of John Upfield, a station engineer.

About 150 colleges and universities are "broadcasting" via carrier-current. Here are details on Purdue's setup.

A UNIQUE type of broadcasting which has come more and more into use since the war, is now being utilized by about 150 colleges and universities throughout the country. It is nick-named "wired wireless", but more accurately it is called "carrier-current" radio.

Few people realize the extent of carrier current operations by the students in the various colleges. Many of these stations sell time, both nationally and locally, and operate exactly like commercial stations. Others, like the one operated by the members of Cary Club (men's residence halls) at Purdue University, are sustained by the listeners directly.

The author knows of two advertising agencies which cater exclusively to such college stations. There is also a national organization, IBS (Intercollegiate Broadcast System) which such stations may join. IBS offers legal, technical, and program aid to member stations.

The installation at Purdue University is typical of the big-time operation that carrier-current really is. The station occupies the sixth floor tower of one of the men's residence units. Its audience is almost entirely students and during peak hours numbers a potential 3000. Often about 90% of the radios in operation are tuned to the student station, WCCR.

The station goes "on the air" at 6:30 a.m. and remains on continuously until 1:00 a.m. the next morning (2:00 a.m. on Fridays, Saturdays, and Sundays) giving the listeners 18½ hours of continuous, non-commercial music. This compares favorably with most local commercial stations. Programs range from jazz and "Dixie" all the way to classics. An unpaid staff of

over 100 men and women run the station its 130 hours a week. We train and maintain a staff of about 30 announcers each year, as no one person can spend too much time with this extra-curricular activity.

Besides the regular staffs for programming, announcing, engineering, news, etc., the station maintains a research and engineering staff. It was this staff that solved the problem of

EDITOR'S NOTE: As we go to press we have received word from Purdue that they now have four off-campus satellites in operation and a fifth is in the process of being installed. The new stations have added about 450 listeners and when the fifth is completed an additional 300 persons will be able to pick up the programs. According to one unofficial source, station WCCR has the largest listening audience of any college carrier-current station in the country. In addition, the school is said to be the only one that has succeeded in tying in some of the off campus buildings.

covering particular sections of the city (not on campus power lines) with our carrier signal.

As in the case of Purdue, the administrations of most colleges are very happy to sanction this type of broadcasting because it fulfills a need—experience and training in radio broadcasting—for the interested students, that could not otherwise be satisfied. These all-student stations also provide a quick and sure way of reaching the student body in cases of emergency.

A carrier-current installation can be

quite elaborate, composed of expensive commercial equipment, or can be very serviceable using strictly home-made gear. WCCR has come up with a combination of the two and is as well equipped as any small commercial station—and many larger ones.

The heart of any radio station is the control console. See Fig 1. Any of the small commercial models (called "consolettes") can be used. We chose to have one custom built for us by the local "Campus Electronics Service." Our board has relay push-button controls on the channel inputs. This was done to make it possible to control the channels remotely. Thus our announcers control their own mikes. When the channels are off, the relays automatically switch the turntable inputs to "cue" (audition). Our board (see Fig. 4) has four input channels: one for each of two turntables, one for the mike inputs, and one essentially for remotes and extra use. A patching arrangement determines which mike will feed the mike input channel. Each mike has its own preamp mounted in a rack in the control room.

The second items of necessity are the turntables. We chose *Rek-O-Kut* Model LP-743 mechanisms and tables, mounted in our own bases. These are three-speed mechanisms accommodating everything from 45's to 16" transcriptions. We use *Clarkstan* Model 212, 16" arms and the commercial type *G-E* triple-play pickups (Model RPX O47).

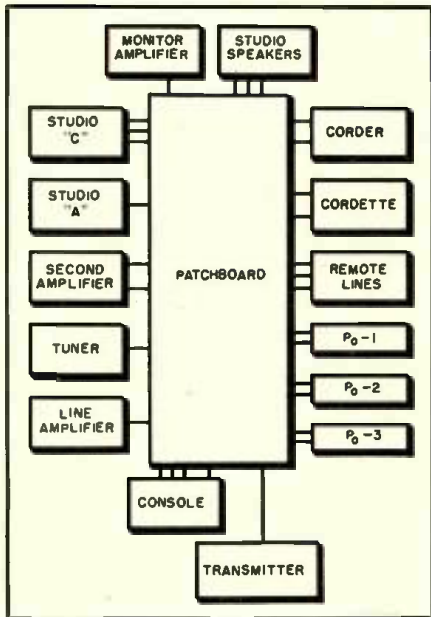


Fig. 2. Patchboard used at Purdue provides increased flexibility of the entire system.

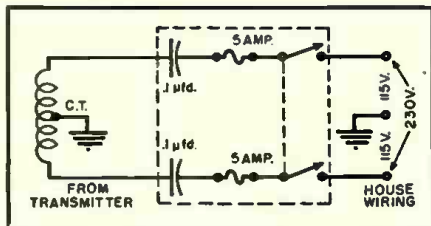


Fig. 3. Method of tying into the power system. Note tie must be made to both sides of 230-volt line for full service coverage.

Because of the many different types of records on the market today, there is often some confusion as to what type of equalization to use. We solved our equalization and turntable preamp problems by buying *Fisher* preamps (Model 50-PR). These self-powered units have four low-frequency turn-over points and four roll-off points.

Our second year on the air we bought a *Magnecord* tape recorder adding another our third year. One unit is rack mounted and the other remains in its portable case, sitting on the rack ready for remotes. It can be used just as though it, too, were rack mounted. See Fig. 6.

We have greatly increased the flexibility of our system with a well-planned patchboard. See Fig. 2. To make the most of our board we use single jacks and plugs. All of the console inputs, preamps (ins and outs), tape recorders (ins and outs), tuner, program and monitor amps (ins and outs), and the transmitter line appear, normalled through, on the board. In addition are a line to WBAA, the local state-owned educational station on campus; a line to the other carrier-current station on campus; the remote lines; and lines to our satellite transmitters in the other living units. This flexible patchboard means, for example, if a preamp goes out another can readily be patched in to take its place. The same holds true for all the other amplifiers, including the main program amplifier. This means the station would never have to be off the air more than a few seconds due to technical failure.

WCCR has taken advantage of its lofty location by installing its FM receiving antenna on the roof, one floor up. This puts the antenna about 100 feet off the ground. The station purchased a *Fisher* AM-FM tuner (Model 50-R). The combination of the high antenna and the sensitive tuner brings in FM stations from as far away as 250 miles. The antenna has six elements—two active and four reflective. We have picked out a good strong FM station with continuous music and re-broadcast some of their programs directly over our station. The station, WEFM owned by *Zenith Radio Corporation*, 120 miles away in Chicago, broadcasts non-commercial music on 99.5 mc. We carry, with permission, five hours of their programs during the time of day when we would normally be short on personnel. The tuner feeds an amplifier which, in turn, feeds our local transmitter and the line amp to our remote transmitters, bypassing the console and other equipment. This means the station can be left unattended during part of the day with only three pieces of audio equipment running—the tuner, its amplifier, and the line amplifier. See Fig. 1.

The thing which makes carrier-current radio unique is, of course, the way the r.f. signal is carried from the transmitter to the individual receivers. By far the most popular means is the

use of power lines—mostly because they are already installed and thus form a free route to each radio on the system. This all sounds simple and most convenient at first glance, but only at first glance.

Since the installation at Purdue is typical and since it involves most of the conditions that might be encountered in a carrier-current system (large buildings grouped together, large buildings a block or so apart, large buildings several blocks or a mile apart, and remotely located buildings on some other power system quite a distance from the studios) it will be described in detail.

The first carrier-current transmitter installed at Purdue was designed to serve Cary Hall, a group of five buildings forming the men's residence halls on campus. These buildings are arranged in a rectangle two blocks long by one block wide and house 1600 men. As mentioned before, the studios are on the sixth floor of one of the buildings and the original plan was to install the transmitter in the studios and tie in with the power lines right there. It was here we learned lesson number one—a power transformer is one of the best r.f. chokes we have encountered. We discovered that each of the five buildings has its own step-down transformer from the university's 2300-volt lines and hence each building is almost completely isolated from the others as far as our r.f. signal is concerned. We solved this problem by running a separate r.f. line from the transmitter to each building and made the tie-in with each local power board.

A point worthy of note here—when tying into a power system, it is necessary to be sure a tie is made to *both* sides of the incoming 230-volt line, otherwise only half of the building will be covered. See Fig. 3.

It is best to use at least a parallel pair when running the r.f. any distance. Better yet is twisted pair, shielded pair, or coax, in that order, the latter being rather expensive for any distance. We have found it quite satisfactory, from a radiation standpoint, to use a parallel pair of wires. Telephone drop line, for example, makes an excellent r.f. line.

The transmitter used in the original installation, Fig. 5 (Cary Hall), was designed and built by the "Campus Electronics Service," mentioned previously. The unit has an adjustable power input of about 10 watts maximum. Using full power we still remain well within the legal limits of radiation as set forth in Section 15 of the FCC rules governing limited radiation devices. In simple language it means that at a frequency of 600 kc. (our operating frequency), you may radiate enough power to be picked up on a good car radio not more than 263 feet from any power line carrying the signal. As the frequency goes up, of course, the allowable radiation limit decreases. This, then, is why most carrier-current operations are found below about 700 kc.

Less than a year after WCCR began

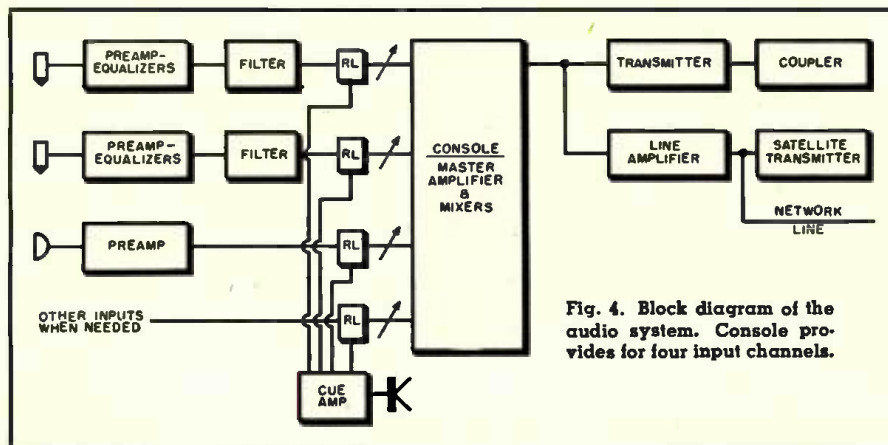


Fig. 4. Block diagram of the audio system. Console provides for four input channels.

operation in the men's residence halls, it was decided to extend the service to the women's halls, which, because of the transformers in the university's power lines, were not getting enough r.f. signal to be detected. One solution would have been to run r.f. lines the mile distance through the university's service tunnels. The cost, however, would have been prohibitive, besides not being sure of having enough r.f. signal left to put an adequate signal into the buildings.

It turned out to be much more economical to have another transmitter built and installed. This unit has about 5 watts' input and seems adequate for the women's buildings and the new men's halls about a block and a half away. See Fig. 7. This third group of buildings, housing slightly over 600 men, was brought into the network shortly after the installation of the women's transmitter, but this time the university's service tunnels were utilized. A parallel pair carrying the r.f. was run the one-and-one-half blocks from the women's transmitter to the main power board in the men's building.

The 5-watt satellite transmitter was fed programs over a rented phone line, commonly referred to as a "radio loop." The transmitter was turned on and off by a simplex circuit on the phone line. The residents of these two housing units have since built their own studios and now originate most of their own programs, however, the original radio loop is still in operation and when they are not originating programs, WCCR can still control and feed programs to their transmitter.

Incidentally, the cost of this radio loop is \$4.75 a month for the half-mile distance. Rental of such loops is charged on a line-of-sight basis. This comes to about \$50 a school year which is quite reasonable considering the service rendered. It would take many years of phone rentals to pay for a permanent line through the tunnels.

It follows that since the signal from the parent station could not be received in the women's halls originally, then no problem involving interference or "beats" would occur. (Both transmitters operate on 600 kc.) This has been verified since the installation.

An entirely different problem of transmission arose when the fraternities and sororities—located from a block up to a mile from the campus—became interested in receiving the non-commercial, all musical programs of WCCR. These houses are on the city, not university, power lines, as well as being on the city, not the campus telephone exchange. Since there was no tunnel system upon which to rely, there was some question as to how we could put an r.f. signal, modulated with audio from our studios, into a potential 66 houses (housing some three-thousand students) spotted here and there over a couple of square miles. The telephone company was unable to provide individual radio loops to each house even if the groups desir-



Fig. 5. Transmitter in operation in Cary Hall. One meter and a multi-position switch gives data on all necessary circuits. Transmitter was home constructed.

ing the service were willing to pay for it. As in the case of many proposed carrier-current installations, the problem at first looked nearly impossible. But an easy survey and the experience of our previous installations brought about a long-range plan which seems to be feasible and reasonably economical.

Please note, however, that the following plan is only in the first stages of execution. We may find ourselves with other technical problems before we are able to cover all of the off-campus housing units.

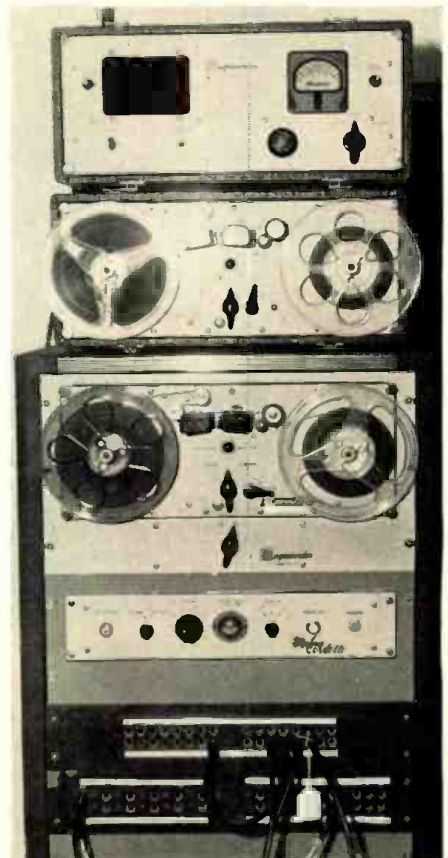
First we broke the 66 housing units under consideration down into groups or zones according to which power transformer they were on. For identification purposes a zone number was assigned—twenty-six zones were used. The idea was, of course, that if we could get a carrier current transmitter into one house in each zone, then theoretically the other dwellings on that same power transformer (zone) would also get the signal—but that houses on adjoining transformers would not get any signal from the other zones' transmitters since we had already determined that r.f. will not pass through a transformer. In the cases of adjoining zones that have fraternities or sororities next door to each other, an r.f. drop line could be run interconnecting the two zones, thus eliminating the need for another transmitter for the adjoining zone.

Secondly, realizing that there were only five main telephone cables serving the sections of the city in which we were interested, it again became evident that if the audio signal from our studios was put on one pair in each of these cables, then it could be tapped off where needed. This made it physically possible for the telephone company to help us in more cases. Of course, each tap off the audio lines was classified as one radio loop rented

line-of-sight from our studios. But now the plan is that 66 houses pay for about 20 radio loops, instead of the original plan of 66 houses paying for 66 separate loops.

We have just begun to put this plan into operation. Our engineers have one

Fig. 6. Some of the equipment used by the station. From top to bottom, Magnecorder, Magnecordette, and 56-position patchboard. All preamps and the line amplifier are mounted in bottom section which is covered by a plate. Not visible in the photo.



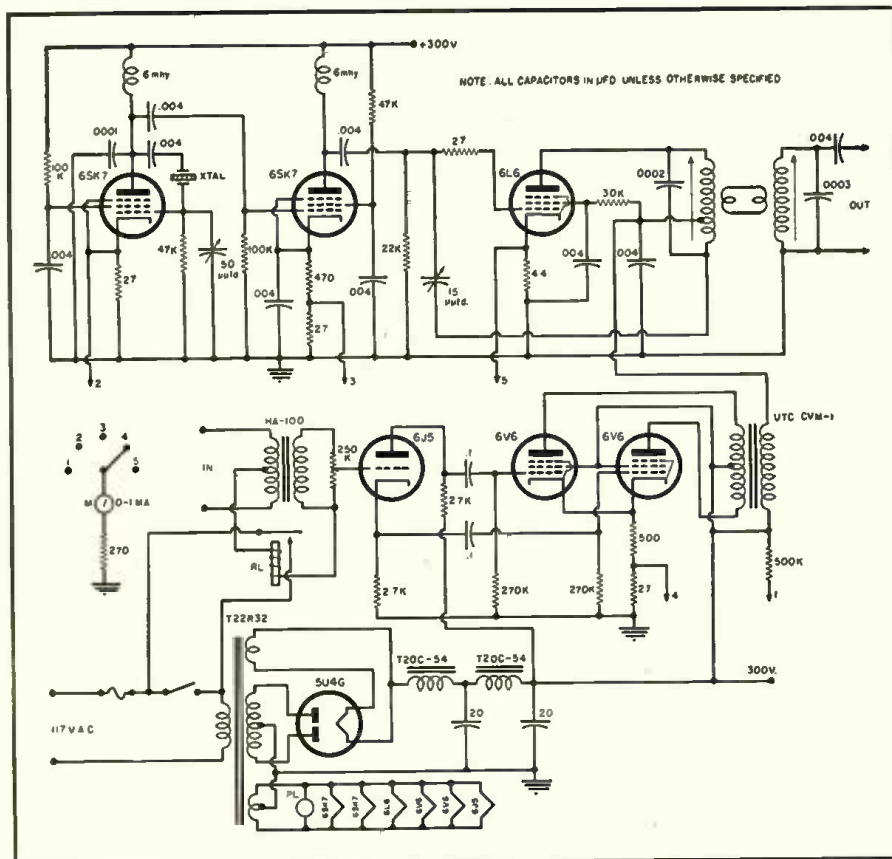


Fig. 7. Schematic of 5-watt unit operating in women's dormitories by remote control.

transmitter installed and the ground-work laid for the others. This year may see up to eight more added to the system. Besides the average of three student residences in each zone, remember too that in most cases there will be several private homes receiving the signal.

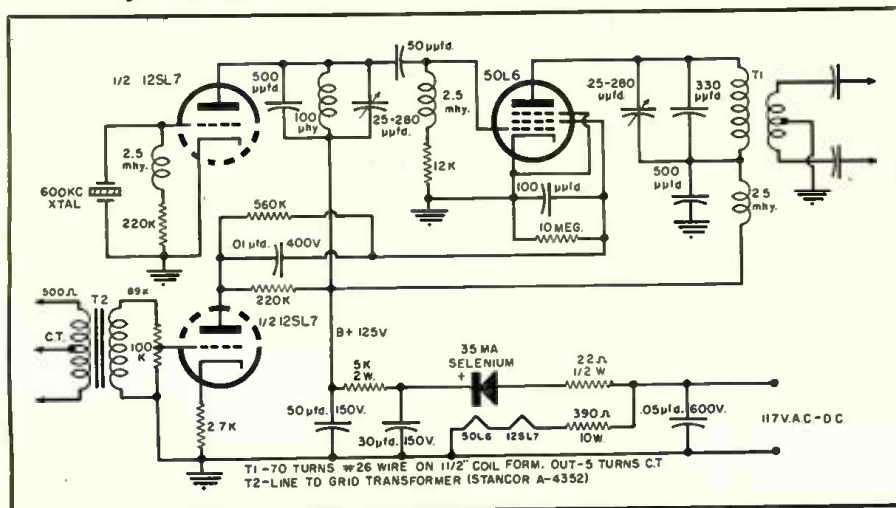
One of the biggest problems in our case is the availability of phone lines. Each campus will, no doubt, have its own unique problems to solve. It was with the idea of sharing the solutions to some of ours that this article was undertaken.

The construction and performance of our one satellite in the city might be of some interest to other stations with

small areas to cover. The transmitter is small and easy to build, employing only 2 tubes. We used crystal control, both for stability and ease of changing frequencies, if necessary. The units were purposely kept small and simple for ease of construction and minimum service. Parts are all standard and can be ordered from any good-sized mail-order house (except for the coil which can be wound on a standard plug-in coil form). The crystal must be ordered specially ground. The total cost, including the crystal, comes to about \$24.00. The schematic of this transmitter is shown in Fig. 8.

We use the same means of coupling for all of our r.f. lines. The switch box,

Fig. 8. Schematic of the two-tube, crystal-controlled satellite transmitter.



fuses, and capacitors will add slightly to the cost. Our standard coupling is shown in Fig. 3.

After making this initial installation on the city power lines, we took a very sensitive portable receiver on a tour of the neighborhood. A good signal was detected in every house within the block, and no signal in the houses in the adjoining zones. However, by following the "high lines," we could get the station (when directly under the lines) for several blocks. From this we deduced that a little r.f. was getting through the transformer to the high lines, but not enough to get back down to the low lines in the next block or zone.

Incidentally, we used 600 kc., but have crystals on hand for adjacent frequencies should there be any danger of beating in adjoining zones.

Even without the proposed new rules, now under consideration by the FCC, a new station should choose carefully when selecting its operating frequency. The frequency preferably should be under 700 kc. and not have a strong station within 20 kc. of it. The strongest station on your operating frequency should not put a signal of more than 1/100 of what yours will be into the area you expect to serve. The beat caused from such interference would be even more noticeable if, as proposed, the carrier-current stations are required to switch to odd multiples of 5 kc. frequencies. The beat then would be 5000 cycles—very objectionable!

Watch that second harmonic, too! Be sure it does not interfere with anyone and that it doesn't over-radiate. It may be necessary to put a filter on the output of your transmitter.

One of the advantages of carrier-current radio is in the frequency response obtainable. Commercial stations are held to 5000 cycle response to eliminate interference between adjacent stations. However, if your choice of operating frequencies has been wise, you may broadcast with a frequency response comparable to FM. Our main transmitter has good response up to about 20,000 cycles. Of course, there are not many receivers capable of reproducing this, but some of the hi-fi fans in our audience have built crystal receivers in conjunction with their high-fidelity amplifiers and they really enjoy the quality reproduction. We have several times sponsored hi-fi programs using master tapes—and, of course, our daytime classical music is rebroadcast right off of FM. We also do at least two remote live musical pickups each week.

This is the story of only one carrier-current radio station. Each of the many in the country is busy solving its own problems, training young people in the art of radio broadcasting, and furnishing thousands many pleasant hours of listening. Carrier-current radio is just another of the many devices currently available for communications, but is a medium that is gathering new adherents at a truly remarkable rate.

A PRACTICAL TRANSISTOR PREAMP

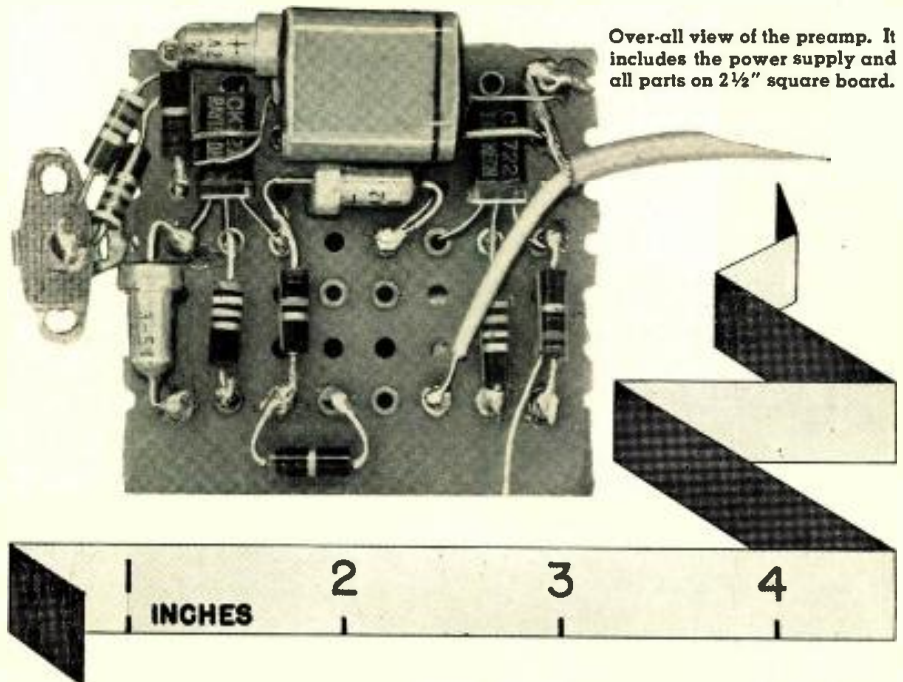
RECENTLY many articles have appeared describing practical applications for transistors. Still, work with transistor circuitry has been avoided by the audio experimenter and hobbyist. Skepticism came with the advent of the transistor (i.e., noise, cost, "temporary" battery supplies) and has remained to discourage much-needed exploitation of the new field.

In a short time, transistors have come a long way. To you, the hobbyist, a simple preamplifier can be constructed in a matter of hours, for a cost equal to that of the commercially available single-tube magnetic pickup preamplifiers. The complete unit may be mounted on a board 2½ inches square, power supply and all. Internal noise is essentially inaudible at more than comfortable music-listening levels. A practical 6-volt battery supply (consisting of *Mallory* mercury cells) will provide better than 2000 hours of service. This means that with an average of four hours usage per day, you can forget about the supply for a year and a half! All parts are easily available on the open market, or in the junk-box.

Several working models of the preamp have been built, with no custom tailoring necessary. A straightforward circuit is used, with grounded emitters and no tricky feedback (see Fig. 1). The *Raytheon* CK727 low-noise transistor is used in stage 1, followed by the popular CK722 in a similar circuit arrangement. In resistance coupling of transistors, there must be a compromise made on the values of load resistance. The impedance match must be as close as possible (about 20,000 ohms optimum), yet this impedance must be low enough to allow proper collector current to flow without demanding too high a supply voltage "pump."

Although transformers solve the problem, they are bulky, expensive, and limited in their frequency response. But with grounded emitters, there is still gain to burn. The db wasted due to compromise will never be missed. This preamp still ends up with a gain of 2000 on voltage. The base resistors were set for low noise, low distortion, and best gain for the stage. The values are not highly critical, and 10% parts are used throughout. The coupling capacitors are large in value, since they work into the low impedance base circuits. Five or eight µfd. electrolytics at very low voltage ratings are small and fairly inexpensive. The author's model uses tantalums, but this is not necessary. Notice that the output impedance is very low, and long leads from the preamp cause no losses. The output capacitor may be smaller, since it is assumed that the unit will work into a high impedance input of the main amplifier.

The simplest solution to the equalization



Over-all view of the preamp. It includes the power supply and all parts on 2½" square board.

By

BERNARD EDELMAN

Dynamics Test Engineer, Convair

The development of the CK727 low-noise transistor makes the construction of this compact unit possible.

zation problem was to equalize right at the pickup. A *G-E* was used for tests, aiming at the NARTB curve. The low impedance input of the CK727 was a help rather than a hindrance, since the equalization components are also of low impedance, and there was no stray pickup or hum problems. The series resistor to the pickup both completed the equalizer design, and presented the proper load to the pickup. The equalization circuit may be glorified into a selector switch choice of a number of the curves, with no evils of high impedance. The attenuation and insertion loss of this equalizer are of no consequence to the preamp following, with its gain of 2000. The resultant output from LP's is close to one volt delivered across the 6800 ohm load resistor.

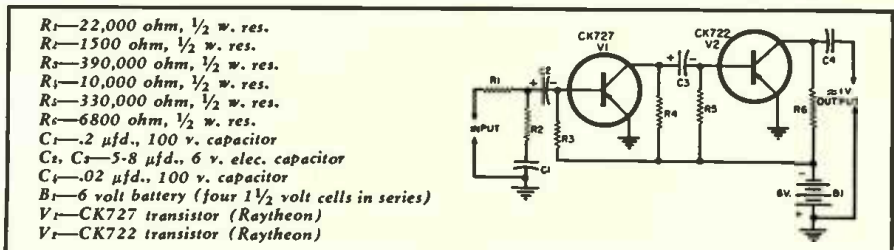
Total battery drain from 6 volts is .9 milliampere. The batteries (4 series

cells) were mounted right on the reverse side of the small fiber board used as a chassis.

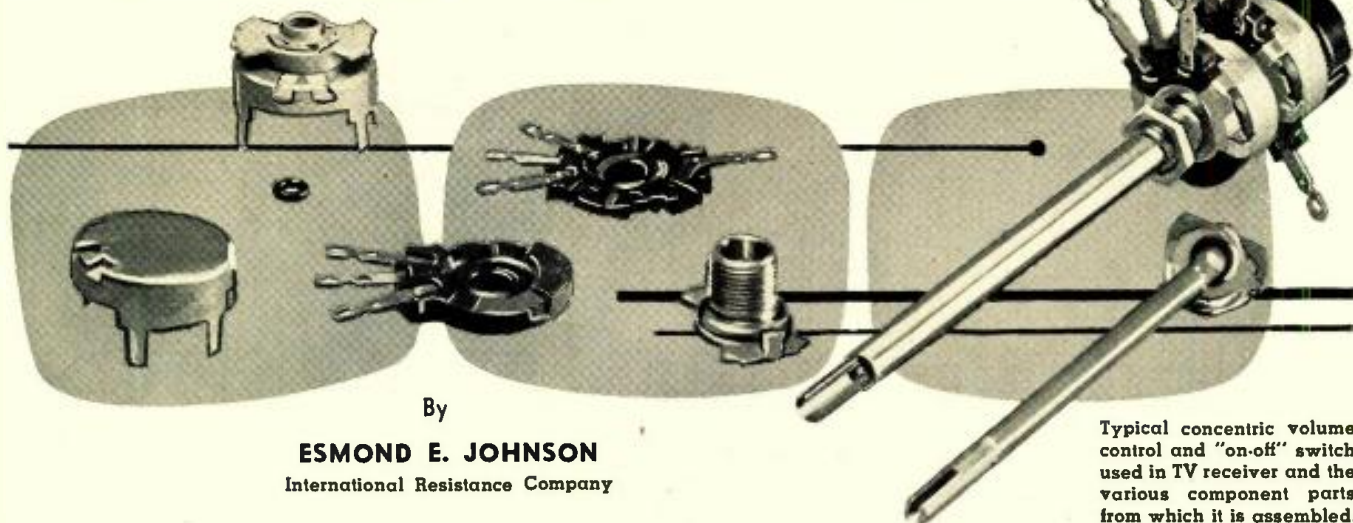
There are features to this little job not to be overlooked. By definition, the hum is zero, not an earthshaking attribute, but a most satisfactory condition. The hum pickup and microphonic susceptibility of the preamp are so low that the unit may be mounted directly below the arm on a changer. The power "on-off" switch can be rigged to a muting switch if one exists, since there is no warmup time. Otherwise, a 117-volt relay may be put across the phono motor.

The over-all result will be an equalized one volt of signal from your turntable, humless and virtually distortionless. The changer (or turntable) may be taken for granted as it always has been, but now you may put your arm—
(Continued on page 86)

Complete schematic diagram and parts list for the compact transistor preamp.



CONTROLS FOR YOUR TV RECEIVER



By

ESMOND E. JOHNSON

International Resistance Company

Typical concentric volume control and "on-off" switch used in TV receiver and the various component parts from which it is assembled.

Part 1. What do you know about taper of TV controls?

You can replace such controls faster if you read this.

ADJUSTING a TV set to produce a bright, sharp, distortion-free picture can be a service technician's lark or his time-consuming headache. It's largely a question of how much the service technician knows about the controls in a TV set—what they are for, how the control circuit works and, especially important, how to replace control rheostats or potentiometers when necessary with exactly the right one for the job.

In the days of radio sets alone, there was little or no adjustment problem. Radio sets, old or modern, have only a volume control, usually a tone control, and sometimes a sensitivity or a hum control, and these are adjusted mainly by ear. The process of receiving a picture, however, is far more complex, and the controls of the TV set for all the functions involved—synchronization, focus, contrast, centering, and picture size—must be adjusted to function as a team if the received picture is to be the clear, undistorted image the customer wants to see.

Not only are there many more controls in a TV set than in a radio, but, in the TV set there are many more concentric dual controls, which makes the control replacement more difficult.

Each of the five major sections of a TV set has several controls which play an important part in getting the picture in adjustment on the screen. An over-all idea of all the controls used in a standard TV set can be obtained at a glance from Table 2.

Manufacturers make each control exactly right for the job in each control circuit. Good TV set adjustment therefore begins with making a control replacement, whenever required, with just the right rheostat or potentiometer for the job. To do this prop-

erly a service technician has to know these basic electrical facts about the control: its resistance, its power rating, and its taper. Power rating is easy to judge by resistor size and is marked on the case. The control's resistance value is also marked. But to replace a control with another of exactly the right taper, the service technician should know the following about taper in controls.

Taper—What and Why

What is taper and why is correct taper so important in each control circuit? Furthermore, if you don't know the correct taper for a control, how do you find it?

The principal characteristic desired in a control is that it should permit smooth adjustment. That is, each 5 or 10 degrees of rotation of the shaft should provide an equal adjustment step in the circuit. The bane of the service technician's existence is those controls in which a slight rotation at the start produces a big adjustment, and rotating the shaft the rest of the way produces very little adjustment. The desired evenly-spaced adjustment is obtained in most cases by giving the control rheostat or potentiometer the right taper.

Suppose you start rotating a control rheostat from the zero resistance, counterclockwise (CCW) end and measure the resistance between this end and the contact arm (CT terminal) for every 10 degrees of shaft rotation, as illustrated in Fig. 1. If you make a graph of the resistance against shaft rotation, this curve (Fig. 2) will show how the resistance tapped off by the contact arm changes with increasing shaft rotation. The shape of this graph is called the control's "taper."

If the control is a wirewound rheostat or potentiometer with the resistance wire the same size throughout and the turns equally spaced, the resistance increases the same amount for each degree of shaft rotation, and the graph for this is a straight line ("A" in Fig. 2). This is called a straight line or linear taper. However, in many control circuits, control adjustment is desired in decibel steps. This requires a rheostat or potentiometer in which the resistance from one end to the contact arm increases slowly at first, then shoots up fast along a logarithmic curve ("B" in Fig. 2), giving the control a logarithmic taper, also commonly called a left-hand (L.H.) log or audio taper. Sometimes a reverse action is desired—a sudden resistance drop, then a gradual decrease ("C" in Fig. 2). This is known as a right-hand (R.H.) or reversed log taper, and provides the same resistance variation as the audio taper when the control shaft of the latter is rotated in the reverse (counterclockwise) direction.

For the most part, all television controls, either composition or wirewound, have one of the three resistance tapers shown in Fig. 2. A practical example will show how a logarithmic taper produces uniform adjustment in decibel steps.

Take, for example, the volume control with the left-hand log taper shown by curve "B" in Fig. 2. The attenuation, in decibels, which such a control produces as the shaft is rotated can be easily computed using the resistance values which are presented in column two of Table 1. The attenuation is calculated from the voltage ratio, that is, the ratio of the voltage across the control's total resistance to the voltage tapped off by the contact arm. Since voltage ratio is the same numerically as resistance ratio, the latter can be used to calculate the db attenuation.

The attenuation in decibels for each

control shaft position for the L. H. log pot of columns 1 and 2 in Table 1, is equal to $20 \times \log_{10}$ of resistance ratio. For example, at 50% rotation, the tapped-off resistance is 10% of the control's total resistance (see Table 1), so the resistance ratio is 10. Since \log_{10} of 10 = 1:

$$\text{Attenuation (in db)} = 20 \times 1 = 20 \text{ db}$$

Computing the db attenuation in the same way for all the resistance values in the center column of Table 1 gives the attenuation values in the last column. If these calculated attenuation values are plotted against per-cent rotation, the curve is very nearly a straight line and shows that the control with this log taper produces nearly equal, uniform (smooth) decibel steps of attenuation as the shaft is rotated.

Another important reason for producing controls with special tapers is that a special taper can cut down the heat dissipation in a control, and permit the use of smaller controls of lower power rating. Some form of R.H. log taper giving 10 to 20 per-cent of the total resistance at 50 per-cent rotation is the type of control most often used for this purpose.

Knowing what the taper of a control rheostat or potentiometer is and why it is important, the next natural question is, "How do you find the taper of such a control when you want to replace it?"

The best way is to refer to the manufacturer's catalogue, which usually says what the taper is for each control. But, if the catalogue is not available, the control's taper can be determined by first checking to see that the control is electrically intact, i.e., has no open circuit, short, or loose contact. Then, hook up an ohmmeter to measure its resistance at different points of shaft rotation. Measure the total resistance of the control with an ohmmeter connected between the counterclockwise (CCW) terminal and center terminal (CT) with the control shaft turned to its maximum clockwise position. Now, turn the control shaft back to 50 per-cent of its rotation and note the reading of the ohmmeter. If the resistance is about 50 per-cent of the total reading, the taper is linear. If the resistance is about 10 per-cent of the total, the taper is audio. A resistance of 90 per-cent of total indicates a R.H. log taper. For better accuracy, a R.H. log taper is usually measured between CT and CW terminals. In this case, the measured resistance at 50 per-cent rotation would be about 10 per-cent of the total.

Once he knows how to get the right control rheostat or potentiometer to replace the one in the control circuit, the other information on TV controls which the service technician needs to know to do a good, quick job of set adjustment and control replacement can best be grasped by studying, one at a time, the control circuits in each major section of the TV set—the audio, video, horizontal sweep, vertical sweep, and low-voltage power supply.

A TV set may have the following

controls in its audio section: volume, tone, AM rejection (buzz), and ratio detector balance. This does not mean that any one television receiver has all of these controls. Some may have only a volume control, others, a volume and tone control, etc. The volume control generally adjusts the sound output from the speaker by regulating the amount of signal fed from the ratio detector or discriminator to the grid of the first audio stage. This control is tapped at 50 per-cent of its total resistance to accommodate a low-frequency boosting network. This is for the purpose of increasing the low-frequency response at low volume levels, to make up for the insensitivity of the ear at low frequencies when the volume is turned down. Two taps with two resistance-capacitance networks are sometimes used in deluxe models to increase the effectiveness of the bass boost over a wide range of volume level.

Since negligible power is dissipated in this control, the only requirement for a replacement is that it meet electrical and mechanical specifications and does not become noisy in service. In many TV sets the volume control is the rear section of a concentric dual control, the other section of which is the tone control.

The tone control either reduces the high-frequency response or the low-frequency response when turned either direction from the position for normal operation. This control dissipates negligible power, so any good $\frac{1}{4}$ to $\frac{1}{2}$ watt potentiometer meeting electrical and mechanical specifications makes a satisfactory replacement. A linear taper control could be employed here, but one with a special double audio taper from center of rotation will perform much more smoothly.

Sometimes, the tone control is of the switch type rather than the continuously variable type. One position of the switch may short out a capacitor in a bass boost network, reducing the low-frequency response. In another switch position, a capacitor from the 1st audio tube plate is connected to ground, shorting out the high frequencies.

Some additional controls in the audio section, as well as the controls in the other sections of the typical TV receiver, will be discussed next month.

(To be continued)

Table 1. Attenuation in decibels for the various shaft positions of a control potentiometer with a left-hand log taper similar to curve "B" in Fig. 2.

PER-CENT ROTATION	PER-CENT RESISTANCE*	CALCULATED ATTENUATION
0	0	∞ db
10	1	40 db
20	1.5	36 db
30	2.0	34 db
40	5.5	25 db
50	10	20 db
60	23	12.8 db
70	45	7.0 db
80	66	3.7 db
90	87	1.2 db
100	100	0 db

*In this particular case, the per-cent resistance is the same as the actual resistance.

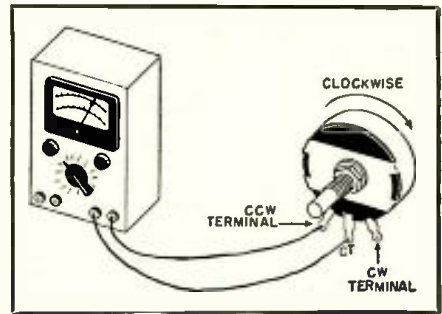


Fig. 1. Hookup for measuring the resistance change in a potentiometer with increasing rotation of the shaft. This is done to find the taper of the potentiometer.

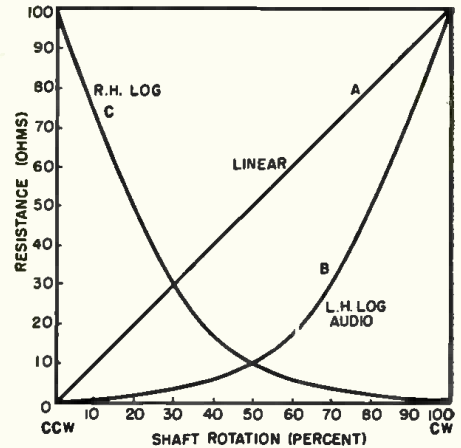


Fig. 2. Graph of resistance variation with increasing shaft rotation of a particular control potentiometer or rheostat.

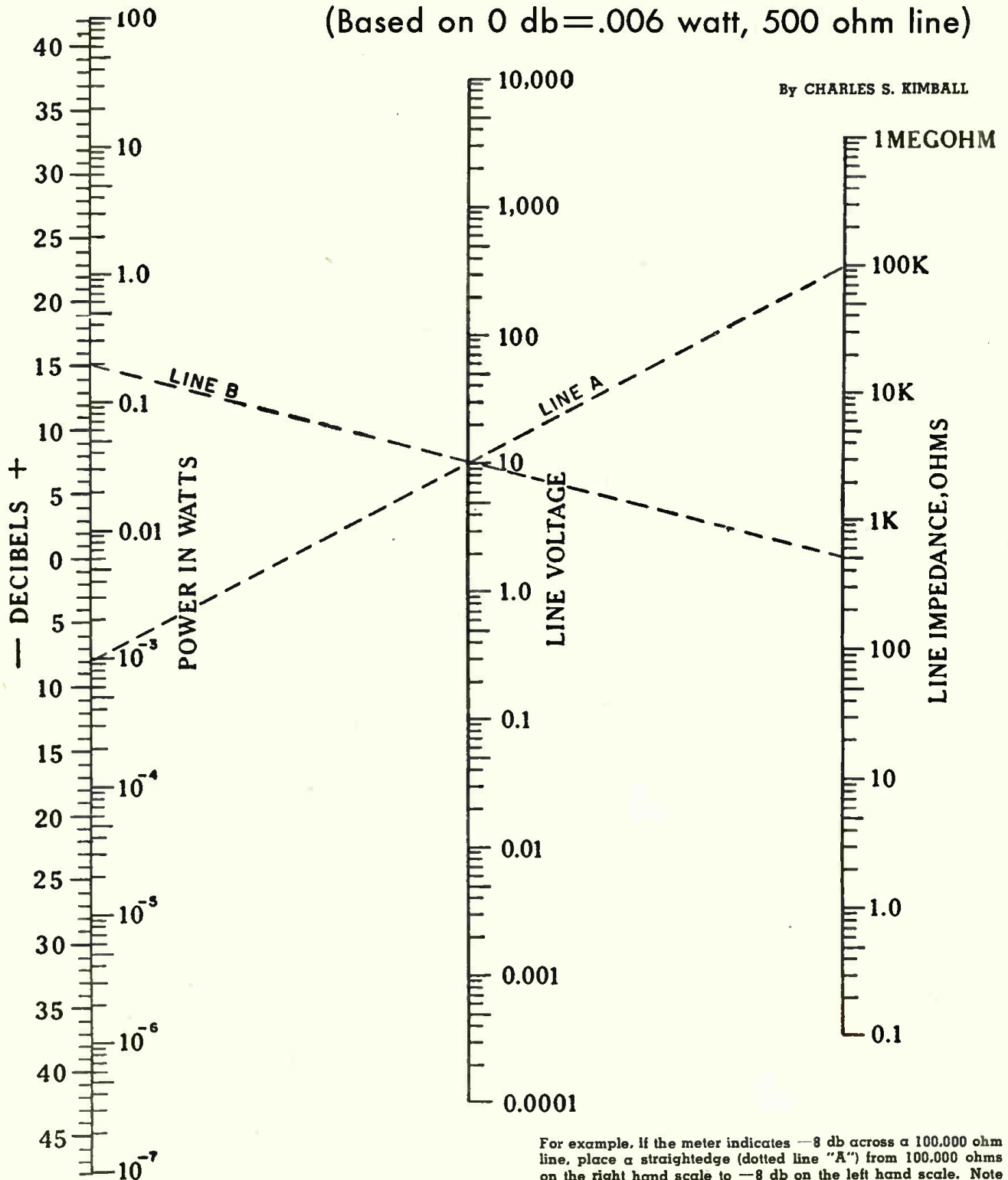
Table 2. The five sections of a TV receiver and the controls used in each.

SECTION	CONTROLS	FUNCTION
Audio	Volume	Adjust sound output
	Tone	Adjust high and low audio frequency response
	AM Rejection (Buzz)	Reduce intercarrier buzz
	Ratio Detector Balance	Compensate for unbalance in components (tubes, etc.)
Video	Automatic Gain Control	Adjust gain to signal level
	Brightness	Adjust picture illumination level
	Contrast	Adjust picture tone values
Vertical Sweep	Height	Adjust picture size to fit vertical height of screen
	Vertical Hold	Adjust frequency of vertical oscillator to lock in with vertical sync pulse
	Vertical Linearity	Adjust height of objects to normal proportions
Horizontal Sweep	Horizontal Hold	Adjust horizontal oscillator frequency to lock in with sync pulse
	Horizontal Width	Adjust picture to fill width of screen
	Focus (Electrostatic control)	Adjust size of electron beam to produce sharp picture
Low Voltage Power Supply	Focus (Electromagnetic control)	Adjust electron beam size to produce sharp picture
	Horizontal Centering	Adjust picture position to center on screen horizontally
	Vertical Centering	Adjust picture position to center on screen vertically

DECIBEL CONVERSION NOMOGRAPH

(Based on 0 db = .006 watt, 500 ohm line)

By CHARLES S. KIMBALL



Frequently in decibel measurements the need arises to use the meter across line impedances other than 500 ohms at which the instrument is calibrated to read decibels; hence a correction factor must be applied to the indicated db meter reading for every line impedance other than 500 ohms. This correction factor can be quickly determined from the accompanying nomograph.

For example, if the meter indicates -8 db across a 100,000 ohm line, place a straightedge (dotted line "A") from 100,000 ohms on the right hand scale to -8 db on the left hand scale. Note that the center scale is intercepted at 10 volts. Next, place the straightedge from 500 ohms on the right hand scale (dotted line "B") through 10 volts on the center scale; this line intercepts the db scale at +15 db. This is the correct reading. Note that the difference between the indicated meter reading, -8 db, and the correct value, +15 db, is 23 decibels; this correction factor remains constant whenever the meter is used on a 100,000 ohm line impedance.



Fig. 1. Shown here is some of the promotional material available from battery manufacturers for your shop windows to make the portable set owner battery conscious and help you sell service.

IT'S TIME FOR PORTABLES

By **BILL BOUIE**

With everyone listening to the baseball games or going on picnics with the portable radio, now is the time to make them aware that your shop is their service center.

IT'S a pretty safe bet that a portable radio of some sort can be found in practically every home in the country. Millions of these sets have been sold and millions more still roll off the production lines each year. They range in size from the compact little units that can fit into a pocket to the big powerful jobs with round-the-world coverage.

To the enterprising service technician, portable radios can constitute a considerable portion of his servicing income. Because of the conditions under which they are operated, they usually require more attention than either home radios or television sets. Batteries have comparatively short lives in most of them because of the drain due to continuous hours of operation. Also, they are subject to defects and breakdowns due to rough handling and outdoor weather conditions, and, of course, the same "normal" faults that affect any other radio device, only more so. So you see, there's a lot of work to be done on these little sets and there is no reason under the sun why you shouldn't get a lot more of it. We'll have more to say later about how to get the business, but right now let's take a look at some of the more common troubles that be-devil portable radios.

Batteries

Since every portable radio relies on

battery power for operation most (and often all) of the time, a substantial stock of the most-used battery types should be on hand during the portable season. In the early part of the season, take advantage of specials offered by most battery distributors to buy in somewhat larger quantities, thereby getting a nice reduction on the regular wholesale prices. Don't overload yourself, but do have a fair size stock on hand for the initial rush. Take advantage of any sales devices the battery manufacturer is using in order to attract attention to your shop and enhance battery sales. Make a special display in your window, using dummy batteries, streamers, and any other attention getter you think will be effective (see Fig. 1).

Have a battery checker on hand at the counter and test every battery you sell, right in front of the purchaser. If you have an English-reading scale on your meter showing "Good," "Weak," and "Bad," your customer can understand the test better. Be sure to put your shop sticker or an identifying mark some place on the battery when you sell it. Also, mark it with the date sold. This will protect you from the "shrewdie" who brings a dead battery into the shop and says he "bought it here" a few days ago and insists on a free replacement. If it is your battery, then you should inspect his radio for a defective "on-off" switch. But he may

have just accidentally left the set turned on at reduced volume.

When putting batteries into a customer's set, check the battery connecting leads for bad connections and corrosion. If the battery compartment is badly corroded from old leaky batteries that were left in the set, suggest that the radio be left for a general inspection. At best, the set is subject to intermittent operation if the battery contacts are corroded.

Switches

Among the common troubles in portables are defects in the switching circuits. The battery-only portable usually has just an "on-off" switch, but the a.c.-d.c. battery (or three-way) radio has an additional changeover switch to cut in either the batteries or the electric power when operated from commercial lines. In the set that covers more than one band of frequencies, a multiple switch is used to select the desired band.

In the small, personal-type portable radio, operating exclusively on batteries, the "on-off" switch is usually so placed that it is actuated when the lid

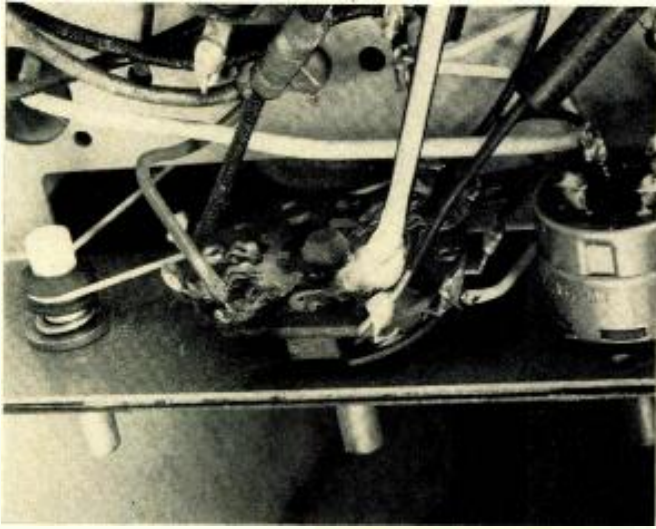


Fig. 2. Cleaning the contacts on a rotary switch with a pipe cleaner and solvent, such as carbon tetrachloride or alcohol.

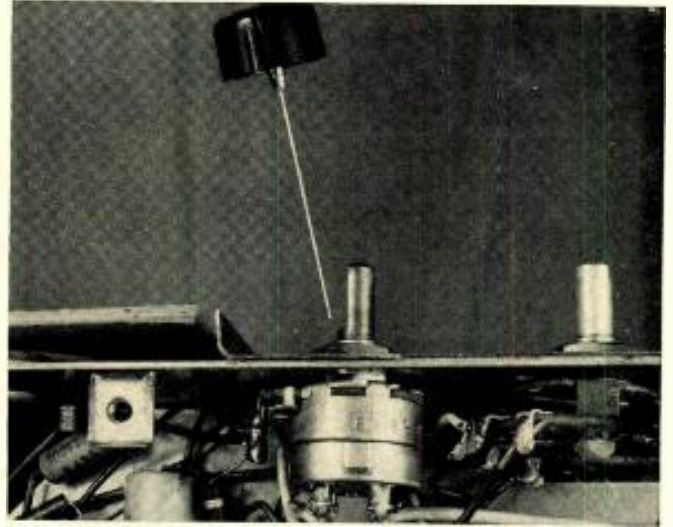


Fig. 3. Using a long thin dropper to place a few drops of a lubricant-solvent along the shaft of a noisy volume control.

of the cabinet is opened or closed. Some of these switches are quite fragile with exposed contacts that are subject to accidental bending so that the circuit is not closed when the switch is actuated. Bend the contact gently back into place, taking care it does not break off in the process. These contacts are also subject to corrosion and should be thoroughly cleaned with carbon tet or a similar solvent. Replacement of these switches usually involves some labor because of the compactness of this type of set. Also, exact replacements must be used, and these usually can only be obtained from the manufacturer.

The changeover, or transfer, switch used in the three-way portable takes many forms. On some sets, the changeover may be effected by a double-pole, double-throw switch, or it may be a three-pole, double-throw switch. Quite often the changeover is achieved for battery operation by plugging the power-line plug into a female switching receptacle located on the chassis. For power-line operation, the plug is simply removed from the receptacle (disconnecting the batteries) and plugged into the line. Some manufacturers use rotary switches while others use slide

switches to serve the same purpose.

The fundamental troubles on these switches are the same for all types. Either the switch action is defective, indicating complete replacement, or the contacts are bent or corroded so badly that they do not make proper electrical contact. Even if the switch is operating normally, an inspection and cleaning of the contacts, as shown in Fig. 2, with carbon tet will insure continued operation. Fig. 4 shows examples of changeover switching circuits.

Noisy volume controls are also quite common. Of course, these can often be cleared up by using a good lubricant-cleaner. Merely insert a few drops along the shaft of the control, as shown in Fig. 3. Rotating the shaft will help the cleaner to act.

Sometimes loose or broken antenna connections can be a bit of a headache. The set will check out OK with all voltages and everything else normal, but no signal will come out of the speaker. The little personal portables with the lift-up lid are most often subject to this trouble. The antenna is usually mounted inside the lid under a thin plate with its leads soldered to two thin flexible metal strips which extend down into the body of the chassis. With constant opening and closing of the lid, the strips wear through in time, or the soldered connections break off inside the lid and the set immediately becomes noisy or inoperative.

Resoldering open leads is simple, but a broken flexible strip sometimes calls for a little improvisation if a replacement is not right at hand. Sometimes a short length of stranded hook-up wire can serve as a temporary repair.

Sometimes the hinges on the lid serve as the connecting link between the antenna and the first stage. In this case, a defective hinge can cause malfunctioning of the set.

Tubes

Defective tubes constitute a high percentage of the troubles encountered in portables. Because of the rough

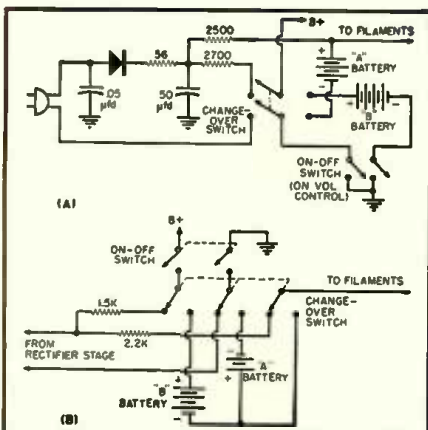
handling, they often jar loose, causing inoperation, or intermittent operation. Cracked, broken, and burned-out tubes are quite common troubles. Be careful when installing a new tube in an unfamiliar circuit. A charge might exist on a filter capacitor in the filament circuit, causing immediate burn-out of your new tube or one of the others in the string. This condition is illustrated in Fig. 5 where an open in shunt resistor R_1 increased the current in the filament line, causing the filament in V_2 to fail. Plugging the set into the power line places a higher than normal charge on filter capacitor C_1 because of the open circuit. This charge is retained since no path exists to bleed it off. Installing a new V_2 closes the filament circuit and the high charge on C_1 is discharged through the tube filaments with resulting burn-out of some tube. This condition is not nearly so prevalent as it was a few years back before the extensive use of properly placed filament shunt resistors, but it is still a wise precaution to remove all the tubes and short all filter capacitors in the line before installing a new tube in an unfamiliar set.

Another cause of tube burn-out is a change in the value of the series resistor (R_2 in Fig. 5). Overheating of this resistor lowers its ohmic value, causing an increase in the current flowing in the filament line. Of course, this is true only if the resistor is of carbon composition.

Some filament wiring circuits currently used in portables are shown in Fig. 6. Note the use of protective shunts to maintain uniform flow of current in the filament line and to protect the tube filaments against sudden burn-outs. It is a good plan to make a study of filament circuits in order to expedite troubles originating here.

When troubleshooting a portable set, be sure to check the filament voltages at the tube sockets. A short across the filaments of any one tube would make the set inoperative, but would have no effect upon the over-all operating potentials. Use a v.t.v.m. to measure

Fig. 4. Examples of changeover switching circuits used to select battery or power-line operation for three-way portable sets.



these small filament voltages, and be careful where you place your test prods when making tests. It is a good idea to insulate your prods with thin plastic tape right down to the ends, leaving only the tips bare. This will prevent your accidentally shorting out something else in the often cramped little chassis, causing additional damage.

If the series and shunt resistors in the filament line are the flat strip type that mounts on the side of the chassis (in older sets), check for possible shorts between the metal case and the terminal lugs.

While the trend in portable radio circuitry has been toward use of the same output tube for both battery and power-line operation, some sets may be encountered where a 3-volt tube is used for battery operation and a 50-volt tube is used for power-line operation. A partial schematic diagram of this arrangement is shown in Fig. 7. Note the way the output transformer is connected to provide proper load impedances for each tube. In this application, if the set operates on one power source and not on the other, the fault may be in the alternate output stage.

A common culprit in the case of an inoperative receiver is the oscillator tube. Very often the tube checks perfectly in a tube checker, but will not oscillate in the set although everything else is apparently normal. A v.t.v.m. hooked across the oscillator grid resistor will quickly show whether the tube is oscillating. The value of the voltage measured here should be from 8 to 10 volts, negative with respect to ground.

Inserting a new oscillator tube will usually restore operation, but don't be satisfied with just this. The real trouble may be caused by a change in the value of the oscillator grid resistor, R_1 in Fig. 8, or coupling capacitor, C_1 . It could also be a defective oscillator coil, or faulty connections anywhere in the tuned circuit. In this case, your new tube may work satisfactorily until it ages a bit, but it will soon quit and you'll have a dissatisfied customer on your hands until the condition is corrected. If the tube oscillates on the power line but does not on batteries, your batteries may be too weak. However, in all troubleshooting procedures, a test of the operating power source should precede tests in the signal stages.

Where selenium rectifiers are encountered, check them with a high-resistance ohmmeter. For a good unit, the front-to-back ratio should be in the neighborhood of 5 to-1, at least.

Oscillations are sometimes a bugaboo in portables, especially the ultra-compact personals. An open filter capacitor in the filament line is a frequent source of this trouble. Oscillations can also be caused by weak batteries, which should be the first suspect. Because of the compactness of the chassis, a disturbance in lead dress can cause trouble. Also, where the

chassis is in two parts a high resistance or open ground between the two sections can be a contributory factor. A screen grid prong broken off in the socket of a pin-type tube (probably when the tube was installed) was one classic example of a hard to find source of intermittent oscillations. Also, an open antenna loop or a high-resistance lead connection can be another cause.

Intermittent operation can be a real headache to trace down. Quite often it is caused by temporary shorts resulting from the extreme compactness of some sets. Be sure to insulate the chassis bottom plate on the inside with tape or thin cardboard cut to fit, to remove this common cause of shorts to chassis. Sometimes prodding all parts and connections with a wooden orange stick or insulated alignment tool (with the set turned on and tuned in, of course) will quickly uncover the cause of the intermittent. Also, in two-section chassis arrangements, pressure against one unit will temporarily show up a hidden short between the two units. Defects in the oscillator stage, already discussed, can also be a cause of intermittent operation.

For routine tests on portable radios, the test procedures that you use on any other radio will apply here as well, and finding and correcting ordinary troubles is not too difficult. A major problem lies in replacement parts. Most of the compact little portables have some special miniature parts that must be procured from the individual manufacturer. It's difficult to decide whether to keep a stock of these special parts because the demand for them is unpredictable. Perhaps the best plan is to contact your distributor and see if he will stock a small supply of the hard-to-get replacements so they are immediately available to you, and to others requiring them. Otherwise, you have no alternative but to order from the manufacturer as the need arises and hope he can deliver promptly. This applies also to the replacement of broken cabinets or parts of cabinets. Usually, these last items can only be procured from the manufacturer.

General alignment methods for portables are similar to those used for other radios. When a loop antenna trimmer is used, it is usually available from the back of the set. Adjust this trimmer for strongest signal at 1400 kilocycles whenever an external antenna is connected. You should remind your customers that weak signals can be expected in areas remote from the broadcasting stations unless an external antenna is used. This can often be just a 10-foot length of antenna pickup wire connected to the short wire lead usually found extending from the loop and intended for this purpose. On some sets, the trimmers on the tuning capacitor must be adjusted with the chassis installed in the cabinet. Usually, a small opening is available in the end of the cabinet to provide easy access to the trimmers.

Many technicians take advantage of

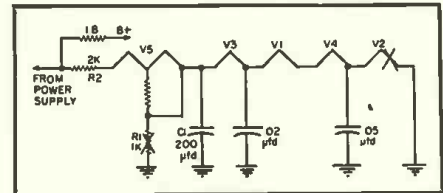


Fig. 5. Portable radio filament circuit in which an open shunt resistor will lead to a burned-out tube and possibly more.

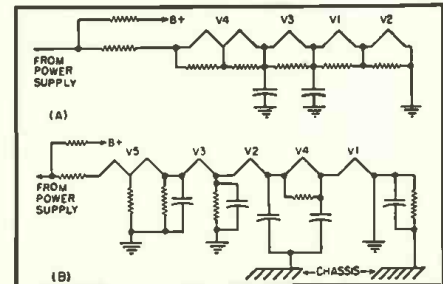


Fig. 6. Two filament circuit arrangements. Note the extensive use of shunt resistors to prevent tube burn-outs and surges.

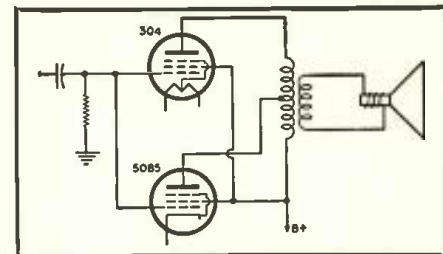


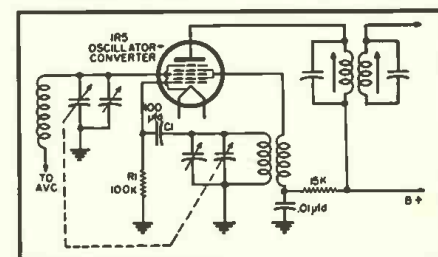
Fig. 7. Partial schematic diagram of the output circuit of a portable radio using one tube for battery operation (the 3Q4), and another for power-line operation.

the early spring trade by setting up a general inspection plan. For a nominal charge of a dollar or so, depending upon the local rates, they take the radio in for a bench test. Included in the test are checks on batteries, tubes, controls, faulty connections, loose mountings, dial cords and pointers, broken handles, cabinets, etc. In addition, the set is given an operational check on both batteries and commercial power to determine general operating conditions.

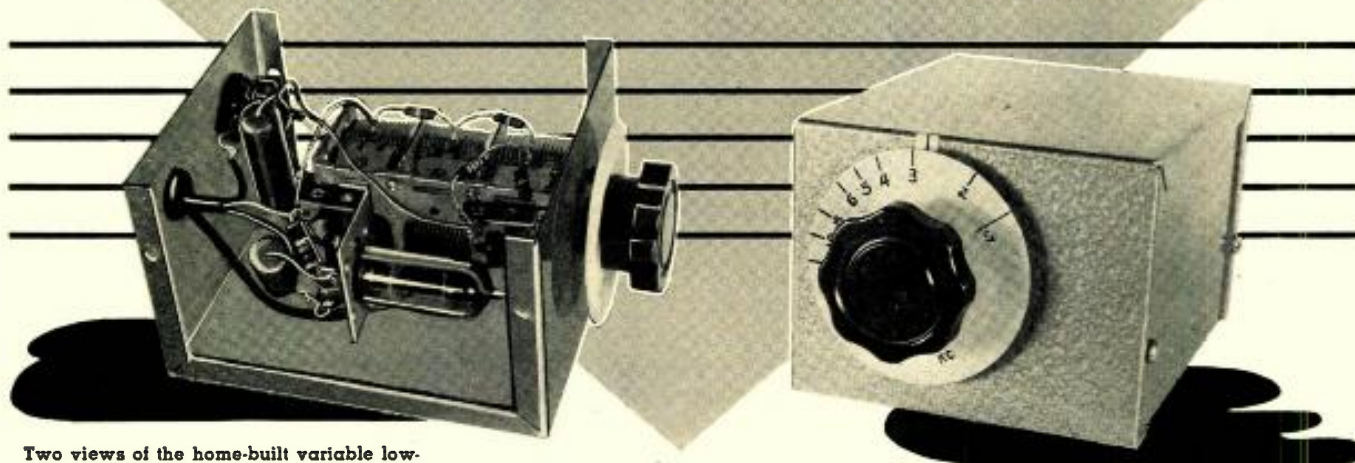
This sounds like a lot of service for the price, but actually, the entire series of checks should not take more than a few minutes. Of course, this general inspection does not include major repairs, alignment, or parts required for

(Continued on page 116)

Fig. 8. Typical oscillator-converter stage. Dead oscillator can be due to change in the values of R_1 and C_1 .



A VARIABLE LOW-PASS FILTER



Two views of the home-built variable low-pass filter. It is housed in a 3" x 4" x 5" aluminum utility box which is small enough to be tucked in almost anywhere.

By LAWRENCE FLEMING

Consultant

Build this versatile unit for your hi-fi system or communications receiver at a total cost of \$7.50.

TONE CONTROLS for hi-fi have become quite standardized in recent years. About 15 db boost or cut available at either the bass or the high end, with the crossover at 600 cycles, has shown itself over long experience to be the best simple tone modifier for building into an audio music system.

But there are plenty of other things that one can do to a response curve. The most useful among these is a rather sharp high-frequency cut-off, obtained with a low-pass filter. With perfect program material, such filtering is not needed, but with much of the program material from broadcast tuners and discs the low-pass will discriminate against noise and hash much better than a regular treble control. Such 9 kc. low-pass filters have been used very extensively, for example, in movie theater sound systems, as giving the best compromise between best fidelity and background noise on the sound track.

The trouble with a low-pass filter of standard design is that it has to be built for a specific cut-off frequency and cannot very well be made variable. A set of such LC filters is rather costly, since the special inductances required cost at least five dollars each.

Variability is quite necessary in hi-fi work. An old scratchy disc may sound best with a 5-kc. cut-off, but with a

tape or a good LP record we need a little dial on the filter with which the cut-off frequency can quickly be run up to 15 or 20 kc.

Such a variable filter has another use: it makes an excellent high-frequency-response tester for the whole sound system, including the record. Merely crank the dial down until the degradation in music quality is just noticeable. The dial reading will then tell about what the top frequencies are in the signal. For a speaker previously measured as starting its high-frequency cut-off at 8500 cycles, for example,¹ this listening test with the filter gave an answer of 8 kc.

The range of cut-off frequencies available with this filter makes it applicable to ham communication as well as to public address and hi-fi work. High cut-off settings of around 8 to 10 kc. will help to take the "edge" off of sound from records which have roughness on loud passages, much more effectively than the usual tone control. A cut-off setting of around 4 to 6 kc. is helpful in playing old 78 rpm records. A 2 to 4 kc. cut-off is useful in ham communication. Here the filter may be

inserted ahead of the last audio stage in a communication receiver, since it will handle around 15 volts of signal without overload; or it will work nicely in the speech amplifier system of a phone transmitter.

Performance

Since it is not practical to make the necessary chokes and capacitors variable in a conventional LC filter, circuits have been developed in which tubes are hooked up with variable RC filters to give sharp cut-off characteristics as good as those obtained with chokes. Excellent and versatile wide-range variable filters of this sort are sold commercially for a few hundred dollars each.

The filter shown in the photographs costs \$7.50 for parts, including cabinet and dial. In versatility this little gadget does not compare, of course, with the store-bought laboratory instrument, nor is the shoulder of the cut-off curve as sharp. But it is stable, reliable, effective, and quiet, and hum and noise are 70 db below normal operating level.

Characteristics of the filter described here are given in Table 1.

The unit is designed to fit in between a hi-fi preamplifier and the main amplifier, borrowing its power from the other amplifiers after the fashion of the little preamps sold for use with G-E phonograph pickups.

Response Curves

Fig. 2A shows the response taken at typical points along the scale of the "tuning" dial. The response is, in general, flat within ½ db up to about 80% of the cut-off frequency. Cut-off frequency is here given the usual defini-

Table 1. Characteristics of the home-built variable low-pass filter.

Cut-Off Frequency:	1700 cycles to 20 kc., continuously variable
Attenuation Rate:	18 db per octave
Type:	Low-pass only
Input Impedance:	400,000 ohms (approximately)
Output Impedance:	15,000 ohms (approximately)
Normal Operating Level:	1 volt
Hum and Noise:	200 microvolts (70 db below 1 volt)
Gain:	1
Tube Complement:	6C4 tube
External Power Required:	6.3 volts a.c. @ .15 amp.; 150-300 volts d.c. @ 2-4 ma.

tion of the frequency where the response is 3 db down. On the low end, the response is flat down to 25 cycles, and down 1 db at 10 cycles.

The shoulder or "break" of the curve where the response really starts down is slightly rounded, but not enough to affect the results discernibly for listening purposes. At settings below about 10 kc. there is a slight rise in response just before cut-off, of 1 db or less; this is unavoidable in the type of circuit used, but the effect on the ear is undetectable. When the program material is good enough, the dial will be cranked all the way up to 20 kc. anyway.

Circuitry

The principle of the circuit is simply that of an RC filter with its effective "Q" stepped up by means of a tube amplifier stage and a feedback connection. The effect of the tube on the response is shown in Fig. 2B. Curve 1 shows response or transmission characteristic of the RC filter alone, at an intermediate dial setting. It is exceedingly gradual and droopy, hardly worthy of the name of a filter. Curve 2 illustrates the same RC filter at the same dial setting, with the 6C4 tube in operation and the feedback connection completed. The curve now resembles fairly well the characteristic of a classical LC filter.

Fig. 1 is the complete circuit diagram. The RC filter circuit is simply made of three resistors and a 3-gang t.r.f.-type broadcast tuning capacitor. The output of the RC filter goes to the grid of the 6C4 tube; output of the complete device is taken from the plate of this tube. The feedback connection runs from the output back to the input of the RC filter via the 680,000 ohm resistor R_2 . A 2.2 megohm grid leak completes the d.c. circuit to ground for the grid of the 6C4.

There is nothing critical about any of the circuit constants or supply voltages. Standard $\pm 10\%$ tolerance resistors are satisfactory. The unit works equally well at plate supply voltages of 150 or 300. Plate supply voltage should be well filtered. Since the current drain is small, 2 ma. at 150 volts (4 ma. at 300 volts), the voltage can usually be "stolen" from the supply for the preamp or one of the voltage amplifiers.

If extra filtering is necessary, use a 4700 ohm $\frac{1}{2}$ -watt resistor and a 20 μ fd. electrolytic.

The gain of the unit is determined by the ratio of R_2 to R_3 . If they are equal, it will be slightly less than 1. The gain should be within 30 per-cent or so of 1, in order that the feedback factor will be somewhere near the right value to do a good job of squaring up the response curves.

The impedance of the signal source should not be too high. 200,000 ohms source impedance is the top limit, and around 50,000 ohms is better. Too-high source impedance will not only drop the gain, but it will round-off the shoulder of the response curves and make the actual cut-off frequencies lower than the dial reading. The effect on calibration is negligible at source impedances lower than 100,000 ohms. Since practically all preamp circuits have an output impedance lower than this, there should be no trouble.

Construction Details

The model shown in the photos was built in a 3"x4"x5" aluminum utility box. The tube socket is mounted on a home-made bracket which is screwed to the tuning capacitor frame. Thus most of the wiring can be done before the capacitor tube assembly is mounted in the box, although actually there is plenty of room to do it afterward. The tuning gang is mounted directly to the front "panel," for which purpose it was necessary to run a 6-32 tap through three small holes which were already present on the front of the capacitor frame. Lead dress is unimportant, since the signal level is high and the gain low.

The input terminal is a regular RCA-type phono jack on the back, and the output a phono plug on the end of a couple of feet of shielded wire.

The dial is a 2½ inch dial plate which happened to be handy, screwed to the back of a regular 1½" instrument knob. The dial plate was painted (auto enamel or most any kind of paint will do), then degreased by swabbing with a hunk of Kleenex dipped in household ammonia, then lettered with India ink. Over this, clear lacquer.

The calibration was made using an audio oscillator and a Heathkit AV-2 audio voltmeter, the original points on

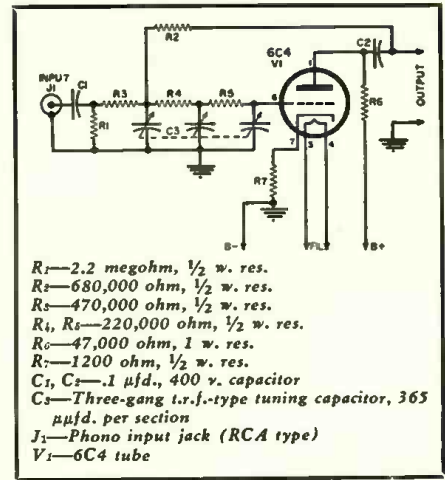


Fig. 1. Complete schematic of the variable low-pass filter. Standard, non-critical parts may be used in its construction.

the dial face being marked lightly in pencil.

Lacking an AV-2, use the low a.c. range on a Voltohmyst, Heathkit V-7, or similar v.t.v.m., but be sure the instrument is the type that uses a diode rectifier for a.c., not the older type with 1000-ohms-per-volt a.c. ranges using a copper oxide rectifier. These disc rectifiers are only good up to about 3000 cycles at best. For this reason the a.c. ranges on most regular voltohmmeters are no good for the purpose.

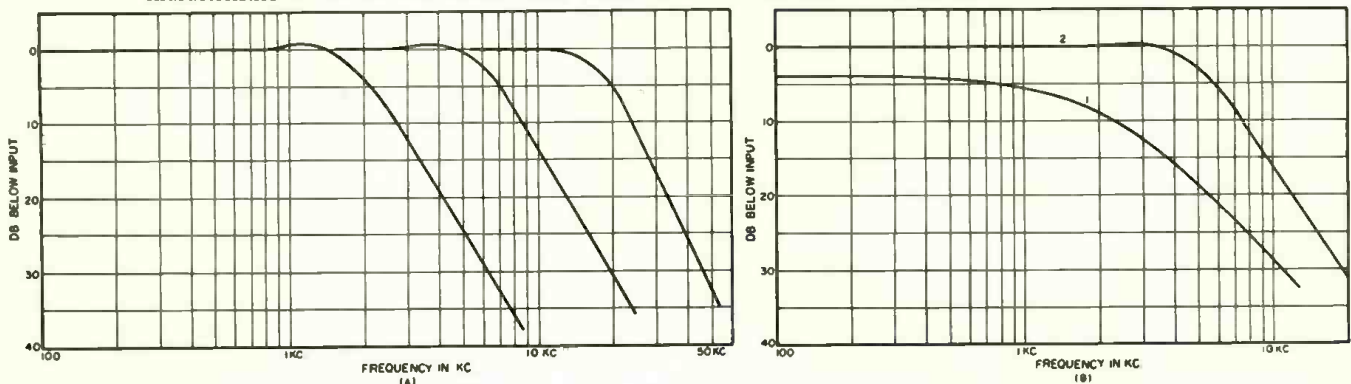
Lacking everything but an oscillator, which is indispensable, connect the just-completed filter to the main audio amplifier and improvise an output meter. Merely hang across the voice coil terminals a 1-ma. d.c. meter, a 1N34 or any other type of germanium crystal diode (not a disc rectifier), and a 1000-ohm resistor, all in series. Lower-range d.c. meters will do; increase the series resistance proportionally, e.g., 10,000 ohms for a 100-microamp meter.

Filters in General

Any type of filter affects the transient response of a system, and the sharper the cut-off the worse the effect. The primary purpose of a low-pass filter in audio work is to better the signal-to-noise ratio. In cases of noise like needle scratch on shellac records,

(Continued on page 101)

Fig. 2 (A) Response characteristics of the filter at dial settings of 1.8, 6, and 17 kc. (B) Curve 1 shows the response characteristics of the RC filter circuit alone while Curve 2 is the response of RC filter plus the tube circuit.



144-148mc.

HANDIE-TALKIE

By H. F. PRIEBE, JR., W2TGP

A compact, two-meter band unit which is ideally suited for CD work since it measures just 10½ x 3 x 1½ inches.

HANDIE-TALKIES have made a fine contribution in our war effort and have found extensive application in the Armed Services. However, the military were not the only ones to recognize their value. Various commercial interests have found this means of communication indispensable.

Handie-talkies are complete self-contained radio sending and receiving stations. They contain, in a single housing, the transmitter, a receiver, and dry batteries for power. The microphone, earphone, and the antenna are mounted on the exterior of the housing. The complete unit is compact enough to be held in one hand and operated in much the same fashion as an ordinary telephone handset.

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The completeness of the handie-talkie makes maintenance as well as operation easy. There is no additional equipment to plug in, to attach, or to worry about bringing along. This is very important when considering emergency operation.

The writer can recall instances when a portable transmitter-receiver unit was hurriedly taken to the portable site to find on arrival that the microphone or the headphones were left behind and a second trip was necessary. There are numerous everyday uses for the handie-talkie, one most of you will appreciate is aiding in TV antenna installation and maintenance. Civil Defense and other emergency services have varying needs for hand-carried, portable transmitter-receivers.

The conditions under which portable equipment must operate are often overlooked in many cases. Hams who have operated mobile stations can readily understand the handicaps of such operation. There are three main obstacles to such operation and they are: (1) Antenna site. It is of course right where you are standing and seldom, if ever, is it a spot you would select for an antenna. (2) Low power. Dry battery operation is extremely low power when compared to mobile equipment. (3) Interference. Usually there

are noise and distractions that make operating difficult. A difficult, if not impossible, task is to fix a performance figure for such units as these handie-talkies. A desirable statement would be to say that these units will maintain reliable communication over a specific distance. To explain, here are the two extremes: The maximum distance between two of these units is slightly over one mile. This is unobstructed line of sight distance. The minimum distance if we take the example of one unit being enclosed in a screen room where the attenuation may be 100 db or greater, is zero. And of course if the communication is between a fixed station with good location and equipment, and one of the handie-talkies, the distance may be many miles.

A separate tube and components are used for the oscillator and detector rather than using a common stage and changing its operating conditions accordingly. Such units that use a single tube for both functions are called transceivers. Separate stages are used for the following reasons: (1) With transceivers when working another similar unit they will "walk" across the band. This happens as a result of the continuous retuning of each unit because the frequency of transmission is different than the frequency of reception for a single tuning adjustment. (2) The use of separate stages permits the transmitter to be "spotted" in the band on a particular frequency and complete freedom of the receiver is maintained. It may be tuned from one station to the other without disturbing the transmitter.

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A push-to-talk button was used merely for convenience. A 3-pole, 2-position slide switch would perform better electrically but would not permit this operating ease.

The Transmitter

The r.f. section of the transmitter uses a single 958A acorn tube in a self-excited oscillator circuit. The oscillator tuning capacitor is adjustable from the exterior through a small hole in the case. In the photograph showing the unit with its back cover removed the oscillator tank circuit can be seen in the upper right corner and the oscillator tube in the upper left. Although a modulated oscillator is used in the transmitter the stability is adequate for reception on most superhets.

The modulator is a 3A4, which is the common audio stage to both transmitter and receiver. Adequate power output is obtained with the single button microphone and microphone transformer as excitation for the tube. Voltage for the microphone is supplied by the "A" battery.

The headphone also doubles as the modulation reactor when in the "transmit" condition. This arrangement includes the sidetone with no additional components. As a matter of fact it saves a plate reactor.

The bias for the 3A4 audio stage is obtained by using the voltage developed across a resistor placed in series with the "B" supply. This may, at first glance, appear to be wasteful of the precious "B" supply voltage but it has the advantage that as the "B" voltage drops the bias to the 3A4 also drops and has an averaging effect on the out-

put. Of course, too, it eliminates the "C" battery.

The Receiver

A second 958A tube is used in the receiver as a superregenerative detector. A single stage of audio amplification follows the detector to provide sufficient headphone volume. The audio stage is the 3A4 mentioned previously. The amount of radiation from the detector is not excessive but it does exist as with all regenerative detectors.

Mechanical Construction

The case is made of 18 gauge aluminum; its dimensions are 10½ inches long, 3 inches wide, and 1½ inches deep. A total of 4 small brackets is necessary to mount the two tuning capacitors, the audio tube, and form a partition for the battery section.

The receiver tuning and the transmitter frequency adjusting capacitors are of the APC type. All except one rotor and one stator were removed from 25 µfd. capacitors for each of the two stages. An insulated shaft extension is modified to fit firmly over the hex adjusting screw on the capacitor shaft.

Looking at the rear-view photograph, we see the transmitter oscillator is at the top and the receiver detector is at the lower right just above the battery section. "The "send-receive" switch is between the receiver and the battery sections. The common audio stage is to the left of the receiver and the "on-off" switch is directly underneath. In between the transmitter and receiver sections can be seen the transformers. The microphone and audio coupling transformers are in the single case. The particular transformer unit shown in the photographs was obtained on the surplus market. They have commercially available equivalents, which are for the microphone transformer a UTC "Ouncer" O-1 and the other, used as an audio coupling transformer, is a UTC "Ouncer" O-9.

The antennas were also obtained in the surplus market and the exact origin not known. Their length is 18 inches. A discarded indoor TV antenna such as the familiar "rabbit ears" would supply the necessary material for making your own. The preferred antenna length is 19 inches.

The batteries are a 67½ volt battery such as the "Mini-Max" or Eveready 467 for the plate supply and a single 1½ volt flashlight cell for the filaments or "A" supply. The connections and mounting of the "A" battery make possible the measuring of its voltage without removing the back cover of the unit. The life of the "B" battery is much longer than the "A" battery.

The push-to-talk switch was made from a standard d.p.d.t. push-button type switch. It was necessary to add a pair of contacts to provide the "make."

The radio frequency chokes are made of #32 enamel wire wound to a length of 1¼" on a ⅛" diameter insulating rod. If there is any question as to whether they are of sufficient in-

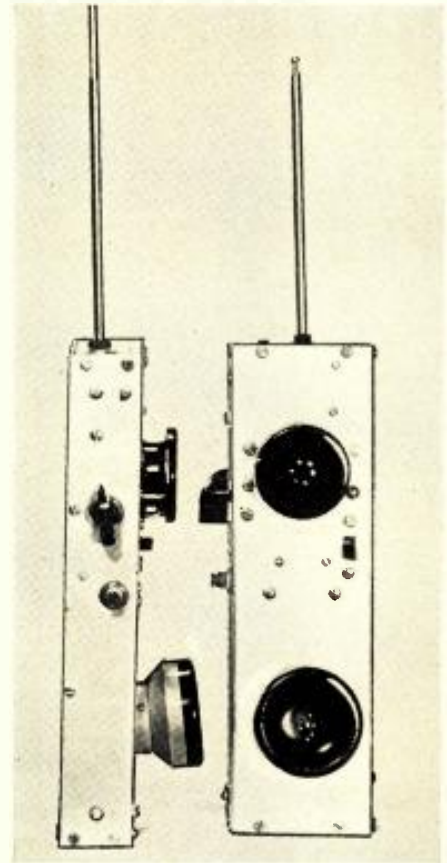
ductance they can be checked when the units are put into operation. Touching the "cold" end of the chokes with your finger should have no effect on detector regeneration or in case of the oscillator no effect on oscillation.

The microphone is of the T17 variety. The slope of the microphone, similar to a telephone handset, was obtained by sawing at an angle when the microphone is removed from the push-button and handle. Two mounting holes are drilled and tapped in the microphone housing. If desired the microphone (and headphone) could be obtained from a regular telephone type handset in a similar manner.

Interstage Coupling

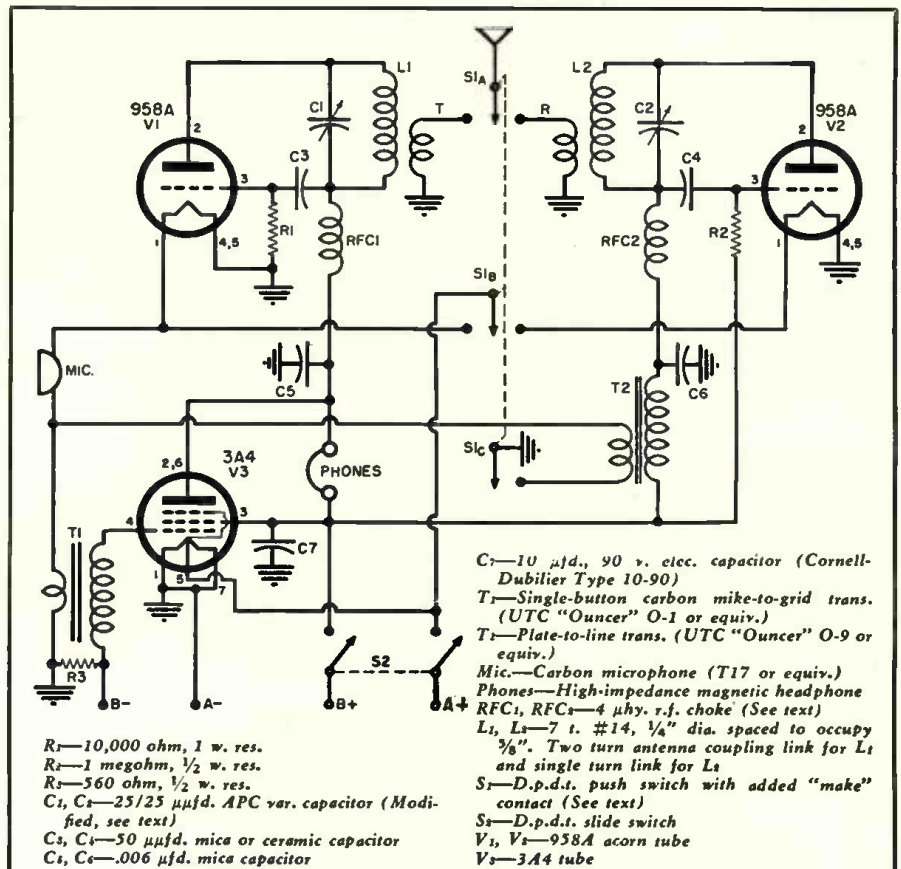
A transceiver transformer of the desired size was unavailable at the time these units were constructed so the novel connection of two transformers as shown in the schematic diagram was used. If the builder can obtain a suitable transformer the circuitry can be simplified somewhat.

In closing, the author wishes to point out that this equipment *cannot be operated* by anyone not holding the *pertinent amateur radio license*. Sorry, fellows, but that is the way the matter stands and we sincerely hope that no one will run afoul of the law and the FCC by building and using this gear if he is not entitled to such amateur radio operating privileges. Finally, this equipment cannot be adapted and used on the Citizens Band. —30—



Front and side views of the handie-talkie. The antenna was a surplus item but a TV antenna of the "rabbit ears" type can be used as well. See text for full details.

Complete schematic of the handie-talkie. The 3A4 is common audio stage for both transmitter and receiver. Single-button mike obtains its current from the "A" battery.

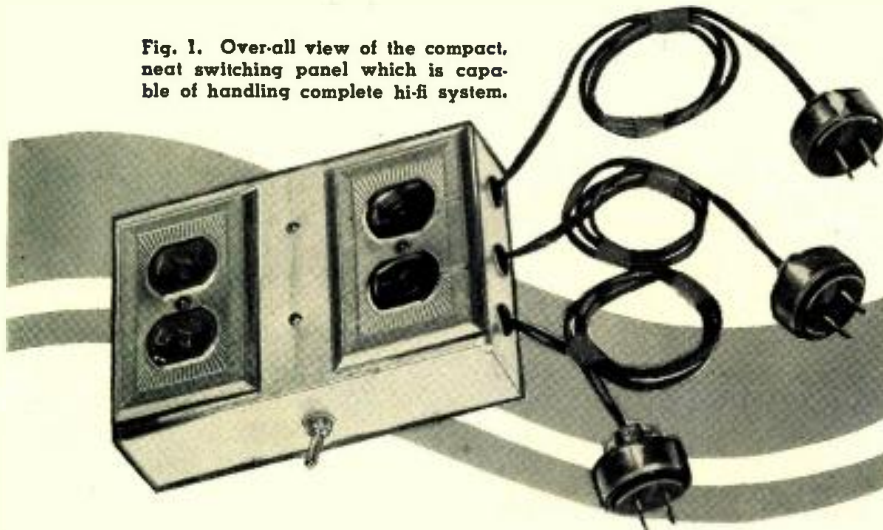


HI-FI SYSTEM SWITCHING



By WILLIAM VISSERS

Fig. 1. Over-all view of the compact, neat switching panel which is capable of handling complete hi-fi system.



Details on a versatile switching system which can be used with many of the existing home high-fidelity installations.

DURING the past year the writer, like an increasing number of others, was bitten by the high-fidelity bug. The eventual upshot was the purchase of an amplifier, FM tuner, record changer, and speaker. The performance was far beyond expectations, except for one thing. The plugging, unplugging, and switching when changing from FM to phono operation and *vice versa* were complicated enough to challenge an electrical engineer, much

less the distaff side of the household, who seemed quite loath to study electrical circuit switching just to be able to turn on the radio or phonograph.

A visit to several friends who owned hi-fi systems showed that they too had encountered this problem. Mostly, they had developed various small switchboards, but often with enough switches to make an instruction book almost a necessity before the equipment could be turned on or off by the uninitiated.

It was soon decided that something should and would have to be done to simplify the operation of our equipment.

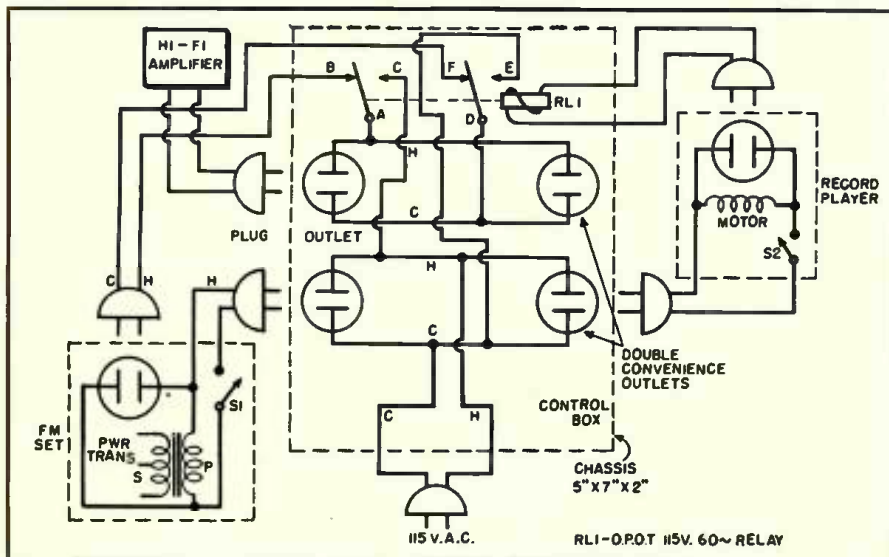
After some thought it was decided that the most satisfactory system would be one that would allow the FM to operate into the amplifier with only the FM "on-off" switch as a control. In addition, the record player should operate into the amplifier with only the record player "on-off" switch as a control. And, finally, when the last record on the stack had been played, the record player shut-off switch should also turn off the amplifier. This last item was deemed necessary since we once found the amplifier running some two days after the record player had turned itself off. This system of automatic control now allows us to put on a stack of records, retire for the night, and be lulled to sleep by our favorite music without having to get up to turn off the amplifier after the records have been played.

Although the switching circuit was developed for the equipment used by the writer, the circuits are general enough to be readily adapted to any equipment. The power switching circuit is shown in Fig. 2, with a photograph of the switch box shown in Fig. 1. The record player is a *Garrard* three-speed Model RC 80. This player, like most others, has an automatic motor cut-off switch, which turns off the motor power after the last record has been played. The record player modification consisted of connecting a 115-volt lamp cord and convenience outlet across the motor terminals. The outlet is mounted on the record player base. This outlet supplies the power to operate relay *RL₁*, which is the heart of the switching unit.

The FM unit had the conventional amplifier power outlet which is energized with line power when the FM set is turned on. This outlet can be added to any FM set not so supplied by connecting a convenience outlet across the FM power transformer primary winding.

Operation of the switching unit is as follows: All of the units are plugged in as shown, and the relay box plugged into the 115-volt a.c. power line. With both the FM tuner and the record player turned "off," the audio amplifier has no power applied. When the FM set is turned on, power is routed to the amplifier through the FM power line switch *S₁*, and contacts *AB* and *DF* of relay *RL₁*. This allows the FM set to turn on the audio amplifier. With the FM set turned off and the record player switch turned to "on" position, the following switching action takes place. Power is applied to the relay coil through switch *S₂*. The relay *RL₁* is energized, and the amplifier now receives power through contacts *AC* and *DE*. When the last record has been played, the automatic switch *S₂* on the record player opens, turns off the record player motor, and de-energizes the

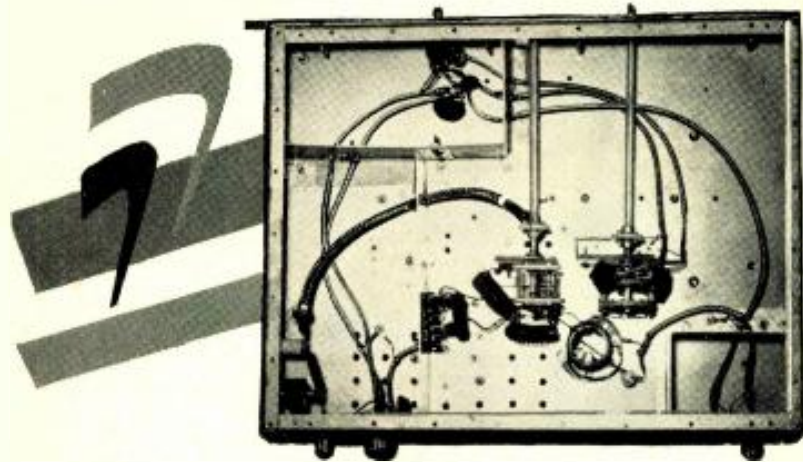
Fig. 2. Schematic diagram of the switching unit. It is important that the polarity of the a.c. wiring be watched very carefully. In most cases the 115-volt line has one side grounded and this must be taken into consideration when wiring this unit. It will be necessary to color code all plugs and sockets so that should these plugs be removed, they can be re-inserted properly. This point is extremely important!



(Continued on page 152)

A TWO-BAND FINAL

By R. H. MITCHELL, W5DWT



Two views of the two-band final. The chassis and cabinet were constructed of Reynolds "Do-it-Yourself" aluminum.

LET'S face it. With the shielding required in today's "TVI-treated" transmitters, plug-in coils are virtually valueless as a means of rapid bandchanging. I had to face this problem, as my pet activity in ham radio is contest work. Unfortunately, I had added shielding gradually to my rig until it took me half an hour to change bands. As any contest operator knows, the new band always goes out in that period.

My first notion was to build a 3.5 to 28 mc. tetrode final, using complete one-knob bandswitching. However, reason and finances prevailed, and the rig shown in the schematic diagram was the simplest solution. My old triode final could be left on any one band, and only three other bands were needed, since 28 mc. hasn't been worth wasting power on recently. Too, I had a perfectly good 150-watt output, all-

Details on a completely TVI-proofed final for 1 kw. input on 7 and 14 mc. It is ideal for contest work.

band transmitter to use as a driver for any legal triode final, so excitation was no problem. Finally, triode amplifier parts and a fair supply of 304TL's were available.

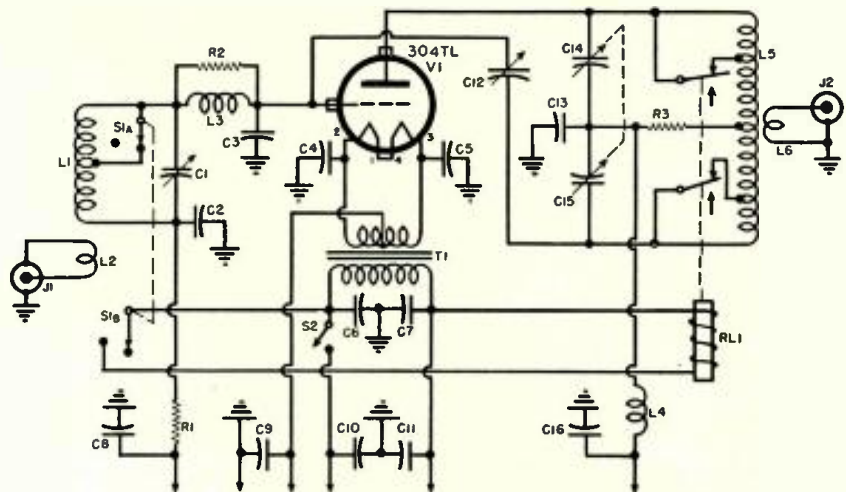
Consequently, it was decided to use the old rig on 3.5 mc. only, and to use a 304TL in the new final for 7, 14, and 21 mc. First plans called for a tapped grid coil on all three bands. A suitable plate-circuit switch was not available, so, with some misgivings, a d.p.d.t. "antenna" relay was used to short out the plate coil. The relay was to leave the entire plate coil in the circuit on 7 mc. On 14 and 21 mc., the relay was to short out enough turns of L_5 to permit tuning 14 mc. near max-

imum capacity, and 21 mc. near minimum capacity of C_{14} - C_{15} . This was an excellent idea, but it developed that 5 $\mu\text{fd.}$ more maximum capacity, or 5 $\mu\text{fd.}$ less minimum capacity was required to do the job. So, this became a two-band final covering 7 and 14 mc. A 70 $\mu\text{fd.}$ per section capacitor at C_{14} - C_{15} should permit coverage of both 14 and 21 mc. at one tap setting.

Construction of the final was straightforward. All wiring, other than r.f. wiring and filament leads, was made with shielded wire. RG-8/U was used for high-voltage leads. All wire shields were grounded on each end and at all points where they pass through shield
(Continued on page 146)

Complete schematic diagram and parts list covering the 7 and 14 mc. (2-band) final amplifier.

- R1—100 ohm, 5 w. wirewound res.
- R2—Part of Ohmite P-300 parasitic suppressor (See text)
- R3—100 ohm, 20 w. wirewound res.
- C1—100 $\mu\text{fd.}$ variable capacitor, .03" spacing
- C2—.002 $\mu\text{fd.}$ 1200 v. mica capacitor
- C3—25 $\mu\text{fd.}$, 7500 v. r.f. type ceramic capacitor (See text)
- C4, C5, C6, C7, C8, C9, C10, C11—.005 $\mu\text{fd.}$, 600 v. ceramic disc capacitor
- C12—2-12 $\mu\text{fd.}$ neutralizing capacitor
- C13—Two paralleled 500 $\mu\text{fd.}$, 10,000 v. ceramic capacitors
- C14-C15—50/50 $\mu\text{fd.}$, 7000 v. variable capacitor
- C16—500 $\mu\text{fd.}$, 10,000 v. ceramic capacitor
- L1—14 t., 1 1/4" dia., 1 1/4" long, tapped at 6th t. from cold end
- L2—2 t. at cold end of L1
- L3—Part of Ohmite P-300 parasitic suppressor (See text)
- L4—28 t. #22 en., closewound on 1/4" form
- L5—40 meter plate coil, tapped 3 t. each side of centertap
- L6—1 1/2 t. link around L5, adjusted for best coupling on both bands
- J1, J2—Coaxial jack
- RL1—D.p.d.t. "antenna relay" (Advance 400, see text)
- S1—D.p.d.t. ceramic switch
- S2—S.p.s.t. toggle switch



T1*—Fil trans. 10 v. @ 12.5 amps.
V1—304TL tube

* Note: Since this transformer is apparently not a standard item in jobber catalogues it would be necessary to have one made up on a

custom basis to meet these exact specifications, however, two 5 volt, 13 amp. filament transformers (Thordarson 21F06) could be used in series to provide the necessary voltage and current.

A MOST UNUSUAL OSCILLATOR

Not new—but novel in that vacuum tubes are used as oscillators without using any form of a "B" supply. The only power required is to heat the tube filament.

By HAROLD C. HUBBARD

The author shown tuning up his electric guitar. The electronic tuner visible on top of the speaker cabinet is the one covered in the text. It is designed simply as a tuner. See text for explanation.

EDITOR'S NOTE: This article should be of considerable interest to those who like to experiment in that the ideas covered can be applied in so many different ways. Basically, the author covers a form of oscillator that can be applied to various types of test equipment and particularly to musical instruments. The article presents an idea and is not intended to cover complete construction details on any specific piece of equipment.

PROBABLY no single piece of equipment is more interesting and useful to the experimenter, radio technician, and those who work in audio than an oscillator. Such circuits seem to be necessary in working with everything from electronic gadgets to electronic music.

The search has always been for a circuit that would satisfy the requirements of small size, low cost, and good stability.

This article will describe such a de-

vice on which patents are pending, and will contain many surprises to the worker familiar with the circuitry of tube oscillators.

A vacuum-tube oscillator, no matter how small or how cleverly designed, has always had the lines labeled "To B Supply" sneaking out toward the border of what otherwise would have been a perfect picture of a small, inexpensive unit. It leaves the reader with the same feeling as when he becomes interested in a miniature one-

tube portable pocket radio only to find a single wire leading out of the schematic labeled "To a 100 ft. ant."

Also, this "B" supply to the oscillator cannot be just any supply around the house since fluctuations in such a supply will affect the amplification of the tube and the stability of the oscillator.

So it would seem if we dropped our plate power supply, we would gain in stability; we could forget high voltage power transformers, filters, rectifiers, regulators, and the space for and expense of these items.

With a tube this seems impossible, because ever since De Forest used a "B" battery we have been taught that there must exist some force which overcomes the atom's attraction for the electron, i.e., a high positive potential on the plate. Also, this voltage determined the velocity and, to a great extent, number of electrons leaving the vicinity of the cathode.

Everything built today is a new "concept" of the thing originally built, from automobiles to the simplest gadget, so the word will not be out of place here. Let's look at a "new concept" of working a simple tube oscillator using no "B" supply and with a.c. on the filament.

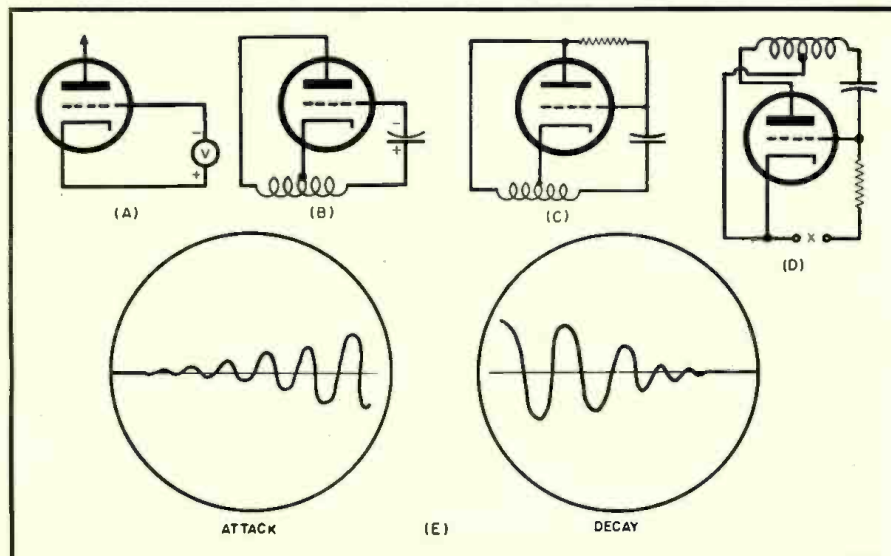
When a cathode is heated to the saturation point, electrons are emitted at a precise rate (Richardson's Equation). Without a high potential on the plate to affect their velocity or number they leave by thermal agitation alone until the space charge limits their movement.

The pressure can be measured between grid and cathode and the cathode will be found positive by the number of electrons it lost. (Fig. 1A.) If a capacitor is substituted for the voltmeter these charges will be placed upon its plates. Adding inductance we have the circuit shown in Fig. 1B. The cathode and plate are at the same positive potential with the grid negative.

By adding a resistor to discharge the capacitor, it can be seen these potentials will oscillate as the capacitor charges and discharges. Inasmuch as this resistor is simply to discharge the capacitor, it can be connected from the grid to any part of the circuit and as it's convenient it will be shown connected to the plate. So the basic circuit becomes that of Fig. 1C.

In this circuit the electrons move

Fig. 1. Basic circuitry of the "unusual oscillator." See text for full details.



from cathode to grid, and from grid to plate due to oscillating counter electromotive forces in the inductance due to the capacitor discharging through it and the final movement of the cloud is from the plate back to the cathode. If the inductance is tuned by a capacitor then the LC circuit acts as an escapement movement, the counter electromotive forces acting at the resonant frequency of the tuned circuit. Thus we have an oscillator with no electrically connected outside source of power to affect its stability.

It will be appreciated that this electron pressure could be devised by means other than thermal agitation.

Due to the circulating currents in a resonating circuit being many times greater than the pulses causing them, a signal of sufficient strength to activate a pair of cheap phones is gained even though the take-off is with a 16-ohm secondary of a standard output.

The secondary could have a greater number of turns and a greater output voltage until enough power was drawn from the oscillator to affect the counter electromotive forces developed. In such a case, the low frequencies would fade first.

Some readers may notice that the circuit looks like a Hartley, but there are many notable differences. A few points of comparison are; the Hubbard oscillator does not start with a plate current flow in the usual sense—the power supply is out in space in the form of a cloud. In the described oscillator the frequency is controlled by the LC circuit, the grid capacitor and resistor having small effect on the frequency. In a Hartley using the same parts, the frequency, except under certain conditions, will depend upon the time constant of the RC circuit in the grid. The tube will act as a relaxation oscillator with the output waveshape any number of variations, depending on the value of grid capacitor and resistor and, to a lesser extent, on LC.

The output waveshape is always the same irrespective of the value of grid R and C in the writer's oscillator. It has covered from 30 cycles to above the broadcast band in r.f. frequencies all on the same value of grid R and C. (Any tone quality or waveform containing either odd or even harmonics can be produced by a tuned lumped inductance in the grid circuit and that quality will remain fixed throughout the range of the oscillator.)

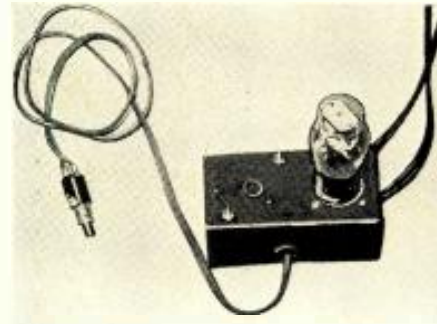
Lastly, the Hartley is useless as a tone generator for electronic music. It is very unstable even with a regulated power supply and will not produce good sine waves but waves of sharp needle points.

It is in this field that the present oscillator shows up very well. Not only for stability but by the fact that if a key contact is inserted at x, as shown in Fig. 1D, signal build up and decay will be a function of the value of the grid capacitor and the frequency generated. With ordinary values it is possible to get gradual attack and decay which shows up nicely on the oscillo-

scope screen and is similar to that obtained by Baldwin with resistance keying. See Fig. 1E.

Inasmuch as there is no potential difference between the plate and the cathode, the tube doesn't amplify and there is no rush of plate current at the time the key is closed. The cheapest contact switch can be used yet gives a beautiful attack and decay to a signal of any frequency. This, plus the fact that these tone generators can be locked together very easily in octave relationships with no problem involving precise voltage values to keep them dividing, solves many of the headaches in the home construction of electronic musical instruments.

Because the filament voltage and current is simply to heat the cathode, it can be either a.c. or d.c., the voltage depending on the type of tube used.

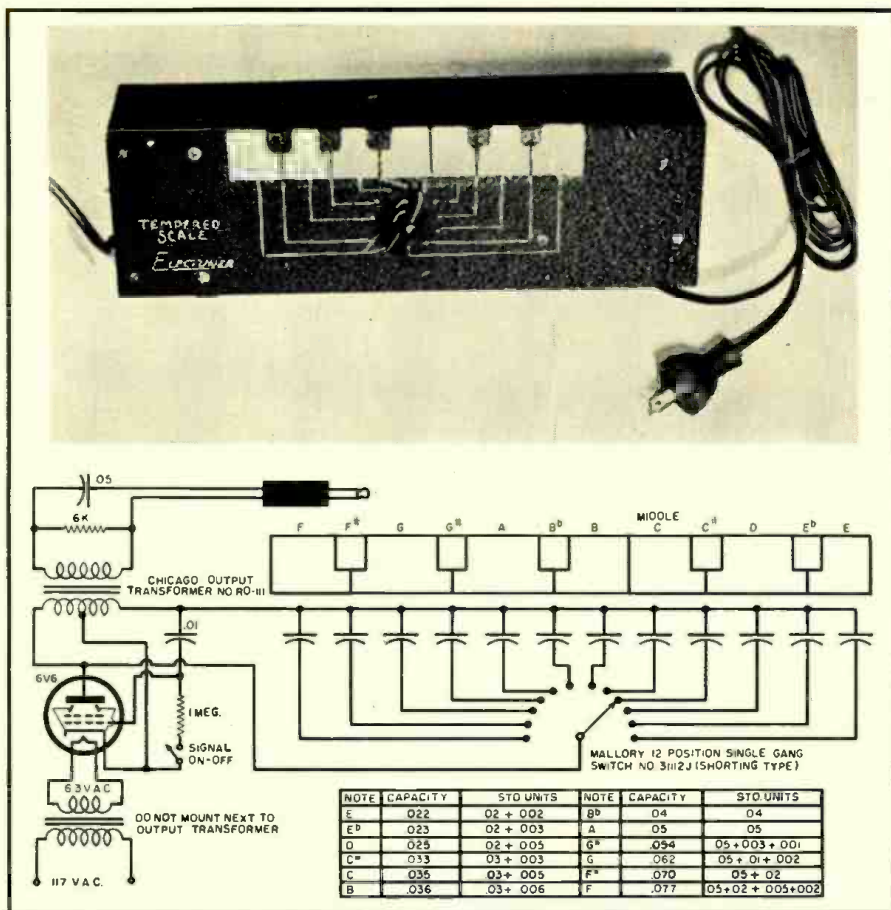


A simple triode tube is used in this instrument as a basic oscillator. It could take the form of a code practice set or an audio oscillator, to name two uses.

Two schematics of oscillators are shown, one using a 6V6 and the other using a 117L7 which lends itself par-

Circuit diagram and two photographs of the electronic tuner discussed in this article. It covers six strings in A major tuning. The panel of this instrument, as well as the number and value of the capacitors can be changed to be used as service oscillators, code practice oscillators, signal injectors, and hi-fi test oscillators using a musical scale to check speaker loading placement and other pertinent points.

C1	.005	E
C2	.0058 (005 + 0003 + 0005)	C ^B
C3	.01	A
C4	.0166 (01 + 001 + 005 + 0006)	E
C5	.0365 (006 + 03 + 0005)	A
C6	.065 (06 + 005)	E



Details on a "piano" 12-note tuner. This circuit can obviously be expanded as desired.

ticularly well to this oscillator circuit since by merely connecting the line current to the filament, our "A" and "B" power supply is wired.

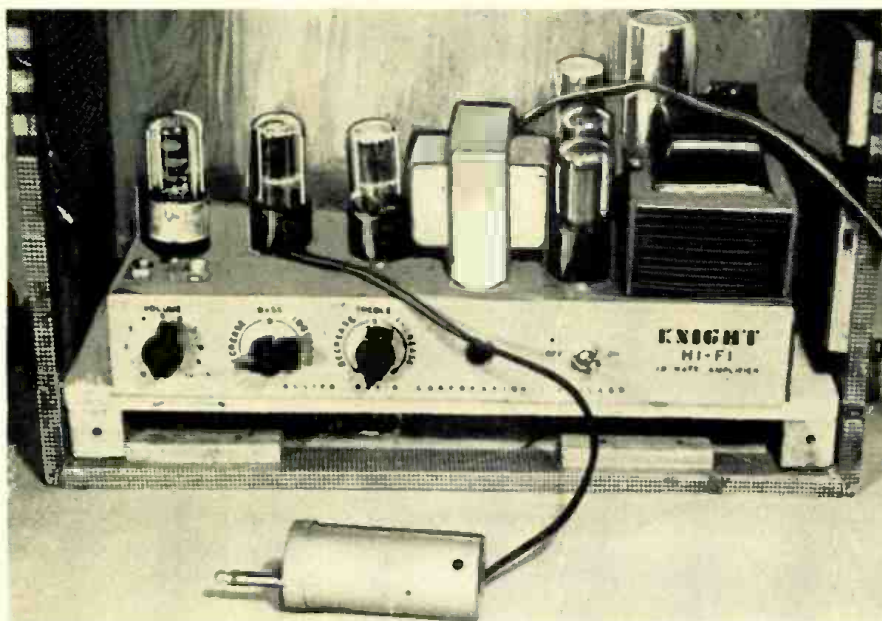
The piano tuner is a tempered octave running from "F" through middle "C" to "E".

The guitar tuner covers six strings in "A" major tuning.

The values of the capacitors shown

may have to be trimmed by a very small amount on the high notes due to tolerance changes or differences in commercial transformers. Substitutes using run-of-the-mill capacitors have been made with as many as five random-picked units yet the frequency remains "on the nose" with a standard. These were *Sangamo* units sealed in plastic which seem to hold fairly close.

A test unit built into a can with plug-power taken from the filament pin on amplifier tube. It can be used as "E" for band work or 400 cycles for test work.



The panels of these tuners as well as the number and value of the capacitors can be changed, of course, to be used as service oscillators, code oscillators, signal injectors, and hi-fi test oscillators using a musical scale to check speaker loading placement, etc.

It will be noted that the octave tuner can be built for about five times less than the cost of a commercial two-note tuner. It will also be noted that by rotating the rotary switch on the decal keyboard tunes can be played.

The writer has built a monophonic instrument with three octaves of keys using the clickless circuit. It has been in use for a year and is still in tune with the author's *Hammond* with which it is used. It uses one tube, an Alnico magnet vibrato, and produces flute, reed, and horn tones. It can be moved anywhere as it is simply an oscillator in back of a keyboard, and plugged into any amplifier instrument or mike jack. Although this instrument is very simple, it isn't classed as a toy—plugged into a good amplifier system it will perform along with either of the two commercial monophonic instruments on the market. Of course, an added feature is lack of service trouble as nothing ever burns or blows out except the tube.

It is hoped the radio technician, experimenter, and particularly the electronic music and audio man will find new uses for this novel circuit.

Under certain conditions it is very sensitive to changes in the strength of a very weak magnetic field and to minute changes of a d.c. potential. The Seebeck effect (thermoelectric effect) from a soldered joint can stop it. It can be controlled directly from a photovoltaic cell of course, and will be useful in industrial control.

A word of caution, however. Do not expect a tube of low emission or high leakage to work in this circuit. Such tubes can, in ordinary circuits, be used with a high positive potential on the plate and force a few electrons to "work", but remember the electrons leaving by thermal agitation are your "B" supply in this case. A space charge that builds up slowly or a tube with high leakage will produce a signal of the LC circuit frequency in small envelope "puffs" of signal.

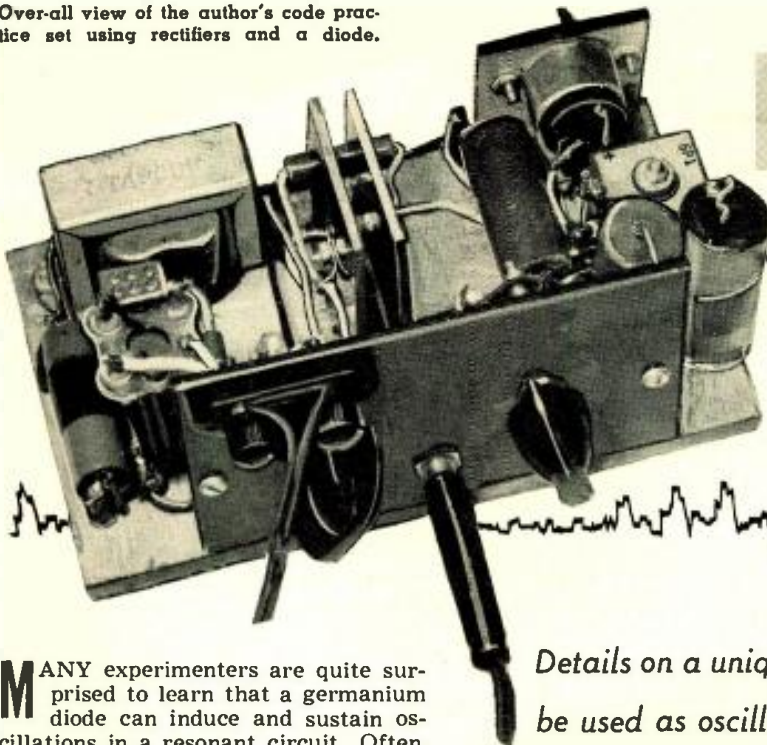
Because this oscillator can be built in a few minutes, many will be constructed of junk box parts—if this is done, the reader should try several of his used tubes for best results.

As a final thought, the author hopes that many experimentally-minded readers will try this circuit since it is fun to build and its applications are numerous enough to offer a real challenge to the builder.

It has the added advantage of being inexpensive—it can be built from the well-stocked junk box or, even purchasing all parts the cost is moderate.

Try it, anyway, you have nothing to lose and you might find this circuit just the sort of thing you have been looking for.

Over-all view of the author's code practice set using rectifiers and a diode.



GERMANIUM

DIODE

OSCILLATOR

By IRVING GOTTLIEB

Details on a unique circuit in which a germanium diode can be used as oscillator for test or code practice applications.

MANY experimenters are quite surprised to learn that a germanium diode can induce and sustain oscillations in a resonant circuit. Often, there is strong insistence that surgery must be performed to transform the diode into a transistor. The surprise is understandable and the inference is logical; it is nevertheless true that a "garden variety" 1N34 germanium diode can be utilized to generate audio frequencies.

This interesting phenomenon can be quickly divested of mystery by referring to Fig. 1 which depicts the voltage-current relationship of a point contact semiconductor diode such as the 1N34. The portion of the curve shown dotted is not always indicated in the graphs accompanying technical literature. An unusual feature of the curve segment extending from "A" to "B" is that its slope is negative. Another way of visualizing this is to note that a sort of "inverse Ohm's Law" applies over this region; that is, a decrease in applied potential coincides with an increase in current ("applied potential" here denotes the voltage measured directly across the terminals of the diode). Indeed, a device of this kind is said to display *negative resistance* over such a region of its characteristics.

The vacuum-tube feedback oscillator is sometimes analyzed by postulating that the tube supplies sufficient *negative resistance* to overcome the losses, or "positive" resistance of the LC circuit. Theory tells us that an isolated "tank" would naturally be in the oscillatory state except for the omnipresent damping effect of dissipation. Of course, it is true that the energy must initially be stored in either the capacitor or inductance. Thereafter, providing this energy does not suffer attenuation from losses, it surges periodically from one reactive element to the other. The losses include those due to conductor resistance, dielectric leakage, eddy currents,

hysteresis, and radiation. All of these together have very much the same effect as a certain value of resistance associated with the resonant circuit and it is just this resistance which must be overcome by *negative resistance*. Better insight into the mechanism of negative resistance can be gained by studying the operation of the "Dynatron" and "Transitron" circuits. In these oscillators, the vacuum tube behaves not merely as an "equivalent" negative resistance, but directly as an element possessing this unique parameter. Also, it should be appreciated that at one time, arc transmitters enjoyed popularity, the electric arc being another means of obtaining negative resistance.

In any event, once we have accepted the notion that inductance plus capacitance plus negative resistance can add up to oscillation, the mere physical form of any of these elements can no longer arouse our suspicion that electronic trickery of some kind must be involved.

The device to be described is intended to be used as a code practice oscillator. It is entirely practical and

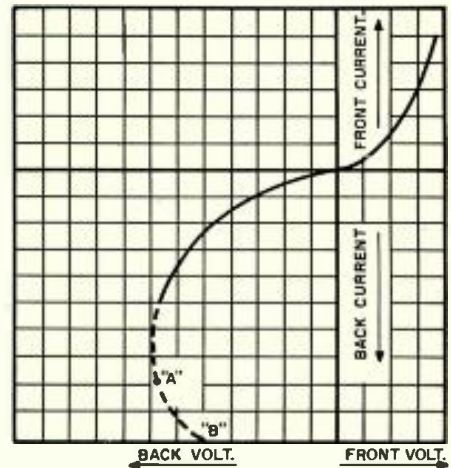
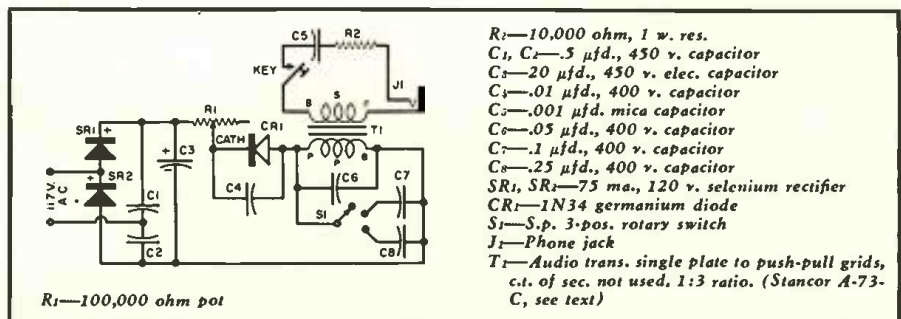


Fig. 1. Typical voltage-current characteristic of a germanium diode. Note that the slope of the curve in the "A"- "B" region is negative, signifying that the potential drop across the diode decreases as current increases. See discussion in text.

performs as well as a vacuum-tube oscillator. The idea is not new, but the oscillating abilities of the germanium
(Continued on page 106)

Fig. 2. Schematic of the diode oscillator. Constructor should carefully check connections to make certain that components with polarized terminals conform to schematic.



TV

SHRINKING PICTURES

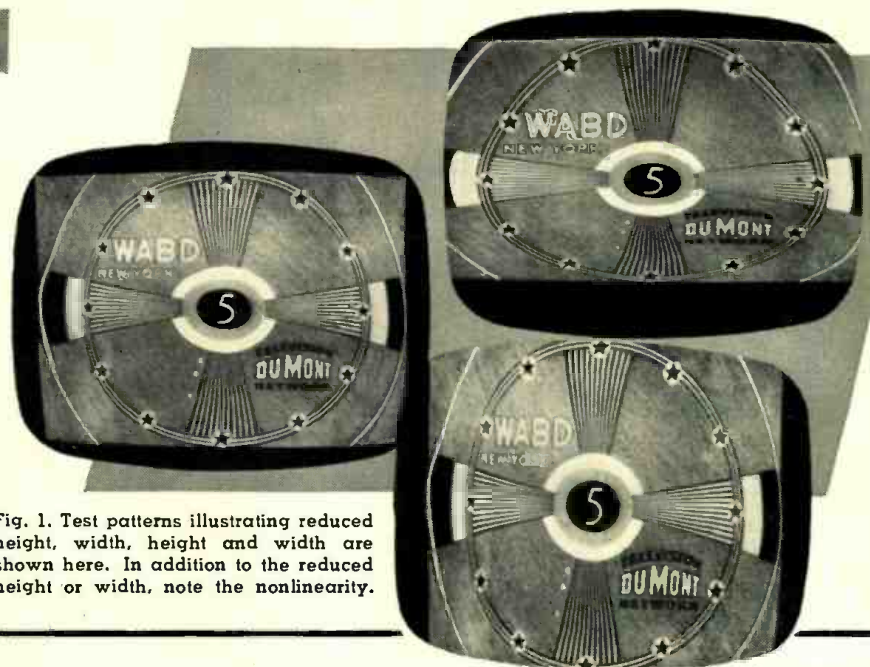


Fig. 1. Test patterns illustrating reduced height, width, height and width are shown here. In addition to the reduced height or width, note the nonlinearity.

By SOL HELLER

The causes of decreasing picture size are numerous—knowing them all can help you find the right one fast.

THE technician is often called upon to service troubles that introduce changes in picture size. Sometimes reductions in size take place that are slow enough to merit the label "creeping." In other cases, picture shrinking develops more rapidly. Width, height, or width and height, may be affected (see Fig. 1). The picture in many cases returns to normal size after periods in which its dimensions are below normal.

Let's consider first those cases in which width alone is affected. One of the commonest sources of trouble is a poor horizontal amplifier tube. Impaired focus may be associated with the loss in width in some receivers. When intermittent shrinking of width is linked with premature failure of the horizontal output tube, a reduction in the cathode resistance of this tube may have taken place. Check the cathode resistor's value, to verify this possibility. Insufficient cathode bias makes the horizontal amplifier largely dependent for its bias on the input sweep signal, resulting in noticeable changes in width in the presence of relatively slight changes in input signal. Insufficient grid drive increases the horizontal amplifier's heat dissipation, and thus shortens its life.

Defects in the damper, horizontal oscillator, horizontal discharge, and low-voltage rectifier tube may possibly cause intermittent changes in width, and should be checked for by suitable tube substitutions.

A drop in line voltage may produce a noticeable decrease in width (without necessarily introducing a visible loss in height). The symptoms are aggravated by the use of inferior or de-

fective horizontal output tubes. Try tubes of different make in this stage of the receiver while the line voltage is low, noting which tube produces maximum width. Availability of an autotransformer with a variable output will permit this test to be made even when the line voltage is normal or above normal. Leave the best tube, i.e., the one with the greatest amount of reserve emission—in the set.

A type of shrinking that rapidly degenerates into a loss of horizontal deflection, and is followed by a total loss of screen illumination, is produced when the grid return resistor of the horizontal output tube opens. A somewhat narrower-than-normal raster tends to appear in this case for a few seconds after the set has been turned on. Horizontal deflection is soon completely lost, with only a vertical line being seen. In the last phase of this rapid sequence, a total blackout occurs.

A relatively slight but noticeable loss in width that develops at intervals may be due to an intermittent open in the cathode bypass capacitor of the horizontal amplifier. Bridging this capacitor when the intermittent is in its active phase, i.e., when width is reduced—will determine whether the source of trouble lies here.

In some cases of intermittent reduction in picture width, arcing in the width coil is responsible. This is particularly apt to occur when the core or slug has been screwed all the way in, bringing the core close to a coil terminal. Re-adjustment of the slug to bring it farther out will often eliminate the arcing. Try this when audible or other signs of arcing in the coil

are noted, or when the coil has become suspect by a process of elimination.

An unusual source of trouble sometimes turns up in the *Capehart* CX-33 chassis. The symptom produced is an approximately $\frac{1}{3}$ decrease in picture width during the first quarter hour after the set is turned on, followed by a gradual restoration of width to normal during the next hour. The trouble is due to a defect in the isolating transformer used in the damper heater circuit. Early-model units had not been properly baked, and had excessive capacitance between their windings as well. Although an obscure trouble of this type is not likely to be encountered by the technician, its occurrence is possible; a heater circuit defect of this kind should not, therefore, be automatically exempted from suspicion when changes in width are the complaint.

Vertical Shrinking

Shrinking of the picture in a vertical direction not infrequently takes place. The picture may be normal in size when the receiver is first turned on, then may fall off in height, generally at the bottom. The loss in height may be anywhere from $\frac{1}{2}$ inch to 2 inches or thereabouts.

The fault may lie in a weak vertical output or oscillator tube. Also, the low-voltage rectifier's emission may have decreased; or perhaps some other fault in the supply has reduced the "B" voltages, and thus made the receiver more susceptible to a falling off in efficiency of a vertical tube, or a reduction in line voltage.

When the output of the damper feeds the vertical as well as the horizontal amplifier, a loss in the emission of the damper or horizontal amplifier—or of any horizontal circuit tube for that matter—will cause reduced voltage to be applied to the vertical amplifier, causing its output to fall off, and

height to be reduced. Measure the damper cathode-to-ground voltage, or substitute horizontal circuit tubes, to check on this possibility.

The slow development of grid emission in any tube may cause a gradual overloading of one or more other tubes, and impose an excessive drain on the low-voltage rectifier as well. The supply voltage to the vertical amplifier may be reduced to the point where height is affected, as a result. Chances are additional stages will be affected as well, producing other symptoms besides a height reduction. "B" voltage and bias checks will help localize this source of trouble.

An insufficiently-advanced horizontal drive setting may (in cases where the vertical amplifier is fed from the "B+" boost line) be a contributing cause of a loss in height. Vertical reserve size may be reduced to the point where a drop in line voltage, or some other source of lowered efficiency, causes an appreciable loss in height. Advance the horizontal drive setting to the point where overdrive lines just become visible, then reduce the setting slightly, until these lines are invisible again, to be certain that the setting of this control is correct.

Intermittent leakage in the coupling capacitor between the vertical oscillator and amplifier may be responsible for intermittent vertical shrinkage. Check the grid-to-ground voltage of the vertical amplifier when the intermittent is in its active phase, to determine whether this fault is present. A d.c. voltage of less than .2 volt should be measured, if the grid is returned to ground. The vertical oscillator tube is removed from its socket or otherwise disabled for this test. If the d.c. voltage measured is larger than .2 volt, remove the vertical amplifier tube (unless a series-heater setup is present) and recheck the voltage. If the excessive voltage is still present, a new capacitor (preferably a molded type) should be substituted, and results noted. Several capacitors may have to be tried to obtain one with acceptably low leakage. (Appreciable leakage in the coupling capacitor will generally cause a bright horizontal line to appear at the bottom of the raster.)

If low line voltage is the cause of vertical shrinking, and a 6SN7 is used in the set as a vertical amplifier, try substituting a 6BL7GT in its place. It should be kept in mind, however, that some 6BL7GT tubes are notorious sources of grid emission—a fault that can introduce vertical distortion as well as shrinking.

When the raster's height decreases after being normal for some hours, and the amount of shrinking is small, height and linearity controls may be adjusted to produce a slight amount of overscan, possibly 1/8-inch or thereabouts. Subsequent shrinking will no longer be visible if this is done.

When a lack of reserve height seems to be responsible for a relatively slight amount of shrinking, try increasing the

vertical oscillator output by using a smaller value of resistance (R_{113} , Fig 2) in the vertical oscillator discharge circuit; or decrease the size of C_{407} . Too great a reduction in R_{113} or C_{407} will, of course, introduce appreciable non-linearity into the vertical sweep, and should be avoided.

When even a slight reduction in the charge-discharge capacitor or resistor introduces too much nonlinearity, try increasing the value of grid resistance in the vertical amplifier (R_{115} , Fig. 2) up to a maximum of one-third more, to boost the vertical amplifier output. Keep in mind, though, that too much of an increase may promote grid emission. Keep the set operating, preferably in its cabinet, for about two hours after such a change, to make sure that emission effects (causing a positive grid and vertical distortion) are not present.

An early-type vertical yoke may be responsible for a lack of reserve height, predisposing the raster to vertical shrinkage. A later, more efficient model using an iron core may have to be substituted, if other remedies prove inadequate.

Vertical shrinking may be due to a change in characteristics of the vertical output transformer. Heat is apt to cause such an undesired change, when certain defects in the transformer are present. Substitution of a new transformer will serve as a test for this defect. It is assumed that a loss in output has been traced to the vertical amplifier, and no other component defect in this circuit is evident.

An intermittent decrease in vertical size is not infrequently due to a defective capacitor in the "B+" boost circuit (when the vertical amplifier is fed from the "B+" boost line). These capacitors are exposed to relatively large voltages and are therefore particularly apt to develop intermittent (or permanent) defects. In the case of Du Mont RA 306/307 receivers, an intermittent leak in C_{208} (see Fig. 3), the 10 μ f.d., 350 volt semipolarized "B+" boost capacitor, will produce, intermittently, a rather low buzz in the sound, as well as a decrease in picture size.

An intermittent open in the coupling capacitor between the vertical oscillator and amplifier can be the cause of intermittent shrinking of height. Try wiggling this unit with a pair of long-nose pliers; if shrinkage is introduced during this test, and disappears when the unit is bridged with an equivalent capacitor, the coupler is bad.

Fig. 2. Vertical sweep circuit used in the Admiral 19B1 chassis. This is a typical vertical sweep circuit for TV sets.

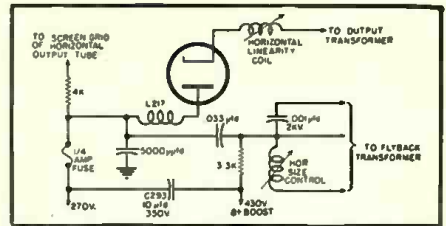
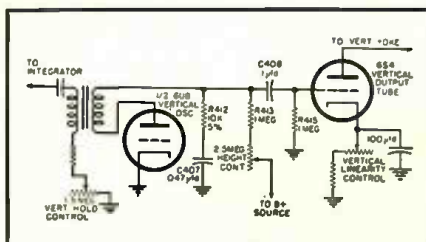


Fig. 3. Damper and boost "B+" circuit used in the Du Mont RA-306/307 chassis.

Over-all Reduction

When both vertical and horizontal size are reduced during receiver operation, a loss of emission may be taking place in a low-voltage rectifier. This is particularly likely if proper focusing is obtained or approached only when the focus control is placed at one extreme of its range; or if contrast, sync, brightness, or synchronization (as well as size) has been affected. Replacement of the rectifier will serve to check on this possibility.

Many cases of loss in size are due to a drop in line voltage. Such a drop, especially when it is abetted by a loss of efficiency in a sweep or low-voltage rectifier stage, will cause vertical and/or horizontal shrinking. Brightness, contrast, sync, sound, or focusing may be noticeably affected as well; on the other hand, such associated effects may not be evident. If a strong signal is coming in, for instance, a reduction in line voltage may not affect contrast appreciably, even though the sweep circuit output is noticeably reduced.

Line voltage in residential areas is generally higher in the morning and afternoon than it is in the evening, when power demands on the lines are greater. If the shrinking in size occurs in the evening, chances are a line voltage drop is the cause; a check of the voltage should be made at the customer's home in the evening, to verify whether the source of trouble lies here.

An easy—but relatively expensive—way to eliminate such troubles is by using a step-up or constant-voltage transformer. Other methods involve boosting the reserve sweep of the receiver in one of various ways. Some makes of sweep tube can deliver more current in the presence of reduced line voltage than others can. This is particularly true of tubes used in horizontal output stages. It is therefore advisable to try other makes of tubes, and several samplings of the same make, to find a sweep tube capable of providing proper height or width, as the case may be. Some means of reducing the line voltage at the shop should be available, if the test is made there. The tube substitutions may, of course, be made in the customer's home at the time that the reduced line voltage has decreased the raster's size.

In some cases, a more efficient type of rectifier may be substituted for the one present, to maintain the "B" voltage at a higher level when the line voltage falls. A 5V4G, for instance, may be substituted for a 5Y3G. If the

(Continued on page 104)

Certified RECORD REVUE

By **BERT WHYTE**

THE record industry is still fussin' and fumin' about the price reductions. Some companies are determined to keep their product pegged at the original prices, others have gone down in price only to go back up again in a few weeks, and as for the rest . . . no one seems to know, "who's on third," or anything else! Well, we've spent enough space in comment on this situation. If any big trend develops, I will try to get "on the inside" and report anything significant to you.

Things must run in cycles in this hi-fi world. Some months, all the letters I get are from people complaining about record surfaces; other months, it seems everybody is having trouble with their crossover networks, etc., etc. This past month seems to belong to the audiophiles with phono-cartridge troubles. Now admittedly, there are plenty of things that can go wrong with a pickup. But gosh-amounty, some of you folks are just aidin' and abettin' trouble! At best a pickup cartridge is not the most rugged of devices. Sure, diamonds are mighty hard and wear at a slower rate than any other type of stylus material. But they are also brittle, and a few hard knocks on the diamond may cause a ruinous crack. The average hi-fi fan is slightly fanatic (or should be) when it comes to keeping his records and equipment clean. But this can be carried too far, with some very disastrous results. For instance, I am in receipt of several very sad letters from some folks who in the course of cleaning dirt from their styli, inadvertently brushed away the silica-gel damping material which is a necessary part of certain cartridges. These well-meaning people were complaining that their cartridges "didn't sound right." I shouldn't wonder, since an undamped stylus can give rise to incredible amounts of distortion, as much as 25 per-cent! The damping material is particularly important in the *Pickering* cartridges. In fact, to assure continuous optimum performance, the *Pickering* factory suggests that these units be returned to the factory once a year for examination. This is a good practice as they will not only make sure the damping material is up to snuff, but examine the stylus for possible signs of wear and inform you if replacement is indicated. This silica-gel damping material is a whitish waxy-looking substance and may be quite firm, or soft and freely movable. Don't touch it! In many instances the damage is done by inquisitive hi-finatics opening up the cartridge cases just to see "what makes it tick." In most pickup units the damping material is well protected within the case and normally would not be subject to tampering. *Don't open your cartridge cases!* Not only may damage result, but most companies have a policy of voiding their warranties if there is evidence of customer "diddling." When you do clean your stylus of dust, etc., avoid the practice of "flicking" the stylus with your finger. This "flicking" is one of the best ways to displace

the silica-gel. It is also wise to avoid "blowing" the dust from the stylus as your moisture-laden breath may find lodging in some delicate parts and cause corrosion. The best thing is to use a soft camel or sable hair brush, and gently clean around the stylus. One last admonition; if your cartridge is used in "plug-in" fashion, when not in use *do not place it near any source of heat*, such as pre-amplifier, etc. The silica-gel is not very stable at high temperatures and you might have a little trouble.

Equipment used this month: *Pickering* 260 cartridge and 190B arm, *Components Corporation* turntable, *Marantz* audio consolette, two *McIntosh* 30-watt amplifiers, *Jim Lansing*, 34001 horn speaker system, *Electro-Voice* "Georgian." Tape equipment: *Ampex* 600.

MAHLER

SYMPHONY #1 ("TITAN")

Vienna Philharmonic Orchestra conducted by Rafael Kubelik. London LL1107. RIAA curve. Price \$3.98.

New York Philharmonic Symphony conducted by Bruno Walter. Columbia SL218. Old NARTB curve. Price \$5.95.

The sixth and seventh versions of Mahler's most "popular" symphony and superior to all that have preceded them, both sonically and performance-wise. I was particularly pleased to find Rafael Kubelik recording with the *London* label. After his splendid recording tenure with *Mercury*, I was hoping he would go with an organization capable of affording him the high quality sound to which he had become accustomed, and which his talent most certainly merits. *London* is, of course, well qualified for this task. This Mahler 1st is to be followed by all the other Mahler symphonies, with Kubelik at the conductorial helm. An ambitious project that will be good news to avid "Mahlerites." Making a choice between these two versions is not an easy job. Bruno Walter is an unquestioned authority on Mahler and to be sure, his reading is magnificent. His tempi are just, his balance impeccable, and his phrasing deft and sure. But more than all of that is his "warm" interpretation. Dr. Walter makes the work "sing" with an easy naturalness . . . no forcing or storming here. It does not lack strength or vigor, however. The impression is that there are sinewy muscles under the velvet glove. Kubelik approaches the score more obliquely. His feeling seems to be as deep, but his expression somewhat restrained. It is best perhaps, to call Kubelik's reading "earthy," rather than romantic. But judicious or not, Kubelik outguns Dr. Walter in the famous "sturmisch bewegt," the last movement. The finale is supposed to be "triumphant" and in

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.

Kubelik's hands it certainly sounds that way! The trumpets and the famous French horns (seven of them!) blare forth in all their glory. Of course, this superiority is in large measure due to the splendid sound of the *London* disc.

The Walter is typical "good" *Columbia* sound, but not one of their outstanding jobs. Dynamics seem cramped, and the bass line is somewhat thick-textured. Dynamic range is one of the most outstanding features of the *London*, along with generally clean string tone, richly resonant brass, and the superbly "live" Vienna Philharmonic woodwinds. While the *London* disc is characterized by wide frequency response, there are some sections (notably in the climaxes), where the sound is surprisingly "coarse," and is not at all typical of their best efforts. Everything considered, however, this is the best-sounding Mahler 1st in the catalogue. You might sum up these two discs this way; The Walter will appeal to those who place performance above all other considerations, and the Kubelik will find sympathetic ears from those who want a reasonably good performance and insist on the best sound. Both discs conformed to their curves and both had moderately quiet surfaces.

STRAUSS, JOHANN WIENER BLUT

Philharmonia Orchestra and Chorus conducted by Otto Ackermann with Elizabeth Schwarzkopf, Nicolai Gedda, Erich Kunz, Erika Koth, Emmy Loose, Karl Donch, and Alois Pernerstorfer, soloists. Angel 13519 (3s). RIAA curve. Price \$9.96. Two discs.

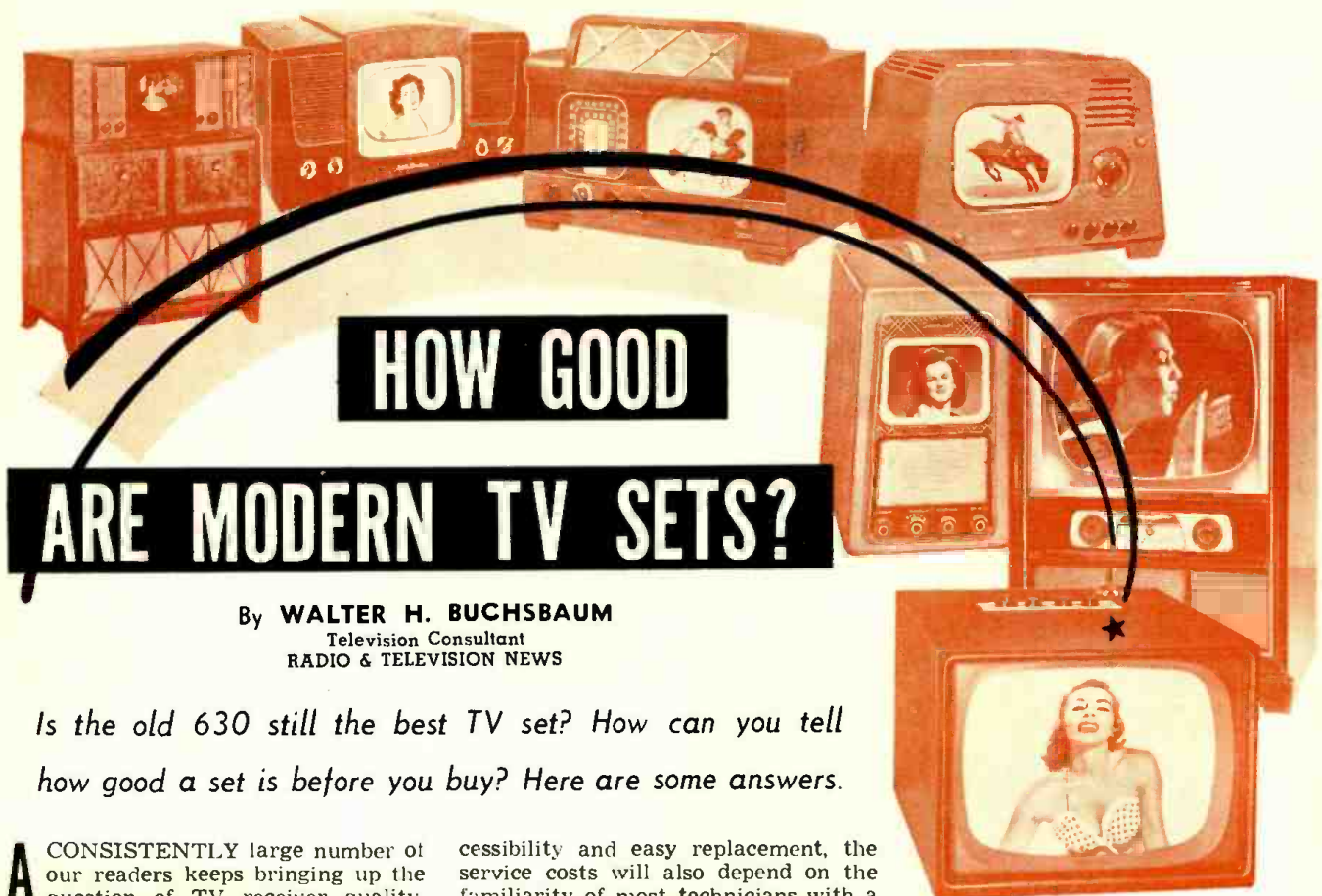
If you are a lover of "Die Fledermaus," or the "Merry Widow," or for that matter practically anything Straussian . . . this is your meat. Cast in the same mold as those earlier works, it is in reality a collection of many songs and settings that Strauss had composed over the years and which were compiled and collated to form "Wiener Blut." Hodge-podge though this might seem, and although Strauss never lived to hear the production it has nonetheless become a beloved favorite the world over. This is a first-rate job on all counts. Schwarzkopf is in her element in this sort of thing and she is completely captivating as Gabriele. Gedda is his usual good self, and it was a pleasure to hear Emmy Loose sing so well after such a long absence from records. The rest of the cast seems quite competent, and the conducting of Ackermann, exemplary. His hand is always light and the whole production fairly bubbles with "Gemutlichkeit." Sound is in the best *Angel* tradition which means suave smooth strings, rich brass and woodwinds, nice "live" acoustics. Choral and orchestral work was of very high order, with good balance and dynamics. It would be a real curmudgeon who could resist the blandishments of this charming work. Highly recommended. Curve and surfaces OK.

ORGAN MUSIC OF THE 17TH CENTURY

Gustav Leonhardt, organist. Vanguard-Bach Guild BG529. Old NARTB curve. Price \$4.98.

You lovers of the baroque in organs and organ music will find this a particularly satisfying disc. Works by such stalwarts as Praetorius, Frescobaldi, and Scherer and other less well-known baroque composers are splendidly performed by Gustav Leonhardt on the magnificent old organ of the Stiftskirche at Klosterneuburg, Austria. Built in 1636-1642, the clear, clean intonation and typical baroque "hoarseness" and "breathiness" of the stops, especially the reeds, is reproduced with startling fidelity. Purists will perceive that the instrument is pitched one half tone above our normal pitch. No big pedals here for you

(Continued on page 95)



HOW GOOD

ARE MODERN TV SETS?

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

Is the old 630 still the best TV set? How can you tell how good a set is before you buy? Here are some answers.

A CONSISTENTLY large number of our readers keeps bringing up the question of TV receiver quality. Are the latest models as good as the old 630-type sets, how does brand "A" compare with brand "B," can fringe reception be as good with a standard model as with a custom-built receiver? Many of our readers have been asked these questions themselves by their customers and friends. Actually, some standards are available to serve as a guide for comparing receiver performances.

Before going into the merits of the various circuits, consider the criteria by which receiver quality can be judged. Certainly price is an important factor. No one expects the same performance from a *Plymouth* as from a *Cadillac* and the same holds true for TV receivers.

In weak signal areas, the sensitivity of the receiver is a vital performance criterion while in metropolitan locations, even poor sensitivity produces good pictures. The quality of the picture depends on such design features as bandpass, noise immunity and sync circuits, and the picture tube itself. With the advent of high fidelity, the sound reproduction capabilities of a TV set are also often important considerations.

As far as troublefree operation is concerned, there is absolutely no way, irrespective of cost or design features, to guarantee undisturbed operation of any electronic device. The set manufacturer who uses only well-tried circuits, reliable components, and careful test and quality control procedures will undoubtedly earn a better reputation. Aside from such features as ac-

cessibility and easy replacement, the service costs will also depend on the familiarity of most technicians with a particular receiver.

Summing up these criteria we can see that from a technical point of view the following features should be considered in comparing TV receivers: 1, picture quality (bandwidth, picture tube, freedom from interference, etc.); 2, sensitivity; 3, circuit reliability; 4, quality of components; 5, serviceability; 6, sound reproduction; and 7, u.h.f. reception.

If we are to compare older sets, about 4 to 5 years old, with the latest receivers, it is obvious that the new models win hands down on such items as picture tubes, high voltage and linearity, and serviceability. The score is not so clear cut when it comes to good bandwidth, good sensitivity, and quality components.

Is the 630 Still Best?

This question is often debated among service technicians. It is true that some manufacturers specializing in custom-type sets have modified the 630 circuit to incorporate all of the latest advantages of better picture tubes, circuits, and components. These versions are naturally very high quality sets since they have retained the best features of the original design and have added only those new wrinkles that really improve the set. Most important however, is the fact that these sets are built usually with the original 630 philosophy in mind—cost was secondary and only performance and reliability counted. With the cost of TV sets as low as they are today, this type of thinking is not very practical except

for the limited, luxury-type market.

The original 630 receiver had many features which would be severely criticized in today's models. Aside from the small picture tube, the tuner, for example, did not stand up for very long. Some companies practically started in business just replacing the detents of the KRK-2 switch tuner in the original 630. Nostalgic TV viewers also forget the many service calls due to misadjusted front panel controls, especially the horizontal hold control. Lack of a.g.c. was another feature of the 630 which is often forgotten. As for ease of servicing, it is fortunate that today's 21-inch chassis do not weigh as much in comparison as the 10-inch 630 did. Did you ever try replacing the vertical output tube in the 630 with the chassis in the original cabinet? How about the high-voltage compartment?

Actually, the 630 circuit was quite appropriate for its time and served as a basis for future development, but there was no magic in it. Sound design, clean chassis layout, and reliable components are just as available today as in the "good old days."

One of the great advances in TV has been in picture tube development. Together with this, the deflection circuitry has been simplified and improved. As an example, compare the two circuits in Fig. 1. Fig. 1A is the circuit used in the original 630. Six and one-half tubes are used for this horizontal sync, flyback, high-voltage section. Of these tubes, only the 6BG6

CHANNEL	NOISE	
	630	21-S-500U
2	14 db	4 db
3	15 db	4 db
4	13 db	5 db
5	14 db	4.5 db
6	16 db	6 db
7	18 db	8 db
8	18 db	9.5 db
9	17.5 db	8 db
10	18 db	7 db
11	19 db	8 db
12	19 db	8.5 db
13	19 db	9.5 db

Table 1. Comparison of the tuner noise figures of the original 630 TV set and of a typical cascade-amplifier tuner.

and the 1B3 were specially designed for TV, while the others were previously-used types from radar and radio receiver applications.

In Fig. 1B, only four tubes are used and only the 6SN7 is not a special TV-type tube. Other receivers use special TV tubes exclusively in this circuit. The important thing, however, in comparing circuits is performance under all conditions, and in this respect, the circuit of Fig. 1B is superior in many ways.

First, there is only one control for horizontal frequency—a secondary control which the customer hardly ever needs to touch. The stabilizing coil in the horizontal oscillator circuit makes

the unit more immune to sudden disturbances such as noise or line voltage surges. Second, because the entire section is more efficient, it requires much less d.c. power and therefore generates less heat. This helps all components to last longer. Third, the 6AX4 damper diode does not require a special heater winding, as did the 5V4, and is also more rugged.

As every service technician knows, the flyback transformer itself is now much smaller and more efficient due to the use of ferrite or similar cores. Last, but not least, the deflection yoke is of the cosine type which provides uniform focus and linear deflection over the entire screen area.

In the 630 high-voltage section, a large amount of power was dissipated in the 6300-ohm linearity-adjustment resistor. The width-control coil and the linearity-control coil were both hard to adjust without removing the chassis, and the fuse replacement inside the high-voltage chassis was often quite annoying.

Leaving the horizontal-deflection section, we can also see advancements and innovations in the i.f. section that brought improved performance. One of the improvements in modern receivers is, of course, the use of a.g.c. to control the gain of the tuner and i.f. stages, resulting in the elimination of overloading under strong signal conditions. Another feature of the modern i.f. circuit is that it frequently consists of a printed-wiring subassembly and uses the new i.f. of 41 to 46 mc. Improved tubes provide more gain-percentage than did the 6AG5 used in the older 630.

An actual comparison of the two i.f. systems shows substantially the same

gain (although modern circuits use only three tubes to the 630's four), a very slight deterioration in i.f. bandwidth, and much greater stability of the new circuit. The reduction in i.f. bandwidth is in the order of 0.2 mc., which is made up by the video peaking circuit in the video amplifier section.

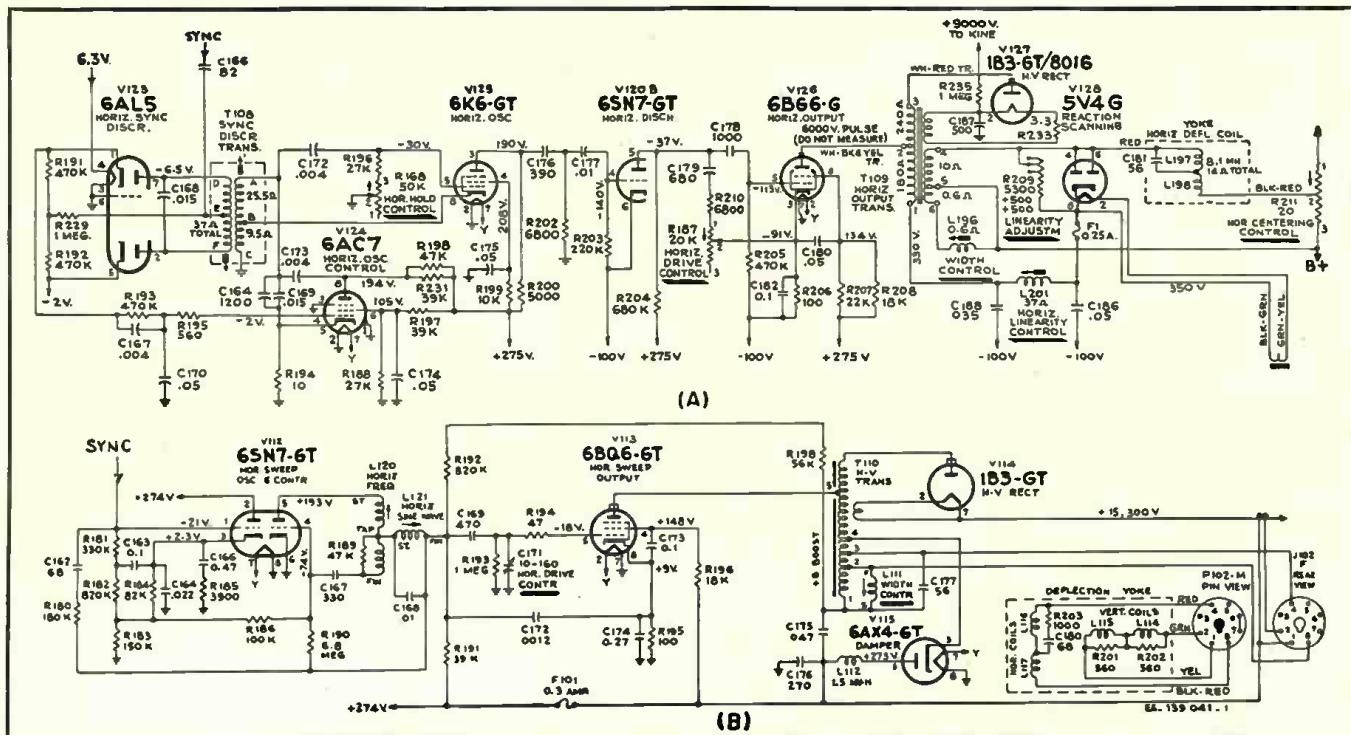
The observant reader will notice that there is only one trap in the modern circuit of Fig. 2; the original 630 had five. One reason for this is the use of intercarrier sound, allowing the sound i.f. to be amplified along with the video. Another factor reducing the number of traps is the higher "Q" of the individual i.f. coils as indicated by the lack of loading resistors in the last two i.f. stages.

Since the new i.f. is 41 mc., the bandwidth required, approximately 3.5 mc., is easier to obtain than with a 21 mc. i.f., for the bandwidth is a smaller percentage of the i.f.

The circuit in Fig. 2 is novel in the use of bifilar-wound i.f. transformers which have almost unity coupling and can be tuned just like a single coil. This greatly simplifies the alignment procedure and thereby greatly reduces the chance of misalignment.

One important difference between the old 630 and new high quality sets is the fact that the new sets can receive fringe signals much better. This is due in part to the use of a cascade r.f. stage in the tuner giving a much better noise figure and therefore less "snow." Also, some kind of delayed a.g.c. bias is often provided, which gives maximum sensitivity of very weak signals. The sync separator sections of most quality sets contain noise immunity circuits which help stabilize the picture against noise interference.

Fig. 1. (A) The horizontal sweep and high voltage circuits of the original 630 TV receiver. (B) Corresponding circuits of the RCA model 21-S-500U, a modern receiver incorporating many of the advances in TV receiver design and manufacture.



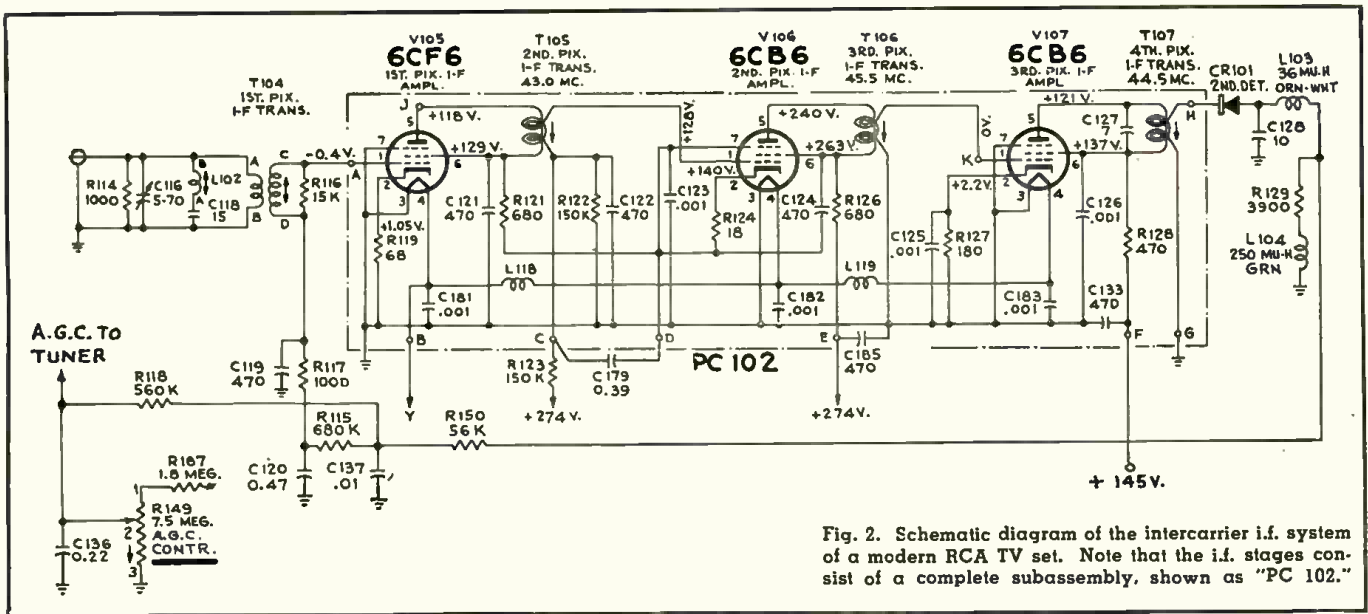


Fig. 2. Schematic diagram of the intercarrier i.f. system of a modern RCA TV set. Note that the i.f. stages consist of a complete subassembly, shown as "PC 102."

Many of these features are found in the custom-type 630 sets now being offered, but were not part of the original model. As a means of comparison of set performance, Table 1 and Figs. 3 and 4 show typical tuner noise figures, i.f. response curves, and over-all response curves of the old 630 and a typical production sample of the RCA 21-S-500U. On all counts, the new set is either equal to or better than its ancestor.

One very interesting thought pertinent to this discussion of the merits of the new simplified receivers is the role this simplification has played in the development of color television. There is no doubt that one of the important factors in whether color sets will sell is their cost, and one of the important items in the cost of the set is the cost of the monochrome and sound sections. Simplified circuitry has reduced this cost materially.

Selecting a TV Set

Individual needs and tests should determine the choice of receiver rather than any rigid technical data we can set down. There is one important consideration which sharply divides all TV sets into two groups and that is fringe reception. Even if five channels come in strong in a particular location, if one is weak the area is practically a fringe location and a fringe-type receiver should be selected.

For the service technician, it is a simple matter to look at a receiver schematic and decide if a set is suitable for fringe reception. He will look at the tuner input to make sure a cascade circuit is used. Next, he will look for a "fringe-local" switch and see if this really increases sensitivity. Another criterion, especially in a noisy location, will be the presence of noise immunity circuits.

There are some general rules which most of the popular brand manufacturers follow and which give an outward indication as to the capabilities of a set. The more sensitive receivers

usually have provision for u.h.f. and a "fringe-local" switch or some adjustment for varying the a.g.c. operation.

TV sets without a power transformer are usually not intended for fringe operation. A good example of such an economy receiver is the CBS-Columbia Model 1601, whose block diagram is shown in Fig. 5. Only 15 tubes are used in the entire set including the picture tube. Series heater tubes are used with a transformerless power supply. Although this set has a three-position switch for different signal levels, only the tuner a.g.c. is varied here and not too much benefit is derived from this feature. This receiver will give excellent pictures in local and near-fringe areas.

After determining whether a fringe or local set is needed, the next consideration will concern the picture size and cabinet type. Most manufacturers make two series of chassis and often both are available in similar cabinets. That is why the layman is often puzzled by the fact that he is offered two different 21-inch sets, of similar cabinetry, but with different prices. The higher priced one invariably has the fringe area feature.

Once the picture size and cabinet style is settled, the profusion of many different brands with only slight price variations still confuse the customer. Here we must tread carefully in advising any particular brand. It has been our experience that the exact price of a set is not an indication of its true comparative value. A set ten dollars cheaper is not necessarily worse, nor need it be better just because it has been widely advertised. The final choice should depend on the availability of competent local service for a particular set, special features such as better sound or better cabinetry, and the reputation of the manufacturer and his local dealer. A small price difference can easily be overcome by better service, for example, over the course of a single year.

Choosing a TV set is pretty much

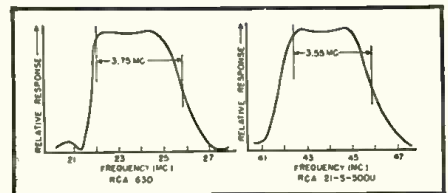


Fig. 3. Comparison of the i.f. bandwidths of the 630 and a modern set.

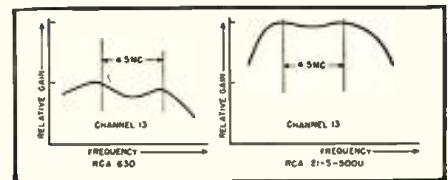
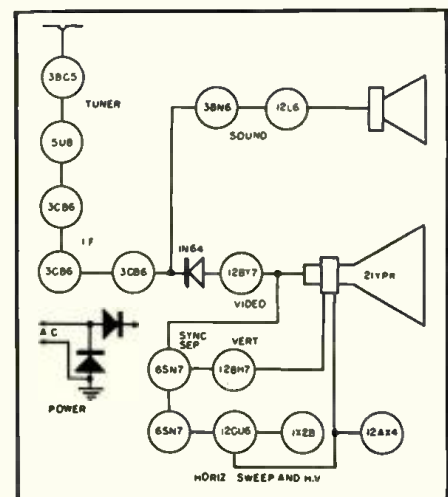


Fig. 4. Comparison of the over-all response at a high channel of the 630 and one of its modern counterparts.

like choosing a car or a girl friend. It is not only the appearance that counts, nor the way it works when on demonstration, but many different factors must be evaluated and step-by-step the choice is narrowed down.

Fig. 5. Block diagram of a new CBS-Columbia economy-model TV receiver.



Front view of the Model S-1000 amplifier-preamp-control system unit by Sherwood.



AN INTEGRATED HI-FI AMPLIFIER

By
EDW. S. MILLER

Gen. Mgr. and Chief Engr.
Sherwood Electronic Laboratories

Design data on a compact unit combining a control unit, preamplifier, and power amplifier in a single housing.

IN RECENT months more and more designers have been turning their talents to the problem of meeting the demand represented by the general market. As a result, several amplifiers have been developed which combine both a phono preamplifier and control system in an integrated, self-cabineted unit.

The unit to be described, the Sherwood Model S-1000, provides these features plus a complete group of operating refinements which the less technically minded music lover will appreciate.

Recent tests by large consumer organizations and experts show that under typical home-listening conditions, essentially no difference can be discerned among different brands of good basic high-fidelity power amplifiers (except in cases where the amplifiers affected speaker operation because of variations in damping).

On the other hand, the same studies showed that differences can be heard among most tone-control designs and other controls which affect frequency response in some way. In addition, annoyances such as switch clicks, hum,

rumble, hiss, etc., were objectionable to even the most untrained listener.

Guided by these findings, the S-1000 amplifier was designed to meet the following requirements: (1) low noise and hum level at least as good as that of an amplifier employing d.c. operated heaters; (2) no switch clicks or other disturbances accompanying any control operation whatsoever; (3) accurate push-button-operated record equalizer selector; (4) cathode-follower recording output preceding the tone controls and the loudness control. Provisions must be made to eliminate possible recorder feedback when playing back from the recorder; (5) calibrated tone controls having accurate flat settings and low distortion, especially at the intermediate settings of the treble control where conventional controls exhibit frequency response curves with a shelf-like shape; (6) a loudness control that operates without compensation at a centered or "12 o'clock" setting and thus provides a reserve of flat gain; (7) a front-panel switch to remove loudness compensation and restore conventional flat volume control action with no change in level; (8) a speaker damping switch to provide a choice of high or low and, especially, negative damping; (9) front-panel operated rumble and scratch filters with 12 db./octave frequency slopes; and (10) a good basic 20-watt amplifier which has

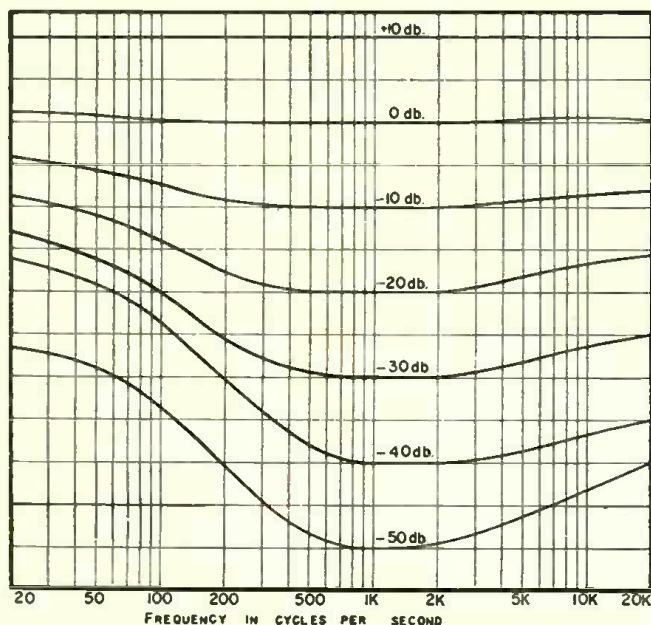
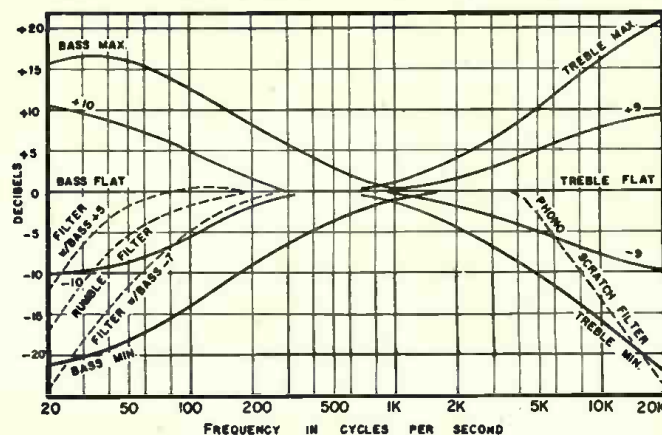


Fig. 1. Compensation curves obtained with the Centrallab Model A control incorporated in the Sherwood Model S-1000 amplifier. Special taps at 19 and 40 per-cent rotation introduce loudness compensation at a more counterclockwise position. See text.

Fig. 2. How the bass control's characteristics combine with the rumble filter's characteristic to give varying frequency turnovers to the sharp low-frequency filtering. For a full discussion of this feature and its effect, refer to article.



less than 1½% intermodulation distortion at 15 watts. (The frequency response at this level must be flat from 30 cps to 15 kc.)

The circuit that evolved is shown in Fig. 3.

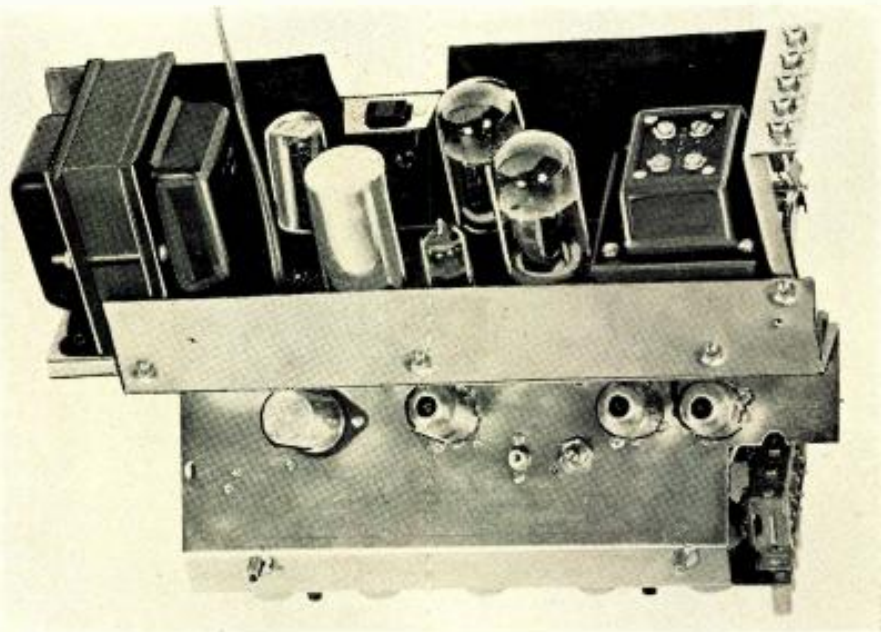
A feedback, bypassed-cathode type phono preamplifier circuit is used with the low-noise, low-microphonic British Z729 input tube. Record compensation is simplified for the music lover by the use of a four-button push type switch. Each button gives exact equalization to 30 cps for LP, RIAA (new AES), London, or European recordings.

By careful heater layout, hum is kept below a -60 db or 1½ μv. level (at input grid). This is equivalent to results obtained with d.c. operated heaters.

A s.p.d.t. switch, in conjunction with C_{25} and R_{26} (across the phono input), is used as a scratch filter with magnetic cartridges. This circuit has a 12 db per octave roll-off and a 5 kc. turnover when used with a G-E pickup.

To avoid the possibility of overloading a recorder by improper tone control adjustment, the recorder output in the circuit is located ahead of the loudness control and the tone controls. If the recorder output is used with the selector switch in the "Phono" position, the push-button record equalizers and scratch filter may be used. Hence the recorded material, when played back, will have the proper equalization.

With the selector switch in the "Tape" position—for playback—the recorder output is automatically disconnected. The reason for this is that



Rear and bottom views of the S-1000 amplifier chassis. Dimensions are 14" x 10½" x 4".

many recorders use interrelated recording and playback amplifier circuitry so that during playback, a feedback situation can develop. Usually, the recorder's input is fed from an amplifier's recording output, which in turn, is connected internally to the amplifier input being fed from the recorder output. To break this feedback loop, it is necessary to remove the recording cable from one of the jacks; or, as is done in the S-1000, the recording out-

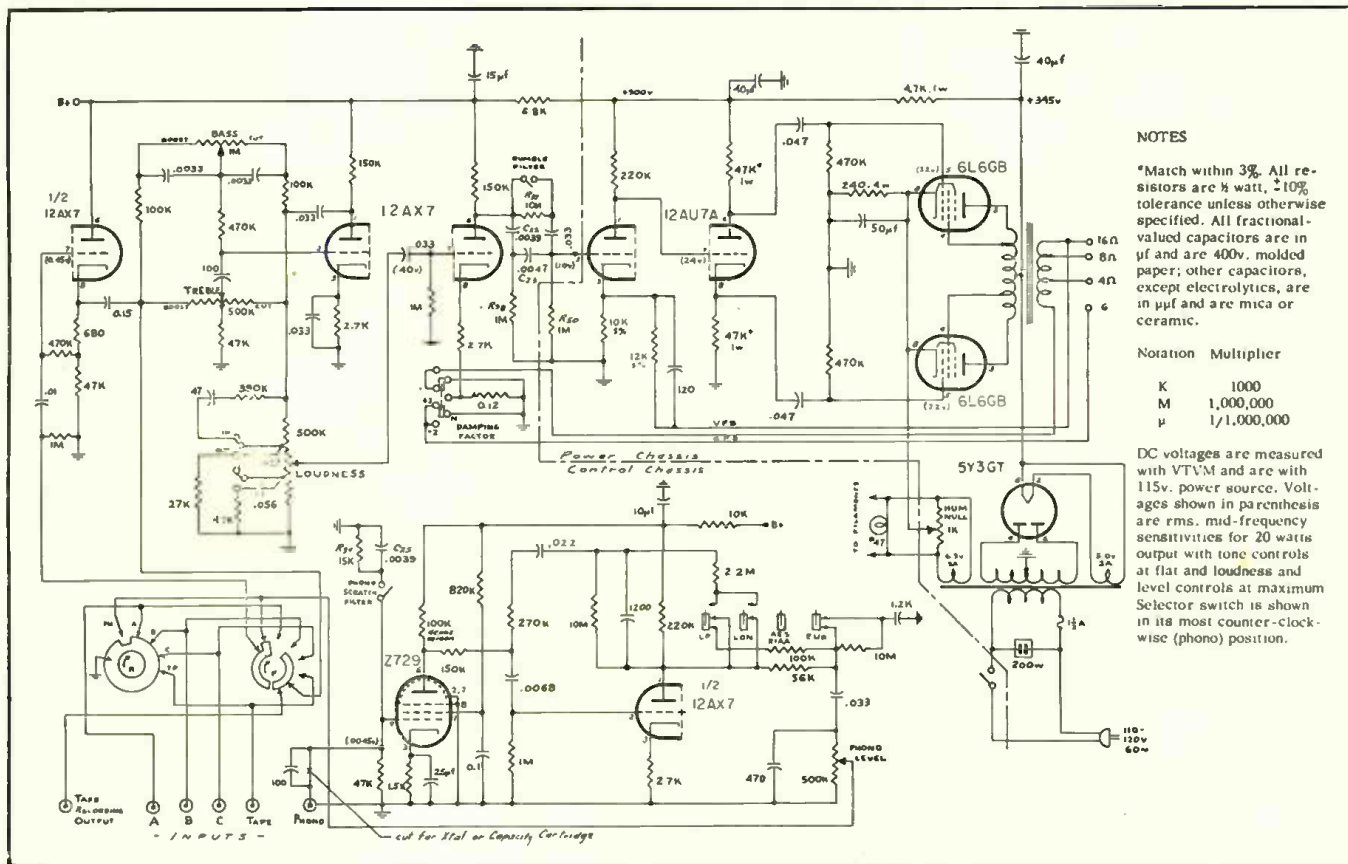
put must be automatically disconnected by the selector switch in the tape position.

Monitoring while recording remains entirely flexible since the loudness and tone control functions are independent of the signal to the recorder.

Even tone controls have various degrees of refinement. Some of the disadvantages of the popular combination bass-treble losser circuit are: (1) poor

(Continued on page 122)

Fig. 3. Schematic of the Sherwood Model S-1000 amplifier. The Z729 tube is a low-noise, low-microphonic British input tube.



NOTES

*Match within 3%. All resistors are ½ watt, ±10% tolerance unless otherwise specified. All fractional-valued capacitors are in μf and are 400v. molded paper; other capacitors, except electrolytics, are in μf and are mica or ceramic.

Notation	Multiplier
K	1000
M	1,000,000
μ	1/1,000,000

DC voltages are measured with VTVM and are with 115v. power source. Voltages shown in parenthesis are rms. mid-frequency sensitivities for 20 watts output with tone controls at flat and loudness and level controls at maximum Selector switch is shown in its most counter-clockwise (phono) position.

AN R/C RECEIVER FOR MODEL BOATS

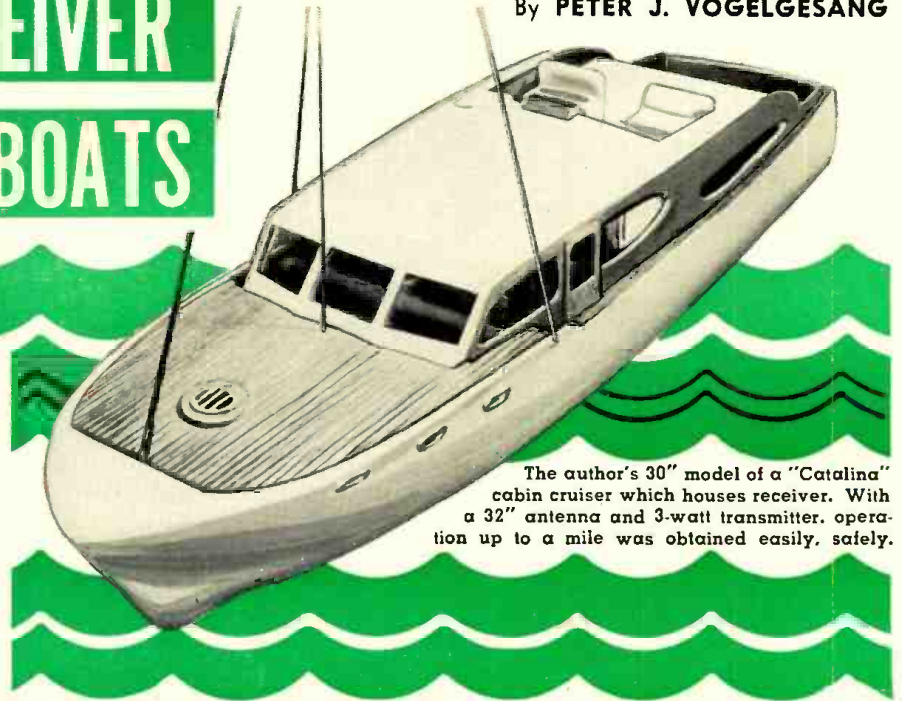
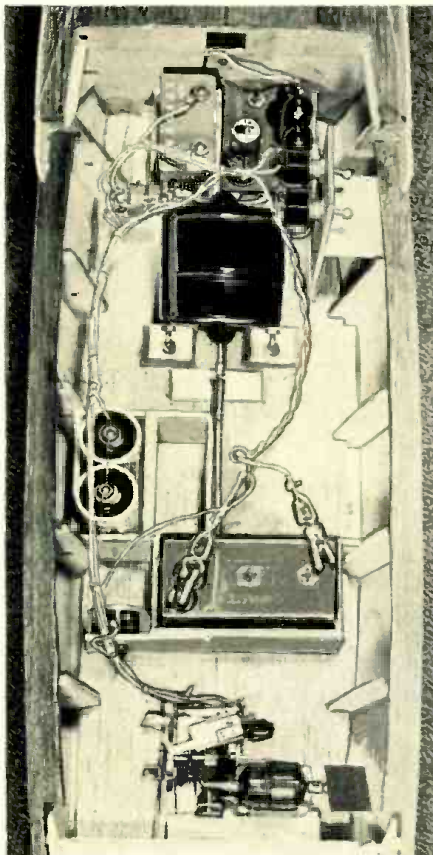
By PETER J. VOGELGESANG

MANY enthusiastic model builders undertake to radio control their models with the promise of many hours of enjoyment only to find that unreliable equipment turns fun to frustration. Nothing is quite so disappointing and discouraging as a model that responds to the controls only half the time. To really enjoy radio-controlled models, the equipment must be reliable above all else.

The severe restriction in size and weight of the radio receiver is the greatest difficulty to surmount in building reliable equipment. Tube and battery complement must be kept low, and heavy relays must be eliminated. The receiver must be sensitive and at the same time display a tolerance to wide changes in battery voltages.

Construction of a reliable transmit-

Interior view of the model boat showing how the equipment is installed for maximum trim and for easiest servicing work.



The author's 30" model of a "Catalina" cabin cruiser which houses receiver. With a 32" antenna and 3-watt transmitter, operation up to a mile was obtained easily, safely.

Designed to be used with any 27.255 mc. radio-control transmitter, this compact, lightweight receiver and its associated escapement offers a wide margin of safety.

ter is not nearly so difficult because size and weight are of little importance, and the unit can be constructed as elaborately as necessary to produce the desired results.

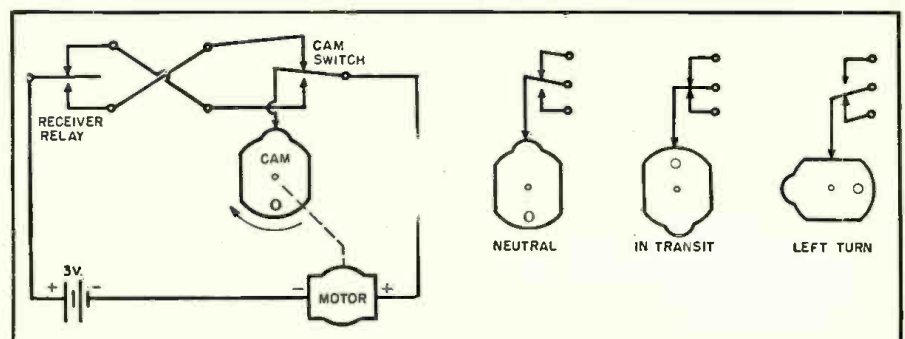
While almost all radio-control receivers are superregenerative detectors, they can usually be classed in

EDITOR'S NOTE: This article covers the construction of a receiver for radio control applications. It may be used with any commercial R/C transmitter designed to operate on the Citizens 27.255 mc. band or with the transmitter described in the December issue of our sister publication, *POPULAR ELECTRONICS* ("The Lorenz R/C Transmitter").

one of two categories, namely, the gas tube receiver and the hard tube receiver. The gas tube receiver uses a gas tube such as the RK61 while the hard tube receiver uses only hard vacuum tubes generally of the 1.5 volt filament, miniature variety. Each kind

of receiver has distinct advantages and disadvantages. For example, a single gas tube will display as much sensitivity as two or three vacuum tubes. Obviously, then, the gas tube receiver utilizes far fewer components with the resultant savings in space and weight and battery power consumption. However, the gas tube is comparatively short lived. At 1 milliampere plate current, fifteen or twenty hours is about all that can be expected from a gas tube, and even during that short life its electrical characteristics change continually. A gas tube receiver must be continually adjusted to compensate for the changing characteristics. The hard tube receiver, while not usually as sensitive as the gas tube type, and not as conservative of space and power consumption, will remain in permanent adjustment during hundreds of hours of operation.

Rudder-control operation under "neutral," "in transit," and "left turn" conditions.



In all receivers, gas tube and hard tube alike, it seems to be the general opinion that a relay current differential of 1 milliampere is adequate. However, only the most sensitive and critically adjusted relay will operate satisfactorily with such a small current differential. Such a relay is susceptible to vibration, shock, dust particles and almost any minute disturbing influences. To function reliably, a relay should operate from a current differential of at least three or four milliamperes.

All these factors must be considered in designing a reliable receiver. The receiver diagrammed and described in this article uses a radically different approach in order to extract the advantages of both the gas tube and hard tube. While an RK61 gas tube is used as the detector, it is operated at such a low plate current that its life is extended many times. The life of a gas tube is a function of the current it conducts, and with a plate current of less than .3 milliampere the tube life is extended well beyond a hundred hours. A gas tube operated as a superregenerative detector produces random noise pulses which disappear upon reception of an r.f. signal. The amplitude of these noise pulses remains constant irrespective of changes in plate current, but their repetition rate increases as the plate current increases. In the circuit illustrated, these noise pulses are capacity-coupled to an amplifier (V_2) where they are both amplified and clipped. They appear at the plate of V_2 as rectangular pulses about 20 volts in amplitude. From the amplifier they are coupled to the top of the voltage divider, R_6 and R_7 . This same point is returned to the diode of V_2 . The diode clamps the pulses and causes a negative 20 volts to be developed across the voltage divider. A portion of this voltage (about 15 volts) is tapped off the divider, filtered, and applied to the grid of the relay puller, V_3 . Since negative 15 volts is sufficient to cut off V_3 , the relay remains open and the entire receiver draws about .4 milliampere without signal. Upon reception of a signal the detector stops producing noise pulses, the bias on V_3 disappears and the relay closes with about 5 milliamperes plate current. Thus, a five milliampere relay current differential is realized from a standby current of less than .4 milliampere!! Such a large relay current differential enables the use of a small, hermetically sealed, plug-in type relay. This relay is rugged and presents no problems insofar as shock and difficult adjustments are concerned.

Thus the receiver retains the excellent sensitivity of the RK61 while eliminating its short life characteristic. About the only disadvantage of the receiver is the comparatively high filament current requirement. A single standard flashlight cell will operate the receiver for a few hours which is more than sufficient for airplane use. In a boat or similar model where



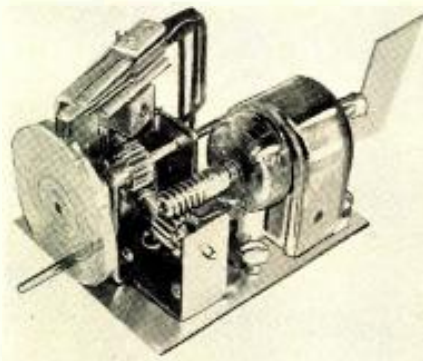
Over-all view of receiver which is constructed on a Formica chassis measuring 3" long and 2" wide. The chassis sets into a balsawood box 1½ inches in depth



weight is not so important, two or more cells can be paralleled. A single, miniature 67½ volt "B" battery gives almost shelf life.

The receiver is installed in a 30" model of a "Catalina" cabin cruiser. With a 32 inch antenna and a three-watt transmitter on 27.255 megacycles, unfailling results were obtained at one mile, a distance at which the boat was completely invisible to the transmitter operator.

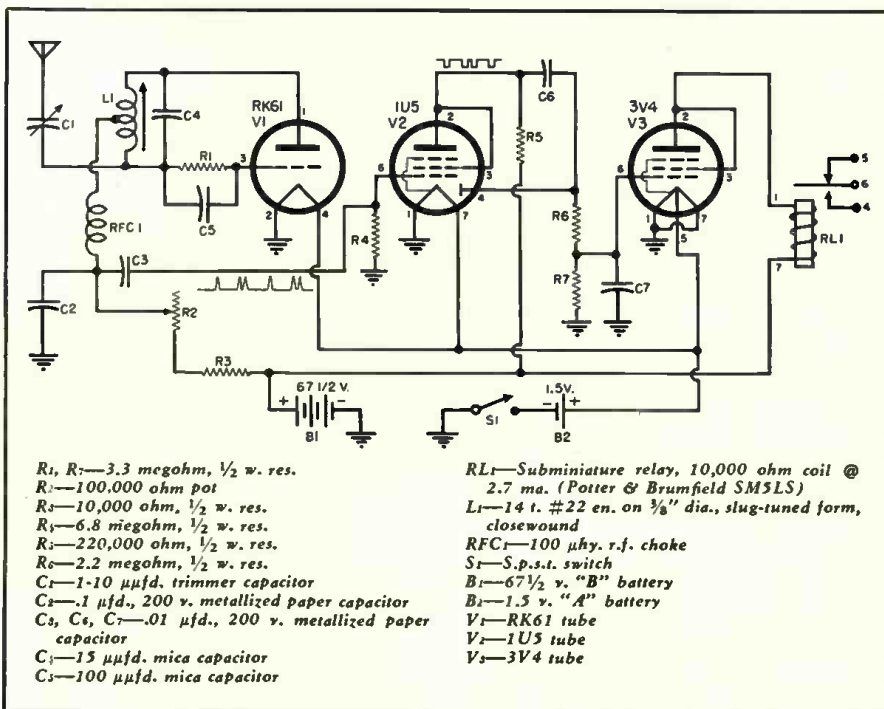
The receiver is constructed on a Formica chassis three inches long and two inches wide. The chassis sets into a balsawood box one and one-half inches deep. Three 7-pin sockets mount the two vacuum tubes and the plug-in relay. The phenolic inserts of the sockets were removed from the metal shells and cemented directly to the Formica chassis. This eliminates both size and



Close-up view of the motor-driven rudder-control. See diagram on opposite page.

weight and the necessity for additional hardware. The RK61 is pressed into a large rubber grommet and the wire (Continued on page 114)

Complete schematic diagram and parts list covering the R/C receiver for 27.255 mc.



V.H.F.-U.H.F. TV GENERATOR

By **BRUCE A. MORRISSETTE**

Ingenious modification of the Mallory "Hideaway" u.h.f. converter yields this inexpensive and useful instrument.

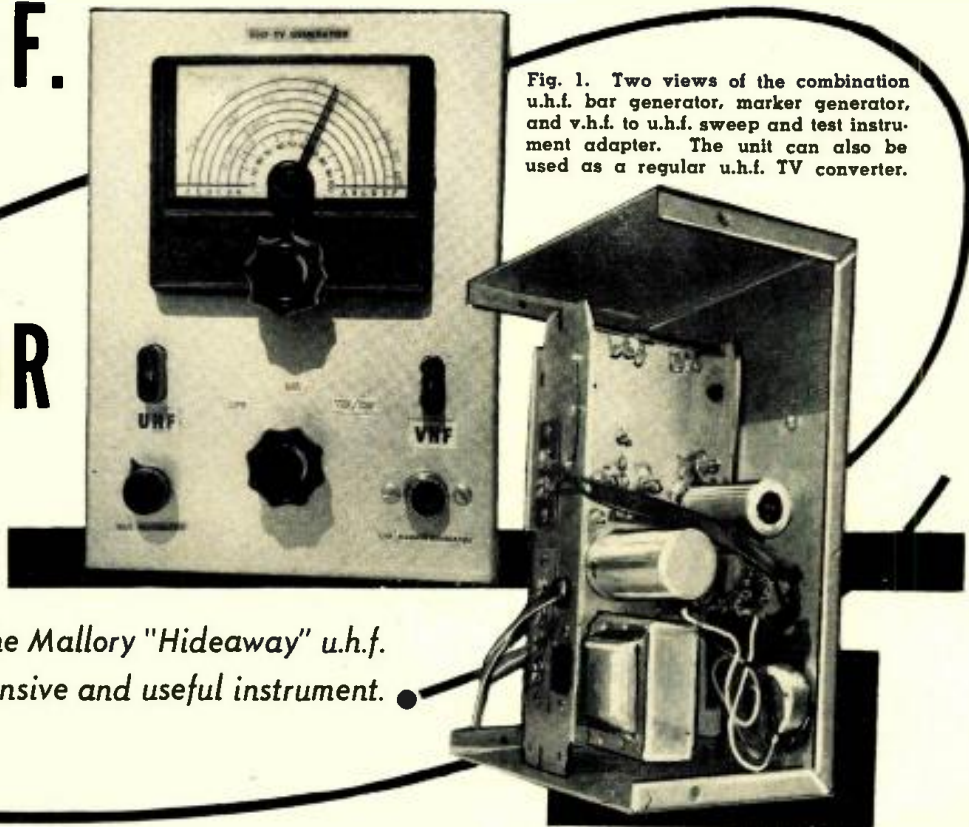


Fig. 1. Two views of the combination u.h.f. bar generator, marker generator, and v.h.f. to u.h.f. sweep and test instrument adapter. The unit can also be used as a regular u.h.f. TV converter.

CONTINUING high costs of u.h.f. test equipment have forced many service technicians and experimenters to depend on weak u.h.f. harmonics from their present v.h.f. signal and sweep generators, or to forego entirely all attempts to test and align the tuned circuits of u.h.f. tuners and converters. Several medium-priced adapter units have appeared on the market, such as the *Philco* v.h.f. to u.h.f. generator adapter described in the September 1953 issue of *RADIO & TELEVISION NEWS*. These instruments permit the technician to use an ordinary v.h.f. sweep generator to develop alignment curves throughout the u.h.f. spectrum, and represent a step downwards in the cost of u.h.f. service equipment.

An inexpensive, home-assembled v.h.f.-u.h.f. TV generator of outstanding performance is shown in Fig. 1. Based on the readily obtainable *Mallory* Model 188 "Hideaway" u.h.f. converter, this unit has four functions: (1) u.h.f. bar generator producing from 2 to 14 horizontal bars on u.h.f. channels; (2) u.h.f. marker generator providing pure r.f. at fundamental frequencies from 400 to 800 mc.; (3) v.h.f. to u.h.f. sweep and test instrument adapter converting any v.h.f. sweep signal in the 75-90 mc. range to any u.h.f. channel frequency from channel 14 to 83; and (4) a regular u.h.f. converter to allow viewing any u.h.f. picture signal on an ordinary TV set tuned to channel 5 or 6.

Construction of the instrument is made convenient and practical by the fact that the builder is not required to do any u.h.f. wiring. A few changes in

switch connections, plus the addition of five resistors, three capacitors, one variable control, and a turret socket, and the chassis is fully remodeled. An 8"x6"x3½" aluminum "Minibox" houses the v.h.f.-u.h.f. unit and provides all the necessary r.f. shielding.

Theory and Operation

The v.h.f.-u.h.f. generator when used as a u.h.f. adapter for test and sweep instruments functions more or less as a u.h.f. converter in reverse, that is, it accepts a v.h.f. sweep signal at its v.h.f. terminals, adds to this the u.h.f. fundamental frequency of its own, filters out the difference frequency or other spurious frequencies that arise in the mixing process, and presents a swept u.h.f. frequency at its u.h.f. terminals. This u.h.f. sweep signal may be placed anywhere in the u.h.f. channel spectrum by tuning the v.h.f.-u.h.f. generator dial. Since the original Model 188 converter is designed to work into channel 5 or 6, the v.h.f. swept signal should be in this range, roughly, from 75-90 mc. It may be of any convenient bandwidth, usually about 10-15 mc. Unlike the harmonics of ordinary v.h.f. sweep generators used at u.h.f., the swept signals from the v.h.f.-u.h.f. generator have the same sweep width as the v.h.f. sweep signal fed into the unit.

Notice that the u.h.f. converter used must be capable of passing a signal in the backward as well as the forward direction in order to serve as the basic unit of a v.h.f.-u.h.f. generator. This means that converters embodying an amplifier tube are ruled out, unless considerable revision of the circuit is

undertaken. The *Mallory* Model 188 is ideally suited for the present job, since it not only functions in either direction, but it has a spare socket hole already punched. Also, it has exceptionally good bandwidth, necessary to maintain undistorted flat sweep output, and a 180-degree tuning mechanism. This latter characteristic is important if a standard calibration dial is to be added.

A typical testing setup for aligning a u.h.f. tuner or converter is shown in Fig. 3. The v.h.f. sweep generator manual should be consulted for the proper way to provide balanced 300-ohm output, which is fed into the v.h.f. terminals of the v.h.f.-u.h.f. generator through a regular *Mosely* plug that fits the crystal-holder type terminals. If no instructions are available, use a 120-ohm resistor in each lead to the v.h.f. terminals, or make up a 50- to 300-ohm adapter box ("balun") from a *Merit* TV-170 transformer. The u.h.f. output is taken from the appropriate terminals of the v.h.f.-u.h.f. generator and fed through 300-ohm line to the antenna terminals of the u.h.f. tuner or converter. Set the v.h.f. sweep generator to sweep approximately 75-85 mc. and set the v.h.f.-u.h.f. dial to the desired u.h.f. channel frequency *minus* this amount. Alignment should be checked at low, medium, and high u.h.f. channels. If markers are desired, another unit similar to the v.h.f.-u.h.f. generator (it does not need to have the bar generator feature), or any u.h.f. marker generator may be used as may harmonics from a v.h.f. signal generator.

Alignment curves may be taken for

scope presentation either at the video detector of the TV set (in which case caution and experience are needed to interpret them properly) or through a crystal demodulator probe at the output of the u.h.f. tuner or converter itself. This latter procedure is the best, and is entirely practicable, because of the high u.h.f. output of the v.h.f.-u.h.f. unit. In fact, one may view the u.h.f. sweep signal itself at the output terminals of the unit, provided the crystal probe is sensitive and the scope has a two-stage amplifier. This output will be found to be remarkably flat, as evidenced by the appearance of two equidistant lines on the scope.

Circuit and Construction

The original Mallory Model 188 converter is provided with double preselection by the selector tuned lines located between the antenna input and the mixer crystal (see Fig. 4). A 6AF4 u.h.f. oscillator operates from 75 to 90 mc. below the signal frequency, in order to preserve the correct relationship between video and sound carriers in the converted v.h.f. output. The oscillator and preselector tuned lines are ganged to a shaft which is ordinarily equipped with a large plastic dial visible over the top or around the side of the TV set. The channel 5 or 6 difference frequency developed in the 1N82 mixer crystal is presented to the v.h.f. terminals by way of the balanced output transformer provided. This transformer, incidentally, is in a large measure responsible for the excellent bandwidth characteristics of the Model 188.

In the modified unit the action of the function switch is simplified and the horizontal bar modulation feature is added. Inspection of Fig. 4, the schematic of the completed unit, will show that the v.h.f. and u.h.f. terminals are permanently wired to their panel connectors. Connect the original leads running between the output transformer and the function switch to the TV set terminals on the back of the Model 188 chassis. The function switch itself is rewired to provide off, bar, and v.h.f.-u.h.f. functions. Position three (v.h.f.-u.h.f.) serves as a marker generator, sweep adapter, and regular u.h.f. converter. In this position, heater and plate voltages are removed from the 6J6 bar modulator tube, allowing the power transformer to run cool during long periods of use as a u.h.f. converter.

The added circuit within the dotted lines is a Belgian multivibrator adapted for use as a variable horizontal bar modulator. The circuit produces a stable, clean-cut square-wave output which may be varied by R_0 from approximately 120 to 800 cycles per second. The other grid (pin 6) is synchronized with the 60-cycle line by coupling through the .01 μ f. ceramic capacitor, C_3 , connected to the active heater pin 3. As the bar control is rotated, the multivibrator falls into sync with successive numbers of lines. Up to 14 horizontal lines may be produced. The large output coupling capacitor C_1

(16 μ f.) preserves the steep edges and flat tops of the modulation waves, giving an unusually sharp and contrasty bar pattern of the type shown in Fig. 5.

As a portable u.h.f. bar generator, the unit permits the testing and adjustment of the u.h.f. portions of all-channel receivers, as well as of u.h.f. converters, in the absence of a local u.h.f. program. Usually it is sufficient to connect a short length of wire to one or the other u.h.f. output terminals of the instrument to allow the u.h.f. bar signal to be radiated through the air to the TV receiver. In case of gross lack of sensitivity or maladjustment, the u.h.f. terminals of the generator may be connected directly to the antenna terminals on the TV set to provide a bar signal powerful enough to force itself through any u.h.f. circuits that are not completely dead. The r.f. and u.h.f. oscillator trimmers may be tuned for maximum response, and vertical linearity may be adjusted using the bar signal. Since the 6AF4 oscillator, by the nature of the converter design, tunes to only slightly past 800 mc., no bar patterns are available above channel 70 on fundamental frequencies. If it is desired to check a tuner at such a high u.h.f. setting, use the second harmonic of the bar generator by reverting to the low frequency end of the dial.

Since the Model 188 chassis conveniently contains an unused 7-pin socket hole adjacent to the function switch, no drilling is required to install the turret-type socket on which the components of the bar modulator circuit are mounted. With the exception of R_1 (mounted on the function switch), C_1 (placed below the chassis), and R_0 (in-

Fig. 2. Interior view of the adapter showing the Mallory Model 188 converter mounted vertically against the front panel of the instrument. Note the bar modulator tube mounted on the underside of the converter chassis. The bottom of the turret socket for this tube is shown in Fig. 1. Note, also, the coaxial marker output cable.

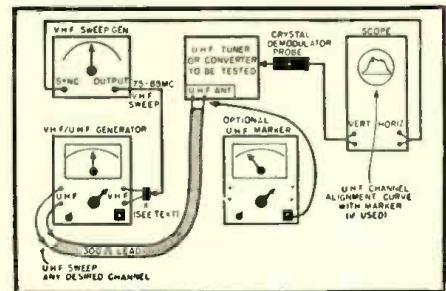
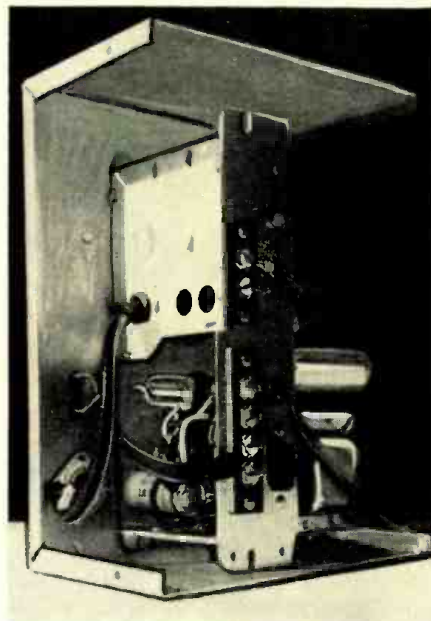


Fig. 3. Typical instrument setup for aligning or testing a u.h.f. converter or tuner using the v.h.f.-u.h.f. generator.

stalled on the front panel), all bar modulator resistors and capacitors are wired vertically around a 7-pin turret socket. As shown in Fig. 2, the vector socket is mounted upside down, with the components above the chassis and the 6J6 tube projecting below the chassis. The reason for this is to avoid crowding below the chassis and to leave undisturbed the delicate output transformer. Rotate the turret socket after it is wired until it fits snugly into the pre-drilled hole. If necessary, drill one mounting hole for a screw to retain the socket firmly. Plate, output, and heater lead wires are brought down through one of the several chassis holes near the socket and connected to appropriate points below the chassis. Connect the bar control potentiometer so that clockwise rotation decreases the amount of resistance in the circuit and thus causes more horizontal lines to appear in the bar pattern.

High level r.f. output for u.h.f. marker and other purposes is obtained by fashioning a small coupling loop at the end of a short length of RG-59/U cable, and inserting this loop into the 6AF4 oscillator compartment through the adjustment hole already present, as shown in Fig. 2. The solid inner conductor of the cable is bent in an arc about $\frac{1}{4}$ " in diameter and soldered to the cable shield. An Amphenol type 83-1R panel connector terminates the cable. To secure maximum uniform output, connect a good u.h.f. crystal (such as the 1N82) in series with the output and a microammeter. Then rotate the coupling loop inside the oscillator compartment while watching the meter. A point will be found that produces a strong r.f. signal of fairly uniform output throughout the tuning range. If the rectified current through the crystal runs between 50 and 100 microamperes, it may be assumed that the output is sufficient for all service and experimental purposes. A rubber grommet in the cable hole will give a snug fit and prevent the cable from twisting away from the best adjustment point.

Details of mounting the dial and other panel elements may be observed in Figs. 1 and 2. Place the 188 chassis vertically in the instrument box and carefully locate the two shaft holes. Then install the dial. The shaft nut of the function switch is sufficient to hold the chassis to the box at the bottom, but at the top a small retaining screw

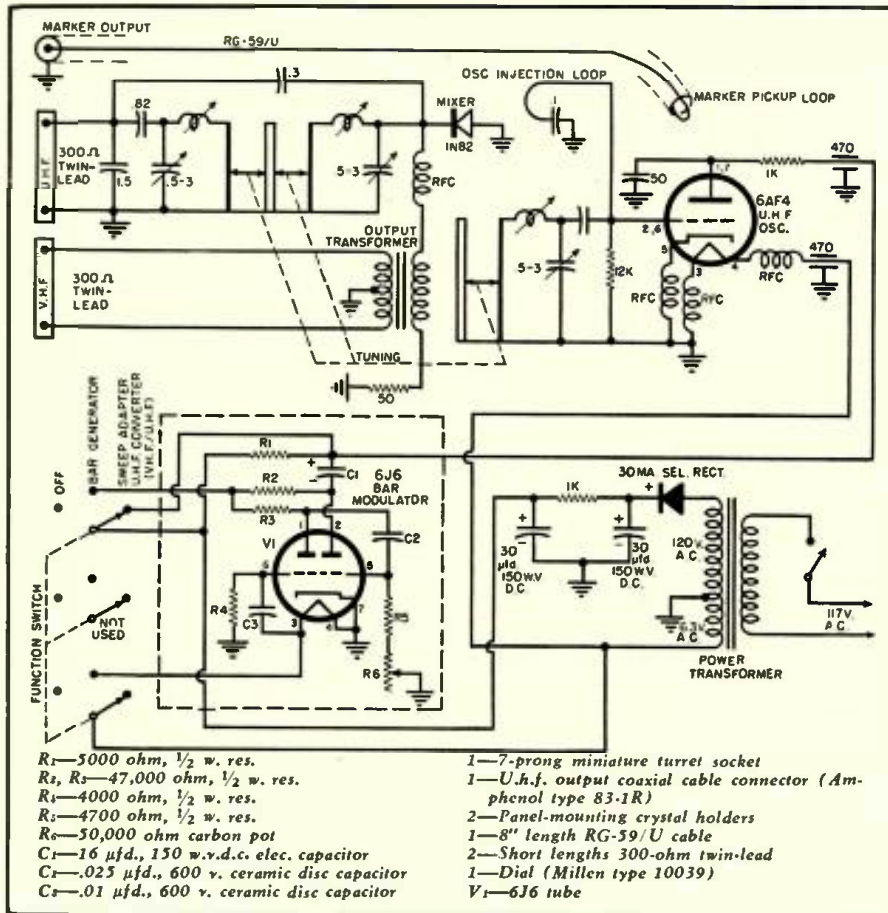


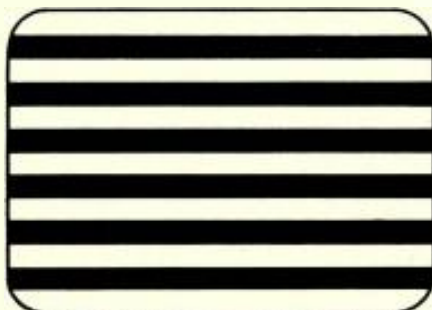
Fig. 4. Complete schematic diagram of the modified Mallory Model 188 u.h.f. converter, and the added bar modulator, with the parts list for the latter.

is installed behind the dial, secured by a nut behind one of the chassis flanges. The two crystal sockets are coupled by short lengths of 300-ohm lead to the appropriate terminals on the rear of the 188 chassis. Labels for the panel may be typed on stiff white card material or cut from magazine illustrations, like those shown.

Calibration

An accurate indication of absolute frequency of the oscillator is the most useful type of calibration for this instrument. If the v.h.f. sweep input frequency is always kept constant at, say, 75-85 mc., it might be desirable to provide an additional ring of calibrations corresponding to the output u.h.f.

Fig. 5. Horizontal bar pattern produced by the v.h.f.-u.h.f. generator on u.h.f. channels, useful for making u.h.f. adjustments on all-channel receivers in the absence of a transmitted station signal.



sweep frequency, perhaps in terms of u.h.f. channel numbers. For marker purposes however, an absolute frequency indication is essential, and with the absolute frequency known, one may always compute the frequency of any sum output. This frequency may then be checked against any convenient list of u.h.f. channels and their video and sound carriers.

Calibration of home-constructed test instruments always poses a problem, unless the builder is well provided with equipment. The following method was used by the author to establish accurate 50 mc. points on the generator, and the method may be extended to secure finer divisions of frequency.

First, a signal generator was set to exact zero beat with the 5 mc. transmission from WWV, as determined by listening to the beat note on a small communications receiver. Next, another oscillator was set to exactly 50 mc., as determined by zero beating with the first (5 mc.) oscillator through a crystal probe connected to a high-gain scope. Precautions must be taken to be sure you are dealing with fundamentals of 5 and 50 mc., and not 5 and 45 mc., for example. A pre-checked grid-dip meter or trustworthy absorption wavemeter may be used to insure that the 50 mc. point is not 45 or 55 mc.

When the 50 mc. oscillator has been calibrated, its output is fed, together with that of the v.h.f.-u.h.f. generator

(taken from the coaxial output connector), to a crystal probe connected to a scope (or even to headphones if a scope is not available). Starting with the low-frequency, counterclockwise, end of the dial, tune slowly until the first beat note is seen (or heard). This will be, unless the 188 oscillator unit has been tampered with, 400 mc. Continue tuning and mark 50 mc. points across the dial. The last one should be 800 mc. Further refinements of calibration are left to the ingenuity of the reader. Note, however, that if a u.h.f. station is on the air in your vicinity, you may exactly mark its video and audio carrier points by coupling the v.h.f.-u.h.f. generator loosely to a TV set tuned to the u.h.f. channel and watching the screen as you dial. At exact video zero beat, the picture looks as if a piece of silk were stretched across the picture tube. On either side of zero beat, herringbone lines will be seen. At exact r.f. coincidence with the audio carrier a sudden sharp drop will be noted in audio level. The two points thus obtained may be marked precisely on the v.h.f.-u.h.f. dial. Since the Model 188 oscillator is extremely stable, all dial calibrations may be counted on to retain their accuracy.

High U.H.F. Channels

For the benefit of those who live in areas where there are u.h.f. channels above 70 and none between 14 and 24, a slight modification of the converter will enable it to furnish markers and horizontal bars on fundamental frequencies at the higher channels. To do this, the range of the 6AF4 oscillator must be shifted from approximately 385-805 mc. to a new range of 470-920 mc. It will no longer be possible to obtain flat u.h.f. sweep frequencies throughout the u.h.f. spectrum, although sweep frequencies for specific u.h.f. channels may still be developed.

To make the change, remove the small bent metal strip inductance between the oscillator grid trimmer capacitor and the tuning mechanism, represented by the variable inductor in the grid circuit of the 6AF4 in Fig. 4. Remove the oscillator grid trimmer capacitor. Using a bit of the metal strip, make the shortest possible connection between the ceramic grid blocking capacitor mounted between pins 2 and 6 of the 6AF4, and the tuning mechanism. The oscillator should now have a tuning range of 470 to 920 mc.

Since the oscillator and preselector tracking will have been impaired by this change, it will be necessary to set the preselector to a desired u.h.f. sweeping range by tuning the associated trimmer capacitors. Good results should then be possible when using this instrument, so modified, to obtain horizontal bars and marker signals on the higher u.h.f. channels.

The v.h.f.-u.h.f. TV generator should find grateful acceptance among technicians and experimenters eager to acquire a versatile u.h.f. instrument of high quality at low cost.



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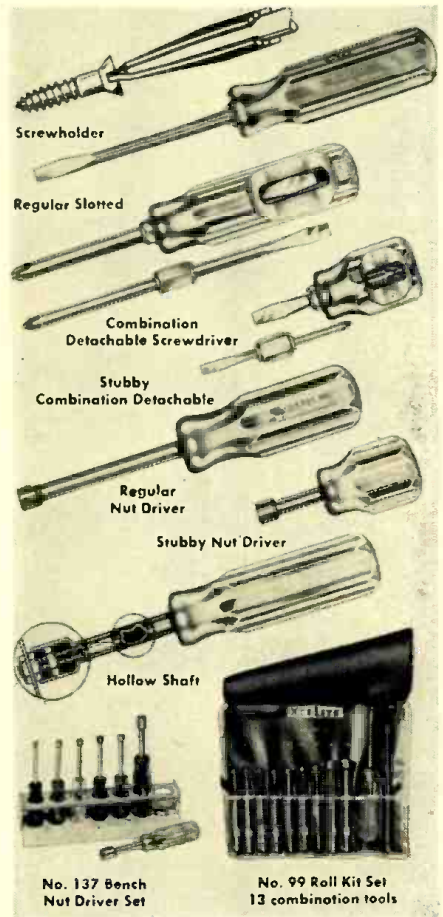
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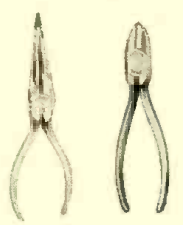
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"MISSIONARY VOICE IN HAITI" MARKS ANNIVERSARY

By **KENNETH R. BOORD**

Short-Wave Listeners to be honored by special series of programs May 20, 21, and 22 over Station 4VEH, Haiti.

RADIO Station 4VEH, "La Voix Evangelique d'Haiti," of the East and West Indies Bible Mission, Box 1, Cap Haitien, Haiti, has planned a series of special anniversary and DX broadcasts for the weekend beginning Friday, May 20. The series is being arranged by 4VEH's technical director, M. E. Picazo, in cooperation with a RADIO & TELEVISION NEWS monitor, Stewart C. West of Union, New Jersey.

The Anniversary broadcasts—in *English*, French, and Spanish—will be radiated to commemorate 4VEH's fifth year on the air. The DX Program is designed to honor the 25th Anniversary of the *International Short-Wave Club*, London, England, one of the oldest radio clubs in the world and which was started in 1929 in the United States; and also to honor all short-wave listeners, radio clubs, and publications—including RADIO & TELEVISION NEWS—that have helped 4VEH during the past five years with reception reports, publicity, and in other ways. Tentatively, the DX Program will include a congratulatory message from, and a brief group of organ melodies played by Ken Boord, former short-wave editor of RADIO & TELEVISION NEWS. And there will be a special dedication to Albert K. (Ab) Saylor, Quantico, Virginia, a veteran monitor who has assisted 4VEH station personnel in many ways over the years.

Mr. Picazo says 4VEH "would like to have reception reports from any listeners who are able to pick up any of these broadcasts. Comparative reports between various transmissions are especially needed." All correct reports of any 4VEH broadcast will be verified with a QSL card.

If an International Reply Coupon (IRC), which costs 13 cents at any U.S. post office, is enclosed with the report, the verification card will be sent by airmail.

Reports should be addressed to Radio Station 4VEH, Box 1, Cap Haitien, Haiti, West Indies.

"A secondary purpose in making these special broadcasts is to find out how well 4VEH can be heard at various times of the day in all parts of the world," Mr. West explains. "It is commonly known that propagation conditions change from day to night and so on. Hence, comparative reports on as many transmissions as possible from listeners wherever the broadcasts can be heard will be welcomed by 4VEH. These reports will be useful to help plan for future extension of broadcasting schedules over 4VEH for listeners who now do not hear the station at a good level." With the completion of a 10 kw. short-wave transmitter—for use in the 19-meter band—these plans will be put into effect gradually, according to Mr. Picazo.

Here is a listing of the planned broadcast schedule for 4VEH during the "Anniversary Weekend" of May 20-23, all times given in GMT (subtract 5 hours for EST, 6 for CST, 7 for MST, and 8 for PST):

Friday, May 20, at 1030-1430 and 2300-0230 Saturday, May 21, Regular Schedule, on 9.639 in the 31-meter band; 0230-0400, Special Anniversary Schedule, 9.639; 0550-0800,

Special Anniversary Schedule, 9.642; 0850-1045, Special Anniversary Schedule, 9.633; 1045-1515, Regular Schedule, including Special Broadcasts, 9.639; 2145-2300, Special Anniversary Schedule, 9.639; 2300-0230 Sunday, May 22, Regular Schedule, including Special Broadcasts, 9.639; 2015-0230 Monday, May 23, Regular Schedule, 9.639.

The transmissions listed in the preceding paragraph will be radiated in the 31-meter band on the "probable" channels given. If by May 20 the new 49-meter band transmitter is ready for use, it also will be employed for these transmissions, and possibly a low-powered transmitter (300 watts) will be put into use on the 19-meter band for the series of special broadcasts. As indicated earlier, the 9.639 frequency will be shifted slightly to give European and Pacific listeners a chance to hear 4VEH "away" from stations in those respective areas.

Here is the broadcast schedule for the Anniversary Programs:

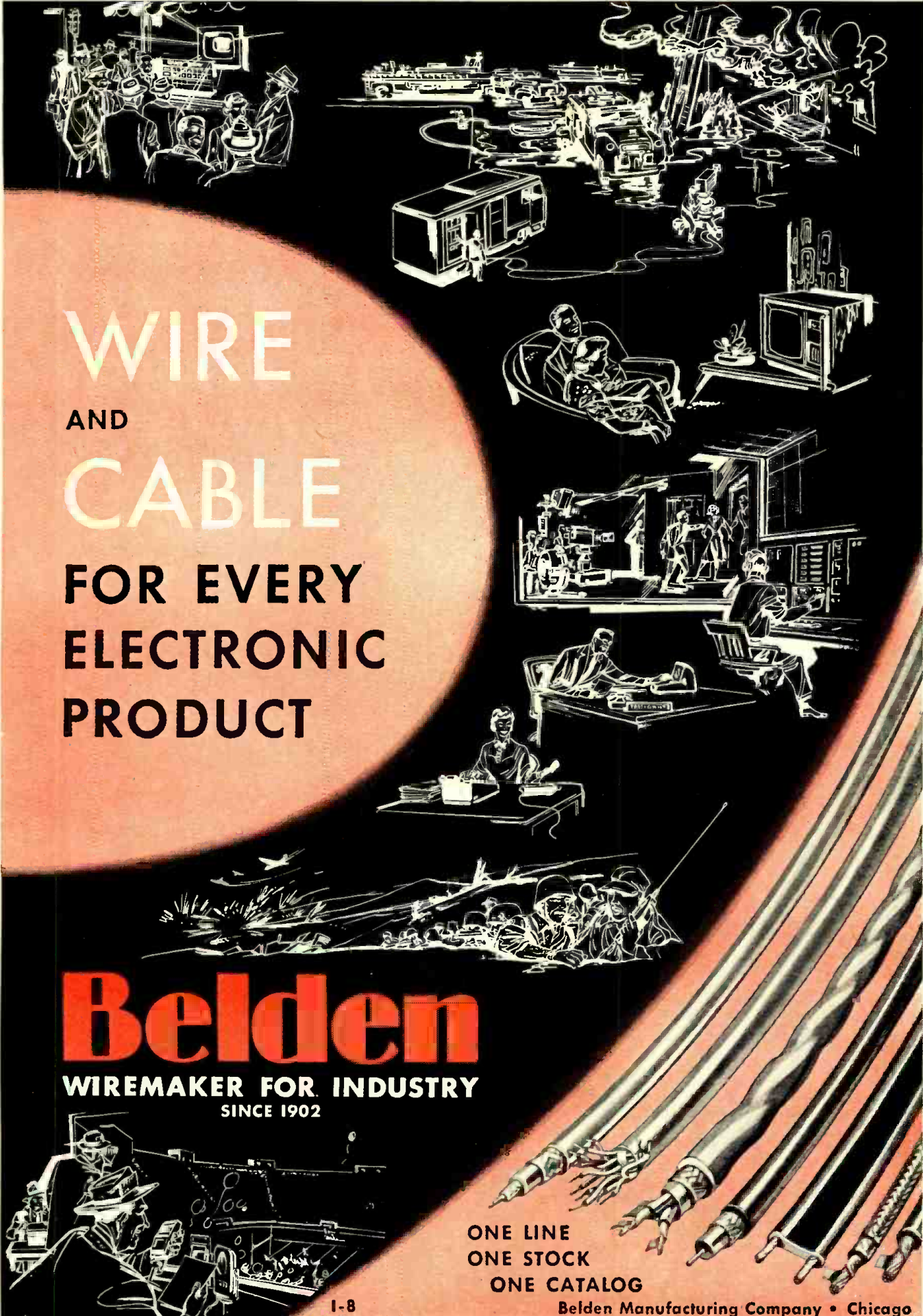
Saturday, May 21, 0230-0300, Anniversary Program; 0300-0315, Haiti Sings; 0315-0345, DX Program; 0345-0400, Favorite Hymns; sign-off 0405; 0550-0600, sign-on; 0600-0615, Anniversary Program in French; 0615-0630, Haiti Sings; 0630-0700, DX Program; 0700-0715, Favorite Hymns; 0715-0745, Anniversary Program; 0745-0800, music; sign-off 0800; 0850-0900, sign-on; 0900-0915, Greetings to Mission in New Guinea; 0915-0945, DX Program; 0945-1000, Favorite Hymns; 1000-1030, Anniversary Program; 1030-1045, Haiti Sings; 1115-1130, Anniversary Program in French; 1200-1230, Anniversary Program in Spanish; 1330-1400, Anniversary Program; 1430-1500, DX Program; sign-off 1500; 2145-2200, sign-on; 2200-2330, DX Program; 2230-2315, Haiti Sings; 2315-2330, Anniversary Program in French. Sunday, May 22, 0000-0030, Anniversary Program in Spanish. (All programs listed are in English unless otherwise cited.)

Current regular schedules of the station on 9.639 are:

Sunday—1030-1430, 2015-0230 (Mon.).
Monday — 1030-1430, 2300-0230 (Tues.).
Tuesday—1030-1430, 2300-0230 (Wed.).
Wednesday — 1030-1430. Thursday — Silent Day. Friday—1030-1430, 2300-0230 (Sat.).
Saturday—1030-1515, 2300-0230 (Sun.). Regular broadcasts are presented in *English*, Spanish, French, and Creole. Has Mailbag Session on Saturday near the end of the first ("morning") transmission, which may be repeated in the second ("evening") transmission on Monday.

Announcements by 4VEH are: *English*—"You are listening to Radio Station 4VEH, located in Cap Haitien, Haiti." Spanish—"Eschucha usted la radioifusora 4VEH situada en Cabo Haitiano, Republica de Haiti." French—"C'est la Voix Evangelique d'Haiti, station radiodiffusion 4VEH, Cap Haitien, Haiti."

Leading personalities of the station include G. T. Bustin, director and president; M. E. Picazo, technical director, and Mrs. M. E. Picazo, director of *English* programs. —30—



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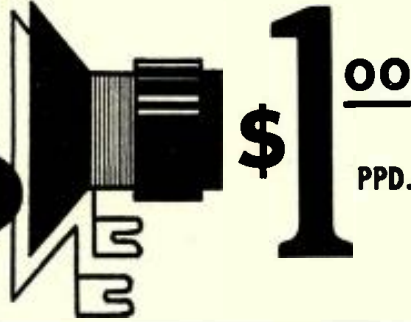
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OUTSIDE U.S.A.—Price \$8.00 cash with order only.
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Complete to the last detail, the Viking "Adventurer" is the ideal CW transmitter for the beginning amateur . . . the perfect standby transmitter for the experienced amateur. Effectively TVI suppressed—professional in appearance and design—easy to assemble and operate! 50 watts input—single knob bandswitching on 80, 40, 20, 15 and 11-10 meters. Packs enough power for world-wide radio contacts with just a simple antenna. Wide range pin-network output tuning—no antenna tuner needed. Kit is furnished complete with built-in power supply, tubes, cabinet, wiring instructions and antenna suggestions.

Cat. No. 240-181-1—Viking "Adventurer" Kit, less crystal and key \$54.95

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Within the Industry
(Continued from page 26)

Avenue, New York City . . . **INTERNATIONAL RESISTANCE COMPANY** has changed the name of its wholly-owned Florida subsidiary to **CIRCUIT INSTRUMENTS, INC.** It was formerly known as **VAN DYKE INSTRUMENTS, INC.** . . . Rollie Sherwood, formerly vice-president of **HALLICRAFTERS**, has organized **SHERWOOD SALES, INC.**, manufacturers' representatives, with head offices at 230 N. Canal St., Chicago, and branch offices in Cleveland, New York, and San Francisco.

* * *

PETER L. STONE has been elected president of **Allen D. Cardwell Electronics Productions Corp.**, replacing Ralph H. Soby who has resigned the post and been appointed special consultant.



The directors also named Richard O. Kennedy, Jr. as vice-president of **Cardwell** which is a Plainville, Conn. subsidiary of **Chesapeake Industries, Inc.**

Mr. Stone was formerly executive vice-president and a director of **Ludlow Manufacturing and Sales Co., Inc.** of Boston and prior to that was assistant to the president of **Harrisburg Machinery Corporation** and associated with **Sperry Gyroscope Co.** and **Crucible Steel Co. of America.**

* * *

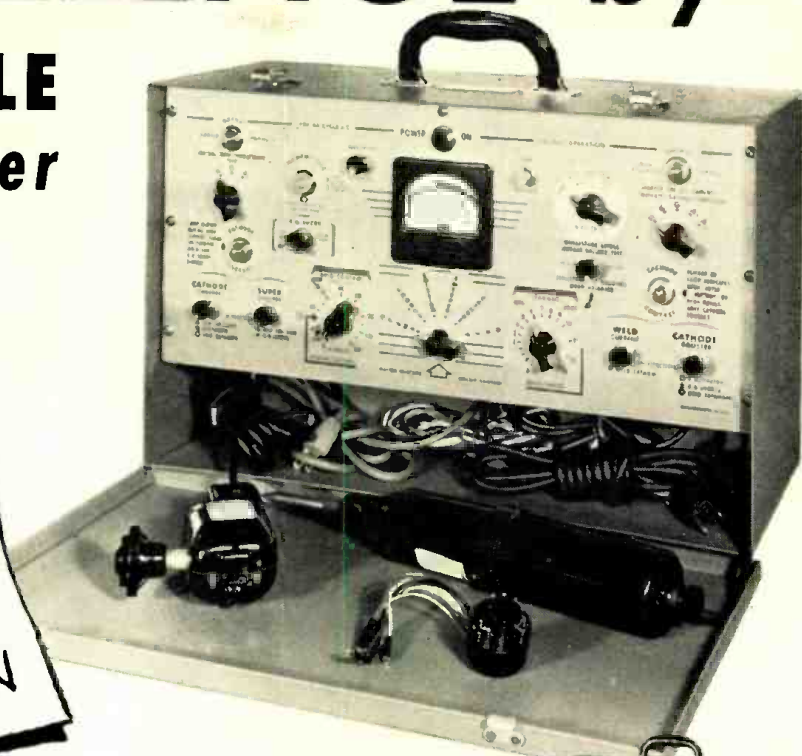
GENERAL INSTRUMENT CORPORATION has built a new million-and-a-half dollar radio-TV-electronic components plant in Statesboro, Georgia. This is the firm's sixth plant in the U.S. and Canada. It is adaptable to either civilian or military production . . . The sales department of **WARD PRODUCTS CORP.** has moved its operations to Ashtabula, Ohio, where the plant is located . . . **THOMPSON PRODUCTS, INC.** is planning a five-million dollar engineering study center on a site just east of its plant at 23555 Euclid Avenue, Euclid, Ohio. The research center will be devoted to the development of new products, processes, and materials . . . The **UTICA DIVISION OF BENDIX** has opened a \$100,000 facility for the engineering, sales, and servicing of its products at 11600 Sherman Way in North Hollywood, California . . . **HAMMARLUND MANUFACTURING COMPANY, INC.** of New York has recently moved part of its manufacturing operations to a new plant in Mars Hill, N. C. . . . **RECOTON CORPORATION** is now occupying a new, modern building at 52-35 Barnett Ave. in Long Island City, N. Y. . . . **ATLAS RADIO CORPORATION LIMITED** of Canada has moved into a new plant at 50 Wingold Ave. in a new exclusive industrial area in North-West Toronto. The building provides 50,000 square feet of floor space.

—50—

RADIO & TELEVISION NEWS

a CHALLENGE by NEW PORTABLE Raytronic Beamer

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service work —
for a
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DEMONSTRATION*



This portable instrument, identical in operation with the bench model, will make 8 tests to show, positively and accurately, the condition of any TV picture tube—and whether or not it is repairable.

The exclusive Cum-o-tron improved Raytronic Gas Test is now the only circuit for commercial use that employs the same circuitry and voltages used in picture tube laboratories, giving direct readings in fractions of one micro amp.

The Raytronic Beamer makes 5 repairs capable of restoring up to 85% of repairable tubes to satisfactory service. Endorsed

and used by leading TV tube and set manufacturers and their distributors, after exhaustive tests.

Thousands of users have verified every claim made for this instrument. They are reaping a new harvest of extra volume, extra profits, attracting new customers, winning loyalty and boosting endorsements from old customers.

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Case cover removed for bench work in horizontal position; rubber base lugs.

Read What They Say!

*(from hundreds of
written statements)*

Raytronic Beamer is the best piece of test equipment I ever used, and will do more for the shop owner. It is actually worth many times its price and is so simple to operate.

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The first day we used the Raytronic Beamer we repaired 20 CRTs—1 27", 4 21", 9 17", 4 16", 1 12", and 1 10". We save at least one CRT per day with this instrument and can't think of anything I would hate to part with more.

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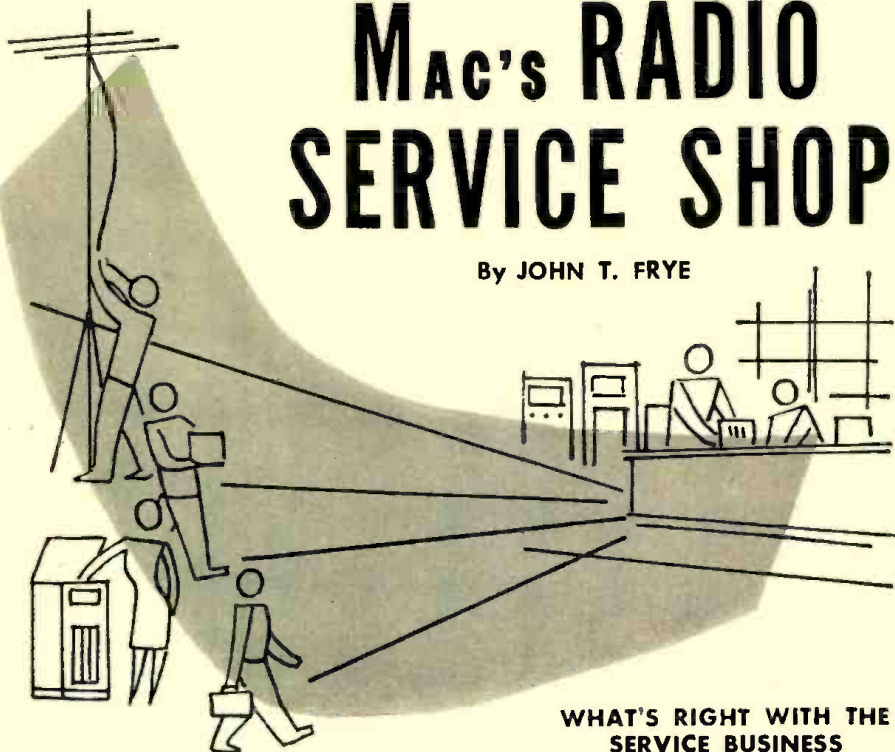
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Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



WHAT'S RIGHT WITH THE SERVICE BUSINESS

IMPATIENTLY Barney threw the pamphlet he was reading on the floor and turned to Mac, his employer:

"Mac, I'm beginning to wonder if I want to be a serviceman—or 'service technician' as I'm supposed to say—after all. Everything I read lately seems to tell what's wrong with the service business and the men in it. The independent serviceman especially is represented as a sort of business moron who not only fails to make any money for himself but—and this is a much more serious crime—prevents Big Time Operators from reaping the harvest they should.

"When I started with you, my first aim was to become a really good radio and TV man; then secondly, I hoped some day to start up a little shop of my own. Now it develops, according to a lot of this literature we get, there is no place for the one-man shop in the future of radio and TV servicing. The fellows who write this stuff say, or insinuate, the small shop owner can't buy the necessary equipment, can't secure the specialized training, and can't command the price that should be had for repairing sets. How about that? Is the future of the independent serviceman—if you'll excuse the expression—as black as all that?"

Before answering, Mac settled himself comfortably on the broad service bench and lighted his pipe. This was an encouraging omen to Barney, for Mac seldom smoked at work. When he did light up his beat-up old briar, this invariably meant he was preparing to sound off, at some length, on a subject to which he had given considerable thought.

"In a single word: No!" Mac began emphatically. "I've noticed, too, a strong calamity-howling tendency in some quarters regarding the future of

the service business in general and the lot of the independent serviceman in particular. A lot of this beefing seems to be given off by a few who are trying to scare servicemen into joining their particular organizations.

"Now don't get me wrong. I haven't a thing against service organizations as such. In fact, I'm a great believer in the motto *In Union There Is Strength*; and I am confident that many of these service organizations are fine ones that provide their members with many worthwhile and valuable benefits. But these good organizations do not proselyte through fear, and they do not encourage one branch of the service business at the expense of another. They work for the good of *all* servicemen and do not arbitrarily try to rearrange the whole service shop pattern and the lives of the owners. To put it bluntly, they encourage growth with fertilizer rather than with the pruning knife.

"Personally, I'm proud to call myself an *independent serviceman*. Both of those words have a clear, true meaning for me. 'Independent' has been a pretty good word in the old U.S.A. for a long, long time, and it is going to take an awful lot of doing to give it a nasty connotation. Independent men built this country; and, for the most part, independent servicemen have done the majority of radio and TV servicing up to date. I'll not be at all surprised if they continue doing a large share of this business in the future.

"And I can see nothing wrong with the name 'serviceman.' I know there are some who hold that giving ourselves an impressive title, such as 'electronic technician' would increase our prestige and command respect, but I rather doubt it. You don't win respect that easily. Undertakers tried for years to make people call them

'morticians' or 'funeral directors'; but nine out of ten people still call them 'undertakers'; yet their over-all volume of business seems to hold up well. Foot specialists refer to each other as 'podiatrists,' but their customers think of them as 'foot doctors' and keep right on taking their sore tootsies to them for treatment. 'Efficiency expert' is a very important-sounding title, but this has not prevented the name from becoming the butt of countless jokes. It's not what you call yourself that matters; it's what your customers think of you. *Being* a technician is a lot more important than *calling* yourself one.

"*Serviceman* to me means just what it says. As the panel of *What's My Line* would have it, I 'deal in services.' Standing shoulder to shoulder with people like the physician and the garage mechanic, I perform an essential service for people that they cannot do for themselves.

"And that brings us to *What's Right with the Service Business*. Since I have been in it for well over a quarter of a century, I sort of feel that I have as much right to pop off on this subject as some of the guys who think they are 'old-timers' because they can remember away back to when we did not have solder guns. When I, and a lot more like me started repairing radios, we did our soldering with a regular tinner's iron heated in the burner of a gas stove.

"I'm not going to contend that many radio and TV servicemen have to pay surtax rates on their income; but neither do I know of any worth their salt who have starved to death or who cannot afford a decent car and a comfortable home. If they have attended to business and have kept up with developments in their field—as any good mechanic does as a matter of course—they are not afraid of what the future holds in store. In fact, things look brighter for them right now than it has at any time since they started in business.

"But if you are my kind of a serviceman, a lot of your income is of a sort that cannot be measured in dollars and cents. I firmly believe a top-notch serviceman is no more attracted into this field by the lure of rich monetary rewards than a fine doctor takes up his life's work solely to make money or a scientist chooses his calling just to pile up a big bank account. A good serviceman loves his work and gets a tremendous personal satisfaction out of restoring a piece of well-designed electronic equipment to first-class operating condition. This won't make sense to those who tell us we should be sharp businessmen first and good technicians second; but you know what I mean, and so does any other good mechanic or good technician or good whatever you want to call him.

"Let me put it another way: when I return a repaired radio to a shut-in and see the smile that lights up his face as he turns on the switch and this little electronic 'escape-hatch' from his sick-

(Continued on page 88)

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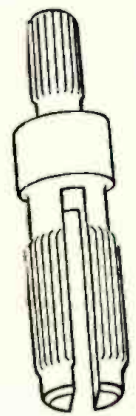


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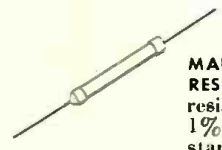
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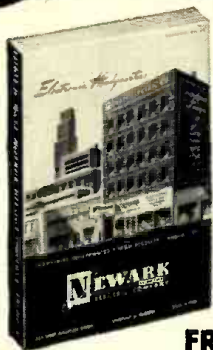
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Technical BOOKS

"**ELECTRONIC MUSICAL INSTRUMENTS**" by Richard H. Dorf. Published by *Radio Magazines, Inc.*, P. O. Box 629A, Mineola, N. Y. 321 pages. Price \$7.50.

For all those electronic musical instrument fans, here is a text which covers both commercially-available organs and the circuitry for two complete instruments that can be home-built.

There are four introductory chapters which cover the nature of music and musical instruments; basic musical facts; requirements of an instrument; and tone color.

Details and schematics are given for *Hammond, Baldwin, Minshall, Consonata, Lowrey, Hammond "Solovox", Wurlitzer, Hammond Chord Organ, Allen, and Strobocorn* instruments. There is a chapter on installing and servicing such instruments and then details for constructing the "Thyratone" and the "Electronorgan". Three additional chapters are devoted to a discussion of electron-tube tone generator circuits, non-tube tone generators, tone coloring, amplification and control. An appendix listing electronic music patents and a bibliography complete the text.

This book will be of help to a diversified group ranging from committees responsible for the selection of instruments for churches and similar installations, to service technicians, to electronic music fans who want to experiment with the medium.

It is our impression that this is the first time that a book of this scope has been published on electronic musical instruments. It should prove to be a welcome addition to the libraries of all those with more than a passing interest in the field.

* * *

"**ELEMENTS OF RADIO SERVICING**" by William Marcus & Alex Levy. Published by *McGraw-Hill Company, Inc.*, New York. 557 pages. Price \$6.00. Second Edition.

According to the RETMA, over ten million radio receivers were manufactured during 1954, which seems to indicate that the "patient" is far from moribund. Technicians who write off this radio servicing potential might be passing up a good source of income.

This second edition of a text originally published in 1947 reaffirms the authors' belief that radio servicing still has much to offer the technician and, as a result, this new book has been released to bring the radio servicing field up-to-date and to reflect the newer circuitry.

In addition to revising the basic chapters, new material has been added on battery and three-way portables and on FM receivers. One especially interesting innovation is the availability of six filmstrips to correlate and illustrate the oscillator, mixer, and parts used in a converter; how to use

RADIO & TELEVISION NEWS

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 1—DC-15. 200 Kc. Reg. value..... 1.99
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YOUR CHOICE OF FREQUENCIES!

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

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SINGLE SIDE BAND—FT-241-A

Low Frequency Crystals 79c

Lots of 10 or more. Each.....89c
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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

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81.05 KC. Octal tube type (Used in SCR-584 & SPM-1).....\$3.99	2870 KC. DC-34.....2.99
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1110	2520	2805	3240	4695	5782.5	6340	7073.3	7520	7773.3	8016.7	8260	8508.3
1129	2525	2915	3310	4735	5800	6350	7075	7525	7775	8020	8265	8510
1150	2530	2915	3310	4735	5800	6350	7075	7525	7775	8020	8265	8510
1195	2535	2920	3320	4780	5820	6373.3	7106.6	7533.3	7783.3	8033	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	3435	4830	5852.5	6406.6	7160	7558.3	7806.6	8050	8290	8540
1940	2565	2945	3465	4845	5860	6425	7173.3	7560	7808.3	8053.3	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	3540	4930	5882.5	6475	7225	7575	7825	8073.3	8310	8566.7
2020	2590	2975	3555	4945	5900	6500	7240	7580	7830	8080	8316.7	8570
2025	2595	2980	3580	4980	5906.7	6506.6	7250	7583.3	7833.3	8083.3	8320	8573.3
2035	2650	2985	3700	4995	5907.5	6525	7273.3	7590	7840	8093.3	8325	8575
2040	2655	2990	3760	5030	5925	6540	7275	7591.7	7841.7	8093.3	8330	8580
2055	2680	2995	3800	5035	5940	6550	7300	7600	7850	8097.7	8333.3	8583.3
2060	2685	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	8375	8616.7
2140	2710	3040	4045	5285	6025	6673.3	7350	7640	7883.3	8130	8375	8616.7
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	2720	3055	4110	5305	6050	6706.6	7363.3	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	4170	5340	6075	6740	7375	7665	7908.3	8158.3	8400	8645
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	8163.3	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	7408	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
2420	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	4535	5730	6275.5	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	3235	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 heat. **\$5.95**
 ing unit. 8-pin octal base. Ea. (Shipping wt. 1/2 lb.)

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. ORDERING INDIVIDUAL CRYSTALS INCLUDE APPROX. \$5 PER CRYSTAL FOR POSTAGE. Also indicate second choice frequencies wherever substitution may be made. Calif. buyers add sales tax.

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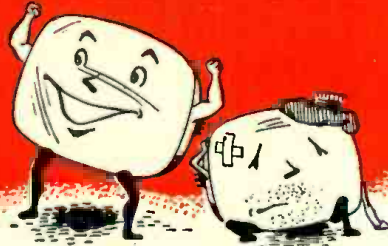
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Model RE-1

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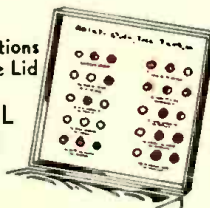
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- Restores cathode emission and brightness.
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the signal generator; and alignment procedures for the i.f. amplifier and front end. These films are available from the publisher's Text-Film Department.

Suitable as both a classroom text and a home-study guide, this book meets the need for a hard-hitting and practical manual on radio servicing.

"TELEVISION PROGRAM PRODUCTION" by Carroll O'Meara. Published by *The Ronald Press Company*, New York. 349 pages. Price \$5.00.

Those interested in the programming end of the television business will find this compact manual a veritable treasure-trove of pre-tested "know-how" prepared by one of the "old timers" in commercial telecasting.

Based on the author's 8-year experience which included the direction of more than 2000 telecasts, the material has been given a practical, down-to-earth treatment.

The book covers such important aspects of programming as camera operation and control, the use of graphic materials, program settings and costuming, lighting, production of various types of program material, script requirements, the duties of the various members of the station staff, and TV recording on kinescope and tape, and finally, color TV.

The text material is well illustrated with photographs and line drawings and lavish use has been made of actual examples of scripts and script notations. Since in a relatively brief book the author has managed to pack an amazing amount of pertinent data, it behooves those interested in the field to get acquainted with this text.

"LICENSE MANUAL FOR RADIO OPERATORS: A GUIDE TO FCC EXAMINATIONS" by J. Richard Johnson. Published by *Rinehart & Company, Inc.*, New York. 393 pages. Price \$5.00.

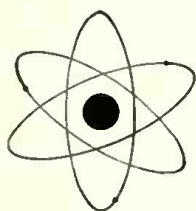
Those seeking their commercial licenses will welcome the appearance of this clear, concise, and up-to-date study guide. Keyed to the FCC's "Study Guide", the material in this book is arranged in the same order to facilitate preparation for the examinations.

The answers are given in abbreviated form yet are entirely consistent with the FCC examination practices. The introduction outlines the various elements required for each type of examination so that the prospective licensee need study only that material which is pertinent to his examination.

There are five comprehensive appendices which the student will find valuable. One gives a student's or instructor's subject outline for study purposes, a second covers information about treaties, laws, and regulations and source references for questions relating to laws, a third covers the "Q" signals, while the fourth and fifth deal with common communications abbreviations and the CAA Mercator correction table.

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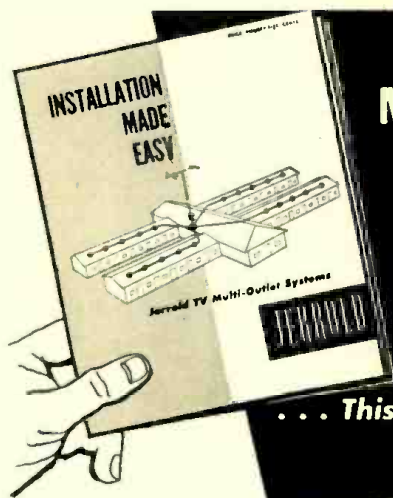
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commercial licenses the student is advised to use only the most up-to-date reference material to insure that his study program is in line with current examination practices. This new book performs this task admirably and should find a wide acceptance among would-be operators.

* * *

"BASIC ELECTRONICS" by Van Valkenburgh, Nooger & Neville, Inc. Published by John F. Rider Publisher, Inc., New York. Five volumes. Price \$9.00. Paper bound.

This course is based on the training programs currently being offered in the U. S. Navy specialty schools and released for civilian usage. This particular phase of the training pre-supposes a working knowledge of basic electricity. Other than that, there are no prerequisites for tackling this material.

The first volume contains introductory material, discusses diodes, dry metal rectifiers, power supplies, filters and voltage regulators. The second volume takes up amplifiers, triodes, tetrodes and pentodes, audio voltage and power amplifiers, while the third volume covers video amplifiers, r.f. amplifiers, and oscillators. The fourth and fifth volumes cover transmitters, transmission lines and antennas, c.w. transmission and amplitude modulation; receiver antennas, detectors and mixers, t.r.f. receivers and superheterodyne receivers.

This course would be an excellent one for home-study purposes since the text material is clearly written in non-technical terms and the illustrative material is presented in a style that contributes greatly to the clarity. Small cartoon-type characters are used throughout the text to call attention to special circuit features or important points.

ELECTRONICS AT A-TEST

AS AN AID to the electronics industry and the Civil Defense Administration in evaluating the effects of nuclear explosions on typical civilian communications equipment, twenty-nine manufacturers of electronic equipment and parts, under the sponsorship of the Radio-Electronics-Television Manufacturers Association participated in the atomic tests held in Nevada recently.

The equipment and parts were exposed to nuclear detonation and will be examined later to determine the post-disaster repair problems that will face communications personnel. The information will be made available to the industry and civil defense personnel not only within the FCDA but also at the state and local levels.

The following firms participated in the FCDA project under RETMA sponsorship: Admiral, Amphenol, Andrew, Antenna Specialists, Belden, Bendix, Cook Electric, Corning, Dale Products, DuKane, Erie Resistor, General Electric, Hallcrafters, Hughes Aircraft, Hydro-Aire, I.D.E.A., JFD, Jefferson Electric, Lenz Electric, Mallory, Motorola, North Electric, Permoflux, Radio Corporation of America, Remler, Shure Brothers, Simpson, Speer Carbon, and Stainless, Inc.

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4. Wave forms are shown right on the TV schematics for quick analysis by 'scope.
5. Voltages appear on the schematics for speedy voltage analysis.
6. Transformer lead color-coding is indicated on the schematic.
7. Transformer winding resistances appear on the schematic.
8. Schematics are keyed to photos and parts lists.

FULL PHOTOGRAPHIC COVERAGE

9. Exclusive photo coverage of all chassis views is provided for each receiver.
10. All parts are numbered and keyed to the schematic and parts lists.
11. Photo coverage provides quicker parts identifications and location.

ALIGNMENT INSTRUCTIONS

12. Complete, detailed alignment data is standard and uniformly presented in all Folders.
13. Alignment frequencies are shown on radio photos adjacent to adjustment number—adjustments are keyed to schematic and photos.

TUBE PLACEMENT CHARTS

14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet.
15. Blank pin or locating key on each tube is shown on placement chart.
16. Tube charts include fuse location for quick service reference.

TUBE FAILURE CHECK CHARTS

17. Shows common trouble symptoms and indicates tubes generally responsible for such troubles.
18. Series filament strings are schematically presented for quick reference.

COMPLETE PARTS LISTS

19. A complete and detailed parts list is given for each receiver.
20. Proper replacement parts are listed, together with installation notes where required.
21. All parts are keyed to the photos and schematics for quick reference.

FIELD SERVICE NOTES

22. Each Folder includes time-saving tips for servicing in the customer's home.
23. Valuable hints are given for quick access to pertinent adjustments.
24. Tips on safety glass removal and cleaning.

TROUBLE-SHOOTING AIDS

25. Includes advice for localizing commonly recurring troubles.
26. Gives useful description of any new or unusual circuits employed in the receiver.
27. Includes hints and advice for each specific chassis.

OUTSTANDING GENERAL FEATURES

28. Each and every PHOTOFACT Folder, regardless of receiver manufacturer, is presented in a standard, uniform layout.
29. PHOTOFACT is a current service—you don't have to wait a year or longer for the data you need. PHOTOFACT keeps right up with receiver production.
30. PHOTOFACT gives you complete coverage on TV, Radio, Amplifiers, Tuners, Phonos, Changers.
31. PHOTOFACT maintains an inquiry service bureau for the benefit of its customers.

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Puts a Photofact Service Data Library in Your Shop. Ask Your Photofact Distributor—He Has the Full Easy-Pay Details.

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Send for it! Your guide to virtually any model ever to come into your shop; helps you locate the proper PHOTOFACT Folder you need to solve any service problem on any model. Once you have the make and chassis number, it

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4055 Redwood Ave. • Venice, Calif.

FINANCING YOUR BUSINESS

By DAVID SEILER*

Service dealers, parts jobbers, and TV retailers may find this method of financing suited to their needs.

THERE'S big competition opening up nearby; you have several thousand dollars outstanding in unpaid bills; there's been trouble in the shipping of your merchandise; and you wonder what to do next. Money troubles are piling up, and, while there is nothing seriously wrong with your business, you do see yourself facing an emergency—a shortage of ready cash. You may be an expert in the repair, servicing, or selling of electronic equipment, but when it comes to money and credit, you've got to go out and seek some good, sound advice.

Perhaps you are currently facing a somewhat different kind of money problem. Maybe you have a chance to buy out the inventory of a nearby firm going out of business. You know you could successfully complete the deal if only you knew where you could get hold of some ready cash. Or then again, perhaps, like the legendary ant, you are anxious to plan ahead to the slow season in and around July, when you know it will be difficult for you to pay up all your bills and still get all the merchandise you need.

In any such situation, you'll soon discover that the most costly money is the money you don't have when you need it, and, although money problems are universal, your problem is distinctly *yours*, and has to be solved in relation to your particular circumstances. Perhaps you are up in Maine and have very little competition to worry about, or perhaps you are located in Cincinnati, and face severe competition. You may be both a retailer and wholesaler. Maybe the quality of your work and the service you give is superior to that given by others. With your special problem in mind, your particular needs in view, a satisfactory solution can be devised.

There are all kinds of ways of letting money work for you; one way is to use solutions available through any of the more progressive commercial financing companies. Like any other field, there are some commercial financing companies which are more progressive than others.

Referring back to the case of the service dealer who wanted to buy the inventory of a firm going out of business, he got the funds necessary by giving a commercial financing company his receivables and inventory as collateral. Thus, he was able to buy out his competitor. In the case of the dealer who looked ahead, a revolving loan arrangement was set up so that when he needed the money during his slow season, it would be available to

him. The excellent factor about this type of planning is that while you will owe a little at the time you borrow the money, and then use it later, you will be only paying for what you actually use, when you use it.

Now you may ask, where does this commercial financing business come in? If I am in temporary need of some extra money, why couldn't a bank help me out just as well? The answer to that question is that banks can help you out with your financial problems—dependent upon your particular situation.

If you are in need of a fairly small amount of money, in a lump sum, for a limited period of time, a bank will suit your needs very well. However, you may be in need of a larger sum of money than a bank would be inclined to give you. Also, when you do borrow from a bank, you borrow the money all in a lump sum, and therefore have to pay interest for a period of time on that amount. But, with a commercial financing company, you borrow only what you need, when you need it.

For instance, perhaps \$1000 a month for a period of six months may be all you need. In that case, all you borrow is \$1000 a month for which you are charged on a daily basis, and you don't have to worry about clearing up your loan once a year, as a bank would have you do. Also worth noting is that a bank's bookkeeping system is not set up to handle accounts on a daily basis. A commercial financing company determines its rates according to the amount of money in use, plus the amount of money needed to operate the business profitably. Just like a bank, a commercial financing company makes a complete financial appraisal, and if they can help will do so, otherwise, they will make other recommendations.

An electronics jobber, selling from manufacturer to retailer, must necessarily carry a large inventory. To assist him in this, the jobber can obtain extra money when a financing company advances him money against his accounts receivable and inventory. A setup can be arranged whereby money will be advanced on both ends, retail and wholesale. Here again, each situation is different, although they all have the same basic needs. Some ventures look risky, but, after thorough investigation, prove to be perfectly safe. It is solely up to the commercial financing company to decide if a project is worthwhile. They know their business, but it is only until they look at a specific problem that they will go ahead and formulate a plan to solve it.

Large loans are given so that wholesalers can stock a complete line, and

* President, A. J. Armstrong Co., Inc., New York, commercial financing and factoring.

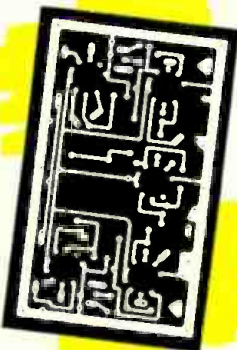
NEW 1955

Heathkit

Engineering Features

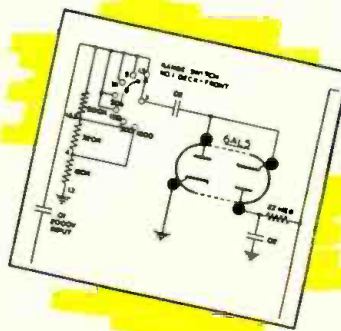
New PRINTED CIRCUITS

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, 11 3/4" deep, 6 1/2" wide, 9 1/2" 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.



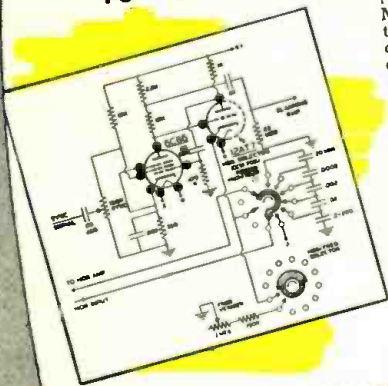
New STYLING New COLOR

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 leather gray. The satin gold bakel enamel cabinet for the WA-1P2 Preamplifier is further indicative of the modern precessing trend in Heathkit styling.



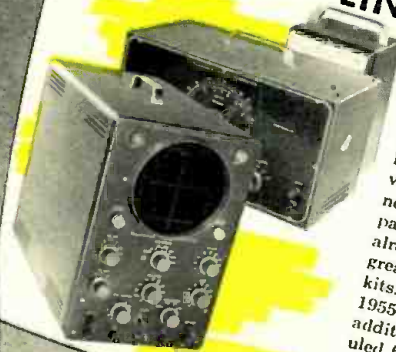
New SCOPE SWEEP CIRCUIT 10 CYCLES — 500 KC

New 1955 Heathkit Model 0-10 Scope features a new sweep generator covering 10 cycles to 500,000 cycles. This coverage is available in five virtually decade 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.

Heathkit ELECTRONIC SWITCH KIT

The basic function of the Heathkit Electronic Switch Kit is to permit simultaneous oscilloscope observation of two separate traces which can be either separated or superimposed for individual study. This is accomplished through the use of two individually controlled inputs working through amplifier, multi-vibrator, and blocking stages. The output of the Electronic Switch is connected directly to the vertical input of the Oscilloscope. A typical example of usefulness would be simultaneous observation of a signal or waveform as it appears at both the input and output stages of an amplifier.

APPLICATIONS

An Electronic Switch has many applications to increase the over-all operating versatility of your oscilloscope. It can be used to check amplifier distortion—audio crossover networks—phase inverter circuits—to measure phase shift—special waveform study, etc. The instrument can also be conveniently used as a square wave generator over the range of switching frequencies, often providing the necessary wave form response information without incurring the expense of an additional instrument. Ownership of this instrument will reveal many entirely new fields of oscilloscope application and will quickly justify the modest cost of the Electronic Switch Kit.

Tube complement:
2—6S7, 1—6X4,
1—6N7.

Continuously variable
switching rates in three
ranges from less than 10
CPS to over 2000 CPS.



Individual input
gain control, po-
sition control,
coarse frequency
control, and fine
frequency control.

Transformer operated for
safety when used in con-
junction with other equip-
ment.

MODEL S-2

\$23.50

Shpg. Wt.
8 lbs.

Heathkit VOLTAGE CALIBRATOR KIT



MODEL VC-2

\$11.50

Shpg. Wt. 4 lbs.

Another useful oscilloscope accessory particularly in circuit development work and in TV and radio service work. The Voltage Calibrator provides a convenient method for making peak-to-peak voltage measurements with an oscilloscope, by establishing a relationship on a comparison basis between the amplitude of an unknown wave shape and a known output of the voltage calibrator. Peak-to-peak voltage values are read directly from a calibrated panel scale without recourse to involved calculations.

FEATURES:

To off-set line voltage supply irregularities, the instrument features a voltage regulator tube. A convenient "signal" position on the panel switch by-passes the calibrator completely and the signal is applied through the oscilloscope vertical input, thereby eliminating the necessity for constantly transferring test leads.

RANGES:

With the Heathkit Voltage Calibrator it is possible to measure all types of complex waveforms within a voltage range of .01 to 100 volts peak-to-peak. Build this instrument in a few hours and enjoy the added benefits offered only through combination use of test equipment.

Heathkit LOW CAPACITY PROBE KIT



No. 342

\$3.50

Shpg. Wt. 1 lb.

An oscilloscope accessory, the 342 Low Capacity Probe permits observation of complex TV waveforms without distortion. An adjustable trimmer provides proper matching to any conventional scope input circuit. Excellent for high frequency, high impedance, or broad bandwidth circuits. The attenuation ratio can be varied to meet individual requirements.

Heathkit

SCOPE DEMODULATOR PROBE KIT



No. 337-C

\$3.50

Shpg. Wt. 1 lb.

Extend the usefulness of your oscilloscope by observing modulation envelopes of RF or IF carriers found in TV and radio receivers. The Heathkit Demodulator Probe will be helpful in alignment work, as a gain analyzer and a signal tracer. Easy construction with the new modern printed circuit board. Voltage limits are 30 volts RMS and 500 volts D.C.

HEATH company

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so that they will be in a position to compete in this perhaps most competitive of all fields. In the radio and television business, where competition is sharp, good financial planning is indispensable if you want to stay ahead of your competitors. In certain areas where there are large service companies that do service work on contracts, financing is arranged on those actual service contracts.

In any case, if you need any help at all, you can always get sound financial advice without charge from reliable financing concerns. Be prepared, however, for thorough questioning. The questions will be something like how much money do you have, how much do you need, what has been your experience and study in your line of work, what type of work you do, how expert you are at it, how many people you employ, how large is your business, what kind of service you give, your credit standing, etc. With the money advanced to you, you can buy in carload lots, take advantage of discounts, and be able to make on-the-spot advance purchases.

Here is a typical case history from our files on one sales and service dealer, let's call him "Mr. X." Mr. X had six employes, two of them inside men. He, like many others after the war, opened a place on Long Island, selecting a town in the very heart of this booming industrial and residential area. Although the town tripled in size, he had rough sledding because competition couldn't have been fiercer. Mr. X sought to meet his ever-increasing competition by giving better, quicker service, and by expanding his facilities. He made a move to a larger, higher rent location, close to a major artery of transportation. In his case, however, it was *after* the move was made that he found out, to his dismay, that he had overestimated his resources, and that he was in difficulties money-wise. However, thanks to outside "investments" he was able to pull through and meet competition.

Mr. X had an annual business volume amounting to \$250,000, and the net worth of the firm was \$25,000. But as a result of his move to his newer and larger location, necessitating the expansion of his entire staff, etc., the service dealer found that he had temporarily depleted his working capital position due to his increased investment in fixed assets.

Help could not be obtained from a bank, but after checking thoroughly, a commercial financing company not only provided the necessary money, but aided in the formation of constructive, long-range financing plans, helping to establish the firm on a sound enough financial basis so that, if necessary, a bank would be willing to continue the financing.

The specific treatment decided upon for Mr. X was accounts receivable financing, advanced on the service charge accounts, plus a revolving inventory financing plan. The results of this financial aid showed themselves

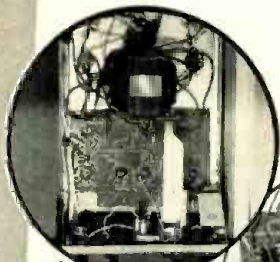
RADIO & TELEVISION NEWS

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

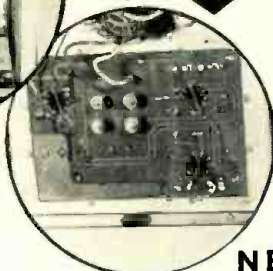
BRAND NEW DESIGN: The new Heathkit Model O-10 Oscilloscope would be something special at any price, but is almost unbelievable at \$69.50. Completely re-designed scope has broadband amplifiers for color TV work and offers brilliant overall performance. Vertical frequency response within 5 db from 5 eps 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 eps to over 500,000 eps. 5 times the usual range for scopes in this price range. An entirely new circuit introduced for the first time in any Heathkit.



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.

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

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 5UP1 CR tube



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

MODEL O-10

\$69.50

Shpg. Wt. 27 lbs.



NEW Heathkit 3" PRINTED CIRCUIT OSCILLOSCOPE KIT

MODEL OL-1
\$29.50 Shpg. Wt. 15 lbs.

New compact utility Scope—light-weight—portable for service work.

Deflection plate terminals—ideal for ham transmitter modulation monitoring.

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 eps to 100 kc, and within 5 db from 5 eps 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 eps to 200 kc, and within 5 db from 5 eps to 500 kc. Hor. sensitivity .25 volts per inch at 1 kc, input impedance of 15 mmfd shunting 10 megohms. Sweep generator covers 10 eps to 100,000 eps 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 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.

NEW Heathkit 5" PRINTED CIRCUIT OSCILLOSCOPE KIT

MODEL OM-1
\$49.50 Shpg. Wt. 24 lbs.

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 eps to 100 kc, and down only 7 db from 10 eps to 500 kc. Sweep generator range from 20 eps to 100,000 eps. 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.

5BP1 CR TUBE



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MICHIGAN

Heathkit MULTIMETER KIT

The new Heathkit Multimeter is a "must" to complete the instrument lineup of any well equipped service shop. Here is an instrument packed with every desirable service feature, many of which are not found in other Multimeters. All of the measurement ranges you need or want. High sensitivity 20,000 ohms per volt DC; 5,000 ohms per volt AC.

★ ADVANTAGES

Complete portability through freedom from AC line power operation—provides service ranges of direct current measurements from 150 microamps up to 15 amperes—can be safely operated in RF fields without impairing accuracy of measurement.

★ RANGES

Full scale AC and DC voltage ranges are 0-1.5, 5, 50, 150, 500, 1500 and 5,000 volts. Direct current ranges are 150 microamps, 15, 150 and 500 milliamperes and 15 amperes. Resistances are measured from .2 ohms to 20 megohms in 3 ranges and db range from -10 to +65 db.

★ CONSTRUCTION

The Heathkit MM-1 features a unique resistor ring switch mounting assembly procedure. With this method of assembly the precision resistors are wired to the rings and range switch before actual mounting of the switch to the instrument panel. This procedure affords the advantage of simpler construction yet complete accessibility of precision resistors in event replacement is ever required. Ohmmeter batteries were selected for convenience of replacement and only standard commercially available types are used. Batteries consist of 1 type C flashlight cell and 4 Penlite cells. All batteries and necessary test leads are furnished with the kit.

20,000-ohms per volt sensitivity DC, 5,000 ohms per volt AC.

Polarity reversal switch eliminates transferring of test leads.

All 1% precision multiplier resistors—sensitive 50 microamp 4 1/2" Simpson meter.

Total of 35 meter ranges on two color scale.

New modern cabinet styling—attractive appearance.



MODEL MM-1

\$29⁵⁰

Shpg. Wt. 6 lbs.

Heathkit HANDITESTER KIT



MODEL M-1

\$14⁵⁰

Shpg. Wt. 3 lbs.

The Heathkit Model M-1 Handitester readily fulfills major requirements for a compact, portable volt-ohm milliammeter. The small size of the smooth gleaming molded bakelite case permits the instrument to be tucked into your coat pocket, toolbox or glove compartment of your car. Always the "Handitester" for those simple repair jobs.

RANGES:

Despite its compact size, the Handitester is packed with every desirable feature required in an instrument of this type. AC or DC voltage ranges, full scale, 10, 30, 300, 1,000 and 5,000 volts. 2 convenient ohmmeter ranges 0-3,000 ohms and 0-300,000 ohms. 2 DC milliammeter ranges 0-10 milliamperes and 0-100 milliamperes.

CONSTRUCTION

The instrument uses a 400 microampere meter movement which is shunted with resistors to provide a uniform 1 milliampere load in both AC and DC ranges. This design allows the use of but 1 set of 1% precision divider resistors on both AC and DC and provides a simplicity of switching. A small hearing aid type ohms adjust control provides the necessary zero adjust function on the ohmmeter range. The AC rectifier circuit uses a high quality Bradley rectifier and a dual half wave hookup. Necessary test leads and battery are included in the price of this popular kit.

Heathkit RESISTANCE SUBSTITUTION BOX KIT

MODEL RS-1

\$5⁵⁰



Shpg. Wt. 2 lbs.

36 standard RTMA 1 watt resistor values between 15 ohms and 10 megohms with an accuracy of 10% are at your fingertips in the Model RS-1 Resistance Substitution Box kit. This sturdy and attractive accessory will easily prove its worth many times over as a time saving device. Order several today.

Heathkit CONDENSER SUBSTITUTION BOX KIT

MODEL CS-1



\$5⁵⁰

Shpg. Wt. 2 lbs.

18 standard RTMA values are available from .0001 mfd to .22 mfd. An 18 position switch set in the panel of an attractive bakelite case allows quick changes without touching the test leads. Invest a few minutes of your time now and save hours of work later on.

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quickly. There was an increase in net worth by profits resulting from the increased business, due to the better service offered by Mr. X and his trained staff, and due also to his more convenient location. Good financial standing was regained, and the expansion of the business accomplished as well. From that time forward, regular bank financing would be no problem to arrange.

Located mainly in New York, but transacting business all over the United States, commercial financing companies operate their businesses somewhat differently than you might expect. When a dealer is no longer in need of financial help, or wishes a bank to carry on the financing, then the financing company bids them farewell, happy to have been of help. In any case, the dealer only pays for what money he uses, when he uses it. The fact that the dealer only pays interest on a day-to-day basis for only the number of days the funds are outstanding, makes the difference in interest between that charged by a bank and that of a commercial financing company quite small. In most cases, the discount that the account is able to earn by prompt payment of bills far exceeds the total charge, which is a tax-deductible expense.

There are many solid results to be obtained through commercial financing, with the end result of a substantial, steady increase in profits. Somewhat like a doctor, a commercial financing company will diagnose the "symptoms", prescribe the needed medicine (in this case, the actual financial aid), and give freely of advice and knowledge gained from long years of experience in the financial world. Then, when the "patient" returns to a healthy business condition, they will quietly step out of the picture. In a business characterized by constant, fierce competition, the ability to get ready money often spells out the difference between success and failure. Or, as someone else once put it, "Opportunity favors the prepared man."

-30-

Transistor Preamp

(Continued from page 39)

plifier in the basement or attic if you so choose.

If tone controls are your problem, then add them after the preamp, and tack on another transistor stage . . . maybe a grounded collector this time, so you can have a higher impedance input, with still a low Z output.

Just keep the soldering iron off those little wire pigtailed. Don't count on a pair of pliers pinching the lead to draw off the heat. Heed the voice of sad experience, and use sockets of the store-bought or home-made variety.

Remember, we can help those little wonders to come down in price and up in variety, if we put them to just a few of the untold thousands of uses of which they are capable.

-30-

NEW Heathkit

VACUUM TUBE

VOLTMETER KIT

PRINTED CIRCUIT DESIGN

New charcoal gray baked, enamel panel with high readability, white lettering, 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.

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.

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.

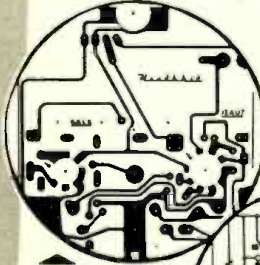
New easy-to-read open panel layout. On-on switch now incorporated in the selector switch.

MODEL V-7

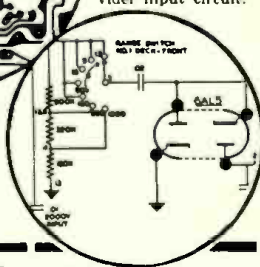
\$24.50

Shpg. Wt. 7 lbs.

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



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



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

Heathkit 6-12 VOLT BATTERY ELIMINATOR KIT

Here is the new 12 volt Heathkit Battery Eliminator so necessary for modern up-to-date operation of your Service Shop. Furnishes either 6 or 12 volt output which can be selected at the flick of a panel switch. Use the BE-4 to service all of the new 12 volt car radios in addition to the conventional 6 volt models.

RANGES:

This new Battery Eliminator provides two continuously variable output voltage ranges. 0-6 volts D.C. at 10 amperes continuously or 15 amperes maximum intermittent and 0-12 volts D.C. at 5 amperes continuously or 7.5 amperes maximum intermittent. The output voltage is clean and well filtered, as the circuit uses two 10,000 mfd condensers.

The continuously variable voltage output feature is of definite aid in determining the starting point of vibrators, the voltage operating range of oscillator circuits, etc.

OTHER USES:

The controllable low voltage DC supply has many other applications besides primary use in car radio service work. Can be nicely used as a battery charger, or low voltage DC supply for electric trains. Has applications in high gain audio work requiring clean DC filament supply. Can be used for low power electro-plating or as a power supply for battery powered intercommunication systems.

Automatic overload relay—self resetting—fuse protected.

New 18 plate split type heavy duty rectifier unit.

Continuously variable output voltage, either 6 or 12 volt operation.

Constant ammeter and voltmeter monitoring.

MODEL BE-4

\$31.50

Shpg. Wt. 17 lbs.



Heathkit VIBRATOR TESTER KIT

MODEL VT-1

\$14.50

Shpg. Wt. 6 lbs.



This time-saving device will quickly pay for itself in your auto radio service shop. 6 volt vibrators can be checked instantly on the Good—Bad type meter scale. Operation requires only a variable DC voltage from 4 to 6 volts at 4 amperes. Model BE-4 Battery Eliminator is recommended for this application.

Five test sockets provide for the testing of hundreds of interrupter and self-rectifier types. Proper starting voltage is determined easily and accurately. Over-all quality is then unmistakably indicated on the panel mounted meter.

Heathkit IMPEDANCE BRIDGE KIT

MODEL IB-2

\$59.50

Shpg. Wt. 12 lbs.



The new Heathkit Impedance Bridge features built-in adjustable phase shift oscillator and amplifier. This instrument actually represents four instruments in one compact unit. The Wheatstone bridge for resistance measurements, the Capacity Comparison bridge for capacity measurements, Maxwell bridge for low Q, and Hay bridge for high Q measurements.

DESIGN:

Panel provisions for external generator use. A new two section CRL dial, provides ten separate "units." Ten separate units switch settings and fractions of units are read on a continuously variable calibrated control. A special minimum capacity shielded and balanced impedance matching transformer between the generator and bridge circuit is automatically switched to provide correct load operation of the generator circuit. The instrument uses 1/2% precision resistors and condensers in all measurements circuits.

Heathkit VARIABLE VOLTAGE ISOLATION TRANSFORMER KIT

MODEL IT-1

\$16.50

Shpg. Wt. 10 lbs.

Variable output voltage between 90 and 130 volts AC. Rated at 100 volt—amperes continuously and 200 volt—amperes intermittently. The principle function of the Heathkit Isolation Transformer is to isolate the circuit being tested from line interference being caused by motors, appliances, etc. It works backward too by isolating such devices from the line. Many other uses, especially with AC—DC type circuits. Do not confuse the Heathkit Isolation Transformer with the hazardous auto transformer type line voltage boosters.



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Mac's Radio Service Shop (Continued from page 74)

room swings wide open again, I feel good and warm and powerful—more so than I'd feel if someone deposited a thousand dollars in my bank account. And when we return a TV set to a home and the kids swarm all over us in their eagerness to know if they can really see their favorite shoot-em-up programs again, and as I listen to their shouts of glee when they find out they can, I get this feeling all over again. Maybe this makes me sentimental, old-fashioned, and unbusiness-like, but it's nice to know that people *need* and depend on your knowledge and skill to insure their happiness. There's a lot of pretty satisfactory compensation in being able to serve your fellow men."

"How about the magazine articles and newspaper 'exposés' that have tried to brand the servicemen as cheats and crooks?" Barney asked. "Do you think they indicate the way most people feel about servicemen?"

"By no means. There will always be some people who through jealousy or just plain cussedness are suspicious of anyone they feel may know more than they do or work harder. These people think all doctors are quacks, all ministers are hypocrites, all lawyers are crooked, and all radio and TV servicemen charge outrageous prices for stealing tubes and parts and messing up sets. It is futile to argue with these ignorant people, for no one can change the mind of a fool. Fortunately, they are in a very small minority, probably bearing about the same ratio to the general public that crooked servicemen bear to the total number in this field. Recently several manufacturers have gone to bat for us and have used their advertising pages in various popular magazines to tell our true story to the public. We certainly appreciate this, for it helps a lot to counteract the vicious and unfounded attacks made on the service industry. I'm pretty confident folks in this town do not consider me a crook and a thief. If so, they must like being cheated, for they keep coming back for more. I'm still working for customers who started bringing me their sets the first year I was in business."

"Any more good things about servicing you can think of?" Barney asked, glancing casually at the clock.

"Lots of them. For one thing, working conditions here are much better than in many other fields. Contrast our job with that of the auto mechanic who must work on his back in dirt and grease, or with that of the doctor who is likely to be called any hour of the day or night, or with the monotonous work of the assembly line worker who keeps performing the same task over and over again until his brain is numbed with the repetition. A friend of mine who gave up a good job as an electronic engineer with a large corporation to start his own radio and TV

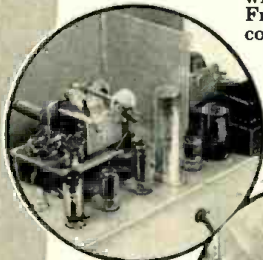
RADIO & TELEVISION NEWS

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.



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.



Controllable inductor sweep oscillator with output entirely on fundamentals.

Triple marker system 4.5 MC crystal controlled—3 sets of 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.

MARKER:

The same instrument incorporates a triple marker system with a crystal controlled reference. A variable marker provides accurate coverage from 13 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 IP, band-pass, 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

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MICHIGAN

Heathkit
VISUAL-AURAL
**SIGNAL-TRACER
KIT**

The new Heathkit Visual-Aural Signal Tracer features a special high gain RF input channel used in conjunction with a newly designed wide frequency range demodulator probe. High RF sensitivity permits signal tracing from the receiver antenna input. Separate low gain channel and probe available for audio circuit exploration. Both input channels are constantly monitored by an electron ray beam indicator so that visual as well as aural indications may be obtained.

NOISE LOCATOR:

A decidedly unusual feature is a noise locator circuit used in conjunction with the audio probe. With this system, a DC potential is applied to a suspected circuit component and the action of the voltage in the component can be seen as well as heard. Invaluable for ferreting out noisy or intermittent condensers, noisy resistors, controls, IF and power transformers, etc.

WATTMETER:

Built-in calibrated wattmeter circuit will prove useful for quick preliminary check of total wattage consumption of equipment under test. Separate panel terminals provide external use of the speaker or output transformer for substitution purposes. Saves valuable service time by eliminating the necessity for speaker removal on every service job. The same panel terminals also provide easy access to a well filtered B plus supply for external use. Don't overlook the many interesting service possibilities provided through the use of this instrument, and let the Signal Tracer work for you by saving time and money.



Substitution test speaker—utility amplifier.

Noise locator circuit—calibrated wattmeter.

RF and audio probes supplied along with necessary test leads.

Visual and aural signal tracing.

MODEL T-3
\$23.50

Shpg. Wt. 9 lbs.

Heathkit **CONDENSER CHECKER KIT**



MODEL C-3

\$19.50 Shpg. Wt. 7 lbs.

Here is a handy test instrument for any Service Shop. Unknown values of capacity and resistance are quickly determined on the direct reading condenser checker dial. Capacity is measured in four ranges from .001 mfd to 1000 mfd. Resistance in the range from 100 ohms to 5 megohms.

DC polarizing voltages of 25, 150, 250, 350, and 450 volts are available for leakage tests on all types of condensers. For electrolytics, a power factor control is provided to balance out inherent leakage and to indicate directly the power factor of a condenser under test. Proper balancing of the AC bridge is reflected in the degree of closure of an electron beam indicator tube.

Model C-3 uses a transformer operated power supply, spring return leakage test switch, and a convenient combination of panel scales for all readings. Test leads are furnished in addition to precision components for calibrating purposes. Quick and easy to operate, the Heathkit Condenser Checker will save valuable time and increase your Shop efficiency.

Heathkit **"Q" METER
KIT**



MODEL QM-1

\$44.50

Shpg. Wt. 14 lbs.

The Heathkit QM-1 represents the first practical popular priced Q meter available within the price range of schools, laboratories, TV service men, and experimenters. This instrument will enable the operator to simulate conditions encountered in practical circuits and to measure the performance of coils or condensers at the operating frequencies actually encountered. All indications of value are read directly on the 4 1/2" 50 microampere Simpson calibrated meter scale. Measures Q of condensers, RF resistance, and the distributed capacity of coils. Oscillator section supplies RF frequencies 150 KC to 18 MC in four ranges. Calibrate capacity with range of 40 MMF to 450 MMF with vernier of ±3 MMF. Investigate the many services this instrument can perform for you.

Heathkit

**AUDIO OSCILLATOR
KIT**



MODEL AO-1

\$24.50

Shpg. Wt. 10 lbs.

The Heathkit Audio Oscillator will produce both sine and square waves within the frequency range from 20 CPS to 20 KC in three ranges. Thermistor controlled linearity results in a variation of no more than ±1 db in a 10 volt (no load) variable output level. There will be less than .6% distortion from 100 CPS throughout the audible range. Low impedance 600 ohm output. Precision 1% resistors, used in the range multiplier circuits to provide accurate calibration.

HEATH company

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MICHIGAN

service business told me recently that doing service work was a lot more challenging and made a much greater demand on *all* the electronic knowledge he acquired in college than did his engineering job of installing microwave relay lines down in South America. He is more than satisfied with his income, his working conditions, and his prospects for the future. He says he cannot understand why more trained engineers do not go directly into servicing.

"Finally, a thing that is much more significant to me than to you at this point is the fact that a serviceman can, if he chooses, have a good long work life. Since physical strength and agility play unimportant parts in servicing, increasing years do not force you to retire, as is the case in many other lines of work. You know my friend, Bill, here in town. Well, I know for certain that he's pushing seventy awful hard, if he's not actually over that hurdle; but he is right in there slinging solder with the best of them.

"Someone has said that nothing is work unless you would rather be doing something else, and in that case a good serviceman does not do any work at all, for he would not trade jobs with anyone from the President of the United States on down. That does not mean he won't growl and gripe about his work, especially when he has had a long run of 'dogs' parading across his service bench; but you separate him from that bench for a few days and he will actually be aching to get hold of a solder gun again. When a lot of fellows feel like that about their job, there can't be too much wrong with it.

"And now," Mac finished with a slow grin as he knocked the ashes from his pipe on the heel of his shoe, "if I've killed enough time to suit you, suppose we go to work."
-30-

"HILLBILLY NET" CARD

THE Kingsport Amateur Radio Club and the Bays Mountain Radio Club of Kingsport, Tenn. have announced the availability of its new model 1955 "Hillbilly Net Certificate."

Rules governing the award of such a certificate are as follows:

1. No contacts prior to January 1, 1955 will be counted.

2. Contacts must be made with ten different "Hillbilly Net" members—contacts with W4TRC and W4ZJA (the club stations) can be included to make up the ten contacts, regardless of who was operating the station.

3. Contacts can be made on any amateur band or combination of bands.

4. Application for a certificate can be made through any means of communication and must include call sign of "Hillbilly Net" member and dates of QSO. Application to any member of the "Hillbilly Net" who will forward it to the Net Secretary, W4VUA.

5. Certificate will not be mailed until contacts have been verified.

6. "Hillbilly Net" member must belong to one of the two sponsoring clubs and must have paid his \$1.00 assessment before his contact can be counted.

The Certificate is pure "hillbilly" and good for lots of laughs.
-30-

RADIO & TELEVISION NEWS

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.

Illuminated for easy reading and quick identification of chart reference.

Simplified construction—new harness type wiring—closer tolerance resistors.

Smart, professional appearance—a valuable in counter or portable models.

Improved smooth running roll chart mechanical action.



Three color Good-BAD, 1 1/2" plastic cased meter.

MODEL TC-2
\$29.50
Shpg. Wt. 12 lbs.

Results of tube tests are read directly from the large 4 1/2" 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.

Heathkit PORTABLE TUBE CHECKER KIT

The portable model is supplied with a strikingly attractive two-tone cabinet finished in rich maroon proxylon 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 4 1/2" 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 $\pm 1\%$ 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 re-

Equalization for LP, RIAA, AES, and early 78.

Separate bass and treble tone controls—special hum control.



Cathode follower low impedance output circuit.

Beautiful, modern appearance, blends with any interior or color scheme.

Five switch selected inputs with individual level controls.

quirements from Heathkit Williamson Type Amplifier power supply 6.3 volts AC at 1 ampere, and 300 volts DC at 10 MA. Over-all dimensions 12 $\frac{1}{2}$ " wide x 5 $\frac{1}{4}$ " deep x 3 $\frac{3}{8}$ " 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

\$19⁷⁵

Shpg. Wt. 7 lbs.

HAM EQUIPMENT

Single knob band switching—pre-wound coils.



Crystal or VFO excitation—metered operation. 52 Ohm coaxial output—built-in power supply.

MODEL AT-1

\$29⁵⁰

Shpg. Wt. 16 lbs.

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.

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

Brand NEW

Smooth acting illuminated and precalibrated dial.

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 Polyester cement and baked for humidity protection. Variable capacitor of differential type construction, especially designed for maximum bandspeed. 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 mls. 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 O A2 voltage regulator.



Copper plated chassis—aluminum cabinet—easy to build.

Seven band coverage 160 through 10 meters at 10 volt RF output.

6AU6 electron coupled Clapp oscillator and O A2 voltage regulator.

MODEL VF-1

\$19⁵⁰

Shpg. Wt. 7 lbs.

Heathkit

GRID DIP METER KIT

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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. Shpg. wt. 1 lb. Price \$3.00



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HEATH company

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BENTON HARBOR 15,
MICHIGAN

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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.

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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.

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NEW Heathkit 20 WATT High Fidelity AMPLIFIER KIT



MODEL A-9B

\$35⁵⁰

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 in-

put 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

\$15⁵⁰

Shpg. Wt. 10 lbs.

An outstanding value, this economi-
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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 avail-
able for crystal and ceramic phono
pickups, tuner, TV audio, tape re-
corder, and carbon type microphone.
Model A-7B features separate bass
and treble tone controls, push-pull
balanced output stages, output im-
pedances of 4, 8, and 15 ohms, and extremely wide frequency
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MODEL A-7C

Provides a preamplifier stage and proper compensation for the
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Heathkit WILLIAMSON TYPE AMPLIFIER KIT

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This outstanding Williamson Type Hi-Fidelity Amplifier is supplied with the famous
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and power supply.

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Frequency response within 1 db from 10 cycles to 100,000 cycles. Harmonic distortion at 5 watt
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for each unit 7" high x 5 $\frac{1}{2}$ " wide x 11 $\frac{1}{2}$ " 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 Ampli-
fier with Aerosound Output Transformer,
Power Supply and WA-P2 Preamplifier.)
Shipping weight 37 lbs.
Shipped express only **\$69.50**

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fier with Aerosound Output Transformer
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weight 29 lbs. Express only **\$49.75**



HEATH company

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BENTON HARBOR 15,
MICHIGAN

Certified Record Revue
(Continued from page 58)

worshippers of the brawny bass, but plenty of sparkling transients enrobed in wide frequency and dynamic range. The spacious acoustics of the old church add to the illusion of "presence." Surfaces in my copy were a little "ticky."

STRAUSS, RICHARD
TILL EULENSPIEGEL'S MERRY PRANKS
DEATH AND TRANSFIGURATION
Pittsburgh Symphony Orchestra conducted by William Steinberg. Capitol P8291. RIAA curve. Price \$4.98.

Steinberg is a good man for this sort of repertoire. His readings are solid, authoritative, and he is never mannered as so many other conductors are with these works. However, neither are his readings overly inspired. Clemens Krauss still has the edge in performing "Till Eulenspiegel," and Furtwangler and Mengelberg outgun him with "Death and Transfiguration." In matter of sound the Capitol engineers have given Steinberg a big edge over all other competition. Strings, brass, all are clean and sharp, the important woodwinds in "Till" have a fine "liveness." Contrabassi are notably sonorous in "Death and Transfiguration." Wide range and good acoustics throughout. If you do not have these works in your library, this would be the choice for a modern version with the best sound and a fairly satisfying performance. Very quiet surfaces, curve was better with slight bass boost.

BACH, J. S.
MAGNIFICAT IN D MAJOR
Pro Musica Orchestra, Stuttgart, conducted by Rolf Reinhardt with soloists and Chorus of Radio Stuttgart. Vox PL8890. Old NARTB curve. Price \$5.95.

The third version of this work on LP and one that certainly was needed. Both of the other versions were made back in the dark ages of LP and their sound leaves much to be desired. This version is not entirely without blemish... there is some choral "blast" and "fusion," strings are occasionally edgy, but generally this is good wide range sound. Dynamic expression is quite good and choral articulation is clean. I find this a most satisfactory performance, although the level of some of the soloists is pretty dismal. Reinhardt is a knowing conductor with this repertoire, and he essays a nice pace and achieves a judicious balance between chorus and instrumentalists. The singing is notable for its warmth and one feels sure the cast approached their task with proper reverence.

LIEBERMANN
CONCERTO FOR JAZZ BAND AND SYMPHONY ORCHESTRA

The Chicago Symphony Orchestra and the Sauter-Finnegan Orchestra conducted by Fritz Reiner.

STRAUSS, RICHARD
DON JUAN

The Chicago Symphony Orchestra conducted by Fritz Reiner. Victor LM1888. RIAA curve. Price \$3.98.

No, you're not seeing things! That is, indeed, the Sauter-Finnegan band sharing the same concert hall with the Chicago Symphony. The work is by the modern Swiss composer Liebermann and is in the 12-tone school. I'm afraid Mr. Liebermann's acquaintance with American jazz is not up-to-date, or somewhat limited, as most of the writing is extremely derivative and loaded with cliché. In spite of this, this manages to be an interesting work. The most notable feature is in

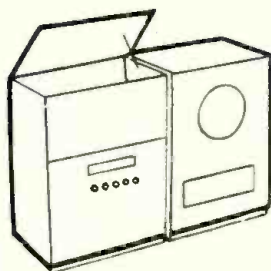
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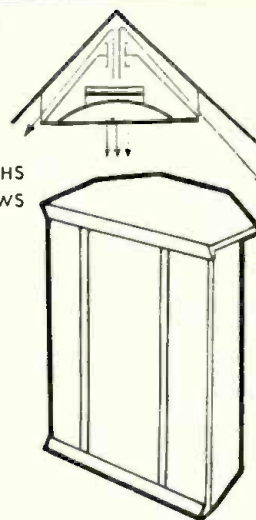
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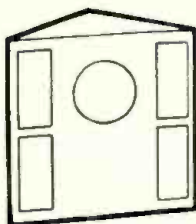
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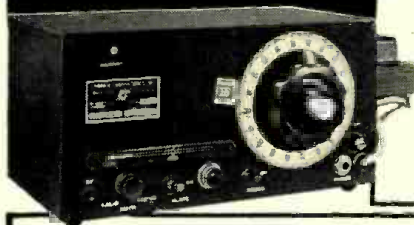
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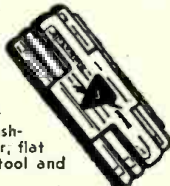
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1E7GT	.43	6AK5	.55	65J7GT	.45	198GG6	1.18
1G6GT	.43	6AL5	.40	65K7	.48	19J6	.66
1H4C	.43	6AL7GT	.70	65L7GT	.57	19T8	.70
1H5GT	.43	6AR5	.48	65N7GT	.57	2A4	.44
1L4	.43	6AS5	.50	65Q7GT	.40	25A7GT	1.50
1L6	.59	6A56	1.75	65R7GT	.43	25AV5GT	.80
1LA4	.59	6A57G	2.25	65S7	.43	25BQ6GT	.80
1LA6	.49	6AT6	.40	6T7G	.63	28V5	.45
1L84	.59	6AU5GT	.60	6V6GT	.48	25L6GT	.48
1LC6	.49	6AUE	.43	6W4GT	.40	25Z5	.38
1LD5	.59	6AV5GT	.75	6W6GT	.56	25Z6GT	.38
1LE3	.59	6AV6	.40	6X4	.35	27	.23
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1LN5	.49	6B4G	.56	6Y6G	.57	35A5	.48
1NSGT	.51	6B8	.70	6X8	.75	35B5	.52
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1R4	.66	6BC5	.49	7A5	.55	35L6GT	.48
1R5	.57	6BE6	.50	7A6	.47	35W4	.35
1S4	.53	6BF5	.41	7A7	.45	35Y4	.35
1S5	.52	6BG6G	1.18	7A8	.46	35Z3	.41
1T4	.58	6BM6	.51	7B5	.41	35Z5GT	.35
1T5GT	.58	6BJ6	.49	7B7	.43	45Z5GT	.40
1U4	.49	6BK5	.70	7B8	.47	45Z5GT	.40
1U5	.50	6BK7A	.78	7C4	.40	50B5	.52
1V	.43	6BN6	.59	7C5	.44	50C5	.51
1X2A	.63	6BL7GT	.77	7C6	.45	50L6GT	.45
2A5	.59	6BQ7A	.80	7E5	.35	70L7GT	.60
2X2A	.23	6BZ7	.90	7F8	.70	75	.44
2B7	.89	6BY5G	.60	7Y4	.35	77	.39
2D21	1.00	6C4	.39	12A6	.40	78	.39
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3V4	.58	6J5GT	.40	12B6	.50	117Z6GT	.65
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935 MAIN AVENUE - PASSAIC, N. J.

his handling of orchestral textures which is widely varied and well done. I hardly need add that hi-fi fans will enjoy this as Mr. Sauter and Mr. Finnegan are much in evidence, and when their drummin' man gets wound up, it sounds more like Chicago's famous "Blue Note," than Orchestra Hall! The Chicago Symphony takes its unusual task in stride and Mr. Reiner must have had a real ball with the jazz boys. As you might expect, there is plenty of nice, clean, exciting bass, and percussion, with the strings getting in a lick now and then. For once, the wonderful acoustics of Orchestra Hall backfired. Too much reverb here for the type of orchestration. "Don Juan" on the flip side gets the best recording to date on LP. Some really sensational dynamics here and the entire work is afforded wonderfully clean sound. Brass is really weighty, almost pungent in strength. Performance-wise, I still like the old Clemens Krauss, but Reiner's is close and virtuosic in all aspects. Curve OK without adjustment. Odd crackling noise on the jazz side about halfway through first movement. Better check your copy.

VERDI
TE DEUM
BOITO

MEFISTOFELE: PROLOGUE

NBC Symphony Orchestra conducted by Arturo Toscanini with The Robert Shaw Chorale and Nicola Moscona, bass. Victor LM1849. RIAA curve. Price \$3.98.

This is a fabulous recording and I can't recommend it too highly. The "Te Deum" is a worthy companion-piece to the "Requiem," but cast in more subdued colors. It has the advantage of reproduction which is considerably better than was that of the "Requiem." Not super wide range sound by any means, but still quite good. The purity of the voices in the Shaw Chorale are something to hear. Magnificently trained, their quality is almost ethereal. Toscanini's handling of the score is in keeping with the nature of the work. No furious drive and incandescent energy here . . . just the gently guiding hand and spirit dedicated to reveal the compelling beauty of the "Te Deum." Quite another matter is the incredible "Mefistofele! This is the white-hot Toscanini, the supercharged high compression man who drives his forces at a breakneck pace. I couldn't begin to tell you about this fantastic music. You'll have to listen to it yourself. I think you will agree that few works so completely encompass human emotions. The singing of the Columbus Boys Choir in the vocal scherzo, is unbelievably delicate, and contrasts with the towering might of the final climax and "Ave"! Again sound is quite good here, but if that climax could have been recorded with the Orthophonic technique, what a staggering sound we could have had. As it is, this is one of the thrilling moments in music and one of the things that makes music so ultimately rewarding! Don't miss this one!

BAROQUE CHAMBER MUSIC

Haydn Society HSL-117. Price \$5.95.

This has a formidable title and admittedly won't appeal to many of the "hi-fi forever" boys, but there is some wonderful music and wonderful sound on this disc. Such musical giants as Telemann, J. C. Bach, and Handel are represented on this record in a group of quintets and trio sonatas. The orchestration is quite a clever combining of woodwinds with harpsichord and violin. Contrary to what most hi-fi fans might think, discs like this are invaluable for test purposes for the demonstration of instrument definition as well as being a good way to detect resonant points in speaker response. But quite aside from any hi-fi usage, the music is interesting and the performances of such stellar woodwind men as Jean-Pierre Rampal on the flute and

RADIO & TELEVISION NEWS

Pierre Pierlot on the oboe are a delight to the ear. Surfaces were moderately quiet in my copy.

TCHAIKOVSKY
CONCERTO FOR VIOLIN AND
ORCHESTRA IN D

David Oistrakh, violinist with Saxon State Orchestra, Dresden, conducted by Franz Konwitschny. Decca DL9755. Old NARTB curve. Price \$3.98.

This will be the first time, I believe, that a review of a David Oistrakh recording has appeared in this column. In spite of the stature of this artist, I honestly felt that the fantastically bad sound of the Russian masters negated any possible acceptance of the recording on artistic grounds alone. It is one thing to hear a great artist on an old record which is merely restricted in frequency response and dynamics. It is quite another thing to hear an artist, however great he might be, on a record which is a distorted, screechy, caricature of the man, his instrument, and the music. That is the way all previous efforts to record David Oistrakh have impressed me. This recording at hand is a different matter. Mr. Oistrakh has fortunately been permitted to travel outside the Soviet Union, and on the occasion of his visit to Germany, he recorded this work under the knowing auspices of *Deutsche Grammophon*.

While this recording is still a long way from competing with the best of contemporary hi-fi, it is an infinitely better sounding disc than the Russian horrors. Thus, newly revealed in a reasonable facsimile of modern sound, Oistrakh is truly a remarkable talent. His tone can only be described as lush . . . a full-bodied, richly vibrant thing of extraordinary beauty. His technique is impeccable and can only be equalled by a Szigeti or Franciscatti. His musicianship is knowing and assured, even if at times, he can be a little mannered. His reading of the Tchaikovsky is fairly simple and straightforward, although there are certain ornamentations and embellishments, certain ideas about cadenza which are more Oistrakh than Tchaikovsky. Oistrakh is clever enough to realize that by depending on his phenomenal tone and prodigious technique, he has the battle half won. Couple this with his suave approach to the score and his uncanny ability to project "feeling" and sincerity, and you have a performance that is just about the best available.

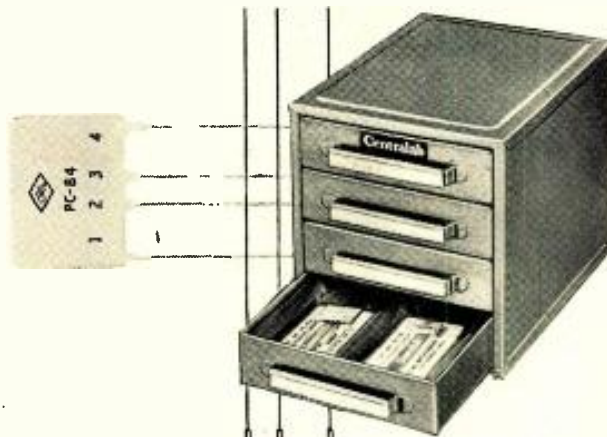
The balance between violin and orchestra is such that it favors Oistrakh. Ordinarily this would be considered a blemish, but in this case it enables us to hear him better, as the orchestral accompaniment is so "muddied up" in many places that the sound of the violin would have been quite lost. What we hear of Oistrakh's violin is quite clean and smooth. No wiry screech here! The orchestral crescendi are the main source of sound trouble. As just noted, the sound is flabby, thick-textured with virtually no instrument definition. Bass is a "tubby" indistinguishable blur. Inexplicably, other sections aren't bad sounding at all, with fairly clean strings and much better definition. Considered as a whole, this has been the first opportunity to have even a remote idea of how Oistrakh really sounds. As a performance, this has few, if any peers. As far as sound is concerned, there are quite a number of other more illustrious versions. A cut in the bass helped the NARTB curve considerably.

TCHAIKOVSKY
SERENADE IN C

PROKOFIEV
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Pittsburgh Symphony Orchestra conducted by William Steinberg. Capitol P8290. RIAA curve. Price \$4.98.

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best string sections in the country, as even the most perfunctory hearing of this disc will attest. Further, he knows how to handle his strings. Of the 11 recorded versions of the "Serenade for Strings" in the LP catalogue, this is the first recording with honest-to-gosh hi-fi sound. And what a difference it makes! The rich, cleanly-defined strings give this old warhorse new life and luster. *Capitol* has achieved a fine "big hall" type of sound here without sacrificing detail. The "Classical Symphony" is equally well served, although the reverb time here might be adjudged by some to be a mite excessive. The 14th version, this is among the most satisfying sonically and the performance is good enough to hold its own in such exalted company as the Koussevitsky, Toscanini, and Ansermet readings. You can't go wrong on this disc. No adjustment of the curve was required and as usual, the *Capitol* surfaces were flawless.

BELLINI NORMA (COMPLETE)

Maria Callas, soprano; Mario Filippeschi, tenor; Ebe Stignani, mezzo-soprano; Nicola Rossi-Lemeni, bass; Paolo Caroli, tenor; Rina Cavallari, soprano with Orchestra and Chorus of Teatro Alla Scala, Milan, conducted by Tullio Serafin. Angel 35170. RIAA curve. Price \$17.85. Three discs.

This recording is a triumph of no mean proportions. "Norma" has always been a success when presented, but the scarcity of sopranos with vocal equipment adequate to cope with the enormous requirements of the role, has limited the opportunities to hear this work, both in this country and abroad. This situation has also prevailed with recordings of the score. There is but one other recording of "Norma" in the LP catalogue, and that is the *Cetra* version with Cigna. In this *Angel* recording we find "Norma" portrayed by the illustrious Maria Callas. No question can be raised here about vocal qualities. Miss Callas is ideally suited to the role and her performance bears this out. Her characterization of the tragic and tempestuous Druid Priestess is highlighted not only by her effortless and beautiful singing, but by her expert handling of the drama of her role. This is thrilling Opera and if I may say so . . . thrilling theater.

Miss Callas is ably supported by such expert practitioners of the operatic art as Filippeschi, as the Proconsul Pollione; by Ebe Stignani, as good here as she was in the *Cetra* effort; and by Rossi-Lemeni as Oroveso. Generally the soloists and the choral work are better here than in the *Cetra* version.

The conductor, Tullio Serafin, is an old hand with opera and under his expert direction, he elicits some beautiful playing from his excellent orchestra. His deft handling of chorus and orchestra, and indeed all other elements contribute in large part to the success of this recording. In matters of sound, there is no comparison between this and the *Cetra* recording. Wider in range and dynamics, smoother of string and much kinder to the voices, this is an infinitely better-sounding recording. It is unlikely that this splendid effort will soon be surpassed. If you like opera, you will find this particularly rewarding. The RIAA curve did not require adjustment and surfaces were quiet.

RACHMANINOFF THE ISLE OF THE DEAD DUKAS LA PERI

L'Orchestre de la Societe des Concerts du Conservatoire de Paris conducted by Ernest Ansermet. London LL-1155. RIAA curve. Price \$3.98.

This is a real prize! Each work is represented here in the third version to appear on

RADIO & TELEVISION NEWS

LP, and both are far superior to the preceding recordings. The "Isle of the Dead," Rachmaninoff's gloomy tone poem, is finally available with modern sound. The old Koussevitsky-Victor and the Mitropoulos-Columbia recordings of this work were transplanted to LP from earlier 78 rpm discs, and, of course, their sound betrays their origin. Ansermet's reading is more impressionistic than the Koussevitsky, which I think is all to the good, and his tempi and dynamics are more in keeping with the score. The sound is the most startling difference. The heavy dark strings of cello and contrabass in the opening bars can at last be heard cleanly and well defined. The fortissimo passages are *really* loud and foreboding. Throughout the work, string tone is extraordinary for the contrasts of delicacy and sonority.

"La Peri" has had two previous recordings with sound which could be considered fairly hi-fi in quality. This recording is a hi-fi delight. There is a world of wonderful effects here, not the least of which are in the large percussion section. The silvery timbre of the celeste, the dry transients of the xylophone, the sharp rap of the snare and taut resonance of the tympani are heard with superbly clean definition. Happily, sound is not the only attraction since this is a perfectly charming score, and it contains lyric sections of exceptional, if not sensual, beauty. Once danced as a ballet, this would be a good vehicle for the always adventuresome New York City Ballet company. I think I would be safe in predicting it would be quite a hit! This kind of score is Ansermet's meat, and he makes the most of it. His hand is always light, his tempi just and his insight into the score, penetrating. Highly recommended for lovers of sound and good music alike.

MENDELSSOHN
OVERTURES (FINGAL'S CAVE,
FAIR MELUSINA, RUY BLAS,
CALM SEA AND PROSPEROUS
VOYAGE)

Vienna Philharmonic Orchestra conducted by Carl Schuricht. London LL-1048. RIAA curve. Price \$3.98.

Warhorses? Assuredly, but you've never heard them done like this! Positively the biggest sounding disc of overtures in the catalogue. This recording has everything... lively inspired readings by Schuricht, who has a habit of springing surprises like this, the superb playing of the Vienna Philharmonic, and terrific sound. Clean strings, powerful insistent bass drum and tympani, rousing bright brass, sweet woodwinds... all combine with wide frequency response and awesome dynamics. The acoustic perspective is definitely "big hall," a huge robust sound, yet detail is not lacking. A little coarseness near the inner diameter is the only flaw in an otherwise super-sounding recording. A "goody" for the beginning audiophile and "old hand" as well! The RIAA curve was better with slight bass boost. Moderately quiet surfaces in my copy.

VERDI
OTELLO (COMPLETE)

Mario del Monaco, Renata Tebaldi, Aldo Protti, Fernando Corena, soloists with Orchestra and Chorus of L'Accademia Di Santa Cecilia Rome conducted by Alberto Erede. London LLA-24. RIAA curve. Price \$17.85. Three discs.

A few weeks before this was written, over 3000 people jammed their way into the Metropolitan Opera House in New York to hear Mario Del Monaco and Renata Tebaldi in "Otello." It was a triumphant evening for all concerned, especially the debuting Miss Tebaldi. The press gave almost unanimous rave notices the next day, and the New York press is a tough bunch to sell. Now through the

"Dream Set!"

—LIFE Magazine

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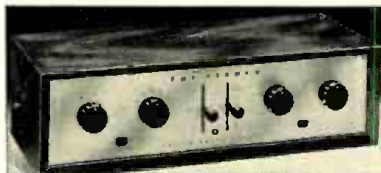
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courtesy of *London*, you can recreate this great night of opera in your own home. Sure, there are some changes here and there, but del Monaco and Miss Tebaldi are still on hand which is the important thing. Any recording of "Otello" must invariably be compared with the great Toscanini's effort. I must confess that good as Mr. Erede is on this album, he can't touch the Maestro, at least not from the orchestral standpoint. And therein lies the whole difference between these two recordings. For "Otello" is, after all, an opera and can't stand or fall on the strength of orchestral virtuosity alone. In every other aspect this *London* recording is superior to the Toscanini. The soloists, especially the principals, are much surer of their ground, the chorus more properly "Italianate" and the general atmosphere more in keeping with the nature of the work. It is beyond the power of words to convey the tremendous thrill and drama of del Monaco's & Miss Tebaldi's portrayals.

London has not forgotten the sonic values in this recording, and in spite of the excellence of their recent issues, like "Der Rosenkavalier," etc., it is safe to say this is *London's* finest opera recording. The orchestra is well defined with nice edgeless strings, brilliant brass, and solid and accurate percussion. The voices are captured with every intonation, every nuance, resonantly alive. Choral and orchestral blur is virtually non-existent and the balance between them is sensible. All is very wide range and distortion-free and the dynamics quite impressive. Curve and surfaces OK.

Tape Review

VIVALDI
CONCERTO GROSSO IN D MINOR
MOZART
EINE KLEINE NACHTMUSIK
BACH-STOESSEL
PRELUDE IN E MAJOR
TCHAIKOVSKY
SERENADE FOR STRINGS
BOLZONI
MINUET

Sorkin Symphonette conducted by Leonard Sorkin. Webcor 2923-3 7" reel, double-track, 7½ ips. *\$12.95.*

Webcor has engaged Leonard Sorkin of Fine Arts Quartet fame, to direct its pre-recorded tape division, and this is one of the first fruits of that undertaking. The repertoire here is certainly catholic and should not be lacking in appeal. The Vivaldi is particularly well performed and the "Serenade" makes an interesting comparison with the Steinberg-Pittsburgh Symphony disc of the same work, reviewed a few pages back. Of course, we must keep in mind that the string complement in the Pittsburgh Symphony is much larger than anything employed here, and therefore will have more "weight" and sonority. However, Sorkin has chosen his ensemble with care and the results, while less spectacular, are quite gratifying. If the string tone in the disc was good, and it was . . . this is so much better, it is amazing, even to one who is used to superior string work on tape. The edgelessness of the strings is a delight to the ear, yet they have more bite, more authority when needed. The overtones are much cleaner and more in evidence. So, in spite of the smaller number of performers here, they don't sound as thin as you might expect. The performance is workmanlike and competent and no one could have much reason to take issue with it. The other works sound equally smooth and well integrated. All are heard in gratifyingly wide range, both frequency-wise and in dynamics. Tape hiss was at such a low level as to be unnoticeable, or at least very unobtrusive. As played back on my Ampex 600, equalization was no problem. A very good tape, with quality which is the equal of anything available presently. —30—

Low-Pass Filter (Continued from page 47)

the low-pass is distinctly more effective than the simple gradual high frequency droop of a tone control. The cut-off cannot be too sharp, however, or the filter will "ring," giving a metallic quality to the music. The filter described here does not cut off suddenly enough to introduce this metallic quality.

There are two main characteristics to a filter: the attenuation rate and the sharpness of the "shoulder" at the cut-off frequency. Attenuation rate depends on the number of reactive elements (*i.e.*, coils plus capacitors) in simple filters. For each coil or capacitor we get 6 db per octave. In the filter described there are no coils and three capacitors, and we get 18 db per octave. Every time the frequency doubles the response goes down by eight times. We would get the same rate in a filter consisting of one coil and two capacitors. This 18 db per octave rate can be scaled off the curves of Fig. 2A (left), in the "cut-off" region where the curves are straight sloping lines.

The extent of the curved portion or shoulder depends on the "Q" of the coils and capacitors. In an LC filter which has coils of infinite "Q," the curve would look like two straight lines (provided the terminations were correct). RC filters have an "equivalent Q", which is very low indeed, less than 1, and give the very droopy curves like curve 1 in Fig. 2B (right). The effect of the feedback circuit and tube is to boost the equivalent "Q" considerably.

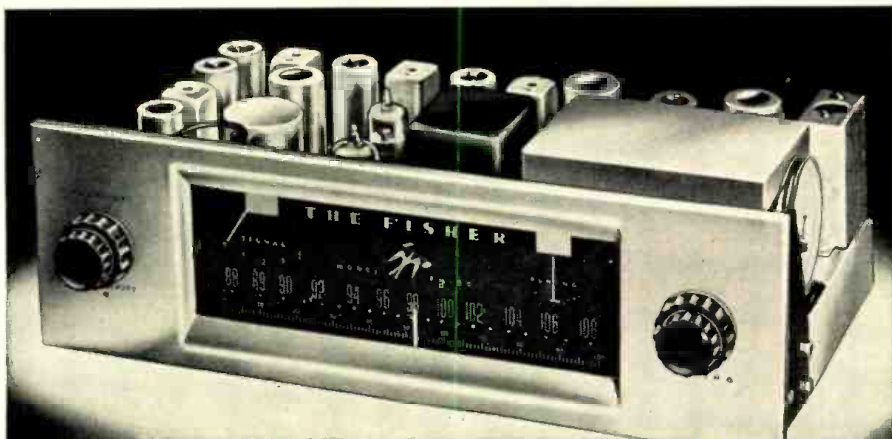
The trouble with LC filters is that they require definite and critical source and load impedances connected at input and output. While the proper impedance can be presented to the filter by using resistors, the problem of making the filter variable is still messy. If the terminations are wrong, the response curve acquires either a droopy shoulder or a nasty peak. If we try to vary the cut-off frequency by varying the inductance, it turns out that the terminating resistances have to be varied too. If we want the terminations to stay constant, then we have to vary both *L* and *C* simultaneously. In addition, air variable capacitors cannot be used in the audio range because the required inductances to go with them become impossibly large.

This information is given as background data for the curious. Problems of instrument design almost always involve balancing a host of factors against each other, a constant search for artifices, dodges, and subterfuges.

Although the author originally designed this filter for use with his audio amplifier, it works beautifully on ham equipment too.

REFERENCE

1. Fleming, Lawrence: "Acoustic Measurements for the Audiophile," RADIO & TELEVISION NEWS, September 1954.



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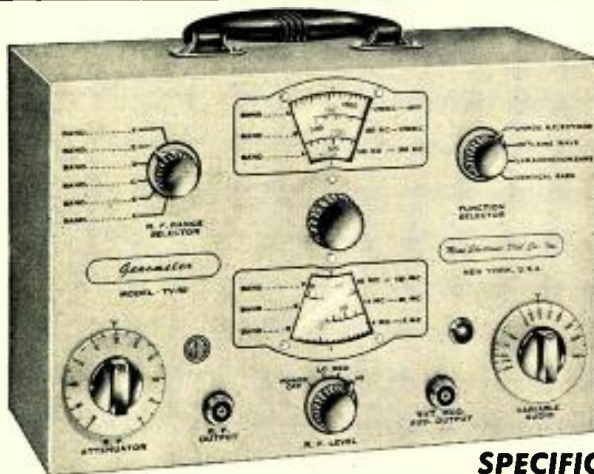
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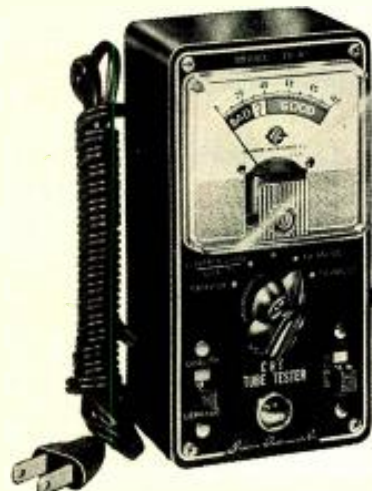
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lator incorporated in this model will detect leakages even when the frequency is one per minute.

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.
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Gun made of best grade non-magnetic steel.

Glass bead type assembly is stronger both mechanically and electrically—gives greater protection against electrical leakage.

Rolled edges in gun minimize corona.

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TUNG-SOL RADIO AND TV TUBES

You Can Build a Reputation On Tung-Sol Quality

Shrinking Pictures (Continued from page 57)

line voltage at times reaches above-average levels in the set-owner's location, however, a substitution of this kind is not recommended, since excessive "B" voltages will be produced, and components may be damaged.

Height losses promoted by line voltage reductions may often be eliminated by substitutions of more efficient vertical amplifier tubes. Thus, a 6K6 may be replaced by a 6W6, 6V6, or 6Y6G; or a 12BH7 may be used in place of a 12AU7. It is important to note that the heater circuit present must be able to handle the larger heater drain if required.

Early-model yokes which perform satisfactorily in the presence of normal line voltages will often produce insufficient width when the line voltage becomes low, even with the width control at maximum. Replacement of the yoke with a later and more efficient equivalent will remedy this trouble, if tube substitutions are inadequate to do the job.

A final service note: Raster shrinking may be caused by two tubes whose emission drops after an interval of normal receiver operation. It is important, then, to note whether *any* improvement manifests itself when a tube has been substituted. If an incomplete restoration of size does occur when some tube is substituted, leave that tube in and go on to hunt for an additional source of trouble. —30—

HAM PICNIC

THE Clifty Falls Picnic, sponsored by the Madison Amateur Radio Club, Madison, Ind., will be held at Poplar Grove, Clifty Falls State Park in Madison on Sunday May 15th from 10 a.m. to 4 p.m.

The committee has announced that there will be no registration fees—just the 10 cent admission charge to the park.

The event has been planned as a family affair with each family being asked to bring its own picnic lunch. The location is only a short distance from Cincinnati, Louisville, or Indianapolis so the group is hoping for a big turnout, rain or shine.

Contact W9QOT, RFD #6, Madison, Ind. for further details. —30—

WESTERN N. Y. HAMFEST

THE Rochester Amateur Radio Assn. is sponsoring its annual "Western New York Hamfest" on Saturday, May 21st in the Doud American Legion Post at 898 Buffalo Road near the western city limits of Rochester.

A program of interest to mobile, DX, traffic, v.h.f.-u.h.f., CD, and hi-fi enthusiasts has been planned. Registration is from 1 to 5 p.m. with the banquet at 7 p.m.

For advance registration, write to Rochester Amateur Radio Association, P. O. Box 1388, Rochester 3, New York. The tariff has been set at \$3.75 per person. —30—

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Impedance	Crossover Selections	Impedance	Crossover Selections
8 Ohms	350, 700	8 Ohms	1250, 2500, 5000
16 Ohms	350, 700	16 Ohms	2500, 5000
4 Ohms	700	4 Ohms	2500

These units can be used singly as 6db/oct 2-way L/C networks, singly as 12db/oct L/C filters, in pairs as 12db/oct 2-way networks and in combination as 3-way networks.

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Built-in continuously variable high frequency control. Matches 16 ohms to 1250, 2500, 5000 cycle crossovers; 8 ohms to 2500, 5000, 10,000 cycles; 4 ohms to 5000 and 10,000 cycles.

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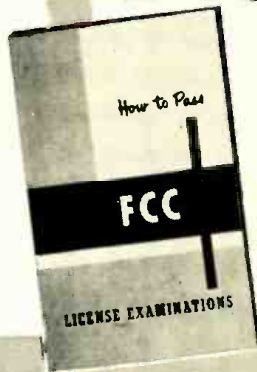
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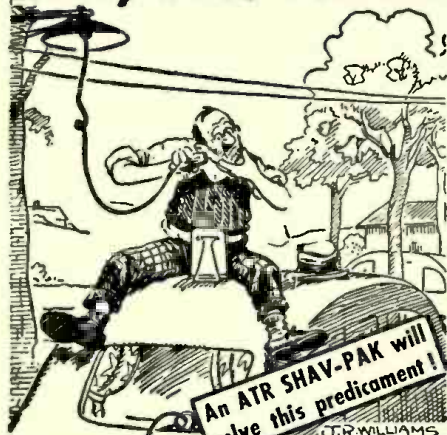
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Diode Oscillator (Continued from page 55)

diode have hitherto been primarily of academic interest for the simple reason that, although it is easy enough to demonstrate the phenomenon, the diode usually burns out within a matter of seconds or minutes. The author was able to overcome this drawback by means of several expedients. First, mounting brackets were made which, by virtue of their thermal conductivity, mass, and radiating area, permit the diode to operate at a temperature only slightly higher than ambient. Secondly, protection is conferred by a power supply deliberately designed to have poor voltage regulation. Finally, a small capacitor connected directly across the diode protects it from injurious transients. This oscillator has survived a thirty-six hour operational test and a great deal of use by a neighborhood lad endeavoring to master the code in order to secure his "ham" ticket. It is believed that there is no reason why the life span of the diode so employed should not at least equal that expected from more conventional applications.

The diode supporting brackets should be constructed very carefully. It is very important that the holes for the diode cartridge be no larger than necessary to provide a tight fit. A sloppy mounting hole will defeat the purpose of the scheme inasmuch as the resulting poor thermal contact will not allow efficient transference of heat from the crystal to the bracket.

The schematic diagram is shown in Fig. 2. It is suggested that the constructor should use the same audio transformer as specified in the parts list. This one was found to be best for this purpose. Other transformers tried by the author did not have a high enough "Q" under the operating conditions. Experiments indicate that the lower audio frequencies are favored by the diode, notwithstanding the "Q" of the resonant circuit. The tone selector switch, S_1 , enables a choice of frequencies of approximately 500, 750, and 1250 cycles per second. The variable resistance, R_1 , may be likened to a regeneration control. The analogy is striking inasmuch as a frying noise can be heard when this control is advanced to the threshold of oscillation.

The function of the series combination, R_2 and C_5 , is to prevent excessive loading of the oscillatory circuit by the phones. Without the isolation provided by these two components, the key-up and key-down frequencies would be different and the keying would be "chirpy." This, of course, is exactly what happens in a heavily loaded vacuum-tube oscillator.

Operation should be brought about by setting R_1 for maximum resistance and S_1 for oscillation at the lowest frequency, that is, with C_5 in the circuit. After the line voltage is connected, R_2 should be slowly advanced. Oscillation should commence when R_2 has been

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turned through about 80% of its allowable rotation. Some diodes have to be provoked into oscillation by several fast repetitions of this procedure. However, once oscillation occurs, such diodes settle down to stable operation. If trouble is encountered, it likely will be with a tendency toward generation of periodic oscillations interspersed by dead intervals, somewhat suggestive of a vacuum-tube oscillator in which the grid leak resistance is high enough to enable periodic blocking to take place. The remedy, in some instances, is to allow the diode to age for a half hour or so, after which time several rapid sweeps of R_1 usually brings about continuous operation. After this treatment, such diodes give satisfactory results. This trouble need not be contended with if one has a selection of several diodes from which to choose. The author obtained results "right off the bat" with four out of six new diodes. The fifth of these was finally pampered into good operation whereas the sixth could not be coerced to oscillate at all. Again, from a selection of sixteen used diodes, ten turned out to be excellent oscillators. The eleventh oscillated only at 500 cps, and the remaining four were not satisfactory. All diodes showed a high front-to-back resistance ratio but this is not the complete story of a diode's ability to oscillate. The real figure of merit is the existence of the negative resistance region and this can be present even when the forward-to-backward resistance ratio is relatively low.

Under normal operating conditions, the oscillating germanium diode is as rugged as a tube. However, do not experiment while the circuit is energized, for shorts and wrong connections can produce transients of sufficient amplitude to injure the diode. Transients generated by manipulation of R_1 or S_1 are completely absorbed by C_1 . It will be found that keying is clean cut and the tone, being quite rich in both even and odd harmonics, is very pleasing to the ear. There is sufficient power available so that two or several pair of earphones can be used if so desired.

The oscillating diode is a circuit element occupying a position between the tube and the transistor. The code oscillator herewith described represents a practical application of a neglected phenomenon. There certainly will be others that will suggest themselves to the experimenter. —50—

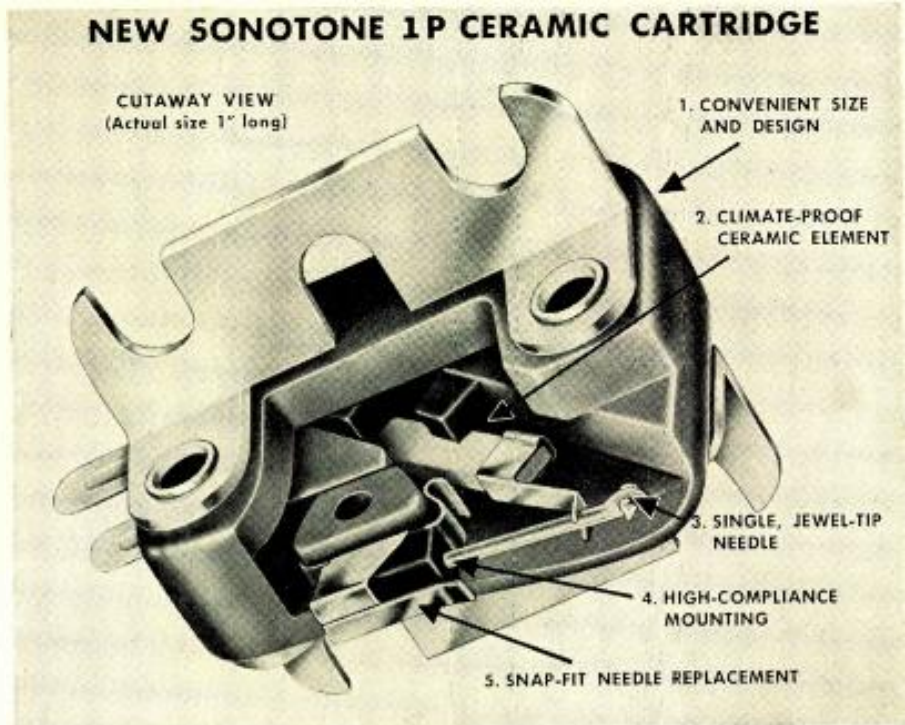
NEW MEXICO HAMFEST

THE Amateur Radio Caravan Club of New Mexico's Albuquerque Chapter will sponsor the 5th Annual N. M. State Hamfest on June 4th and 5th. Stations will be on 29.6 mc. and 3838 kc. for contests and to direct mobiles.

All amateurs whether New Mexico residents or not are invited to attend. For further information contact the club at 107 Washington Street, S.E., Albuquerque, N. M. A varied program awaits attendees. —50—

May, 1955

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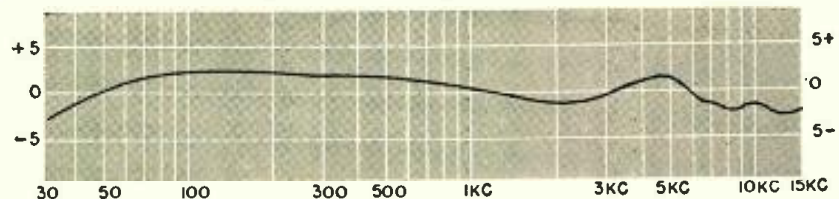
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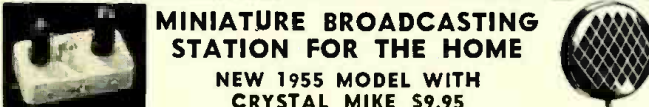
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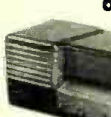
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3-TUBE AMPLIFIER—8" SPEAKER



New, 3 speed amplified record player kit for only \$10.95. Leatherette covered cabinet 9 1/2" x 12" x 18 1/2" high, made to set on floor. Completely wired 3 tube amplifier has separate tone and volume controls, 128K6-85W4 and 6X4 tube, 60 watt booster amplifier, all play pickup, motor and turntable. Cabinet is pre-cut. All you have to do is fasten the amplifier, speaker and motor in the cabinet. Only a few minutes required to assemble. Complete with instructions to follow instructions and all necessary items to build this 3 speed amplified record player. Buy this kit at less than the cost of the parts. Shipping weight 15 lbs. Model No. ARP-347K, Sale price only \$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 6 lb. potted case high fidelity output transformer with taps at 4-8-16-60 and 250 ohms. 225 ml 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 6 1/2" x 14 1/2". Model No. PA-55N. Ship. wt. 26 lbs. Sales price, \$39.95. PR-2X, 2 mike input pre-amplifier plugs into the 55N 50 watt booster amplifier. Allows use of 2 microphones, either crystal or dynamic and one low level input. Furnished with 1 ft. connecting cable and plug for remote control of the 50 watt booster. Chassis size, 5 3/4" x 3 1/2" x 2 1/2". 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.

12" PM speaker with same quality 12" wall baffle, only \$7.49 each, 2 for \$14.00.

BOTH FOR \$5.49

FAMOUS STANDARD COIL CASCODE TUNERS



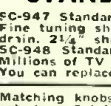
TV-2000 series Standard Coil cascode tuners complete with 6J6 and 6BK7 or 6BQ7 tubes. Thousands of TV sets use this famous tuner. Tunes 12 channels (2 thru 13). For 21 mc I.F. circuit. This tuner will give 2 to 3 better reception than the old pentode type. Many servicemen replace all older tuners with this cascode model. Available with 27" or 4 1/4" 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.

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. 3 3/4", 4 1/4" 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. 6 3/4" shaft. With tubes 6BQ7 and 6J6. Used in Sentinel, MW, Arvin, etc. Sale price, \$12.95.

SALE PRICE \$12.95
2 FOR \$25.00

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 drive. 2 1/4" shaft. With tubes 6BQ5 and 6J6. Sale price, \$9.95.

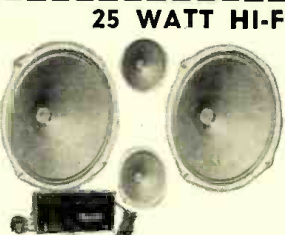
SC-948 Standard Coil Pentode 12 channel tuner with 6BQ5 or 6AG5 and 6J6 tubes. Millions of TV sets now in use have this tuner. 1 3/4", 2 1/8", 3", 4" or 5" shaft length. You can replace that old tuner cheaper than it can be repaired. Sale price, \$9.95.

Matching knobs for Standard Coil tuners. Set No. SKC-2 for fine tuning and channel selector. Set VCK-2, matching volume and contrast knobs. Either set only \$9c a pair.

25 WATT HI-FI SPEAKER SYSTEM

2-12" Woofers 2-5" Tweeters Power Supply and L-C Cross-over Network

SALE PRICE \$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. SP5-12125, 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.

NEW 4 SPEAKER 25 WATT HI-FI SYSTEM

2-12" Woofers 2-5" Tweeters and Baffle

SALE PRICE \$24.95

With 350 Cycle L-C Type Crossover Network... \$34.95



New 4 speaker, high fidelity speaker system with baffle board, 3/4" laminated plywood baffle is 21 1/2" x 28 1/2" long. Complete with two 12" high fidelity woofers having 32 oz. Alnico V magnets and two 5" tweeter speakers for high frequencies. Frequency response 50 to 18,000 cps. Easy to connect to any 8 ohm output of your amplifier or hi-fi radio. This speaker system is ideal for a home music system. Can be installed in wall or cabinet of your choice. Note: baffle will not fit cabinet shown below. Stock No. 4P-55, 4 speaker system. Ship. wt. 20 lbs., Sale price \$24.95. 4P-55 speaker system with Model CR-350, \$30.00 list, 350 cycle inductance-capacitance type cross-over network, \$34.95. New interwoven plastic grill cloth for above; either golden blond or mahogany, \$2.00 extra.

4 SPEAKER-HIGH FIDELITY SPEAKER SYSTEM

With \$25.00 List L-C Crossover Network. Choice of Blond Oak, Mahogany or Walnut. \$49.95




NEW 600 CYCLE CROSSOVER NETWORK

\$25.00 LIST SALE PRICE \$9.95

CABINET AND BAFFLE WITH GRILL ONLY \$24.95

NEW HIGH FIDELITY CONSOLE SPEAKER SYSTEM



New High Fidelity console speaker system, housed in an attractive cabinet 37 1/2" high, 24" wide and 20 1/2" deep. Your choice of three beautiful finishes: blonde oak, mahogany or walnut. Cabinet is equipped with 4 PM speakers: 12" woofer, 10" middle range and two 5" tweeters which respond only to the high frequencies. Speakers are fed from a 600 cycle inductance-capacitance type cross-over network. Easy to connect to any amplifier that you now have. Input matches any 8 ohm output tap. Response 20 to 20,000 cycles. Has separate gain control for middle range and high frequency speakers. Any amplifier will sound better with this speaker system. Model HF-121055, Ship. wt., 90 lbs. Specify cabinet finish desired. Sale price, \$49.95.

High fidelity console speaker cabinet with baffle and grill, less speakers and cross-over network for only \$24.95. Your choice of blonde oak, mahogany or walnut finish with baffle cut for 12", 10" and 5" speakers. Complete with new interwoven plastic grill cloth. Use cabinet as used in the above speaker system. Specify if you want baffle board uncut. Stock No. HF-CC4, Ship. wt., 80 lbs. Sale price, \$24.95.

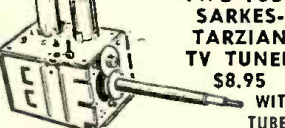
New \$25.00 list, 600 cycle inductance-capacitance type cross-over network as used in the HF-121055 speaker system. Designed to feed frequencies below 600 cycles to the woofer only and frequencies up to 20,000 cycles to the middle range and tweeter speakers. Housed in metal case with terminals for input from any 8 ohm amplifier output and connections to low and high frequency speakers. Has gain control. Frequency response 20 to 20,000 cps. Model CR-600, amp. wt., 6 lbs. Sale price, \$9.95.

NEW IMPERIAL IV with General Electric 8 in. HIGH FIDELITY SPEAKER \$19.95



New 1955 Model IMPERIAL IV, High fidelity speaker system with General Electric 8" speaker. Housed in a high quality leatherette covered plywood cabinet 10" x 10" x 24" long. Fully enclosed; covered on all sides except back. Use as an auxiliary speaker or with any high fidelity radio, amplifier or home music system. The IMPERIAL IV contains a General Electric Model 850 extended range high fidelity 8" PM speaker with 6.8 oz. Alnico V magnet and curvilinear cone with 8 ohm voice coil and a 5" tweeter. Response 50 to 15,000 cps. Model IV Imperial \$19.95.

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 6BQ5 tubes. Used in CBS, Arvin, Crosley F170LBU, TOLM, TOLU, F21CDL8H, etc. Also, ideal for general replacement use. A good replacement for one tube tuners. 3 1/8" shaft. No. TT-3A, Sale price, \$8.95. Takes SKC-2 knob set described at left.

3 TUBE SARKES-TARZIAN, RCA, GEN'L. INST.



V-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, 6BM6 and 6AG5 tubes. Use with separate sound or intercarrier. Has converter coil. 2 7/8" shaft. Sale price, \$7.95. Famous RCA ZOLEE, 13 channel tuner with 3-6J6 tubes. Brand new as used in RCA 630 chassis. Stock No. RCA-13P, Sale price, \$7.95.

RC-4P-12, 12 channel printed circuit tuner used in Hallcrafters. With 6J6 and 6B6 tubes. 6 3/8" shaft. Sale price, \$9.95.

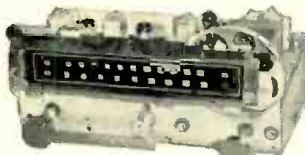
GI-44 General Inst. 12 channel tuner with 6BQ5, 6AG5 and 6J6 tubes. 5" shaft. 21 mc I.F. Sale price only \$4.95.

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**

CUSTOM RADIO CHASSIS-CHANGERS-HI-FI SPEAKERS

17" TO 21" TELEVISION CABINETS—LESS THAN FACTORY COST!

SPECIAL PURCHASE SALE!



**CROSLLEY
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 6TR. Power to operate this chassis is to be picked up from your present audio amplifier or television set. (6.3 volt filament and 225 to 180 volts at 20 mill "B" voltage required.) Chassis size, 5 1/2" deep, 10 3/4" long, 5 3/4" high. Illuminated slide rule dial 8 1/2" long and 1 1/2" 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 6TR 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 TV 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 escutchion, knobs, diagram, instructions and parts list.

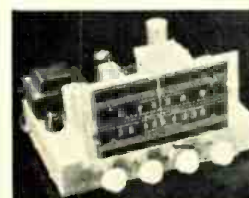
Crosley 362-2VC, FM-AM tuner, same as above, but with volume control and power supply added to make a completely self-powered FM/AM tuner. Shipping weight 10 lbs. Sale price \$24.99.



9-TUBE HI-FIDELITY
12 Watts Audio **\$39.95**
Dual Tone Controls

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. Radiophone switch on front of chassis. Shielded output transformer matches 3.2 or 8 ohm speaker. Heavy duty 150 mill power transformer. 9 1/2" 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 9 1/2" deep. Complete with tubes: 2-6BA6, 6AV6, 6BE6, 6SN7, 6AT6, 2-6V6 and 5Y3. Knobs, escutchion, diagram and instructions included. Ship, wt. 9 lbs. Sale price, \$39.95. 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 HALLCRAFTERS

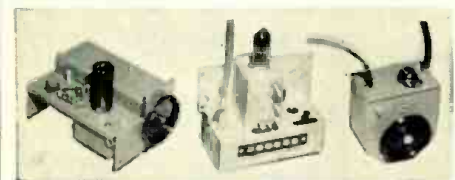


Regular \$89.50 **\$69.95**
McGEE'S SALE PRICE
★ HIGH FIDELITY
★ AUTOMATIC FREQUENCY CONTROL

Hallcrafters Model 5-78A, 11 tube FM-AM super-separate custom chassis. Size 7 3/4" x 12 1/2" x 11" deep. Complete with tubes, knobs, escutchion, 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. Full 11 tube transformer powered chassis. Ship, wt. 11 lbs. Sale price, \$69.95. S-78A Hallcrafters 11 tube FM-AM chassis. Ship, wt. 22 lbs. Sale price, \$69.95. S-78A Hallcrafters with our CU-14Y 12" coaxial PM speaker. \$79.95. S-78A Hallcrafters 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-052 G.E. cartridge. Size, 13 1/2" 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. 14 3/4" long, 12 1/4" wide and 4 3/4" above motor board, 2 7/8" below. Available in grey, cream and gold hammettone. 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. 1 3/4" wide, 15 1/2" deep and 8" high. 2 1/2" 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. 1 3/4" x 15 1/2" x 5 3/4" above motor board and 3 7/8" below. Net price, less cartridge, \$68.11. With crystal flip-over cartridge, \$72.06. With G.E. RPX-052 Golden Treasure, \$88.11. 45 RPM spindle, \$3.43 extra.



**UHF CONVERTER
TUNERS \$2.95**
3 FOR \$7.50

Take your choice of any of these three UHF converter tuners at \$2.95 each, 3 for \$7.50. (1) Mallory inductor-tuner with 6AF4 and 1N72 diode. This is a complete

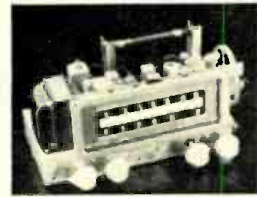
UHF osc-tuner similar to the one used by Mallory in a converter and by many set manufacturers in their UHF TV sets. (2) CBS-Columbia single channel UHF converter intended for use in UH11 and UH12 CBS TV sets. Complete with 6AF4 tube. (3) Small compact UHF converter tuning assembly with 6AF4 tube and diode. Many applications for this in UHF. Your choice of any of these for only \$2.95 each, or 3 assorted for \$7.50.

McGEE RADIO COMPANY

PRICES
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OUR NEW ADDRESS IS
1901 MCGEE ST., KANSAS CITY, MISSOURI

HI-FI FM-AM TUNER AND 10 WATT P.P. 6V6 AMPLIFIER



BOTH FOR **\$49.95**
9 TUBES-PLUS
2 RECTIFIERS
PHONO INPUT

10 W. AMP.

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: 6V6's, 6SN7, plus rectifier. Full supernet circuit with AVC and 3 position tone control. Illuminated slide rule dial with gold color escutchion 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. \$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 **\$23.95**

12-Inch Model CU-14Y 15-Inch Model P15-CR



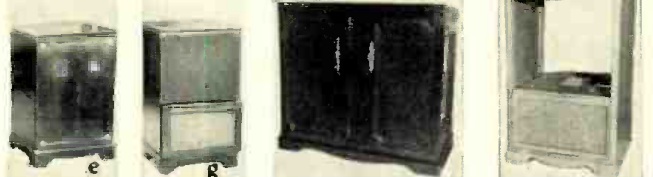
Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.8 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't 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 21 1/2 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 \$16.95



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 curvilinear 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 high fidelity 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 14 1/2 oz. Alnico V magnet with 1 1/2" 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 a 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 HF-15J, 15" "Blue Streak" High Fidelity low frequency woofer speaker. This is an ideal woofer for any high fidelity system. Use a crossover network for best results. Has 14 1/2 oz. Alnico V magnet with curvilinear one piece molded cone and 1 1/2" 8 ohm voice coil. Will respond to frequencies down to 50 cps and up to 9,500 cps. Takes 15 watts. This speaker used with a woofer for a high fidelity speaker system. Stock No. HF-15J, 15" "Blue Streak" woofer, Ship, wt., 12 lbs. Sale price, \$16.95.



\$29.95 **\$19.95** **NRT-21M \$59.95** **BT-210 \$22.95**
17" FULL DOOR **\$29.95** 17" with PHONO DRAWER **\$19.95**
Fig. (c) No. AM-42 Mahogany with full doors. 36" h., 24" w., 21 3/4" deep. Chassis area 22" w., 17 3/4" h., 18 3/4" deep. Blank panel. Holds 17" TV easily. 19 3/4" wide, 13" deep. Baffle cut for 10" speaker. Ship, wt. 75 lbs. Sale price, \$29.95.
Fig. (d) SE-21 Mahogany TV cabinet with phono drawer 40" h., 24" w., 18 1/2" deep. Blank panel. TV chassis area 19" w., 20 1/2" h. Chassis area 19 3/4" wide, 13" deep. Baffle cut for 10" speaker. Ship, wt. 75 lbs. Sale price, \$19.95.

DELUXE 21" MAHOGANY TV-PHONO CABINET

No. NRT-21M, Deluxe piano finish mahogany combination radio-phono-TV cabinet for 20" or 21" TV chassis. Beautiful full door style with matching front panels. 37" high, 40 1/2" wide and 22 3/4" deep. Baffle cut for a 12" speaker. TV chassis area 21" high, 23 1/2" wide and 19" deep. Changer shelf 15" x 17" with 9" height clearance. Ship, wt. 90 lbs. No. NRT-21M, mahogany cabinet, sale price, \$59.95. 21" mask and safety glass, \$6.95 extra. No. A13-9, ball bearing changer drawer slides, \$1.39 Pr. extra.

21" BLONDE \$22.95—MAHOGANY OR WALNUT \$19.95

No. BT-210, blonde 54" 21" TV cabinet. 37 1/2" high, 24" wide and 20 1/2" deep. TV chassis area 20 1/2" high, 23 1/2" wide and 18 1/2" deep. Baffle cut for 10" speaker. Open front, no blank panel furnished. Shipping weight 85 lbs. Sale price, \$22.95. No. WT-210, walnut 21" TV cabinet, same as above. Sale price, \$19.95. No. NT-210, mahogany 21" TV cabinet, same as above. Sale price, \$19.95.

TERADO



Trav-Electric CONVERTERS

Provide

House Current Anywhere

—from battery in car, truck, boat. At the beach—picnic grounds—at cabin—on trips—anywhere!

Easy! No installation! Just plug Trav-Electric into cigar lighter on dash.

Trav-Electric Operates:

- Tape Recorders
- Electric Shavers
- Radios
- Soldering Irons
- Dictating Machines
- Small Electric Drills
- Portable Phonographs
- Etc., etc., etc.

6 Models—10 to 100 Watts
—a size for every need

"MIDGET"

Model 6-11160
10-15 Watts
About as small as a pack of cigarettes
\$11.95 LIST



PORTABLE PHONOGRAPH



Dictating Machine



ELECTRIC SHAVER

"JUNIOR"

Model 6-1110
115 Cycle—30-40 Watts
\$12.95 LIST

"SENIOR"

Models 6-1160
Size 2 1/2" x 2 1/2" x 4 1/2"
35-40 Watts
\$15.95 LIST

"MASTER"

Model 6-51160
40-50 Watts
Size 4" x 5" x 6"
\$27.50 LIST

"SUPER"

Model 6-71160
(Shown at top of ad)
60-75 Watts
Size 4" x 5" x 6"
\$37.95 LIST

—and now, the "CHIEF"

New—just out—Model 6-81160—75-100 Watts—automatic on-off switch—**\$49.95 LIST**

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A SIMPLE BIAS SUPPLY

By **BRUCE F. BROWN, W6TWW**
Chief Electronics Technician, USN

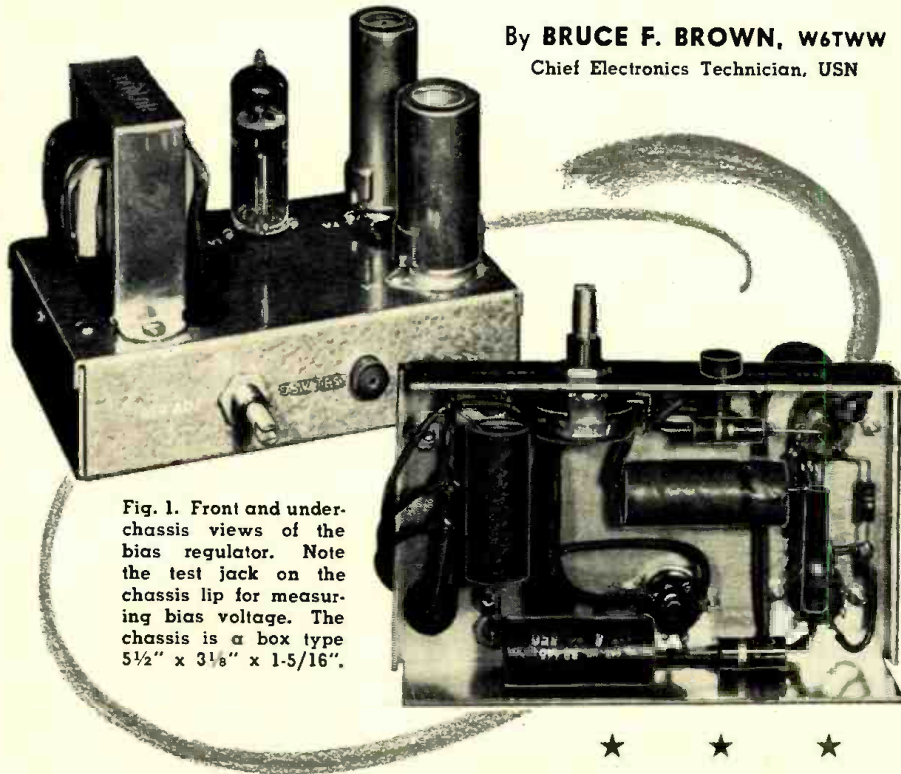
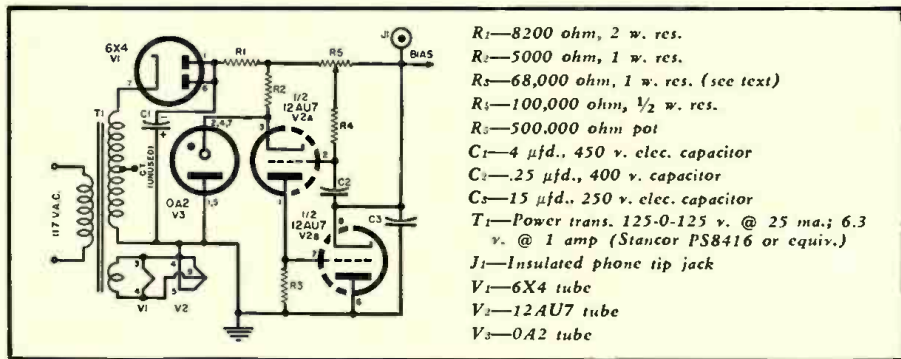


Fig. 1. Front and under-chassis views of the bias regulator. Note the test jack on the chassis lip for measuring bias voltage. The chassis is a box type 5 1/2" x 3 1/8" x 1-5/16".



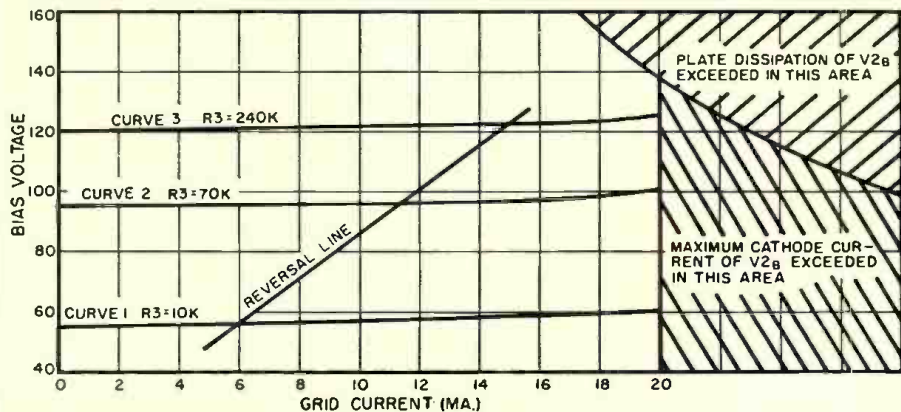
Details on a shunt-type regulator that provides good regulation, is small in size, and is not expensive.



- R₁—8200 ohm, 2 w. res.
- R₂—5000 ohm, 1 w. res.
- R₃—68,000 ohm, 1 w. res. (see text)
- R₄—100,000 ohm, 1/2 w. res.
- R₅—500,000 ohm pot
- C₁—4 μfd., 450 v. elec. capacitor
- C₂—25 μfd., 400 v. capacitor
- C₃—15 μfd., 250 v. elec. capacitor
- T₁—Power trans. 125-0-125 v. @ 25 ma.; 6.3 v. @ 1 amp (Stancor PS8416 or equiv.)
- J₁—Insulated phone tip jack
- V₁—6X4 tube
- V₂—12AU7 tube
- V₃—0A2 tube

Fig. 2. Schematic diagram of the bias regulator. It requires only five more components than a simple voltage regulator tube circuit and is inexpensive to build.

Fig. 3. Graph of final amplifier grid current plotted against grid bias showing that for normal operation the maximum plate dissipation and maximum cathode current ratings of the shunt regulator are not exceeded. For full details, see text.



RECENTLY, the need for 95 volts of well-regulated bias arose during the conversion of a push-pull class C amplifier, employing a pair of 813's, to a push-pull class B linear amplifier for single sideband.

The nearest value of regulated bias obtainable from a voltage regulator tube was 90 volts. Therefore, it was decided that a shunt-type electronic regulator would be designed and constructed to supply the desired bias.

This shunt-type regulator had to meet three requirements: good regulation within its range of operation, small size for installation in the existing transmitter with a minimum of equipment modification, and reasonable cost.

This regulator has few components (only five more than a simple voltage regulator tube circuit), requires very little filtering, and is simple. Cost of the few extra parts is partially offset by the reduced cost of filter components.

The grid current drawn by the 813's on voice peaks is small so it is unnecessary to use bulky and expensive tubes, such as the 6AS7G, for regulation of the bias voltage. Accordingly, a circuit using a miniature-type tube was developed.

The regulator, as shown in Fig. 1, provides a useful output voltage range from 50 to 125 volts at grid currents up to 20 milliamperes. Since this range is considerably in excess of the requirements of the 813's the unit is usable with any other tube, or tubes, in a linear amplifier in which the grid current and grid voltage requirements are within its capabilities.

The unit is designed for optimum regulation at 95 volts output. However, for best regulation of other output voltages, within its range of operation, a change in the value of R_3 is required. This change will be explained later.

The circuit is shown in Fig. 2. V_1 provides half-wave rectification of the entire high voltage secondary of T_1 and delivers 200 v. of partially filtered d.c. to the top of R_2 and R_3 . R_1 serves to assist the filtering action and, due to the low current drain on the rectifier, is used instead of a filter choke. A fixed negative reference potential of 150 volts is provided by V_3 at the cathode of V_{2A} . This is the regulator control tube. It controls the bias on the shunt regulator, V_{2B} . The regulated bias voltage is developed across the cathode-to-plate resistance of V_{2B} ; the potentiometer, R_5 , is used to set this bias to the desired value.

To follow the sequence of regulation, assume that the grid current flowing in the biased amplifier is increasing. This grid current flows to ground through the shunt regulator, V_{2B} , and tends to increase the bias voltage due to the tube's internal resistance. Any increase in the bias voltage is coupled, in part, through R_2 and R_1 to the grid of the control tube, V_{2A} , and causes its conduction to decrease.

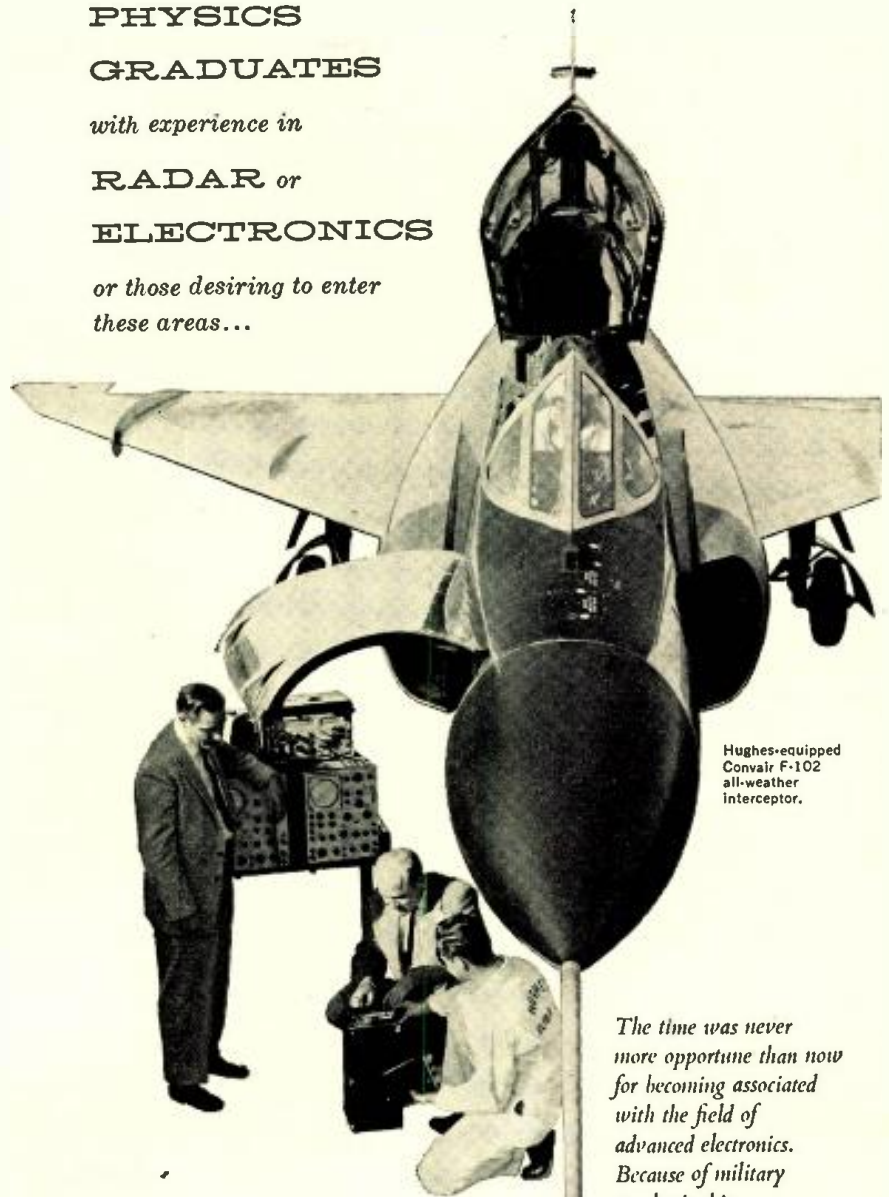
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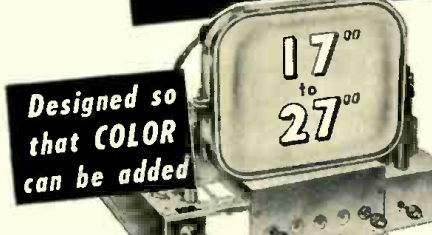
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R_3 produces a decrease in bias on the shunt regulator, thereby lowering its resistance and tending to maintain the bias voltage at a constant level.

Capacitor C_2 supplements the filtering action by coupling ripple voltage or transients, in full amplitude, to the grid of the control tube. This makes the filtering action so effective that C_2 can be reduced to .5 μ fd. and the output ripple voltage will be only .3 volt peak-to-peak! However, if C_2 has too much leakage, regulation at higher voltages will be impaired by its shunting effect on V_{2B} .

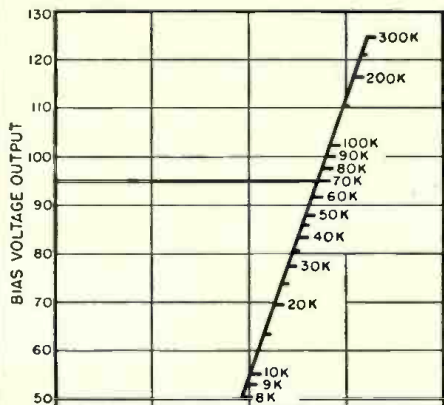
Plotted in Fig. 3 is a family of curves illustrating the regulating ability of the unit. Curve 2 denotes a one-volt change in bias at a grid current of 12 milliamperes. This indicates that the unit is the equivalent of a constant voltage generator in series with a resistance of 83 ohms. This effective internal resistance will increase slightly at higher and lower output voltages.

When the grid current flow from the biased amplifier stage swings to the right of the "reversal line" (see Fig. 3) the grid of the shunt regulator, V_{2B} , swings positive with respect to its cathode. The grid current drawn by V_{2B} causes some curvature in the regulation characteristic to the right of the "reversal line." Although the unit is intended for use at currents up to the maximum current of 20 milliamperes if less exact regulation can be tolerated.

As previously mentioned, a change in the value of R_3 is required in order to maintain optimum regulation at different output voltages. The correct value of R_3 may be determined from Fig. 4 and is 70,000 ohms for 95 volts of bias. Since 70,000 ohms is not a standard RETMA value, 68,000 ohms was substituted.

As with most regulated power supplies, the output voltage will change if the power line voltage varies. The variation in output with sustained line

Fig. 4. Chart showing optimum value of R_3 vs bias voltage for best regulation. To determine R_3 , when the desired bias voltage is known, follow horizontally from bias voltage scale to resistance scale. The point of intersection on the resistance scale gives the optimum value of R_3 . From the chart it was determined that R_3 must be 70,000 ohms for 95 volts of bias output. A 68,000 ohm unit was used.



STOP! LOOK! READ!

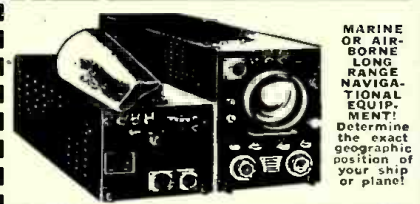
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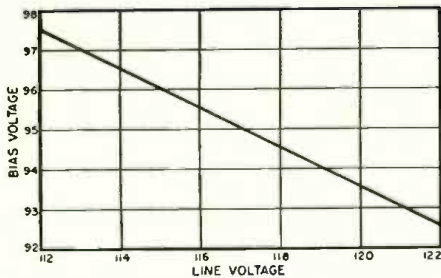


Fig. 5. Graph showing the variation in bias caused by changes in the line voltage.

voltage change is illustrated in Fig. 5. The use of a 15 μ fd. capacitor at C_3 smooths out most output voltage variations caused by non-sustained fluctuations in line voltage, i.e., those due to the high current drawn by the transmitter on voice peaks.

In the event that line voltage regulation is very poor, satisfactory regulation may not be obtained when a high power transmitter is used. This may be corrected by replacing R_2 with an OB2 voltage regulator tube. In addition, it will be necessary to use a transformer that has higher secondary voltage in place of T_1 .

In short, the unit described is capable of providing good regulation of bias voltage at small grid currents, is inexpensive, and is small enough to install in the majority of transmitters without extensive modification of the equipment.

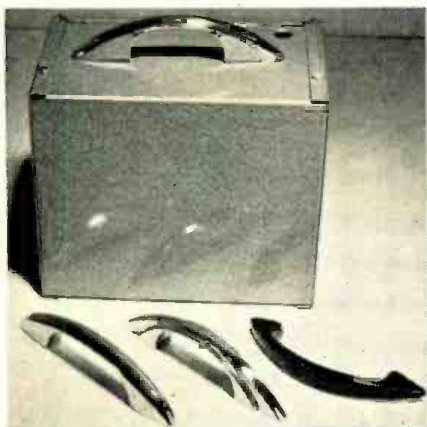
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SOLDER

R/C Receiver (Continued from page 65)

leads are soldered directly into the circuit. All wires to and from the receiver are soldered to the pins of a miniature connector to permit easy removal of the receiver from the model.

Adjustment of the receiver is very simple. Before applying power to the receiver, be sure R_2 is set for maximum resistance. This is very important because too low a value of plate resistance could damage the RK61. After applying power, touch the probe of a high impedance or vacuum-tube voltmeter to the plate end of R_2 and tune the coil and antenna trimmer to obtain the highest voltage possible. With the antenna and coil tuned, decrease R_2 until the relay opens. R_2 should be set at the maximum resistance at which the relay will remain open because the lower the plate current, the slower the RK61 will age. The transmitter should be removed as far from the receiver as possible during the tuning operation. Every ten or twenty hours as the RK61 ages the resistance of R_2 will have to be reduced to maintain sufficient noise output.

As important as a good receiver, is a reliable rudder actuating mechanism be it in a boat or an airplane. Again, the mechanisms most generally in use are inadequate. Most of them fall into the escapement category where power is supplied by springs or rubber bands. An escapement device similar to that used in a clock is pulsed by the receiver relay. So many pulses give a right turn and so many give a left turn. But if the operator happens to forget what position the escapement is in or if the receiver misses a pulse, disaster may occur before the situation can be righted. So, the first requisite of any rudder control mechanism is that it be self-neutralizing, that is, it must return automatically to neutral after the execution of a turn. Any escapement driven by springs or rubber bands can perform only a limited number of turns before losing power. Here again the operator might exceed his allotment with disastrous results. Therefore, the second requisite of a control mechanism is that it be capable of performing an unlimited number of turns.

The rudder-control device is a motor driven, self-neutralizing control. A small, three-volt motor drives a 1½ inch diameter cam through a 256:1 gear ratio. The cam, in addition to supplying power to the rudder, operates a simple switch that sequences the operation of the unit. The switch can exist in one of three possible conditions. Over the rise on the cam, only the center and upper contacts are closed. On the surface of the cam all three contacts are closed, while in a flat of the cam only the center and lower contacts are closed. Power to

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run the motor is fed from the receiver relay to the upper and lower contacts of the switch. If the receiver relay is open (transmitter off) the motor will turn the cam until the rise opens the center and lower contacts, whereupon the motor will stop the cam in the neutral position; hence, self-neutralization. If a right turn is desired, the transmitter is keyed on. The receiver relay closes and power is then applied to the motor through the upper contact. The motor will turn the cam until a flat opens the center and upper contacts, whereupon the motor will stop the cam in the right turn position. The cam will remain in this position until the transmitter is keyed off and then it will automatically neutralize. A left turn is accomplished simply by turning off the transmitter long enough to allow the first flat of the cam to pass under the switch contacts. Since the cam makes one complete revolution in about two seconds, the timing is not critical and a little practice is required to obtain perfection. Obviously, the transmitter used with the system should have push-button keying.

If the motor is allowed to run without load, inertia will carry the cam past the rise and flats. A small piece of tin can be attached to the shaft of the motor to slow it with a fan action. While this limits the speed of the motor it doesn't seriously affect the power of the motor.

The cam is machined from a piece of

soft steel and the rise is created by brazing a glob of brass to the surface and filing it to the proper contour. The cam is about the only part of the mechanism that cannot be made with ordinary hand tools, and even it, with care, can undoubtedly be filed to shape by hand. The gears can be purchased in any hobby store. The entire mechanism weighs six ounces and develops about ten inch-ounces of torque. Weight can be reduced by substituting aluminum for the cam. The switch contacts were taken from an old relay. Two ordinary flashlight cells will operate the unit intermittently for many hours because the motor consumes only 500 milliamperes at three volts. The model boat in which this unit is installed uses a six-volt storage battery for propulsion power, and to eliminate additional batteries, a small rheostat is used to drop the voltage to three volts from the main storage battery.

The opening of the 27.255 megacycle Citizens band has at least doubled the number of radio control enthusiasts in the past couple years. While the equipment described here is certainly not the only remote control equipment that operates with reliability, it operates more reliably than most of the equipment in use. With care and patience in construction you can construct a radio-controlled model with complete confidence that it will give you the gratification that it should. Best of luck and have fun!

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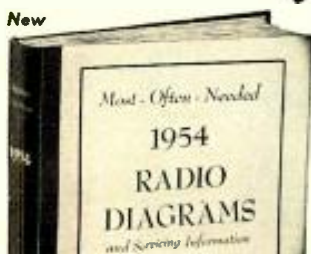


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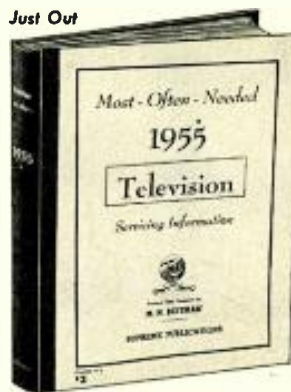
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Time for Portables

(Continued from page 45)

replacement. Making a list of the troubles found and actually pointing them out to the customer will usually result in your getting the job of putting the set back in proper shape. You can work out a deal where the initial inspection charge is absorbed in the final service charge, but make it plain to the customer that the inspection charge is to be paid for examining his radio, whether or not he decides to have the required repairs made.

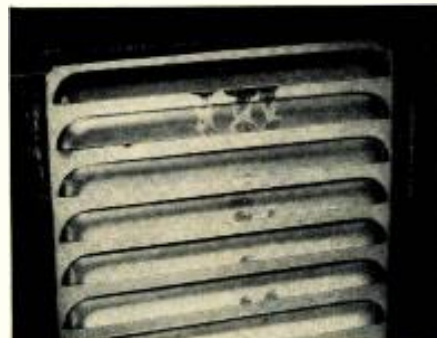
After you have inspected one of these jobs, always clean the dust off the chassis and polish the cabinet a bit. It takes only a minute or two, but it certainly pays off in good-will as it shows the customer that you take a personal interest in his property. (Polishing off major rust spots, such as those shown on the grille in Fig. 9, would take time and effort and should not be attempted unless it's part of the job.) If the external appearance of the set appears the same as when he brought it in to you, there might be a question in his mind about just what you did do to his set.

Getting the Business

This brings us to the final, but by no means least, point in our discussion. How to go about getting the business. A sign in your window is one method. Handbill throwaways or an ad in the local paper are others. However, your biggest drawing card can be your own window.

We have already referred to the use of dummy batteries to boost your battery sales, but your whole window, or a substantial part of it might be dressed with the accent on portable radios. Use the manufacturers' posters, signs, and streamers, and put a portable radio chassis into your window connected up to a spare meter to accent the repair feature. Build your display as attractively as you can and make the best use of your attention stoppers to get people to look into your window. All this combined with pleasant and efficient service will insure your getting a greater amount of the portable radio repairs in your community.

Fig. 9. Bad corrosion on a metal speaker grille such as shown here, is difficult and time consuming to eliminate.



Among important activities at Hughes is a program involving comprehensive testing and evaluation in connection with Hughes-developed radar fire control and navigation systems for latest type military all-weather interceptors.



Convair F-102 all-weather interceptor.

System Test Engineers

There is need on our Staff for qualified engineers who thoroughly understand this field of operation, and who have sufficient analytical and theoretical ability to define needed tests; outline test specifications; assess data derived from such tests, and present an evaluation of performance in report form.

Engineers who qualify in this area should have 1 a basic interest in the system concept and over-all operation of test procedures; 2 experience in operation, maintenance, "debugging," development, and evaluation testing of electronic systems, and knowledge of laboratory and flight test procedures and equipment; 3 understanding of basic circuit applications at all frequencies; 4 initiative to secure supporting information from obscure sources.

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

SCIENTIFIC AND ENGINEERING STAFF

Culver City, Los Angeles County, Calif.

RADIO & TELEVISION NEWS



3-D SLIDES OF LINE
 Trav-Ler Radio Corporation of Chicago is using 3-D color slides and 3-D stereo-viewers as a means of introducing its 1955 line to its distributors. The idea is to present the merchandise to the distributors in such a way that the distributors could clearly visualize all of the features of the firm's line of TV sets, radios, clock radios, and phonographs.

LITTELFUSE DISPLAY
 Littelfuse, Inc., 1865 Miner St., Des Plaines, Ill., is now offering a versatile display card to its jobbers.

The black and yellow card, featuring the company's logo, is marked on the back for proportional trimming, thus



the 24-in. x 30-in. card can be trimmed down to 20 1/4 in. x 20 in. for use where space is at a premium.

The cards will be given to jobbers by the company's representatives.

ANTENNA MOVIE

Channel Master Corporation of Elmhurst, N. Y., has produced a full-color 30-minute film entitled "Up She Goes!"

The film presents information about TV antennas and accessories never before filmed, according to the company. It will be shown to TV dealers and installation men at a series of TV installation clinics which will be sponsored and conducted by the firm's distributors throughout the country.

The film covers antennas, rotators, masting, and couplers. The presentation is designed to help the dealer take advantage of every profit-making opportunity by informing him of today's latest time-saving, labor-saving installation techniques.

The film will also be available on loan to radio and television schools and other educational institutions.

COUNTER DISPLAY CARD

The Regency Division of I.D.E.A., Inc., 7900 Pendleton Pike, Indianapolis 26, Ind., has released a counter display card to its jobbers to display its Model TR-1 transistorized radio receiver.

May, 1955



"555"

metal-cased
MULTIMETER



POCKET SIZE WITH A 4 7/8" LENGTH SCALE
 an instrument of **PERMANENT ACCURACY**
 in a case that **WON'T BREAK**

- ✓ AC CURRENT RANGES
- ✓ SEPARATE RANGE & FUNCTION SWITCHES
- ✓ SIMPLICITY . . . ONLY 2 JACKS
- ✓ EASY-TO-READ, LARGE 4 COLOR SCALES
- ✓ 43 UNDUPLICATED RANGES
- ✓ MAGNETIC SHIELDING
- ✓ 3% DC, 4% AC PERMANENT ACCURACY

Accessories Available

GENUINE LEATHER CARRYING CASE \$5.95

PANEL MOUNTING ADAPTER \$1.50



\$39.95

"555" MULTIMETER
 complete with probes and batteries
 at your **PARTS DISTRIBUTOR**

PHAOSTRON COMPANY 151 PASADENA AVE., SOUTH PASADENA, CALIF. U.S.A.

the
Audio Console
control preamplifier-equalizer

Quality Designed by
marantz

Owners of the Marantz Audio Console invariably comment on the immediate improvement in sound quality of their systems. Such a fine instrument cannot be produced by the thousands, but only through careful assembly and thorough testing of each unit.

Naturally, its components are uncompromisingly chosen for superior quality. This and the character of its workmanship makes it the obvious choice for those who wish to improve their present installations. Chassis suitable for installation \$142.50, with cabinet \$155.00.

Write For Complete Details **s. b. marantz** 44-15 Vernon Blvd., L.I.C., New York

The card comes in sturdy cardboard and has a space in which to fit one of



the units. The set itself comes in red, ivory, black, or grey and adds an effective color note to the display.

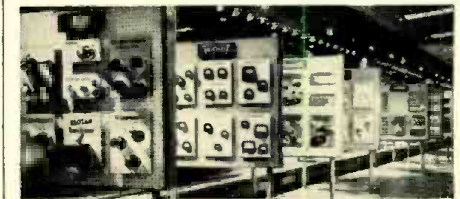
COUNSELING SERVICE

In a concerted drive to develop individual markets within distributorships through personal distributor counseling in advertising and sales promotion, *General Electric Company's* radio and television department in Syracuse, N. Y., has set up a series of round-table discussion meetings which will be attended by representatives of the company's distributors and by the department's district sales force.

Led by Marcus S. Chacona and Raymond Mann, advertising specialists, the information gathered at these meetings will be a strong factor in future cooperative advertising and sales promotion schedules. Each distributor will be shown a survey of his individual market area, including such information as national advertising circulation, primary and secondary newspaper coverage, radio and television listening areas, etc.

ALLIED'S "VISI-DEX"

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Illinois, has set up a unique visual index of its various electronic units in its huge Chicago showroom.



The items displayed are changed frequently, allowing customers to see and measure some of the 25,000 items in this distributor's stock.

PENTRON SALES AIDS

The Pentron Corporation, 777 South Tripp Avenue, Chicago 24, Ill., is backing up the sales effort behind its new "Monomatic" Model CT-1 tape recorder by making available a group of specially-planned sales aids.

Included in the group of sales aids are die-cut, 2-color counter cards and

RADIO & TELEVISION NEWS

TEST EQUIPMENT REPAIRED

Contractors to U. S. Government

Repairs and calibration by skilled craftsmen on all makes of Meters, Testers, Sig. Gens. V. T. V. M's, Scores. Our nineteenth year. Low Factory prices. Stock of Genuine parts. Prompt service. All work guaranteed. Write for estimate—or ship P.P. Ins. to:

DOUGLAS INSTRUMENT LABORATORY

Electronic Instrument Repairers

176 Norfolk Avenue Boston 19, Mass.

ENJOY 3 COLOR TELEVISION FILTER SCREEN NOW

Changes dull eye-straining black and white pictures into beautiful color tones. Seconds to attach. No tools used. Helps eliminate glare. Order direct. Send \$1 for screen size up to 16", \$1.25 size 17", \$1.50 size 20", \$2 size 21", \$2.50 size 24", \$3 size 27". We pay postage except on C.O.D. orders. Satisfaction guaranteed. Inquiries from dealers also welcomed.

Zingo Products, Johnstown 19, New York

STAN-BURN SPARKS

CATHODE RAY TUBE SPECIALS

One Year Guarantee		G. E.		STAN-BURN	
10BP4A	\$14.95	10BP4	\$10.20	10FP4A	21.10
12HP4A	24.45	12LP4	11.90	12FP4A	21.10
12LP4A	18.75	12QP4	13.95	12RP4A	21.10
12QP4A/B1014		12UP4	11.90	12RP4A/B1014	
Dumont	25.10	12UP4A	14.50	12RP4A/B1014	
12UP4B	34.25	14CP4	15.60	Dumont	26.75
14CP4	22.50	15DP4	17.50	16AP4A	34.25
15DP4/B1014		16KP4	17.50	16DP4A (N.U.)	25.25
Dumont	26.75	16QP4	17.50	16GP4A or B	33.25
16AP4A	34.25	16DP4 or A	17.50	16KP4/16RP4	24.20
16DP4A (N.U.)	25.25	16JP4 or A	17.50	16KP4A	
16GP4A or B	33.25	16CP4 or A	17.50	(Aluminum)	28.35
16KP4/16RP4	24.20	16FP4	17.50	16JP4A (N.U.)	27.95
16AP4A	34.25	16QP4	17.50	16LP4A	28.50
16DP4A (N.U.)	25.25	16RP4A	23.00	16WP4A	27.50
16GP4A or B	33.25	16EP4	19.00	16GP4B	30.75
16KP4/16RP4	24.20	16EP4A	23.50	17BP4A	27.50
16AP4A	34.25	16CP4 or A	21.00	17BP4B	29.75
16DP4A (N.U.)	25.25	17BP4	18.50	17CP4	29.95
16GP4A or B	33.25	17CP4A	21.60	17CP4B	
16KP4/16RP4	24.20	17CP4B	22.60	(Aluminum)	38.50
16AP4A	34.25	19FP4	23.00	19AP4A	39.75
16DP4A (N.U.)	25.25	19FP4A	24.00	20CP4	30.00
16GP4A or B	33.25	19AP4	23.90	20LP4	37.50
16KP4/16RP4	24.20	19AP4A	24.90	21AP4	30.75
16AP4A	34.25	20CP4	23.95	21EP4	31.80
16DP4A (N.U.)	25.25	21AP4	25.50	21EP4A	36.35
16GP4A or B	33.25	21AP4	26.50	24AP4A	89.75
16KP4/16RP4	24.20	24AP4	49.00		

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

AUTHORIZED DISTRIBUTORS for General Electric, Kenrad, Tung-Sol, National Union, De Wald, Regal, Automatic and General Motors.

CASCADE TUNERS—Long shaft.	\$15.95
BRAND NEW. While they last.....ea.	
WEBSTER CHANGER—Model 113 Flip-over cartridge	\$25.49
VM CHANGER—Model 950.	\$23.49
Special	ea.

REGAL 5-TUBE SUPERHET. RADIO

Modern styled cabinet. IVORY—\$14.25. **\$13.95**
RED & BLUE.

6 x 9 REAR SEAT SPEAKER KIT
Includes: 6x9 speaker, grille, mtg. screws, switch, bracket and wire. List \$9.95. **\$4.82**
SPECIAL

STAINLESS STEEL MOUNTS	
Z Type	\$1.29 ea.
Y type	\$1.49 ea.
3" WALL MOUNTS	.29 ea.
CHIT REPLY ENATOR	.65 ea.
72 OHM CO-AXIAL CABLE... 500' spool	14.75
CHEATER (OILDS)	.19 ea.
TUNER BELT for RCA	.19 ea.

Automatic Custom-Built Radios for Plymouth, Ford, Chevrolet and many others, always in stock.

We carry a Complete line of HI-FIDELITY and sound equipment. Send us your requests.

We also carry a complete line of popular makes of Radio Tubes at 50/10 discount. Also many other special Purpose and transmitting types, and all electronic parts and equipment at lowest prices. Send us a list of your requirements for prompt quotations. Terms: 20% with order. Balance C.O.D. All prices F.O.B. NEW YORK Warehouse. Minimum order \$5.00. Write for our latest price list and Hi-Fi catalog to Dept. RN-5.

STAN-BURN RADIO and ELECTRONICS CO.
1697 BROADWAY • NEW YORK 19, N.Y.

BEACON RECEIVER

BC-1206 CM—200-400 KC., Setchell Carlson, operates from 24-28 VDC, 5 Tubes, 135 KC IF—Size: 4" x 4" x 6". Boxed. **\$11.95** W/Man. NEW:



6 VDC VIBRATOR POWER SUPPLY

RCA MJ-8—6 VDC Input; output 275 VDC 80 MA w/024 Tube, 11 Ft. Batt. & Power Cable, Switch & Fused Line. 4 1/2" x 4" x 6". NEW: **\$7.95**

SELSYN

115 VOLT 60 CYCLE. Synchronous Transmitter C-78414. 5" x 3 1/2". Long Leads w/Bracket Removed from New Equip. **PAIR: \$15.00**

MAGNETRON MAGNET

HEAVY DUTY PM MAGNET—Approx. 2000 Gauss—5 1/2" x 7 1/2" x 2 3/8". 10 1/2 lbs. Removed from New Equip. **\$5.95**

ANTENNA EQUIPMENT MAST BASES—INSULATED:

MP-22 BASE—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 1 3/4" 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. Larger Diameter Section: MS-54. **@ 50¢ Each**

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/175 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/2 A; 5 V/2 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 #30728. **\$12.95**

Choke 12.5 H/100 MA. **\$1.95**
 Choke 12H/250 MA. 180 Ohm. **4.95**
 Choke 15 H/165 MA. 125 Ohm. **1.95**
 Choke 5 H/150 MA. 85 Ohm. **1.50**

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. **\$8.95** Price. USED:

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**

TRANSMITTER & AUTOMATIC KEYS

TRANSMITTER T-121—3.5-4 MC; 50 Watt Crystal Control MD. P.A. for CW. W/2.1625. 1/2516 Tubes & Crystal. Keyer consists of 24 VDC Keyer Ass'y. & Code Wheels. Size: 8 1/2" x 6 3/4" x 9 1/2" w/In-struction Book. NEW: **\$9.95**



ANTENNA RELAY UNIT

BC-442 consists of switching relay, 0-10 RF Indicator, & 50 MMF Vacuum Capacitor. NEW: **\$3.95**

COAXIAL CABLE & CONNECTORS

CD-1071 CORD—With PL-259 Plugs each end. 50 ohm coax 2 Ft. long. Prices: 50¢ Each—Or in Lots of 10 @ 50¢ Ea.
 PL-259—Plug. Ea. End & 32" RG-54/U—58 ohm. 50¢
 SO-239 Chassis Conn. 1/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 .06 1/2 .06**
 RG-34 71 Ohms—145 Ft. Length. **\$15.00 Per Leth.**

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. **\$29.95** less Tuning Units—Price. USED:

TUNING UNITS For BC-375 & BC-191:	NEW:	USED:
TU-5—1.5 MC to 3 MC.	\$5.95	\$4.95
TU-6—3 to 4.5 MC.	3.95	3.95
TU-7—4.5 to 6.2 MC.	3.95	2.95
TU-8—6.2 to 7 MC.	3.95	2.95
TU-9—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 Vener Lock Dial. 100 Watt Capacity. (Pictured at left.) Size: 7 1/2" x 3 1/2". USED: **\$9.95** UNIT with 0-8 RF Meter and Panel. (Removed from BC-375) USED: **\$12.95**

BLOWERS:

12/24 VDC-AC CAST ALUMINUM BLOWER—100 CFM: 3" intake; 2" outlet. Shunt Motor 4" x 2". 3000 RPM **\$5.95** @ 24 VDC.
 115 VAC 60 CYCLE SINGLE TYPE—100 CFM: 2 1/2" intake; 2" outlet. Complete Size: 5" x 6". No. 1C939. **\$8.95**

115 VAC 60 CYCLE DUAL TYPE—100 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; 4 1/2" intake; 3 1/2" x 3" Dis. Complete size: 4 1/4" W x 8 3/8" H x 8 3/8" D—No. 2C067. **\$14.50**

115 VAC 60 cycle FLANGE TYPE—140 CFM: 3 1/2" intake; 2 1/2" Dis. Complete size 7 1/2" W x 7 1/4" H x 6 3/4" D—No. 1C807. **\$13.95**

115 VAC 60 cycle FLANGE TWIN—275 CFM: 4 1/2" intake; 3 1/4" x 3" Dis. Complete size: 11 3/4" W x 8 3/8" 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: 4 1/2" x 3 1/2". No. 3110. **\$5.95**

115 VOLT 60 CYCLE BLOWERS:

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**

RT-34/APS-13—Transvr.—Comp. less Tubes..U: 3.95
 FL-8A Range Filter—\$1.40—FL-5 Filter.....U: 1.00
 TS-9 Carbon Hndset.—U: \$3.95—TS-13 Hndset..U: 6.95

BROADCAST BAND RECEIVER

NAVY/TYPE—520 to 1500 KC..NEW: **\$24.95**

NAVY TYPE REC.—1.5 to 3 MC. Less Tubes USED: **\$ 9.95**

NAVY/TYPE REC.—6 to 9 MC. Less Tubes USED: **3.00**

BC-455 REC.—6 to 9 MC. With Tubes USED: **4.95**

R-28/ARC-5 REC.—100 to 156 MC. With Tubes USED: **14.95**



BC-221 FREQUENCY CASE

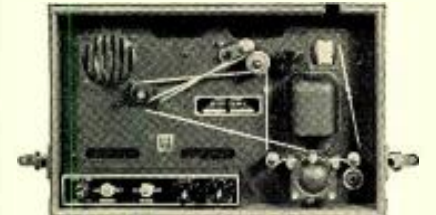


BC-221 FREQ. CASE—Aluminum Case for BC-221 or TS-164 Freq. METER—W/Voltage Regulator Supply using 1/V.R.105—2/Ballast Tubes, Relay, Cable, etc. Front Comp. 9 3/4" x 7 1/2" x 7 3/4". Rear Compartment 2" Deep. Shock-mounted. NEW: **\$5.95**

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	\$8.95
14	250	50	DM-25	6.95	
14	1000	350	BD-77	14.95	29.95
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	300	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

TG-34A KEYS NEW—\$16.95



TG-34A KEYS—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 10 1/2" x 15-13/16". Shipping weight: 45 lbs. NEW—While They Last— **\$16.95** ONLY

TG-10 KEYS—Same function as TG-34A described above—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 2 1/2" W x 18 1/2" D. Price—USED—TESTED.....Only **\$17.95**

METERS:

WESTON AC AMMETER: (Pictured) in portable leather case, with Test Leads. 2 1/2", 0-15 AC and 0-3 AC Scale. **\$5.95**
 DC AMMETER HOYT: In portable metal case, with Test Leads, 4 1/2" Fan. Mirrored Scale 0-15 ADC. **\$4.05**
 0-3 RF AMMETER IS-128; 2 1/2" Rd. NEW: **2.95**
 0-500 MICROAMMETER: TRIPLET, 2 1/2" Sq. **4.95**
 0-5 MA DC WESTINGHOUSE: 2 1/2" Sq. **3.95**
 DB METER: 10 to Plus 6—G. E.—3 1/2" Rd. **4.95**
 TS-291/U VOLTOHMETER. NEW: **7.95**
 0-8 Amp RF w/Thermocouple IS-89; 2 1/2" Rd. **4.95**
 0-15 AC-DC—2 1/2" Rd.; IS-122. **4.95**
 0-500 MA DC—2 1/2" Rd.; IS-22. **4.95**

CLASSIFIED

BC-459 Transmitter—7 to 9 MC. Used: **8.95**
 BC-645 Transceiver—Conv. 420 to 500 MC. New: **24.95**
 BC-654 Transceiver—3600 to 5800 KC. Used: **34.95**
 BC-705 Amplifier Batt. Op. 1 Tube—N: \$3.95; U: **1.95**
 R-1/ARR-1 Receiver—Conv. 2 of 6 Meters. New: **3.95**

FAIR RADIO SALES 132 SOUTH MAIN ST. LIMA, OHIO

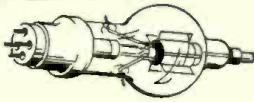
ARKAY WORLD'S FINEST KITS
 RADIOS PHONOGRAPHS TV TEST EQUIPMENT HI-FI
 Write for FREE Brochure
RADIO KITS, INC. • 120 Cedar St., N. Y. 6
 May, 1955

RADIO CONTROL YOUR MODEL PLANES BOATS CARS
 CUSTOM ONLY MIDGET **\$9.98**
 LICENSE FREE BAND OPERATES SAME AS 5500 SELS. INCLUDES LONG RANGE TRANSMITTER RADIO, RECEIVER RADIO AND CONTROL ACTUATOR ALL 3 EASY ASSEMBLY WITH OUR PARTS AND PLANS 39¢. PLANS ALONE \$1.
 RADIO MODELS BOX 36 DEPT. RT. BALTIMORE & MARYLAND
 DETAILED INFORMATION & RADIO CATALOGUE 20¢ SPECIAL "SUPPLY" SOURCE DIRECTORY & 1750 SUPPLY COUPON... **\$1.00**
 BOOK "RADIO CONTROL OF MODEL AIRCRAFT" CONTAINS 14 PLANS **\$3.95**
 RADIO CONTROL GARAGE DOOR **\$1.00**

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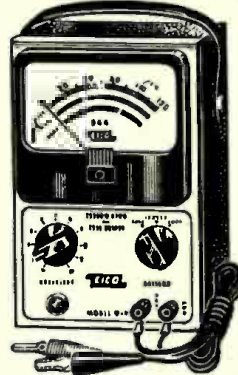
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window streamers, envelope stuffers, catalogue sheets, and advertising mats of all sizes. Theme of the sales literature ties in with the firm's national advertising theme, "So Simple to Operate".

Also offered is a plasticized counter display on hi-fi tape components and a new folder on the complete Pentron line. All of these items are described in a newly-released 4-page brochure entitled "Pentron Packs a Powerful Sales Punch," which is available from the company on request.

KRYLON SALES "TOOLS"

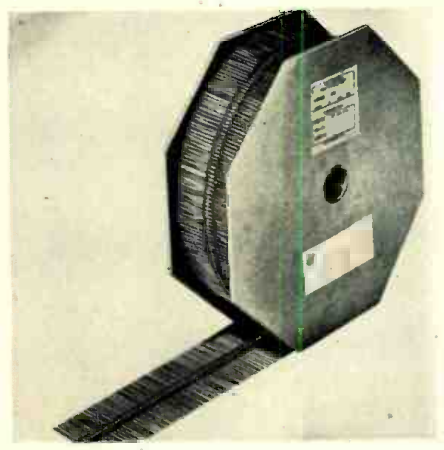
Krylon, Inc., 2038 Washington Avenue, Philadelphia 46, Pa., has introduced a distinctive and novel promotion manual for use by its field organization from coast-to-coast.

The covers of the manual are unique and unusual. The covers, wrapped in clear vinyl plastic, display the actual full-color catalogue sheets issued by the company. The covers are bordered with two-tone tan and brown.

The manuals themselves include data on the company, its products, pricing, advertising, merchandising aids, publicity, testimonials, bulletins, and reserve sections for the salesman's additions.

RESISTOR PACKAGING

A new method of packaging standard 1/2-watt, 1-watt, and 2-watt fixed resistors is now being offered by the



Allen-Bradley Co., 136 W. Greenfield Ave., Milwaukee 4, Wis., for chassis automatic assembly lines. Octagonal 12-in. reels are available. Each reel contains 5000 resistors of the 1/2-watt size, 2000 of the 1-watt size, or 1000 of the 2-watt units.

The resistors are attached to the adhesive surface of a pressure sensitive tape which adheres only to the body of the resistor and not to the leads. A 12-in. leader precedes the first resistor.

The reel, which is expendable, consists of a pair of octagonal corrugated board ends with metal bearings for use with 9/16-in. mandrels.

SOLDERING AIDS

CBS-Hytron of Danvers, Mass., has come up with two more ingenious tools for the service technician. The latest additions in its line of "by-and-for-

servicemen" tool program are two hexagonal-handled models of its original soldering aid.

One of these redesigned "hex" units has the original straight reamer tip while the second offers an angled tip for reaching into a close-packed chas-



sis. The new flat-sided handle gives the tool a firm grip and checks elusive rolling when it is set down. The fork tip is as versatile as a pair of tiny metal fingers and obviates fumbling with long-nose pliers. The spade-type reamer tip clears the lug hole of solder or pushes unwanted wires aside.

Both of these tools are available from the company's distributors, who also handle the other items in the tool program line.

MARS STATION IN FRANCE

NEAR La Rochelle, France is a busy MARS station which is providing a three-fold service to the military and civilian population. This station does three things, i.e., it keeps a channel open for military radio traffic in case of breakdown in land lines or in time of emergency; it allows standby operators and men working toward fulfilling their license requirements to practice sending in code; and it handles all types of morale messages for troops in the area.

In carrying out the third of these duties, MARS provides an excellent type of radio-telegraphic service for military personnel in Europe. Any number of "telegrams" may be set free of charge through their facilities to any place in the world. A soldier, dependent, or Department of the Army civilian has merely to contact the men affiliated with MARS to give them his message. They, in turn, send out all messages at a given time each day to the communications headquarters at Heidelberg, Germany, where they are relayed to Washington. From Washington the messages are sent to the military installation nearest the final destination where contact is established with a ham operator in the desired community and the information is dispatched to the address. The average time consumed in the delivery process from its initial transmission is 24 hours although there have been cases in which delivery has been made in 6 hours.

Officially the MARS equipment is government property and is maintained as such. However, men holding French amateur radio operators' permits are allowed to use the equipment for contacting other hams throughout the world when it is not being used for official business. Operators holding only American licenses are permitted to send only on MARS frequencies. The La Rochelle Amateur Radio Club, which numbers 18 American and 3 French members, works directly in conjunction with the MARS operation. This club, the only active one of its kind in France, provides facilities for licensed hams to keep their hand in and for newcomers to get the required practice for their licenses.



TG-34A CODE KEYS

Self-contained automatic unit, reproduces code practice signals recorded on paper tape. By use of built-in speaker, provides code-practice signals to one or more persons at speeds from 5 to 25 WPM. **BRAND NEW, in original carton... \$16.88**

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New... \$2.45

Model	Description	Excellent Used	BRAND NEW
HS-23	High Impedance	\$2.25	\$4.35
HS-33	Low Impedance	1.79	4.65
HS-30	Low Imp. (featherwt.)	1.49	1.85
H-16 U	High Imp. (2 units)	2.75	7.95
CD-307A	cords, with FLS Plug and JK26 Jack		.88

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Four Band. 105 to 9050 kc. Low Freq. Ship. Broadcast-40 and 80 meters. Includes tubes and dynamotor for 24 volt operation. Easily converted for 110 V., 12 V. or 6 V. Schematic included. Excellent Condition. Overall: 8 1/4" x 7 1/4" x 15 1/4". Wt. 30 lbs. Special **\$18.65**

Model	Description	Excellent Used	BRAND NEW
T-17	Carbon Hand Mike	\$5.45	\$7.95
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T-25	Navy Lip Mike	1.25	1.25
RS-8	Navy Type	1.95	5.95
T-24	Carbon Mike		3.95

FAMOUS BC-645 XMITTER-RECEIVER

Makes wonderful mobile rig for 420-500 Mc. Easy to convert for phone or CW 2-way communication. **CONVERTS TO N. D. I. A. GRAM INCLUDED.** This swell rig originally cost over \$1000—yours for practically a song! You get it all in original factory carton. **BRAND NEW, complete with 17 tubes, less power supply. Shpg. wt. 25 lbs. \$29.50**
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CONVERSION BOOKLET, instructions for most useful surplus rigs. \$2.50

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Type	Description	USED	Excellent USED	BRAND NEW
BC-946	520 to 1500 Kc. Broadcast Revr., Incl. Tubes	\$14.95	\$16.95	\$29.50
BC-453	Revr. 100-550 Kc.	8.25	9.95	24.50
BC-454	Revr. 3-6 Mc.	6.75	8.95	17.50
BC-455	Revr. 6-9 Mc.	6.75	8.95	12.45
BC-456	Modulator		2.75	4.65
BC-457	Xmitr. 4-5.3 Mc.	11.95	14.50	16.95
BC-458	Xmitr. 5.3-7 Mc.	7.95	9.75	17.95
BC-459	Xmitr. 7-9.1 Mc.	11.95	12.95	19.95
BC-450	3-Rev. Control Box		1.49	1.95
BC-451	Xmitr. Control Box		1.79	2.95
3-Receiver Rack			1.25	1.49
2-Transmitter Rack			1.79	3.25
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Type	Input	Output	Excellent Used	BRAND NEW
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DM-36	28V 1.4A	220V .080A	9.95	
DM-37	25.5V 9.2A	625V .225A	12.95	
DM-28	28V	224V .07A	1.95	4.95
DM-53A	28V 1.4A	220V .080A	2.95	6.95
DM-33A	28V 5A	575V .16A	1.95	3.95
	28V 7A	540V .25A		

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Complete with 5 tubes. Tunes 195 KC to 420 KC. 1 F Frequency—135 KC. Receiver Sensitivity—3 Microvolts for 10 Milliwatts output. Output Impedance—300 Ohms and 400 Ohms. Volume Control—RF Gain Control. Power Supply—24-28 Volts Aero-plane Battery. Current—75 Amperes. **BRAND NEW, with Tubes... \$995**
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OSCILLATOR. Complete with two 955 tubes and cavity. **BRAND NEW, in metal housing 9 3/4" x 6 3/4" x 7" hrb. OUR LOW PRICE... each \$3.99**

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3 Amp. Hour. **BRAND NEW, 3 3/4" x 1 1/2" x 2 3/4" Uses Standard Electrolyte... Only \$1.85**

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TU-10	10 to 12.5 Mc.	2.95 2.25
BC-306	Antenna Tuner	3.45 2.45

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Hi-Fi Amplifier (Continued from page 63)

flat setting using normal tolerance parts, (2) distortion difficulties because of high driver-tube voltage levels, and (3) intermediate treble curves have shelving actions.

Some of these difficulties can be overcome by using similar circuitry in a feedback configuration. Here, however, problems of instability are introduced with the shelving action still evident in one form or another.

A recent circuit with unity gain² eliminates the first two difficulties mentioned. The problem of shelving can be avoided by proper choice of a resistor inserted between the treble control tap and ground. The Sherwood design uses 47,000 ohms.

The response with the controls in the flat positions is $\pm 1/2$ db or better. The controls' rotational positions for this response, in addition to being marked, are well defined due to a flat portion in the resistance element curve at the middle of the controls' range.

Following the tone controls is the loudness control. Its exact circuit position was determined as the best compromise between a too-high level position, which is free from hum pickup problems but subject to early stage overloading, and a too-low level position with the difficulties of hum and noise amplification.

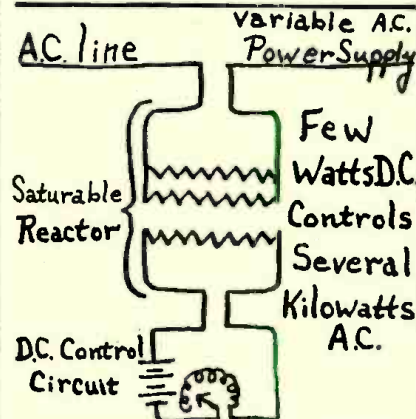
Although loudness controls with continuously variable compensation based on Fletcher-Munson curves^{3,4} are quite familiar to the audio engineer, the less-informed high-fidelity user frequently condemns their operation, requesting that a loudness compensation "in-out" switch be provided to restore the action to that of a foolproof volume control. This user's difficulty arises from his usage habits with the conventional volume controls found on commercial radio and television sets. Here, the normal listening level is almost always obtained with the volume control near the "12 o'clock" or center position. A similar position on a typical loudness control results in as much as 15 db bass compensation, which is only desirable for low-level listening. Therefore, the user having his loudness control adjusted at 12 o'clock for normal listening, immediately complains of excessive bass compensation and loses faith in loudness controls. On the other hand, a flat or uncompensated level is usually available only near the full clockwise position. Controls thus adjusted, lack that extra reserve of gain which enables the user to show off his powerful amplifier's performance without disturbing preset level adjustments.

The loudness-control designer, desirous of overcoming these difficulties, is immediately confronted with a manufacturing problem. In order to have the loudness compensation introduced at a more counterclockwise position, he requires the control to be supplied

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Variable AC Power Supply

Some uses include furnace temperature control, motor speed control, theatre light dimming, etc. GKVA GE Saturable Reactor, size 22" x 10" x 8", net wt. 200 lbs. \$250 value. Only \$80 or \$40 in lots of 20.

G. E. SATURABLE REACTORS

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1.0	460/230	230/115	12.50
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2.5	430	100	25.00
4.0	460	100/82/50	45.00
8	230/115	274/8	150.00

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AMPS	VOLTS	PH	PRICE
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FG32 GE Mercury Vajor Rectifier List	\$14.00
Special	4.98

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with taps lower than the standard 37% and 62% rotation. At this time, no control has been made available in the highly mass-produced $\frac{15}{16}$ in. diameter size with other than these standard taps. *Centralab*, however, now supplies its premium Model A ($1\frac{1}{16}$ in. dia.) control with special taps at 19% and 40% rotation. In addition, the advantages of its low-noise, long-life construction, made possible by a non-rubbing contact design, are "extra" benefits in the amplifier design.

The compensation curves obtained with this control are shown in Fig. 1. Note particularly the reserve +10 db range with no compensation above the 0 db reference level (normal loud listening). All compensation is completely removed (without change in level) for conventional volume control operation by means of a d.p.d.t. switch. To reduce the number of operating knobs, this switch was ganged with the power "off-on" switch.

One might ask whether the flat response settings of the control (see Fig. 1) do not violate the commonly accepted Fletcher-Munson loudness contours. On the contrary, they follow closely the equal-loudness contours for levels of 90 phons, and above, which are practically flat; thus offering a range of compensated loudness control operation complete from below 40 to 100 phons.

A 12AX7 27 db-gain stage follows the loudness control. Its cathode resistor is returned to ground through a $\frac{1}{2}$ ohm resistor (2 inches of 0.75 ohm/ft. resistance wire) which is also in series with the output transformer's secondary ground return. Depending on the polarities of this connection (determined by the damping-factor selector switch), positive or negative current feedback from the speaker output is added to the voltage feedback around the power amplifier. With no current feedback (switch in center position), the amplifier has a damping factor of 7. This means a speaker connected to the 16-ohm terminal sees a 16/7-ohm source impedance. If the damping selector is switched to its "-2" damping position, current feedback is applied with the result that the speaker is driven by a minus 16/2 or minus 8-ohm source. This increased damping condition is frequently necessary with otherwise underdamped speaker systems to reduce transient bass hangover and distortion.

For already well-damped speakers, it might be preferable to use the "+7" or "+2" damping positions. Details of variable speaker damping have been covered in several articles.^{5,6,7}

The output of the 12AX7 feeds through a double RC high-pass filter network (R_{39} , R_{20} , C_{23} , C_{23}). This network was designed to attenuate 27 cps (the most frequently-encountered phono turntable motor "rumble" frequency) by 12 db. The double RC frequency curve rises rapidly (see Fig. 2) so that bass notes of 100 cps are down only $1\frac{1}{2}$ db. A typical bass tone control curve with this attenuation at

May, 1955

TEMPERATURE HIGH? HUMIDITY LOW?



TRY THE TAPE TEST

Make this simple test on the VTVM you're using now. Take a strip of plastic electric tape... press it firmly over the meter face... then pull it off with one quick, sharp tug. Notice that meter deflection? Notice how long it takes to re-zero?

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100 cps would only be down 5 db at 27 cps. Conversely, a bass curve attenuating 27 cps by 12 db would still be down 8 db at 100 cps. From this, one can see the importance of having available such a special filter. Obviously, even the best bass tone control is not designed to handle this special turntable rumble situation.

On the other hand, the bass control's characteristics combine nicely with that of the rumble filter to give varying frequency turnovers to the sharp low-frequency filtering as shown in Fig. 2. Although the turntable rumble frequency is not always evident with less-effective loudspeaker systems, its presence still might drive a woofer into non-linear operating regions. The effectiveness of this filter, in this case, is in removing speaker IM distortion. A simple front-panel s.p.s.t. switch shorts out the filter for normal flat operation. Note the 10 megohm "click"-removing resistor, R_{cs} .

In the power amplifier, virtues of the ultra-linear, push-pull output were utilized in obtaining 20 watts (at output tube grid current point) with either 6L6GA's or the newer 6L6GB's. The latter tubes allow more compact design and offer the advantages of the more modern button-stem construction.

The output pair is driven by a d.c.-coupled, split-load phase inverter, popularized by Williamson. Used in

this stage is the new 12AU7A tube which features low-microphonic construction similar to that introduced in the premium 12AY7 tube.

The 14 db of inverse voltage feedback around this 3-tube system reduces the intermodulation distortion (60 cps:7 kc./4:1) to less than 1% at 10 watts while still maintaining a wide stability margin for use where the speaker load impedance happens to be capacitive.

The performance and flexibility found in a complete unit of this type was unheard of just a few years ago. Combining uncomplicated circuitry and simplicity of controls with complete versatility and excellent response—all in one compact unit—represents another step forward for the high fidelity enthusiast.

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HIGH-EFFICIENCY, LOW-POWER AUDIO STAGE

By LAWRENCE FLEMING

MOBILE receivers and intercoms are among the items that require only 1/3-watt or so of audio output to the speaker, but where high gain and low power drain are important. A quarter of a watt of audio is actually enough for a living room, except for peaks, where the listening is at ordinary conversational levels.

Regular power pentodes like the 6AQ5 require a lot of plate power, and their power sensitivity is not particularly high because they were designed primarily for high output. The most sensitive power pentode, the 6BK5, gets its high gain by using a large cathode, and the heater alone draws 7.5 watts. To get high sensitivity at low power input, what is needed is a tube having high transconductance per ma. of plate current, and a reasonable-sized heater. Voltage amplifier pentodes, such as the 6AU6, fill these requirements.

It turns out that a 6AU6 makes a junior-sized output tube that is more sensitive than any except the 6BK5, and at a fraction of the power drain on the supply. It has, moreover, a much higher power sensitivity per watt of drain from the supply than any of the audio power pentodes.

Fig. 1 shows a typical circuit. The load impedance should be about 20,000 ohms. Changing it to 15,000 or 25,000 ohms will not make much difference. A good output transformer is one rated for battery-type power tubes, such as the Stancor A3327 or Knight 62G94.

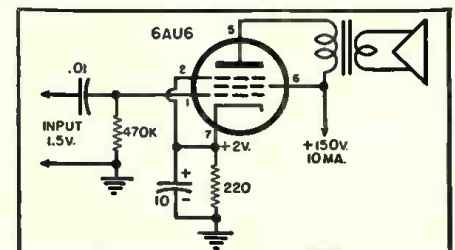
If the plate supply voltage is higher than 150, use a dropping resistor in series with the screen of the 6AU6 and bypass the screen to the cathode with a 10 μ fd., 150-volt electrolytic, otherwise the

screen will overheat. For a 300-volt supply, the correct resistance is 56,000 ohms and for a 250-volt supply, 33,000 ohms. For all supply voltages the 220-ohm cathode resistor is best, and the plate and screen currents are 7 and 3 ma. respectively.

At 1.5 volts audio input, the 6AU6 so used will put out 360 milliwatts of audio. In comparison, a 6AS5 at the same 1.5 volt signal supplies only 140 milliwatts and a 6AK6 only 65 milliwatts. With a 300-volt supply and the necessary screen dropping resistor, 6AU6 output is about 500 milliwatts at overload.

While many other small pentode types such as the 6CB6 and 6AH6 have even higher transconductance per ma., they are not satisfactory for class A power service because their screen current rises too high during large signals. In general the operating conditions for maximum power output in class A are low grid bias together with the highest screen voltage permissible within the rating of the tube.

Fig. 1. The high-efficiency, sensitive audio output stage for intercoms and mobile gear. Output is .36 watt with 1.5 volts input and only 10 milliamperes power drain.



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RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

THIS month, we would like to present information about the programs drawn up by various representative TV and radio service associations. An excellent idea of the problems facing the service technician and dealer can be obtained from these programs since their purpose is to aid the association membership to overcome their problems.

NATESA

The goal of NATESA in the coming months will be the improvement of consumer relations as fast as possible. Too many set owners have vague ideas of what is honest service. They have not been told that the set they purchased will require regular maintenance, or that parts not only break down, but wear out with use, just as the tires on their car. Too few set owners know what constitutes a legitimate service call or shop job fee, so they fall prey to phony advertisers. Therefore, they condemn all service people.

Since these problems hinge upon education of set owners, NATESA's aim will be to expedite its consumer relations activity. Already, occupational standards have been created and these will be expanded based, largely, on industry standards. NATESA will set up a system for guaranteeing its members' work. Advertising and other media will be used.

Another serious loss of revenue independent service is suffering is through wholesale sales to retail customers. Trial runs are now in process on an idea which may prove conclusively the fallacy of such sales activity.

To achieve their plans, a drive is in progress to bring into NATESA every local and regional association not yet affiliated. NATESA invites all service people to attend and take part in the next Radio-TV Service Industry Convention and Show in Chicago from August 19 through the 21st.

ARTS

In considering a program of action for the Associated Radio & TV Servicemen of Chicago, its Executive Committee has taken into consideration several things. The ARTS is a young association and has, so to speak, weathered its infancy and come of age. They feel that they have found so many things crying to be remedied that it is hard to determine which should come first. Consequently, the plans which the group contemplate stretch beyond the limits of the next several months. to be outlined and put to work on a more or less long-range basis.

One of the first things that has been undertaken is a program of lectures on color. The splendid cooperation of the manufacturers of color TV sets and equipment made these lectures possible. The lectures made quite an impression on those technicians who attended and caused them to inquire about the group's aims and policies. This has indicated to the officers that these lectures are a needed service. Given the chance, they will draw technicians together.

The next series of lectures, to be presented next Fall and Winter, will be on subjects related more to business operation than to technical material.

The next major undertaking which is now being put into action is the organization's fight against "jobber back door selling." The Association last year adopted a resolution defining its stand with respect to this evil. The ARTS policy is to let technicians know that there is a strong group which is fighting this practice.

Another matter brought to the attention of the ARTS is the apparent lack of respect with which the average technician regards himself and his work. The ARTS officers plan a campaign that can best be described as "Serviceman, don't sell yourself short." The goal is to get service businessmen to respect their knowledge and work and place a value on themselves, so that they will begin to demand and get the respect from the general public.

TSA

TSA of Michigan has grown from a small group of fifteen to over one hundred select members and associates in four years' time.

In May of 1952, the TSA was confronted by a multitude of problems—mainly those of malpractices, fly-by-night tactics, and general incompetence. At that time a joint committee with various civic groups and law enforcement agencies was formed to unify the efforts for curing the evils in the TV servicing field. This affiliation and unification of thinking made an ideal union. The association engaged in a series of policing activities which resulted in a thorough analysis of the advertising methods and operational characteristics of television service companies detrimental to the television profession.

A bait advertising ordinance was an outgrowth of the investigation, and it was made a city ordinance in 1954. The TSA and the governing body of Detroit felt that this ordinance was a stop-gap since theoretically, its application could remove the "foot in the door." However, it became apparent that in order to make this law effective, every form of advertising had to be scrutinized, its gimmick determined, and then proceedings begun for conviction.

The TSA, in addition to this activity, promulgated many educational programs in conjunction with manufacturers and industrial groups. The relationship between all civic groups and the Association has resulted in many progressive programs—such as the promotion of the u.h.f. channel for the Detroit Board of Education.

Although the TSA in the past has fought all forms of licensing legislation, they now believe that existing laws cannot curtail unethical practices which are on the increase. The TSA in a unanimous vote decided in favor of a licensing ordinance. This ordinance was drawn up by a TSA committee and presented to the legislative body of Detroit for evaluation.

TRA

As the result of several months of planning and meetings, the Television Radio Association of Alameda County, Incorporated, of California, has developed a working organization. From all indications, the problems of the television servicing businesses in California seem to be the same as those in New York City or Timbuktu.

Probably the most serious questions

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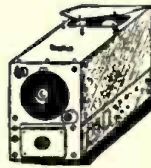
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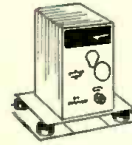


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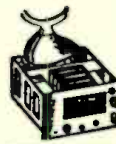


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Now it's easy to save thousands of weak and inoperative TV picture tubes. As much as 80% of the troubles which arise in picture tubes may easily be repaired with the CRT. This amazing portable instrument creates new profitable picture tube repair business. Saves servicing time, speeds work. Assures more satisfied customers. Eliminates tube transportation. Saves money on trade-in reconditioning. And at such low cost, the CRT quickly pays for itself—and continues to make big profits for TV service-dealers.

See Your Distributor, or
Write for Bulletin No. 102-N

TESTS and REPAIRS TV PICTURE TUBES

Amazing
Low Price **\$54⁹⁵** NET

No extra accessories necessary



CATHODE REJUVENATOR TESTER

DOES ALL THIS

TESTS FOR Emission,
Inter-Element Shorts,
Leakage, Open Circuits,
Grid Cut-Off, Gas Content,
Probable Useful Life

RESTORES Emission
and Brightness

REMOVES Shorts

REPAIRS Open Circuits

Less than one foot long.
Weighs only five pounds.

B&K MFG. CO. 3731 N. Southport • Chicago 13, Illinois

USED RECORDING TAPE (PLASTIC BASE)

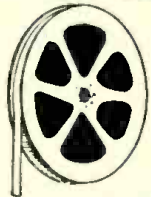
ATTENTION: Radio Stations, electronic calculators, industrial users: We have the new 1½ or 2 mil mylar, "Sound-Plate," "lifetime," or "H.O." tapes and we will buy or exchange your present

1 mil mylar or plastic tapes.
1.79 for 7"—1200 foot
.99 for 5"—600 foot
.59 for 4"—300 foot
.29 for 3"—150 foot

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USED "MYLAR" TAPE (1 Mil)

1800 ft. (7" reel) . . . 2.99



New empty plastic reels in boxes for easy labeling. 3" 10c; 4" 22c 5" 24c; 7" Professional reel (2¼" hub) 29c ea. **EMPTY BOXES:** 3" 3c; 4" 5" 7" 5c ea.

We carry all brands of new tape, recording blanks, tape recorders, etc., at low prices. PLEASE INCLUDE SUFFICIENT POSTAGE.

SEND FOR NEW PRICE SHEET

COMMISSIONED ELECTRONICS CO.
2503 Champlain St. N.W. Washington 9, D. C.

NEW ELECTRONIC GARAGE DOOR OPERATOR



Now you can install your own electronic garage door operator—and save over half the cost. The Bellford-Matic is precision engineered with a ¼ h.p. Westinghouse motor, Cutler-Hammer relays and other top quality components and is sold on a money-back guarantee. Post Controlled Unit—Complete assembly kit \$69.00. Post Controlled Unit—Factory assembled, ready to install \$89.00. Radio Controlled Unit—Factory assembled includes transmitter, receiver, operator and controls, ready to install \$139.00. All prices F.O.B. Factory. Write for complete folder. Dealer inquiries invited.

BELLFORD-MATIC, INC.

Dept. R, Maurice Ave., Cleveland 27, Ohio



demanding settlement are those of bait advertising, and the tube puller and backyard mechanic. To combat this competition the Association is making available to its members inexpensive, cooperative advertising material for direct mail. Membership identification cards are available, to be followed by newspaper advertising requesting customers to ask for the cards. Group insurance will be offered soon, to cover shop owners, their families, and all employees. Financing arrangements are being worked out to finance shop repair jobs—the plan being considered permits the shop to arrange all details without the customer going to a finance company office to sign papers and give credit information.

As for Association activity itself, the program for 1955 is quite ambitious. Currently, in cooperation with the Better Business Bureau, a new Code of Ethics is being written and will be presented to the industry as a whole during the next few weeks. The new code is aimed primarily at bait advertisers and junk displays seen in the daily papers. A \$5.00 service charge was deemed fair by the Better Business Bureau and anything under that amount would be considered bait advertising.

The Association is also busily compiling as much data as possible on licensing, including what has been done in other parts of the country. From this information, a licensing bill will be drawn and held ready for presentation to the State Legislature if conditions warrant such action. However, it is felt that licensing, with all the ramifications and policing problems in a large state such as California, should be the last resort.

LIETA

Last Fall, the Long Island Electronic Technicians Association presented its members to the public in a booth at the Mineola Fair, and a month later in a booth at a local home-furnishings show. It was so successful that LIETA plans to participate in more and more of them.

The LIETA also aims to enlarge their community service program of providing television and radio service free to hospitals and some shut-ins. This program has gained for them an excellent press relationship with the leading papers on Long Island. They are also enlarging their lecture program in Nassau County and are striving to set up a standard price structure.

This association also tests bench equipment, instruments, and tools and grants a "LIETA Seal of Approval" to equipment they think is superior. The LIETA employment exchange helps its members find the right man for their job openings.

In our attempts to bring our service readers up-to-date on the events in their field, this column has reported on the activities of five service associations. More news on association

activities and plans for the future will be presented in forthcoming issues of this magazine.

We wish to thank Frank Moch, President, National Alliance of Television and Electronic Service Associations; Howard Wolfson, Chairman, Associated Radio and Television Servicemen of Chicago; Harold Chase, Television Service Association of Michigan; Ernest S. Copley, Television-Radio Association of Alameda County; and Harold F. McFarland, Long Island Electronics Technicians Association for their valuable contributions to this column. —50—

OVER 7.1 MILLION TV SETS SHIPPED TO DEALERS IN 1954

THE Radio-Electronics-Television Manufacturers Association reported that over 7.1 million television receivers were shipped to dealers during 1954, an increase of nearly half a million from 1953. The actual figure was 7,161,362 as against 6,704,193 TV sets shipped in 1953. The table below shows TV set shipments to dealers by states for the year 1954.

STATE	TOTAL	STATE	TOTAL
Alabama	108,829	New Jersey	202,155
Arizona	34,985	New York	24,487
Arkansas	92,192	New York	653,852
California	517,935	North Carolina	176,317
Colorado	59,352	North Dakota	34,858
Connecticut	95,560	Ohio	356,009
Delaware	15,960	Oklahoma	102,161
D. C.	47,895	Oregon	84,913
Florida	216,286	Pennsylvania	465,785
Georgia	160,606	Rhode Island	24,356
Idaho	41,679	South Carolina	99,891
Illinois	439,127	South Dakota	24,409
Indiana	216,884	Tennessee	152,683
Iowa	157,285	Texas	379,646
Kansas	119,186	Utah	27,850
Kentucky	94,038	Vermont	26,324
Louisiana	146,149	Virginia	122,330
Maine	92,954	Washington	126,418
Maryland	85,703	West Virginia	80,735
Massachusetts	190,475	Wisconsin	191,612
Michigan	295,771	Wyoming	8,088
Minnesota	145,082	U. S. TOTAL	7,147,953
Mississippi	59,239	Alaska	3,166
Missouri	204,599	Hawaii	10,243
Montana	26,588		
Nebraska	75,443	GRAND TOTAL	7,161,362
Nevada	8,596		
New Hampshire	34,876		

CATHODE-RAY TUBE SALES SET NEW MARK

A NEW record for the sale of cathode-ray tubes was set during 1954 when 9,913,504 units worth \$209,182,344 were sold by manufacturers, according to a RETMA report. This compares with 9,839,138 tubes valued at \$234,861,041 sold in 1953. Receiving tube sales in 1954 were down from 1953 with the 1954 figures 385,089,458 for a worth of \$275,998,903 as compared with 437,091,555 tubes valued at \$303,675,313 sold in 1953.

TV RETAIL SALES ESTABLISH A RECORD

RETAIL sales of television receivers in 1954 increased by nearly 1 million units from the level of 1953 to establish a new high, according to the RETMA. Some 7,317,034 TV receivers were sold at retail compared with 6,370,571 sets in 1953. Retail sales of radios, excluding automobile receivers, totaled 6,430,743 units as compared with 7,031,293 sets sold in 1953. An additional 4.1 million automobile radios were manufactured during the year. Most of these receivers are sold direct to auto manufacturers for installation in new cars. —50—

May, 1955

SENSATIONAL SAVINGS AT AIREX

Airex's New Auto-Focus 30-Tube 1955 Channeloc 630FA4

ACCLAIMED BY THOUSANDS AS THE WORLD'S FINEST TV RECEIVER

• Up to 200 Miles Reception • Hi Gain Cascade Tuner • 4 Microvolt Sensitivity

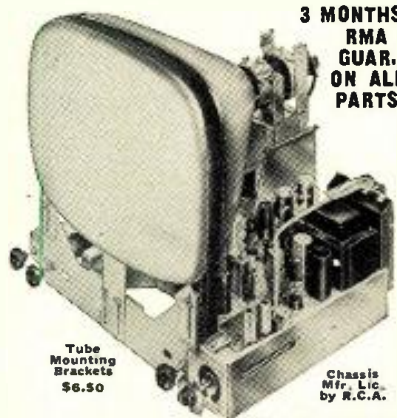
The Perfect Chassis for Fringe Areas
New Exclusive Advancements

• Pictures always in focus • Hi & Low sync. Amplifier • Channeloc—Locks picture & sound together • Drift free operation • Automatic Freq. control • Gated A.G.C. • Full 4 MC Picture Bandwidth • Phono connection & Switch • Efficient Retrace Blanking • Automatic Brightness Control • Full Focus Cosine Yoke • Fused HV Power Supply • Molded Plastic condensers • 6CB6 Tubes in Video I.F. • Handles up to 24" Rnd • Improved Sync System • Autoformer Fly Back • Improved Video amplification • Heavy Duty Power Transformer • Improved Horizontal sweep • Full range 12" Loudspeaker • 4 Microvolt Sensitivity • Ready for UHF Stations • Size 22" x 22" x 24" with 21" tube mounted.

\$149⁹⁵

With 12" Hi-Fi RCA Speaker, Less CR Tube & Brackets

Detailed Service Manual & Schematic \$1.00



3 MONTHS RMA GUAR. ON ALL PARTS

Tube Mounting Brackets \$6.50

Chassis Mfr. Lic. by R.C.A.

Sensational Cabinet Bargain FOR 630 CHASSIS



Beautiful lustrous hand rubbed, mahogany finished cabinet for 21" tube size. Price includes mask, glass & wood mounting brackets. Brochure available. Mahogany finish \$49.95
Blond Mah. finish \$59.95
For 24" & 27" tubes Mahogany finish \$74.95
Blond Mah. finish \$84.95

Combination Saving
FA-4 Chassis 21" Tube Mah. Cons. Cabinet. **\$224⁹⁵**

Plastic Masks
20" and 21" \$ 7.95
24" \$14.95
27" \$17.95

630-9 TV Chassis for 24" & 27" Tube

• Channeloc—Picture & sound locked together • No drift • Reception up to 200 miles • 90 degree deflection • 22 KV high voltage power supply • For 24" & 27" rect. tubes • Phono connection & switch on chassis • Adaptable for color • RMA guarantee.

\$179⁹⁵ With 12" Hi-Fi RCA Speaker

Tube Mtg. Brackets \$9.95

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Nationally Known Brands. Aluminized TV Tubes.



New. Full 1 Year Guarantee.
• 21" Tube \$34.95
• 24" Tube Rect. \$39.95
• 27" Tube Rect. \$74.95

Send For Hi-Fidelity Parts Catalog

New OGYRO Invisible TV Antenna

This twin dipole antenna is invisible when installed. Full dipole efficiency assures excellent results. Eliminates unsightly rabbit ears and roof antennas in most locations. Uses patented Ceroc wire for invisibility. **\$1.00**

SENSATIONAL TV TUNER SALE

Here is your chance to get in on a special purchase of NEW TURRET TV TUNERS. Because of this low, low price, we can't give the mfr's name. Complete with 6J6 and 6AG5 tubes. Built-in wave trap, removable channel strips, positive click stop. Shaft length 2 1/4". For 21 MC IF circuit. An ideal replacement for all sets . . . \$7.95 each Lots of 3 **\$6.95**



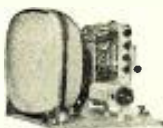
CUSTOM MADE 10 WATT HI-FI AMPLIFIER

Here is the perfect amplifier for a budget installation. Push-pull 6V6 output tubes, 6SC7 pre-amp for reluctance cartridges. 6SL7 phase inverter and 6X5 rect. Power output 10 watts. Less than 1% distortion. Frequency range 20-20,000 cps ± 1 db. Separate base and treble control. 4, 8, 16 OHM output taps. Size 9x7x5" **\$24.95**

Nationally Known Recording Tape
7" reel, 1250 ft., red oxide base. Lots of 12. . . \$1.59
In lots of 3 1.75
LP 7" reel (1800 ft.) Mylar Tape .001—\$4.79

EASY-TO-BUILD TV KIT

Here is your opportunity to make a television set at an unbelievable low price. New Vertical chassis design saves 50% space requirements of conventional sets. Complete with 14 tubes, all parts, step-by-step instruction manual, large wall mounting diagrams. Free factory service department at your disposal. Send today for your TV kit. Knowledge of television is not necessary. Cabinets available. Illustrated folder. **79⁹⁵** LESS CRT.



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Model 140 Webster with the new turnover Ronette hi-fi cartridge & 2 sapphire stylus. Automatic shut-off feature. WEBSTER WITH G.E. RPX050 RELUCTANCE CART. **\$29⁹⁵** HEAVY DUTY 4-POLE MOTOR

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One of the finest British changers made. Automatic shut off. Weighted turntable. 4 pole motor. Complete with 2 plug-in heads. 45 RPM Spindle for Garrard Changers. **\$2.75**

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Type GE RPX050

Reluctance triple play cartridge complete with dual sapphire needles. An excellent replacement cartridge for all types of changers and pickups.

RECORD CHANGER BASES & BOARDS
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12" COAXIAL SPEAKER
12 watt output. 35 to 15,000 cps response +6 db —8 ohm impedance. Crossover—2000 cps. 6.9 oz. Alnico 5 Magnet in woofer. 5" tweeter reproduces the highest of notes with utmost clarity. Aluminum moisture-proof voice coils for better heat dissipation. **\$12.95**



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CATHODE FOLLOWER

By RICHARD C. SAUNDERS

MOST r.f. signal generators are provided with a 400-cycle audio oscillator to modulate the r.f. signal, with a separate output also provided for audio output.

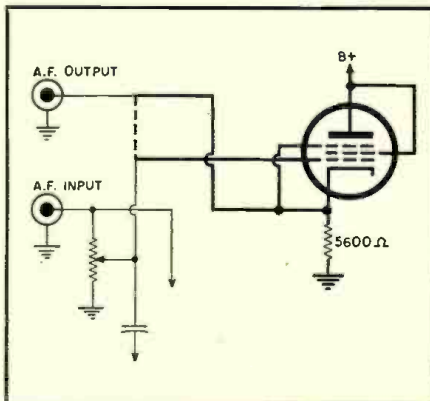
However, this audio signal is often too weak for many applications such as distortion, impedance, and inductance measurements. A simple method of improving the signal output is to provide a cathode follower stage in the output circuit.

The accompanying diagram shows a simple circuit which requires a minimum of parts, yet is quite efficient in operation. There are a number of tubes which may be used for this purpose, such as a 6C4, a triode-connected 6AU6, etc. If space is not at a premium, some of the larger GT tubes may also be used.

In the circuit shown, using a triode-connected 6AU6, an output of approximately 3 volts may be obtained, whereas previous to the addition of the stage, the output of the audio oscillator alone would barely deflect a voltmeter.

The power requirements for the additional stage are small, and may be obtained directly from the signal generator power supply in most cases.

The cathode-follower output stage (shown in heavy lines) has been added to a Heath-kit SG-8 r.f. signal generator. The dotted line indicates the only circuit change in the generator. The only parts required are tube, socket, and 5600 ohm resistor.



**NOW! ONE TUBE TESTER TESTS BOTH!
MUTUAL CONDUCTANCE
AND EMISSION!**

Precise Model 111



NEW

Tests Tubes Under Actual Operating Conditions
At a record low price
Model 111K (in Kit)

\$69.95

Factory Wired
Model 111W
\$139.95

Never before a single tube tester like the revolutionary Precise 111. It gives you the right answer on tube performance based on more than one tube application. Roll chart shows the most important single test—mutual conductance or emission, or both as required. (Ordinary testers check tubes only one way.) Also, fast check for series string filament tubes. Filament currents and bias voltage are read directly on meter while tube is being tested. Ten switches for checking each tube element individually. Simple to use, tests all modern tubes. Sets up easily for testing even new tubes as developed. Rugged steel cabinet. Portable. Order 111K (Kit form) \$69.95. Model 111W (factory wired) \$139.95. Tests CRT with CRT adaptor PTA, \$2.95 in Kit, or PTA-W (factory wired) \$2.45. Satisfaction guaranteed.

We carry complete Precise line.

NEW! 10 Watt Hi Fi Amplifier Kit



Model A-12
Completely NEW Arkay Hi Fi Amplifier In Kit Form. Less than 3% distortion. 20 to 20,000 cps ±1 db. Bass boost of +8db at 10 cps. Treble boost of +10 db at 10,000 cycles. Inputs: Reluctance and crystal pickup, mic., radio. Hum —70 db below rated output. Tubes: 6BC7, 6SL7, 5Y6GT & 2 6V6GT.

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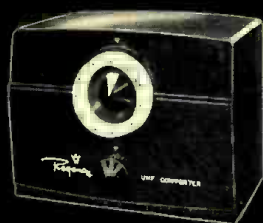
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**MECHANISM PARTS
Over 50,000 Parts IN STOCK**

Send us your broken parts and machine model number (if possible), and we will quote you on the cost of replacements (post-war only). If we can't, we'll return your parts promptly.

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Regency, world's leading manufacturer of TV accessories including VHF boosters, FM boosters, voltage boosters, UHF converters, remote TV control, high pass filters and a complete line of high fidelity equipment.

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INDIANAPOLIS 26, INDIANA

**PLAY YOUR
TRUMP**

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.

TUBE TESTER KIT

Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Illinois, is now marketing its new, low-cost "Knight" tube tester kit, an easy-to-build and versatile unit.

In addition to measuring tube performance by the cathode-emission method, the tube tester checks for shorted elements, opens, and heater



continuity. It can be used for testing 4-, 5-, 6-, and 7-pin large, regular, and miniature types as well as octals, locals, 9-pin miniatures, and pilot lamps.

A 4½" meter, plus a line voltage compensator and a clearly marked, smooth-operating roll chart, assure quick, highly accurate testing. The kit is available in two types—one for counter use and the other in a portable carrying case. An adapter to permit checking TV picture tubes is available at a slight additional charge.

MOBILE RADIO LINE

General Electric Company, Syracuse, New York, is now offering its new "Progress Line" of FM mobile and base station two-way radio communications equipment for both 25-54 mc. and 144-174 mc. land-mobile radio services.

Featuring the use of plug-in chassis, the new line has been designed around



twelve basic "building blocks" of standardized physical dimensions. Flexibility has been provided by designing each of the chassis (transmitters, receivers, and power supplies) so that it

May, 1955

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PERMA-TUBE STAYS UP**
... and so does your reputation!

**J & L
M**

Look for this brand mark
—only genuine Perma-Tube
gives you this protection

Here's why . . . sturdy steel PERMA-TUBE is stronger than any other television mast

1. Its resistance to bending is *five times stronger* than structural aluminum.
2. Its resistance to deflection is *three times stronger* than structural aluminum.
3. Its resistance to destruction by wind-force is *twice as strong* as structural aluminum.

ADDITIONAL REASONS FOR USING PERMA-TUBE EVERY TIME

PERMA-TUBE IS CORROSION PROOF . . . it's treated with vinsynite—then coated *inside and outside* with a metallic vinyl resin base.

PERMA-TUBE IS EASILY INSTALLED . . . it's the *only mast* with *both ends* of the joint machine fitted.

ONLY GENUINE PERMA-TUBE GIVES THIS PROTECTION AND SERVICE . . . *look for this brand mark . . . accept no claims from substitute materials.*

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**LABORATORY STANDARD
REMOTE CONTROLLED
AMPLIFIER**

Here is the product of perfectionists, for the perfectionist in hi-fi. Designed as a laboratory standard by one of America's foremost amplifier specialists since 1937. Remote control unit less than four inches high and deep, only nine inches wide, can be placed up to 100 feet from equipment center. Response inherently excellent to 100,000 cycles... distortion less than 1/100% up to 10 watts... less than 3/10% at 20 watts... full 25 watt output... "Audi-Balance" distortion control gives you lifetime freedom from distortion, and only Newcomb has it... 6-position bass crossover and treble rolloff controls give 36 recording curves. Write for complete details.



NEWCOMB
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NEW! HI-FI Guidebook

"Hi-Fi Is For Everybody" explains how to select and install your system. Thoroughly illustrated. Not a catalog.



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6824 Lexington Ave., Hollywood 38, Calif.

- Here's 25¢ for new book, "Hi-Fi Is For Everybody"
- Please send free information on the Newcomb Classic Series 2500 Amplifiers

Name _____
Address _____
City _____ State _____

is completely interchangeable with other units of its type mounted in either a base station or mobile housing. The twelve basic building blocks consist of two receiver, four transmitter, and six power supply chassis. Sixty different mobile two-way radios are available as standard units by combining the appropriate "blocks."

LINK MOBILE UNIT

Link Radio Corp., 125 W. 17th Street, New York 11, N. Y., has added the Model 2365-M-Ed.8 mobile combination transmitter-receiver to its line of two-way radio communications equipment.

The unit which operates in the 25-50 mc. band (25-30 watt output) is de-



signed to work from either a 6 or 12 volt battery without wiring, component, or cable changes. The change-over is accomplished by merely shifting a plug located on the top of the chassis.

This new equipment, which is designed for police, fire, taxi, commercial fleet, and utility applications, is supplied as a complete package with necessary accessories.

PRINTED CIRCUIT KIT

Circuit Engineering Co., 1871 Grove Street, Glenview, Illinois, has developed a printed circuit kit which enables the experimenter or beginner to apply the same methods used by manufacturers to his own circuits and construction.

This inexpensive kit comes complete with copper clad laminate, etching tray, resist ink, ferric chloride solution, pen holder, pen point, and complete instructions for making a number of complete printed circuit chassis.

BRACH "MAGNE-TENNA"

Brach Manufacturing Company, 200 Central Avenue, Newark, N. J., has in-



troduced a new antenna which will absorb TV signals like a magnetic funnel, making it an efficient design.

The "Magne-Tenna" incorporates a formulation of magnetic material as well as new circuit techniques which

A... Always
B... Buy
C... Columbia

OIL CONDENSERS! NEW!

Just arrived!

2 MFD @ .50	4 MFD @ .51.29
4 MFD @ .75	1.000 V . . .
600 V . . .	8 MFD @ . . .
10 MFD @ . . .	1.000 V . . .
600 V . . .	1 MFD @ . . .
1 MFD @ . . .	.5 MFD @ . . .
1.000 V . . .	2.500 V . . .

McELROY CODE KEYS

Model 443. Consists of Wheatstone perforator with 3-key board. Electronic 110 AC power supply WITH SPEED CONTROL. One reel and tape ADDED FREE! New Boxed. **\$19.95**
SPECIAL

APS-13 TAIL END CHARLIE

BRAND NEW. Complete with ALL TUBES and DYNAMOTOR. Limited quantity. **\$12.95**
CITY. EACH
Two (2) for ONLY. **\$25.00!**

COMMAND STEALS!

"Q" 5'ER—This is the real McCoy! Good condition. Complete with all tubes. A regular \$19.95 value, JUST REDUCED TO **\$7.95**
AIRCRAFT 75 & 80 METER RECEIVER: Good condition. Complete with tubes. ONLY. **\$5.95**
4-5, 3 MC TRANSMITTER: This baby is in beautiful condition! Easily convertible to 75 and 80 meters band. WITH ALL TUBES, ONLY **\$7.95**

MINIATURE MIKE INPUT TRANSFORMER

Pr. Imp. 1.4 ohms, Sec. 80 ohms. Brand new—packaged. Used in BC 745. Horsie-Talkie, Ea. **49¢**

HS-18 HEADSET: High impedance, 8,000 ohm. with 14 Un's. New. Original package. Per PAIR. . . . **\$1.39** 2 PAIR for. . . **\$2.75**

HOFFMAN SILVER CIRCLE TV TUNERS!

Removed from TV sets. Continuous tuning type. Fair condition. Each ONLY **49¢**
3 for. . . . **\$1.25** 6 for. . . . **\$2.25**

DYNAMOTOR GIVEAWAYS!

We mean cheap!

PE-55—The ones you wanted! Terrific for your transmitters! 12 V. Input. 500 V. output @ 330 mls. Excellent **\$17.50** cond.

RECEIVER DYNAMOTOR

For ver mobile rig! 12 V. input. 172 VDC output @ 135 MA. Small compact. BRAND NEW, with spare parts **\$1.95** kit. Ea. 4 for **\$6.50**

PE-103 DYNAMOTOR

Input 6-12 VDC. Output 500 VDC @ 200 MA. Brand new. **\$29.95**
Orig. box

TRICKLE CHARGER TRANSFORMER

For 2 V. batteries. 110 V. 60 cycles, 3.9 V. @ 4 amps. output. New boxed. **\$1.25**
Ea. 49¢; 3 for.

FILAMENT TRANSFORMER: 110 V. 60 cycles.

10 or 12 V. output @ 4 amps. NEW. 2 for **\$3.50**. Each. **\$1.89**
6 V. CONTROL RELAY: Many contacts. NEW BOXED. Each 65¢ 3 for. **\$1.75**

SURPRISE PACKAGE!

We're putting this in to see if you guys are really paying attention. We will actually give you 20 LBS. OR MORE of Signal Corps electronic and radio items. NO JUNK. EACH PIECE IS GUARANTEED TO BE BRAND NEW. LIMITED QUANTITY. **\$3.50**
20 LBS.

METERS

HALLICRAFTERS "S" METER: 3" rd. Illuminated scale 0-5 MA. basic movement calibrated to 40 DV over S-9. New in box. **\$4.95**

METERING KIT: Contains 0-10 MA meter and 10-2 MA meter. With test leads and plugs. Built into beautiful, black crackle finish case. In excellent cond. **\$3.95**

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RADIO & TELEVISION NEWS

the company claims, could, as it now stands, replace all standard indoor antennas. In time, with further developments, they claim that it will replace practically all of the outdoor type antennas. The magnetic core assembly, although small in size, does have extremely high "Q" and with its highly concentrated flux density makes an effective pickup unit for TV signals.

Measuring only 14" x 6" x 4" with no protruding rods, it is enclosed in a decorative cabinet.

POWER SUPPLY KIT

Heath Company, a subsidiary of Daystrom, Inc., Benton Harbor 15, Michigan, is marketing a variable-voltage power supply kit, the Model PS-3.

Designed for both laboratory and service shop application, the unit provides hum-free d.c. output for "B+" and 6.3 volts a.c. at 4 amps for filaments. The output is continuously variable from 0 to 500



volts d.c. at no load. The supply is linear from 0 to 10 ma. at 450 volts d.c. and 0 to 130 ma. at 200 volts d.c. The output voltage or current is monitored on a large 4½" meter.

High-voltage d.c. and low-voltage a.c. are isolated from ground for use with a.c.-d.c. circuits or to furnish a negative voltage value with respect to a test chassis.

NEW TV TUBE

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y., has announced a new tube type, the 6BC8, a miniature 9-pin, medium-mu dual triode with semi-remote cut-off characteristics.

The tube lends itself to applications as a cascode amplifier in v.h.f. television tuners and provides more satisfactory performance in a.g.c. systems under both strong and weak signal conditions.

According to the company, the new tube provides relief from objectionable cross-modulation effects when reception of a weak signal is degraded because of strong adjacent-channel station interference. This effect is minimized because the transfer curve of this tube approaches the desirable square law characteristic, which is the optimum shape for minimizing cross-modulation.

LINEAR AMPLIFIER

Central Electronics, Inc., 1247 W. Belmont Avenue, Chicago 13, Ill., has developed a broadband linear amplifier which covers all bands, 10 through 160 meters, by single-knob band-switch.



The Model 600L uses newly-developed bandpass r.f. couplers which results in the complete elimination of tuning controls. The amplifier tube is a single 813 operating in class AB₂ and requires only 4 watts peak envelope drive power for 500 watts of d.c. power input. The manufacturer claims a useful peak envelope power output of 600 watts on SSB, AM, PM, and CW with very low intermodulation distortion.

VIDEO PROBE METER

Research Invention & Mfg Co., 617 F Street, N. W., Washington 1, D. C., is in production on a unique, compact test instrument which can be used for checking television receivers and signal tracing radios.

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HOME STUDY COURSE

trains you in the "why" and "how"
of Color TV Servicing

Study Color Television Servicing from the very source of the latest, up-to-the-minute Color TV developments. Train under the direction of men who are experts in this field. Take advantage of the big future in Color TV through RCA Institutes' Home Study Course, which covers all phases of Color Servicing. It is a practical down-to-earth course in basic color theory as well as how-to-do-it TV servicing techniques.

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Without obligation on my part, please send me a copy of your booklet on the Home Study Course in Color TV Servicing.

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770**HICKOK****WIDE RANGE
HIGH SENSITIVITY**

MODEL 770

Engineers' Scope**FREQUENCY RANGE:**

- a. Vertical Amplifier:
 1. DC to 2.5 MC, 3db Down, with Band Width Switch in Narrow position.
 2. DC to 5 MC, 3 db Down, with Band Width Switch in Wide position.
- b. Horizontal Amplifier: DC to 500 KC, 3 db down.
- c. Sweep Circuit Oscillator: 2 cycles to 30 KC.
- d. Fixed Sweep Frequencies: 30 cycles and 7875 cycles.

INPUT IMPEDANCE:

- a. Vertical Amplifier: 2.2. Megohms—50 MMF.
- b. Horizontal Amplifier: 2.2 Megohms—50 MMF.

DEFLECTION SENSITIVITY:

- a. Vertical Amplifier:
 1. .010 RMS Volts/Inch with Band Width Switch in Narrow position.
 2. .035 RMS Volts/Inch with Band Width Switch in Wide position.
- b. Horizontal Amplifier: .075 RMS Volts/Inch.

SPECIAL FEATURES:

- a. Illuminated, Calibrated Screen backed with a green filter for reducing incidental illumination in the room—for accurate measurements and comparisons.
- b. Built-In Calibrated Voltages: Peak-To-Peak—100, 10, 1, .1 Volts. Ideal for Observation of Color Burst at 3.58 MC.

THE HICKOK ELECTRICAL INSTRUMENT CO.
10524 Dupont Avenue • Cleveland 8, Ohio

The device is a broadly tuned probe and absorption meter which is designed to pick up general frequencies associated with a TV or radio set such as local oscillator, i.f., video, horizontal oscillator, and output.

The attachable pick-up coil can be used for either 22 or 44 mc. i.f.'s. The probe, which can be held in one hand, incorporates a 0-500 volt d.c. (22,000 ohms-per-volt) *Triplet* meter which is inset in the top of the probe for easy reading.

A data sheet describing the operation of the probe is available on request.

CRT REJUVENATOR

Central Electronics, Inc., 1247 W. Belmont Avenue, Chicago 13, Ill., has recently introduced a new cathode-ray



tube rejuvenator which has been trademarked the "Multiphase Rejuva-Tube."

Available in both kit and factory-wired form, the new unit tests, repairs, and rejuvenates all types of electrostatic and electromagnetic TV picture tubes without the necessity of removing the tube from the set, according to the company.

The tester detects open or shorted elements and leakages as high as 3 megohms between elements. A special metered circuit removes "particle" shorts between cathode and heater.

Write the manufacturer for a manual on CRT rejuvenation using the "Rejuva-Tube."

COMMUNICATIONS RECEIVER

The *Hallicrafters* Company of Chicago has added a new and inexpensive receiver to its line of communications equipment, the Model SX-99.

The receiver has 7 tubes plus a rectifier and covers the standard broad-



cast band in addition to three short-wave bands from 1680 kc. to 34 mc. The set features over 1000 degrees of calibrated bandspread over the 10, 11,

SURPLUS BARGAINS**MOBILE DYNAMOTORS**

Made by PIONEER GEN-E-MOTOR

Compact, efficient dynamotors designed for commercial services. Filter boxes attached to bottom of dynamotors contain A and B filters, oil condensers and RF filters. Dynamotors have internal cooling fans. Ideal for taxi, aircraft, marine and amateur services. Fully guaranteed.

5.5 TO 6 VOLT DC INPUT

OUTPUT	ICAS*	CCS*	FILTER	PRICE
400 VDC	275 ma	175 ma	with	\$19.95
500 VDC	300 ma	200 ma	with	22.95
500 VDC	300 ma	200 ma	less	19.95
250 VDC	100 ma	65 ma	with	11.95

11.5 TO 12 VOLT DC INPUT

OUTPUT	ICAS*	CCS*	FILTER	PRICE
400 VDC	275 ma	175 ma	with	17.95
500 VDC	300 ma	200 ma	with	21.95
500 VDC	300 ma	200 ma	less	18.95
400 VDC	175 ma	105 ma	less	9.95
210 VDC		40 ma	less	4.95

*ICAS—Inter. Duty *CCS—Cont. Duty

MOBILE RELAY

0 VDC Coil SPST. 30 amp contact for Dynamotor starting. Plus extra contacts for silencing receiver. SPST normally closed. Made by Struthers Dunn. Specially priced at **\$89¢ ea.**

WESTON MODEL 506

2" Round, Bakelite Case. Panel Meter, 100-0-100 Microamperes **\$4.95 ea.**

GLOBAL NON-INDUCTIVE RESISTORS

9 ohm 100 Watt. 6 for \$1.45
35 ohm 25 Watt. 5 for .95
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Brand New. Ceramic Ins.

1 MFD 3000 VDC.	\$1.85
6 MFD 1500 VDC.	1.95
2 MFD 2000 VDC.	1.50
10 MFD 600 VDC.	1.19
10 MFD 1400 VDC.	2.50

EIMAC VACUUM CONDENSERS

32,000 VDC

12 MMF (VC 12-32) \$8.50

PANEL METERS

GOV'T SURPLUS. G.E., WESTINGHOUSE, WESTERN ELECTRIC, SIMPSON, ETC.

2" METERS		3" METERS	
0-4 amp RF	\$2.95	0-500 Microamps	\$5.95
0-50 ma DC	2.95	0-50 Mill.	3.95
0-15 ma DC	2.95	0-80 Mill.	4.50
0-300 ma DC	2.95	0-150 Volts AC	4.95
0-10 amps RF	2.95	0-15 Volts DC	4.95
0-10 amps DC	2.95	0-1.5 Mill.	3.95
		3" METERS	
		0-200 Microamps	\$6.95
		0-50 amps DC	4.50
		0-500 Microamps	5.95
		0-10 Mill. DC	3.95
		0-200 Milliamp	4.50
		50-0-50 amps DC	3.95
		0-3 Milliamp	3.95
		0-15 amps DC	3.95

WESTINGHOUSE METER SPECIAL

Type MX35. 3" round bakelite case.

0-300 MA DC \$4.75 ea.
0-500 MA DC 4.75 ea.
(2 FOR \$8.95)

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4 MFD-600VDC \$.95	4 MFD-2000VDC \$3.95
2 MFD-1000VDC .95	5 MFD-2000VDC 4.95
3 MFD-1000VDC 1.25	2 MFD-2500VDC 3.95
3 MFD-1500VDC 2.65	1 MFD-7500VDC 1.75
5 MFD-1500VDC 2.85	0.025 MFD-25KV 5.50
3 MFD-2000VDC 2.95	5 MFD-660VAC 1.95

G. E. RELAY CONTROL

(Ideal for Model Controls. Etc.)

Contains a sigma midget 8,000 ohm relay (trips at less than 2 MA), high impedance choke, bimetal strip, neon pilot and many useful parts. The sensitive relay alone is worth much more than the total **\$1.25 Each 10 for \$9.90**
low Price of

WIRE WOUND RESISTOR KIT. 25 popular assorted—5, 10, 20, 50, 100 watt—Kit \$1.95

READ 'N' SAVE BARGAINS

6 Henry 80 ma chokes . . . . .	.85
Erle 500 mmf ceramics	10 for .50
15V AC relay SPST 15 Amp contacts	1.75
220V AC relay SPST 15 Amp contacts	1.75
.01 mmf. 1000 VDC Micacs	5 for .95
.0004 2500 VDC Micacs	5 for .95
.04 600 V Micacs	5 for .95
100,000 ohm, 100 Watt resist.45

Min. Order \$3.00—25% with Order—F.O.B. New York.

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Phone WOrth 2-5439

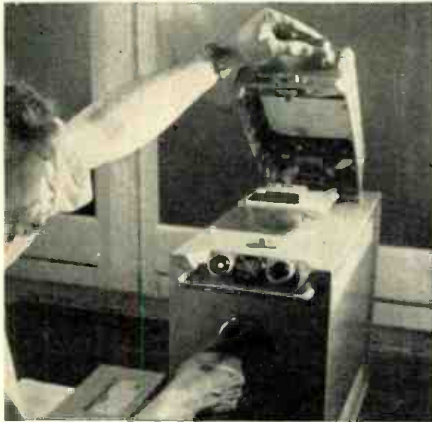
RADIO & TELEVISION NEWS

15, 20, 40, and 80 meter amateur bands, a separate bandspread tuning capacitor, crystal filter, antenna trimmer, "S" meter, one r.f. and two i.f. stages, and new styling. Audio power output is two watts.

The set is housed in a gray-black steel cabinet with brushed chrome trim and piano hinge top.

DIELECTRIC HEATER

The Industrial and Scientific Products Division of *Curtiss-Wright Corporation*, Caldwell, N. J., is marketing



a dielectric heater designed for the heating of non-metallic material by molecular friction.

The heater uses r.f. energy to heat such materials as plastics, wood, paper, foods, or chemicals. The equipment has been designed primarily for research, development, and small plant use.

The high-frequency generator is built into a compact, well-shielded metal cabinet measuring 9 x 22 x 24 inches. Objects up to 1 x 6 x 6 inches can be treated. A timer and milliammeter insure reproducible results.

The company will supply additional information on request.

ARRESTER FOR U.H.F.

LaPointe Electronics, Inc., of Rockville, Conn., has come up with one solution to the problem of arrester loss on u.h.f. with the introduction of its new "Vee-D-X" Type ULA universal lightning arrester.

The completely hermetically-sealed arrester stops up to 50% of the loss of u.h.f. signal, according to the company. The device incorporates patented special low-loss printed circuits which insure efficient operation at u.h.f. by maintaining correct line impedance with low distributed capacity and minimum signal attenuation.

The Type ULA arrester accommodates all popular types of wire; flat, tubular, oval, foam, and open. Information on prices and distributions is available from Dept. C-4 of the company.

MINIATURE PLUGS AND JACKS

Switchcraft, Inc., 1328 N. Halsted Street, Chicago 22, Ill., is meeting the demand created by the new small size radios, tape recorders, and musical instruments by introducing a line of

May, 1955



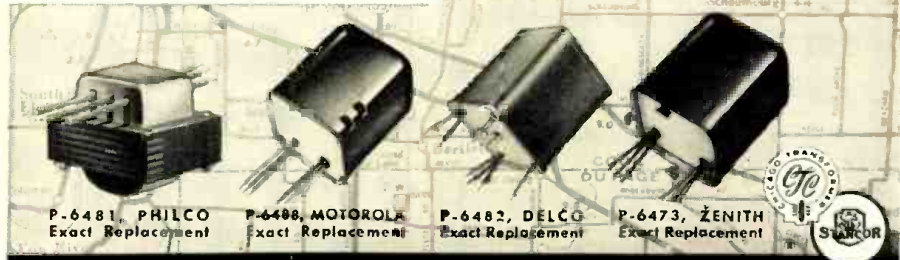
REPAIR AUTO RADIOS quickly, easily with STANCOR EXACT REPLACEMENT AUTO VIBRATOR TRANSFORMERS



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New STANCOR Auto Radio Transformer Replacement Guide, the most complete ever published. This valuable book lists accurate replacement data for over 540 car radios, built or used by over 40 manufacturers. Both vibrator powers and audio outputs are included. It's available FREE from your CHICAGO STANDARD distributor.

You can increase your auto radio repair profits by reducing installation time with STANCOR exact replacement vibrator transformers. Like STANCOR flybacks, STANCOR auto vibrator transformers are faithful duplicates of the originals they are designed to replace.



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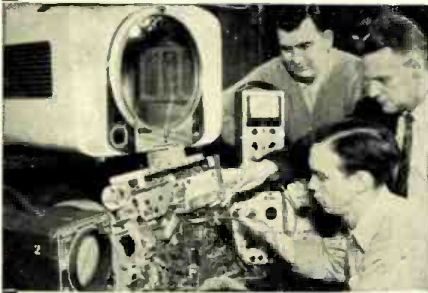
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Type	Price	Type	Price	Type	Price
1B3	.59	6BG6	1.00	12A7	.67
1R5	.48	6BL7	.78	12AU7	.55
1X2	.61	6BQ6	.70	12AV7	.67
5U4	.45	6CB6	.46	12BE6	.44
5V4	.55	6CD6	1.10	12BE6	.44
5Y3	.40	6HG	.38	12BH7	.57
6AB4	.46	6J5	.40	12SA7	.52
6AC7	.60	6J6	.40	12SK7	.50
6AG5	.46	6K6	.38	12SN7	.53
6AK5	.70	6SA7	.40	12SQ7	.49
6AL5	.42	6SK7	.40	19B G6	1.38
6AT6	.38	6SL7	.59	25BQ6	.74
6AU5	.61	6SN7	.45	25L6	.40
6AU6	.40	6SQ7	.40	35L6	.40
6AV6	.38	6T8	.70	35W4	.40
6AX4	.55	6V6	.46	35Z5	.40
6BA6	.44	6W4	.40	50L6	.42
6BC5	.46	6W6	.51	117Z3	.38

Tubes not listed take 75% off list. 2% discount on orders over \$50—5% over \$75—10% over \$125
TERMS: 25% with order, balance C.O.D. Orders over \$15.00 with full remittance, prepaid to you in Continental U.S.A. Prices subject to change without notice. Minimum order \$10.00.

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**Enter Radio and Television
— courses 12 to 18 months**

You can be a radio technician in 12 months. In an additional 6-months you can become a radio-television technician with Associate in Applied Science degree. Color television instruction is included in this program.

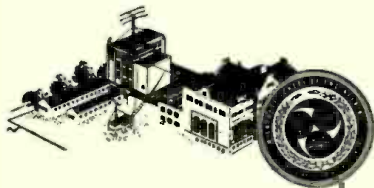
These technician courses may form the first third of the program leading to a degree in Electrical Engineering. Twenty-one subjects in electronics, electronic engineering and electronic design are included in these courses.

Courses also offered: radio-television service (12 mos.); electrical service (6 mos.); general preparatory (3 mos.).

Terms—July, September, January, April

Faculty of specialists. 50,000 former students—annual enrolment from 48 states, 23 foreign countries. Non-profit institution. 52nd year. Courses approved for veterans. Residence courses only.

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miniature plugs and jacks that are approximately one-half the size of former standard units.

Known as "Tini-Plugs" and "Tini-Jax," the plug design features high-grade insulation throughout, one-piece tip rod-staked into the tip terminal to insure tightness, terminals and body of the plug interlocked to eliminate shifting. The jack features notched insulating washers which mechanically interlock the springs and solder lugs eliminating the probability of shifting resulting in electrical shorts or change in adjustment.

INDUSTRIAL TV GEAR

The Electronics Division of Curtiss-Wright Corporation, Carlstadt, N. J., is now offering a compact closed-circuit television system consisting of three basic units—a camera, control unit with camera control, and a receiver.



The camera measures 8¼" x 6" x 3½" and weighs six pounds. Complete automatic or remote control of the optical system is possible. The camera can thus be panned, tilted, focussed, lens changed, and iris settings made from a remote location. A choice of various accessories is available dependent upon the use desired.

The unit is especially adaptable to checking signatures in banks and department stores, photographing safety deposit box subscribers, identification of personnel from a central file or location, observing customer density, shoplifters, etc., showing inside store scenes as window displays, etc.

A data sheet on this equipment is available on request.

NEW CAPACITOR LINE

Illinois Condenser Company, 1616 North Throop Street, Chicago 22, Ill., has recently added a new type capacitor to its line.

The new Type ITC capacitors have unusually high insulation resistance, low power factor, and long-life performance at high temperatures, according to the company. Their non-inductively wound foil assemblies are oil impregnated and hermetically sealed in steatite cases. They are overload tested and have a standard tolerance of ±20%. Thermoset end seals will not soften or flow with soldering or at any conceivable operating temperature.

The new line is available in capacity ranges from .0005 to 1 μfd. and in

WORLD'S LARGEST MANUFACTURER
OF CUSTOM BUILT TELEVISION

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SILVER ROCKET 630 CHASSIS

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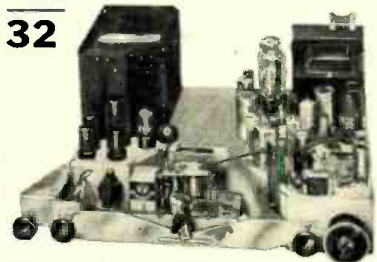
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for Better DX Reception**

Featuring *Synchromatic Tuning*

Tube Complement:
28 tubes
3 rectifiers
1 CRT

Select Your Channel
SOUND IS
AUTOMATIC!

32



Tuneable Booster

- Broad band single knob control pre-amplifier built in to eliminate long leads which may cause regeneration and attenuation of signal.
- ONLY THE MATTISON 630 CHASSIS HAS AN ALL CHANNEL TUNEABLE BUILT-IN BOOSTER THAT INCREASES SIGNAL STRENGTH UP TO 10 TIMES.

Also Available The World Renown

- MATTISON 630 SILVER ROCKET CHASSIS with-out built-in booster.
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ALL CABINETS MADE IN MATTISON'S OWN CABINET FACTORY. AVAILABLE IN EVERY FINISH AND STYLE. WRITE FOR COMPLETE CATALOG.

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SOUND-OFF!



Build fully automatic electronic brain. The MUSICON cuts out commercials. Lets any radio, TV play only music! Pricelss possession for home, business, office. Work, study, read, relax with music. Simple, low-cost construction. 2-tubes. Booklet, full instructions, schematic, PLUS special component, \$3.50 with order. Free literature.

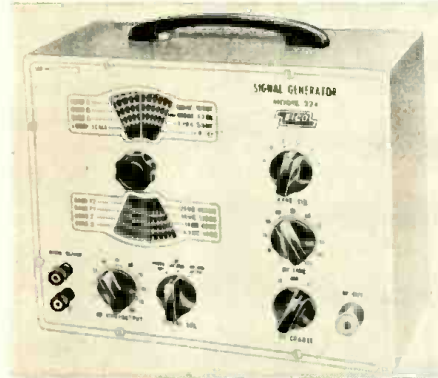
NORMAN ELECTRONICS COMPANY
P.O. Box 733 Brooklyn 1, N. Y.

RADIO & TELEVISION NEWS

200, 400, 600, and 1600 volt ratings. Tinned copper leads, 2" minimum length, make for easy soldering.

SIGNAL GENERATOR

Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, N. Y., has



added the Model 324 signal generator to its line of test equipment in kit and factory-wired form.

The unit can be used for i.f.-r.f. alignment, signal tracing, and trouble-shooting of AM, FM, and TV receivers on fundamentals, as a marker generator for alignment of both the high and low frequency TV i.f.'s, for 400 cps sine-wave audio testing, and for laboratory and experimental work.

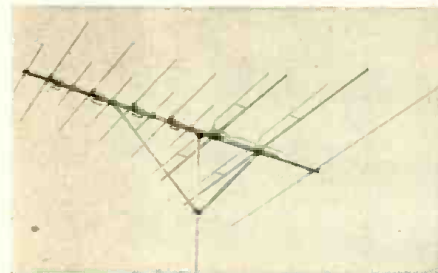
Its frequency range is 150 kc. to 145 mc. on fundamentals in six bands and 111 mc. to 435 mc. on calibrated harmonics. Accuracy of the dial calibration is $\pm 1.5\%$ with a 6:1 vernier tuning knob and excellent spread at the most important frequencies.

The company will supply full details on written request.

"INTERCEPTOR" ANTENNA

Winegard Company, Burlington, Iowa, has been granted a patent covering nine claims for its antenna construction.

The "Electro-Lens Focusing" system



is incorporated in the firm's "Interceptor" antenna. The system uses aligned dipole and unitary directors in an in-line arrangement in which the dipole director serves as a director in both the high and low bands without shielding either the unitary director or the driven element in the high band.

According to the company, this feature has been found highly effective in increasing the gain of the driven element over the entire v.h.f. TV spectrum.

U.H.F. TV TUNER

Radio Condenser Company, Davis & Copewood Streets, Camden 3, N. J.,

May, 1955

Hearing is Believing

STEPHENS

Cavalier



brings you all the virtuoso quality your sound system can produce

TRIM straight lines characterize this smart upright enclosure that fits neatly into a corner. Engineered to present a Stephens speaker system at its best, the "Cavalier" blends unobtrusively with either modern or contemporary settings. Choice of high-lustre, hand-rubbed blonde or mahogany finish. Enclosure Model 626 alone, Net \$120.00. 32" wide, 32" high, 21" deep. Shipping Weight 105 lbs.

And a speaker that delivers the most satisfying sound from your hi fi equipment is the Stephens 15" 152AX, a two-way coaxial speaker. Employs two voice coils and 2½ lb. Alnico V permanent magnet, has 5000 cycle network. Shipping Weight 26 lbs. Speaker alone, Net \$88.50.

Cavalier with speaker system installed. Complete, Net \$208.50.

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CONTAINS THE AMAZING NEW PERMA-FILM!

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Available in 8 oz. bottles and quart cans. Nearest distributor — or write us today.



PERFECT CONTACT RESTORER...

Cleans & restores volume controls, band switches, push button assemblies, electrical contacts. NO NOISE is not a carbon tet solution.



- ★ **CLEANS!** . . . dirt and oxidation immediately on contact.
- ★ **LUBRICATES!** . . . one drop eliminates scratch, hum and noise.
- ★ **PROTECTS!** . . . assures continued top performance.

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2 oz. bottle. Net to Servicemen . . . **\$1.00**

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New
REK-O-KUT
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TURNTABLES

The Rondine Deluxe

3-speed with hysteresis motor..... **\$119⁹⁵**

The Rondine

3-speed with 4-pole induction motor..... **74⁹⁵**

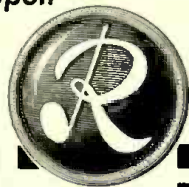
The Rondine Jr.

2-speed with 4-pole induction motor..... **49⁹⁵**

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Which one belongs in your home music system?

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City _____ Zone _____ State _____

My dealer is _____

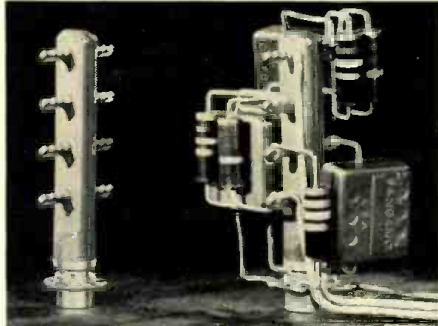
has released a new u.h.f. television tuner which was developed to meet the radio frequency interference objectives of both the RETMA and the FCC.

Designated as the Model T-90, the new tuner features a rearrangement of the usual television tuner components and better shielding which combine to act as oscillator radiation fixes, thereby preventing the oscillator from radiating interference outside the recommended limits.

Bulletin T-90 covering this new unit is available from the manufacturer.

COMPONENT MOUNTING POST

Sangamo Electric Company, Springfield, Illinois, has developed a unique component mounting post to improve



the "bug resistance" of model and production wiring in government and industrial gear.

Tradenamed the "Tote-m-pole," the new unit provides ideal mounting support for small components such as resistors, capacitors, diodes, and transistors at their operating point. Critical leads to grid suppressor resistors, for example, can be reduced to pigtailed.

The unit mounts with a single chassis drill hole. It can be reused many times for model mock-up or component replacement. It is adapted to jig wiring practice whether the jig is of cardboard for design study or a production type.

REPLACEMENT TV TUBES

Raytheon Manufacturing Company, Newton 58, Mass., has announced the addition of three aluminized picture tube types to its line of replacement components.

The three new tubes are the 17LP4A, 20DP4C, and 21AUP4A. The 17" tube is a direct-view electrostatic focus and magnetic deflection picture tube. It employs a rectangular filter-glass face plate having a cylindrical front surface for elimination of reflection and a metal-backed screen. The 20" tube is a direct-view magnetic focus and magnetic deflection tube whose other specifications are the same as for the 17" model. The third tube, a 21" unit, is a direct-view electrostatic focus and magnetic deflection tube. In other respects it is the same as the other tubes.

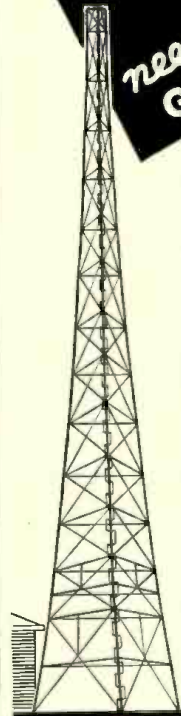
These new units are currently available at the company's distributors.

DOT-BAR GENERATOR

The Tube Division, *Radio Corporation of America*, Harrison, N. J., has announced the availability of a modified version of its WR-36A dot-bar gen-

STEEL ANTENNA TOWERS

need no GUY WIRES



Improve radio and TV reception. Easy to erect . . . self-supporting 3 post towers . . . last a lifetime. Built of galvanized steel sections—no guy wires necessary—safe and resistant to high wind.

Available in heights of 33, 47, 60, 73, 87, and 100 feet.

TERRITORIES OPEN FOR JOBBER-DEALER FRANCHISE

Write for dimensions, structural details, prices, discounts, and available territorial assignments.

AERMOTOR COMPANY

Dept. 6105, 2500 Roosevelt Rd., Chicago 8, Ill.
BUILDERS OF STEEL TOWERS SINCE 1888



Need a Tube Tester?

FOLLOW THE LEADER . . .

Buy **EICO**

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**TUBE TESTER #625
KIT \$34.95 Wired \$49.95**



More Servicemen buy EICO TUBE TESTERS—in KIT and wired form—than any others sold through distributors. Why? Because EICO gives you the MOST value at LOW-EST cost.

- Test all conventional & TV tubes and pilot lights.
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- 4½" meter, 3-color "Good-Bad" scale.
- Line-adjust control. Blank socket for new tubes. Protective overload bulb.

In stock at your local jobber. Write for free Catalog RT 5 Prices 5% higher on West Coast.

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

RADIO & TELEVISION NEWS

erator which can be used for making convergence adjustments in both small-screen and large-screen home color TV receivers.

Owners of the first WR-36A instruments, introduced early in 1954, will be provided with a special kit of modification parts needed for converting these dot-bar generators for use with large-screen receivers. The kits will be available without charge to service dealers and technicians who have returned warranty registration cards on their dot-bar generators to the factory.

NEW CRYSTAL DIODE

The Electronics Division of *Sylvania Electric Products Inc.*, Woburn, Mass., has announced the development of a new silicon crystal diode, the 1N286, a broadband, coaxial, point-contact type of unit.

The new diode is designed for use as a crystal mixer. Its unique internal geometry makes it possible to cover the band of frequencies from 10,000 to 20,000 mc.

Crystal holders for 10,000-15,000 mc. and 15,000-22,000 mc. are available to house the new diode.

The Type 1N286 is especially adapted to such applications as tunable frequency radar systems and counter-measure devices. This crystal diode is the only product of its type currently available, according to officials of the company.

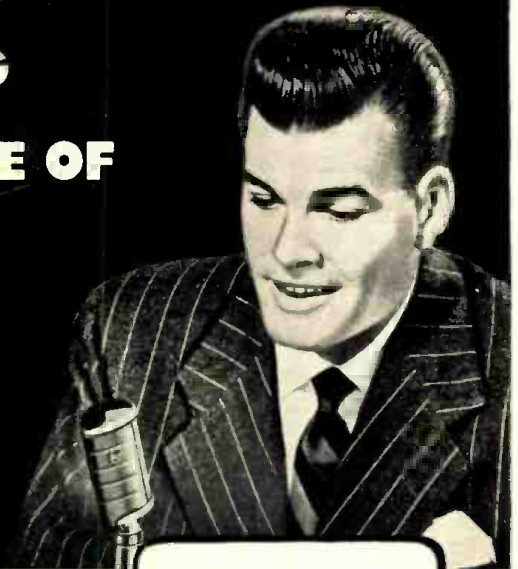
-30-

Shown here are the movable test equipment racks of Clarence Fisher, Townsend, Montana, radio and TV service shop operator. All the test equipment needed for any repair job is mounted on these channel-iron frame racks on casters so that they may be moved easily about the shop. The test instrument panels are mounted with bolts and wing nuts for easy removal or replacement if desired.

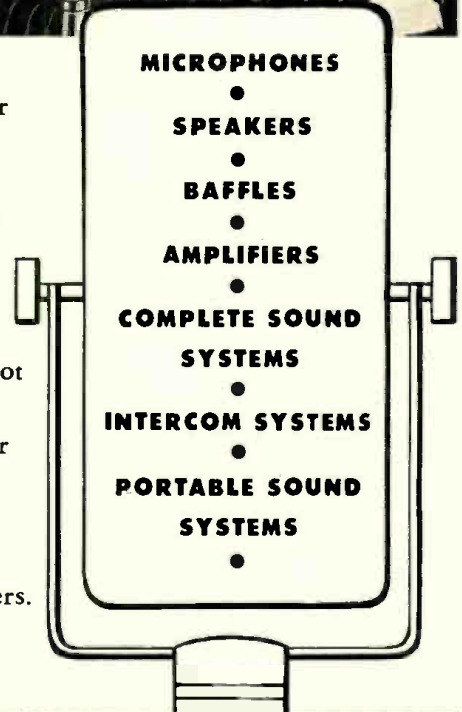


May, 1955

GETTING YOUR SHARE OF SOUND SYSTEMS BUSINESS?



Wherever people congregate for work or amusement, you'll find a likely prospect for sound amplification. And whatever the requirements of the installation, you can do the job right *the first time* with RCA engineered sound equipment. This means not only an installation you'll be proud of, but one on which your net profit is really *net*. Your RCA Distributor has everything necessary for a complete system that will recommend you to others.



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CONCORD'S BUY OF THE MONTH

Western Electric
Extension Telephone
Ideal for Dispatch or Switchboard Use

Only
\$6.95
ea.



Tremendous Value! These brand new Western Electric Extension Telephones are in demand wherever it is desirable to have the operators hands free for other tasks. Used as standard equipment in most railroad dispatchers offices. Telephone transmitter arm uses standard type F-1 carbon button. Earphone is regulation Western Electric type HA-1 magnetic reproducer. Transmitter arm has earpiece holder equipped with transmitter cut-off switch. Accordion type extension holder will transport phone a full 14 1/2". Brand New and individually packaged. Shpg. wt. 10 lbs.

Stock No. W1148DC. Reg. \$48.00. **\$6.95 ea.**

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20% deposit with C.O.D. ORDER \$5.00
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RUST
PROOF



- ★ Seven — 18 Ga. Stranded Wires
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- ★ High Strength Aluminum Alloy for all Types of Antennas
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*Packed 2-500 ft. continuous coils per carton marked every 100 ft. with bright red tape.



PACKAGING DATA		
ITEM	PKG. NO.	DESCRIPTION
TV Grd. Wire	8	100 ft. coil per box, 10 boxes per ctn.
TV Grd. Wire	9*	2-500 ft. continuous coils.
TV Cable	50	100 ft. coil per box, 10 boxes per ctn.
TV Cable	60*	2-500 ft. continuous coils.

Order from your jobber or write us direct. Address Dept. TV-15

NICHOLS
WIRE & ALUMINUM CO.
DAVENPORT, IOWA
World's Largest Manufacturer of Aluminum Nails

Spot Radio News (Continued from page 18)

Another Congressman, Rep. William Colmer, violently disagreed with the premise that TV should be used. He said that . . . "nothing could bring about more abuse . . ." than to TVize . . . "prima donnas . . ." and there were plenty in the House.

TOLL-TV, boxed and pummeled around for years, but somehow always off the mat and able to take more, is now in a grandstand tussle, that will either end in a hail or a wail and the count of ten. For the Commission has finally made up its mind to find out, in a conclusive way, what to do about this business of pay-see TV.

Specifically the FCC invited comments on a series of questions, which asked, in part: What effect will subscription TV have on the broadcast of news . . . What safeguards would be necessary to insure that the public in all areas of the country continued to received well-balanced programs without charge . . . Should subscription TV operations be limited to a single system . . . Should general standards be provided within which a number of systems can be used . . . Should pay-see programs or transmissions be limited to a number of hours per day, or a segment of a broadcast day . . . Should subscription programs be limited only to u.h.f. stations, or to stations in small markets.

The Commission also wanted to know whether subscription television constitutes broadcasting, and if it is not, whether it is to be construed as a common-carrier type of service; they were also anxious to determine if they had the authority to permit subscription TV to employ channels assigned to telebroadcasting. And if, posed the FCC, they do not have the authority to authorize and regulate pay-see TV, then what amendments to the Communications Act would be required, to permit the Commission to supervise the operation.

Those who control the subscription-TV patents were asked to provide all technical data describing the dependability of the equipment to be employed, and the extent, if any, of the degradation to the quality and character of the primary broadcast service, either black-and-white or color. In addition, the Commission wanted to know if any interference could result to other stations on the same channels, adjacent channels, or other pertinent frequencies. And, how would receivers be affected by pay-see operations.

The patent picture was also brought into the scene and the Commission asked what arrangements will be employed for licensing for the competitive manufacture of subscription equipment. The motion picture industry was asked what role they would play, and the networks were also similarly queried.

DOLLAR SALE!

Popular Electronics Assortments



This Handy Blue and White Box Means VALUE!

- 50 CERAMICON CONDENSERS. Scoop! Tubular, Disc, Button types. Over 20 values. 4.7 to 4000mmf. Popular mfrs. Wt. 2 lbs. Reg. \$13. **\$1**
- 60 TUBULAR CONDENSERS. .00035 to 1mf. up to 1600V. Pop. mfrs. and sizes. Wt. 1 lb. Reg. \$10. **\$1**
- 25 OIL CAPACITORS. Bath tub and tubular. .1 to 2mf. @ 600V. Well-known mfrs. Wt. 4 lbs. Reg. \$17. **\$1**
- 10 ELECTROLYTICS. Tubular and PP units. .8 to 1000mf. Up to 450V. Many multiple sections. Wt. 2 lbs. Reg. \$11. **\$1**
- 50 RF COILS, CHOKES and slug-tuned coils, for TV, radio, lab. Wt. 1 lb. Reg. \$15. **\$1**
- 60 RESISTORS. 56 ohms to 20 meg. 1/2, 1 and 2 watts. Many 5%. Insulated. Wt. 1/2 lb. Reg. \$12.15. **\$1**
- 50 PILOT LITE SOCKETS. Builders' special! Screw and bayonet bases. Wt. 2 lbs. Reg. \$8. **\$1**
- 1500 PIECES SPAGHETTI tubing, lengths 1 to 4"; 10 sizes: fiberglass, cambric, plastic. Reg. \$7. **\$1**
- 15 W.W. RESISTORS. Power, candim and "dog-bone" types. 5 to 10000 ohms. 2 to 50 W. Popular values. Wt. 2 lbs. Reg. \$11. **\$1**
- 10 RADIO CHASSIS. 5, 6 & 7 tube punched chassis. New! Workshop must! Wt. 8 lbs. Reg. \$8.50. **\$1**
- 75 KNOBS. Some worth 25c. TV 7 Radio; Push-on, set-screw, nuts, lugs, etc. Wt. 2 lbs. Reg. \$8.50. **\$1**
- THREE LBS. HARDWARE. Assorted. Over 1200 pieces; screws, nuts, lugs, etc. Reg. \$6.50. **\$1**
- 12 CONTROLS. Up to 1 meg. Some w/ switch, some duals. Wt. 2 lbs. Reg. \$12. **\$1**
- 75 TERMINAL STRIPS. 1 to 10 terms. Push & solder types. Wt. 1 lb. Reg. \$6. **\$1**
- 50 PADDERS. Singles, duals, up to 300mmf. Wt. 1 lb. Reg. \$9.50. **\$1**
- TEN 25 ft. ROLLS WIRE. Plastic & cloth insulated, solid & stranded. #18 to 24, nsstd. colors. Wt. 2 lbs. Reg. \$5.50. **\$1**
- 15 SWITCHES. Rotary, push, micro, toggle. Experimenters note! Wt. 3 lbs. Reg. \$12. **\$1**
- 25 TUBE SOCKETS. Up to 9 pin, some w/ shield base, some ceramic. Handy shop asst. Wt. 6 lbs. Reg. \$6.50. **\$1**
- 200 COIL FORMS. 50 sizes & shapes, bakelite & ceramic. Lab. must! Wt. 2 lbs. Reg. \$14. **\$1**

OTHER FABULOUS BUYS!

- MARION 3" RECT. METER. Brand new. Measures 0-10 V DC. Movement 10mm. Has special scale. Wt. 2 lbs. Reg. \$8.50. **\$1.88**
 - PHILCO car radio permeability-tuned (slug-tune coils) assembly. Covers broadcast band. Push-button controls. Reg. \$5.50. **59c**
 - FULL-WAVE BRIDGE RECTIFIER. In-18VAC, out 12VDC @ 250ma. Reg. \$4.50. **2 for \$1.25**
 - ERIE TRIMMERS, 3-12: 7-45; 8-50; 10c ea. state value wanted. Reg. \$1.15. **12 for \$1**
 - VARIABLE CONDENSER, dual—15mmf. W/2 drum. Reg. \$2.50. **3 for \$1**
 - EXCLUSIVE R/C ASSEMBLY. From current production. Mounted on 17 pt. terminal strips. 23 Capacitors .0001 to .047 M. F. D.; 17 molded 600 V, 3 paper 400 V, 3 micas; 20 Resistors, 320 Ohms. 1 Meg.—1/2 W. Assorted popular values. 1/2 to 1" leads. Shipping wt. 3 lbs. Reg. \$16.00. All 3 assemblies for \$1. **\$1**
- Please send check or M.O. Include estimated postage. C.O.D. order 25% down payment.

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RADIO & TELEVISION NEWS

Soon after the Commission issued its book of questions, pro and con comments began snowing on Washington. Defending the toll idea, the prexy of one association said that it would . . . "add a new dimension to the entertainment scene which would double or triple activity in New York and Hollywood . . ." In his opinion, this new medium will . . . "greatly expand the employment horizons of writers, composers, actors, directors, musicians, dancers, singers, designers, and all of those who contribute to the creative side of our entertainment."

Continuing his enthusiastic approval, he said that toll-TV will . . . "make available to millions of Americans entertainment which they have never before been able to see in their own homes—complete Broadway plays, the latest films, and the nation's great opera companies—and at only a fraction of the cost of seeing them outside their homes."

But a dim, dim view was taken by the public relations counsel for a joint committee on toll-TV. Appearing before a meeting of the Drive-In Theatres Association, he said that subscription TV would set the stage for a . . . "giant grab of the public domain, which could lead to a ten-billion dollar-a-year combine, tying Hollywood, Broadway, sports, and television together in a powerful monopoly."

Those who control the pipeline into the living rooms of America, he said . . . "will assume total control of everything from Marilyn Monroe to opera at the Met, and major league baseball."

The promotion of toll-TV was attacked as an insidious propaganda campaign well conceived, heavily financed and skillfully executed, which can be explained only in terms of the astronomical stakes involved should such a system be adopted.

OKLAHOMA CITY'S five radio and three television stations recently saved a veteran's life by making a successful emergency appeal for a rare type of blood.

Shortly after noon one recent Sunday, the VA hospital in Oklahoma City admitted a veteran patient. Doctors decided on an emergency operation. And after all preparations were made, it was found that a transfusion would be required. But the blood required was an extremely rare type—B negative—which occurs in only seven out of every hundred persons. No such blood was on hand at the hospital; nor was any available at other medical centers.

It was then decided to make a plea to the public *via* radio and TV. Thirty-two minutes after the announcement was made, a blood donor was on a table next to the operating room, providing the precious blood. And two hours later thirty-four persons with type-B negative blood had rushed to the hospital. But, by that time the operation had been successfully completed.

May, 1955

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HALLICRAFTER SX-99
Only **\$11.92** per mo.
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HALLICRAFTER SX-96
Only **\$13.62** per mo.
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CASH PRICE: \$249.95 \$25.00 Down

The smartly styled receiver with the 10, 11, 15, 20, 40 and 80 meter amateur bands and separate bandspread tuning condenser. Has crystal filter, antenna trimmer, "S" Meter, RF stage and two IF stages. Seven tubes plus rectifier. Band selector, sensitivity, main tuning, standby, noise limiter controls and others. Broadcast band: 540-1680 Kc. Three short wave bands: 1680 Kc - 34 Mc. Chrome-trimmed, grey-black steel cabinet. Ship. wt.: 36 lbs.

Selectable side band receiver with improved stability through temperature compensation of the HF oscillator circuits and use of the crystal control second conversion oscillators. Precision gear drive dial system on main tuning and bandspread dials. Includes 50 Kc highly selective IF system, AVC-noise limiter and grey-black cabinet with brushed chrome trim. Ship. wt. 43 lbs.

R-46A Speaker \$19.95

We Carry All Of The LATE MODEL HALLICRAFTERS

In Stock! Immediate Delivery Here's Just A Sample!

You Pay Only 10% Down On All Items

Model	Pay Per Month	Cash Price
S-38D	\$ 3.97	\$ 49.95
S-93	7.95	99.95
S-85	9.54	119.95
SX-62A	19.07	349.95
SX-88	36.80	675.00

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ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

Please rush me: **FREE 1955 Catalog**, and information on items checked below! Quote your top-trade offer for my: _____ (present equipment)

on your _____ (New WRL Eqpt. Desired)

SX-99 SX-96 Other _____

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TO HELP YOU SELECT THE CORRECT HI-FI ENCLOSURE

AUTHORITATIVE GUIDE

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Please send copy of your latest book "The Karlson Enclosure" to

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BC-221 FREQUENCY METER

Real Value! QUANTITY IS LIMITED—no first come, first served. They are just like new, with original calibration charts. Range 125-20,000 KC with crystal check points in all ranges. Complete with crystal and tubes. **\$139.50**
Standard with AC Power supply **\$159.50**
MODULATED TYPE **\$179.50**
MODULATED TYPE with AC Power Supply **\$199.50**
Limited quantity of BRAND NEW MODULATED FREQ. METERS **\$210.00**



WE CARRY A LARGE PARTS INVENTORY FOR THE FOLLOWING EQUIPMENT:

SCR-694 BC-348 BC-375

Let us know your needs. We will quote you promptly.

CONTROL BOXES

C-4/ARN7 Control Box for automatic direction finders, excellent used **\$20.00**
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Field Telephones
Army surplus, completely reconditioned and electrically tested, using 2 flashlight cells and a pair of interconnecting wires. GUARANTEED.
Like new

TELEGRAPH KEYS



J41 **.99**
J45 **2.99**

HEADSETS

HS-23 high impedance, BRAND NEW with ear pads **\$4.65**
HS-33 low impedance, BRAND NEW with ear pads, cord and PL34 PLUG **\$4.65**
CD-307A Cords, 6 ft. **1.10**



SCR-274N COMMAND AND ARC-5 EQUIPMENT

BC-455 Receiver—6 to 9 MC, Brand New. A Terrific Buy! **\$5.95**
BC-456 Modulator, Brand New. Get yours now at this saving! **\$3.29**

MOBILE DYNAMOTORS

Pioneer Type E-3, input 5.6 volts @ 22 amps, output 400 volts @ 175 mill. **\$14.95**
Gothard Type SF-20, input 5.6 volts @ 32 amps, output 400 volts @ 300 mill (less endbell). **\$13.95**
Gothard Type SP-17, input 5.6 volts @ 22 amps, output 400 volts @ 175 mill. With endbell. **\$14.95**
Less endbell **\$11.95**
These motors are in excellent used condition.

BUY-OF-THE-MONTH!!

SAVE! SCR-522 RECEIVERS

less oscillator assembly, frequency shifter and tubes. Contains Coils, Transformers, Resistors, Condensers and other valuable parts. **\$3.95**
A Sensational Buy

SCR-522 TRANSMITTER

less freq. shifter & tubes, but contains most all other component parts—such as transformers, relays, coils, cond., resistors and other valuable parts. Order Yours Now **\$5.95**

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Immediate delivery—send 25% deposit on C.O.D. orders. If sending full remittance, allow for postage and save C.O.D. charges. All shipments F.O.B., N.Y.C. warehouse. (N.Y.C. residents add sales tax.)

PLATT ELECTRONICS CORP.

Dept. A, 125 West 17th St., N. Y. 11, N. Y.
PHONE: CHelsea 2-1100

A salute to the stations of Oklahoma City and its loyal listeners and viewers.

SNAIL-LIKE ACTION on new station grants still prevailed as this column was being prepared. Congressional inquiries were blamed for the pokey moves.

Many months will pass, it has been generally admitted, before any real drive for station authorizations is made. Firm, conclusive action in Washington could spark action, all agreed.

Stations and new calls OKed, as this

issue was being put to press, appear below.

AMERICA HAS SET UPON A COURSE of developing her broadcast industry within the framework of the free enterprise system and her concepts of free speech.

Thus declared FCC Commissioner John C. Doerfer, in an address on the dangers of control by government, before the Commonwealth in San Francisco, several weeks ago.

Noting that there is a substantial difference between regulation and operation, the Commissioner said that

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.)
Louisiana Baton Rouge	WBRZ	2	54-60	17.8	100
Texas Waco	KWTV-TV	10	192-198	5.08	107
Canada Halifax, N.S.	CBH-TV	3	60-66	16.06	56.5

The frequency of the video carrier = 1.25 + channel lower freq. limit. Total number of TV stations now on the air in U.S.: 433 (120 of which are u. h. f.)

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*
Idaho	Lewiston	.....	3	60-66	1.48
North Carolina	New Bern	.....	13	210-216	49
Pennsylvania	Sunbury	.....	38	614-620	12.9

NEW CALL LETTER ASSIGNMENTS

STATE	CITY	CALL	CHANNEL	FREQUENCY
Arkansas	Jonesboro	KBTM-TV	8	180-186
D. C.	Washington	WETV	20	506-512
Georgia	Savannah	WSAV-TV	3	60-66
Hawaii	Hilo	KHBC-TV	9	186-192
"	Wailuku	KMAU	3	60-66
North Carolina	Washington	WITN	7	174-180

CALL LETTER CHANGES

Idaho	Boise	KBOI-TV (Formerly KBOI)	2	54-60
Pennsylvania	Pittsburgh	KDKA-TV (Formerly WDTV)	2	54-60
Wisconsin	Milwaukee	WXIX (Formerly WOKY-TV)	19	500-506

*ERP=(effective radiated power, kw.)

..... Call letters to be announced

SCHEMATICS—CONVERSIONS FOR SURPLUS GEAR

NEW LIST! MANY ADDITIONS!

Send stamped, self addressed envelope for List C. Add 25c for chart explaining AN nomenclature.

R. E. BOX 1220
GOODHEART BEVERLY HILLS, CAL.

Tape Splicer

F. REITER COMPANY
3340 Bonnie Hill Drive
Hollywood 28, California

CARBOLAY CUTTER AUTOMATIC

FREE \$1 MILLION

WORTH OF QUALITY WHEN YOU BUY

PICTURE TUBES, 1 YR. WARRANTY:

TUBE	PRICE	TUBE	PRICE
10BP4	\$ 9.95	17BP4A	\$14.95
12LP4A	10.95	17CP4A	16.95
14BP4	12.95	17HP4A	16.95
16AP4A	16.50	17LP4A	16.95
16GP4A	16.50	19AP4A	19.95
16KP4	13.95	20CP4A	18.95
16RP4	13.95	21AP4A	21.95
16TP4	13.95	21EP4A	19.95
16CP4A	15.50	21FP4A	20.95

Full Line of Top Quality TV-Radio Parts in Stock.

• Ram-type X-032 Flybacks: \$3.95
• Set of 8 screwdrivers & rack: 98c
• Auto radio fuses, 9, 14, 20 amp: 2c each
All items new, best brands, guar. 1 yr.
Export Orders Solicited.

Min. Order \$5. Send 25% dep. Bal. C.O.D.
MONEY-BACK GUARANTEE. Write for catalog.

DURO ELECTRONICS CO.
78 Atwells Avenue Providence 3, R. I.

the primary design of the regulatory process is to . . . "curb excessiveness and prevent unreasonable discriminatory practices . . . and operation means management. . . ."

"In America," Doerfer explained, "management is reserved for private individuals, courageous enough to risk their energy and their savings."

A number of persons, although opposed to government operation of a broadcasting system, languish for stricter controls or more censorship, members of the club were told. Reminding his listeners that we can just as easily and irretrievably lose some of our cherished freedoms through inadvertence, as we can through intentional abandonment, the Commissioner said that we can gain nothing by compromising these fundamental principles.

A poignant observation, indeed. L.W.

NORTH FORK MEET

The North Fork Amateur Radio Club of Western Oklahoma will hold its third Annual Hamfest and Picnic at the Quartz Mountain State Park and Lagert Lake, on May 21st and 22nd.

Registration fees will be \$2.50 and will include overnight bunkhouse privileges, as well as eligibility for an impressive list of prizes.

All those who register prior to May 15th will be eligible to compete for an extra prize of a completely wired and tested Johnson "Adventurer."

Those wishing further details on this event are asked to contact Jay Thompson, W5ZZP of Sayre, Oklahoma. -30-

ST. LOUIS HAMFEST

The Greater St. Louis Radio Amateur's Annual Hamfest has been scheduled for Sunday May 22nd this year.

The committee in charge has planned an interesting program consisting of games and entertainment with plenty of good prizes for the lucky contest winners.

Refreshments will be available at the Creve Coeur Farmer's Club where the event will take place. Admission for adults is \$1.00 per person with children being admitted free.

Those desiring further information on this event should get in touch with Lawrence Schwarz, 7 North 7th Street, St. Louis 1, Missouri who is serving as publicity chairman for this event. -30-

SPEAKER SERVICE HINT

By WILLARD S. WEISS

HERE is one way to locate those elusive speaker troubles.

Occasionally, a loudspeaker may become noisy and rattle due to such things as a loose eyelet where the voice coil wires are attached to the cone, "unstuck" glue, etc.

A quick way to find such trouble is to energize the speaker with some frequency at which the noise can be heard. Then, by using a piece of rubber tubing held to your ear with the other end near the cone, the trouble can usually be isolated.

A medical stethoscope, if available, can be used for the same purpose as the tubing. -30-

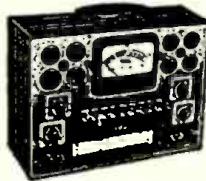
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3Q5GT61	6BJ651	6SK7GT45	12BA646
3V448	6BK575	6SL7GT60	12BA758
5V4G49	6BK778	6SN7GT60	12BE646
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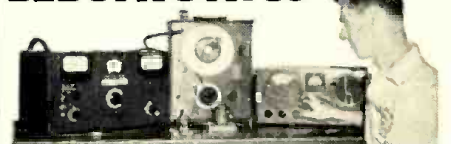
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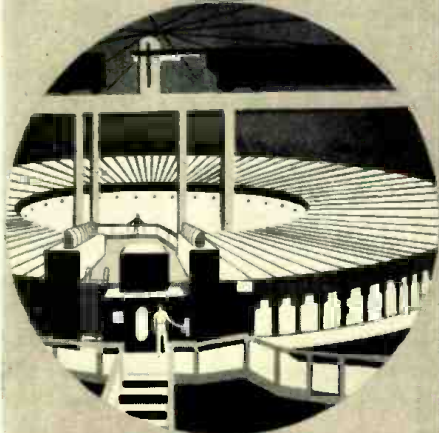


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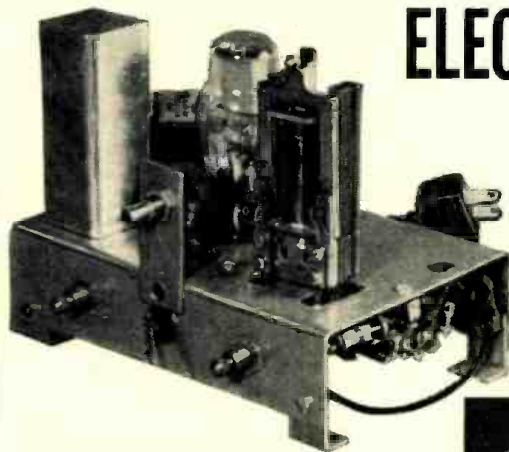
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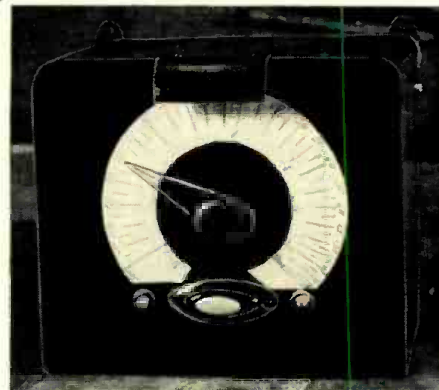
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ELECTRONIC TIMER FOR PHOTO ENLARGER



Top chassis view of the unit. Note how potentiometer, R_1 , is mounted above the chassis. See text.

Over-all view of the home-built timer. The dial is calibrated in minutes and seconds. A shielded red bulb lights the dial face.



By
DORIS and DARYL WILEY

Construction details on a fairly simple unit which covers range from two seconds to over three minutes.

WHEN making several prints from one negative, it is easy to become confused and to make each one different, spoiling a number in the process. However, by using the reliable and very accurate electronic timer shown in the photographs your worries are over. Merely set the dial to the correct exposure, press the button, and do another chore while the timer thinks for you and automatically shuts off the enlarger. Each print will be exactly the same for that particular setting of the dial, whether you set it for ten seconds or for three or four minutes—this timer never varies.

This circuit is patterned after the

Nema 1A timer which is used in welding controls, the main difference being in the time constant of the grid circuit.

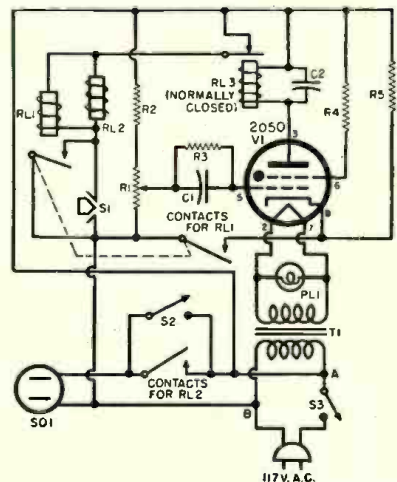
When the unit is turned on and A is negative with respect to B , current flows through R_2 from cathode toward the grid, thus charging C_1 . The charge on C_1 , being negative toward the grid, is determined by the voltage divider arrangement of R_1 and R_2 . (See Fig. 1.)

This phenomenon, known as grid conduction, occurs only during half of the cycle, and keeps C_1 charged to the proper potential and polarity until contact is made with the push-button, S_1 .

This operation then starts the timing cycle. When contact is made, relays

Fig. 1. Complete schematic diagram of the electronic timer for a photo enlarger.

- R_1 —50,000 ohm pot
- R_2 —50,000 ohm, $\frac{1}{2}$ w. res.
- R_3 —10 megohm, $\frac{1}{2}$ w. res.
- R_4 —100,000 ohm, $\frac{1}{2}$ w. res.
- R_5 —47,000 ohm, $\frac{1}{2}$ w. res.
- C_1 —4.2 μ f. capacitor (Authors used a surplus unit. A 4 μ f., 150 v. bathtub can be used)
- C_2 —.1 μ f., 200 v. capacitor
- RL_1 —D.p.d.t. a.c. relay, 115 v. (Only d.p.s.t. operation, normally open, is used)
- RL_2 —S.p.s.t. a.c. relay, 115 v., normally open
- RL_3 —S.p.s.t. d.c. relay, 6 v., normally closed
- T_1 —Fil. trans. 6.3 v. @ 1 amp.
- S_1 —S.p.s.t., normally open, push-button switch
- S_2, S_3 —S.p.s.t. toggle switch
- SO_1 —Female receptacle
- PL_1 —#47 pilot light
- V_1 —2050 tube



RL_1 and RL_2 close. Part of RL_1 completes the cathode circuit to R_1 . The other contacts on RL_1 close across the push-button contacts, S_1 , to complete the relay coil circuit, and RL_2 turns on the photographic enlarger. Capacitor C_1 now discharges through the 10 megohm resistor R_3 across it, until the potential of the grid is low enough to allow the tube to conduct.

Upon conduction of the tube, relay RL_3 energizes due to the plate current through it, which opens the relay coil circuit for RL_1 and RL_2 . At this instant the enlarger is turned off and capacitor C_1 recharges to the set potential of R_1 .

Capacitor C_2 is connected across the RL_3 relay coil in order to keep it from chattering due to the pulsating d.c. current through it.

Before constructing this unit, first decide on your parts layout for most economical utilization of the allotted space.

Cut all chassis holes before mounting any of the parts.

Next mount the parts. (Mount the push-button and pilot light on the cabinet, if desired.) It is best to mount the 50,000 ohm potentiometer about 2 inches above the chassis on a special extension so that the dial and pointer can have nearly a full circle swing.

Wire according to the schematic. For best results, start with the line cord and follow through. Solder all connections well.

One of the "on-off" switches is necessary to turn on the unit, and the other is used to bypass the relays to turn on the enlarger for focusing, sizing, and getting ready to expose the print.

Plug a lamp into the enlarger outlet and plug the unit into the home outlet for a thrilling test. Build a suitable cabinet and finish it as you desire.

The ideal pointer is made by forming a piece of lucite to desired shape, scoring a line up the center of the back and filling with black paint. Glue this to an ordinary radio knob.

Fasten the completed unit into the cabinet with screws from the bottom as is done in small radio installations.

To make the dial, place a circular piece of heavy white paper in place and calibrate. Use a clock or watch with a good second hand and check twice for accuracy. You will probably wish to remove this paper for completion of dial calibrations. Be sure to mark its position exactly before removing it, so it can be replaced in the same location.

Form the reflector from metal and place it and the pilot light over the calibrated dial. Buy a red bulb or paint one red.

Put hooks on the back of the cabinet if you wish to hang it up. Hang it on the wall near your enlarger, set the dial, press the button, and you have a perfect print every time!

Considering the simplicity of this device and the relatively-low cost of the required parts, this timer has a lot to offer the serious photo fan who enjoys enlarging his own choice prints.

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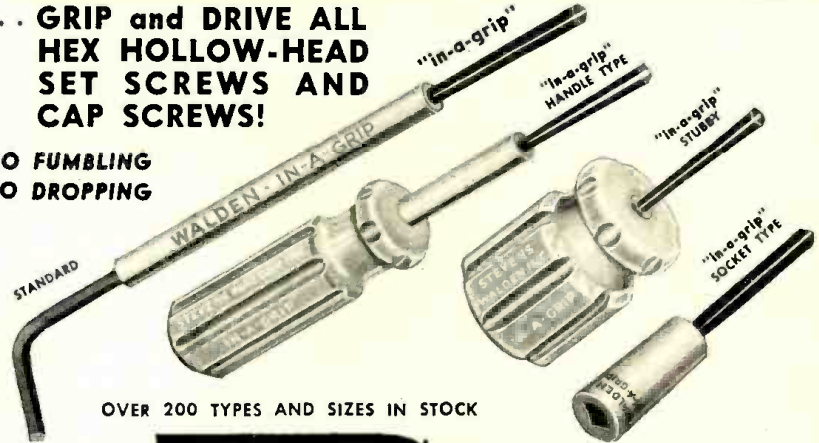
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A Two-Band Final (Continued from page 51)

partitions or the chassis. Initially, RL_1 was mounted on a piece of 3/8-inch Lucite, which was mounted on the chassis. The shielding cabinet was built of Reynolds "Do-it-Yourself" aluminum sheet, using Reynolds one-inch aluminum angle for supports. These materials are soft aluminum, and are a pleasure to work with, compared with dural, and construction of the cabinet and tapping of all holes took up only one afternoon. The aluminum angle is tapped, and 6-32 machine screws are used to screw the panel, top-and-side cover, and back cover to the angle. The top-and-side cover was bent, using a hammer and 2 by 4, from one piece of aluminum and allows 3/4-inch overlap on each side of the chassis. The rear cover has the same overlap.

When the rig was first fired up at 1000 volts, everything was fine. 1800 volts was tried next, and nothing blew up. At 2500 volts, there was a loud "pop," and smoke started pouring out. The trouble was found to be in the relay mounting system. The combination of 2500 volts d.c. and the unknown amount of r.f. appearing on the hot ends of the tank circuit had resulted in a voltage rupture of the Lucite. From the relay to chassis ground. The consequent fire ruined the relay. A new relay was installed on some one-inch stand-offs and the final was fired up again—successfully, this time. At least, it was successful on 14 mc. However, on 7 mc., the amplifier would not neutralize correctly, and a few minutes of operation with plate voltage applied, in an effort to find the trouble, resulted in more smoke. This was traced to the plate r.f. choke, which evidently had a hot spot at 7 mc., despite being rated by the manufacturer for the ham bands. Substitution of R_3 for the choke cured this difficulty and the final neutralized properly on both bands.

Initially, no parasitic suppression measures other than the incorporation of C_3 and the use of copper strap leads in plate and neutralizing circuits had been taken. No parasitics evidenced themselves while operation was conducted on both bands for a few days. Then, a careful check for parasitics was made. First, antenna and excitation were disconnected, the amplifier was run at 2500 volts, and bias was reduced to about 220 volts, at which point the plate current was 150 ma. Plate and grid tuning capacitors were run throughout their ranges with no grid current flow and no changes in plate current noticed. Next, the plate voltage was reduced to 700, and the grid-bias lead was grounded. This resulted in about 500 ma. of plate current, as well as some weird and wonderful variations in plate and grid current, when the earlier tuning tests were repeated. Since I hoped to use

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this rig as an amplifier for a single-sideband rig, the parasitics had to go. Therefore, three parasitic-suppression measures were taken. The grid suppressor, R_2-L_3 , was added, a 50,000-ohm resistor, consisting of several paralleled 2-watt non-inductive resistors, was connected across the grid coil, and three paralleled 33-ohm, 2-watt resistors were inserted between the grid and the neutralizing capacitor. Clipping and unclipping leads proved the two latter measures to be unnecessary. The series grid suppressor was required, but cut the grid current by some forty percent. Removal of C_3 brought the grid current up to within ten per-cent of its former value, and the amplifier still was completely stable. (No, I don't know why, either: Checks with a grid-dip oscillator showed no untoward resonances with C_3 in or out of the circuit.)

One other difficulty manifested itself with this rig. It had been planned to operate the final into an external antenna coupler, which has moderately variable antenna loading control, and it was decided that variable-link coupling to L_5 was unnecessary. This was an unfortunate error, as it was not possible to reduce coupling sufficiently with the original L_5 to permit legal inputs on either band, when operating into flat 52-ohm lines. If I could figure out some way to do it within the limited confines of the shield can, I would substitute a 1000-watt coil with variable-link coupling (which should be controllable from the front panel) for the present L_5-L_6 setup.

Aside from the difficulties mentioned, the rig has been quite satisfactory. When operated through a low-pass filter and an antenna coupler, it causes no TVI in my own receiver. However, a day or so after steady operation was started with the full kilowatt, my next-door neighbor complained that his set lost its picture each time the key was pressed. A check showed that this was happening on all channels. This was a puzzler, as a test with other neighbors revealed their sets to be clear of TVI, and his trouble was not coming from r.f. in the a.c. line, nor from front-end overloading. Then I noticed that his house and mine were fed by a common power line. His line voltage showed a drop of nine volts when my key was pressed. This drop, when taken from our normally low line voltage was sufficient to pull the local oscillator in his set completely out of oscillation every time the key was pressed. That, unfortunately, is just another of the ill effects of high power. Now I run the kilowatt only when the line voltage is high, but even then, it's nice to be able to change bands as quickly in the final as I can in the exciter.

For those who enjoy contest work or want the convenience of rapid band-changing, this circuit is well worth the small investment of time and effort that is required to build up this amplifier. Try it for smooth operating convenience.

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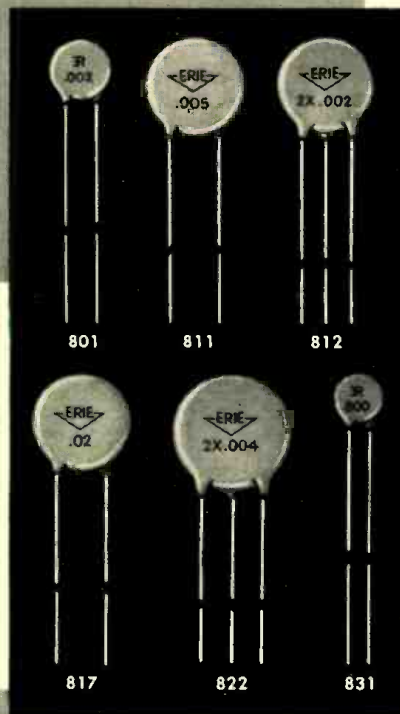
Enclosed is \$1 in full payment for the recordings of 10 jazz classics listed. Enroll me as a Trial Member. Privileges: No purchase obligation ever! Advance notice of releases, 5-day free trial on any discs. I may reject records before or after receipt; may cancel membership at any time. For future l.p. discs I keep, I'll pay only \$2.75 each, plus shipping and excise tax... saving 40% of usual retail price!

Name.....
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Use the complete line...

ERIE DISC CERAMICONS®

Erie Disc Ceramicons are available at Distributors in four classes as standard stock:—High Stability General Purpose Ceramicons in a wide range of values, (5mmf to 1800 mmf) with 10% capacity tolerance.—Hi-K By-Pass and Coupling Ceramicons from 470 mmf to .02 mfd GMV.—Hi-K Dual Ceramicons.—High Voltage Ceramicons rated at 1500, 3000, and 6000 Volts, DC. Working. Characteristic of all classes is smallness of size graduating with increase in capacity value. For complete listing of styles and values available write for D-54 Catalog which includes all Erie Distributor products, or ask your nearest Erie Distributor.



ERIE ELECTRONICS DISTRIBUTOR DIVISION

ERIE RESISTOR CORPORATION
Main Offices: ERIE, PA.

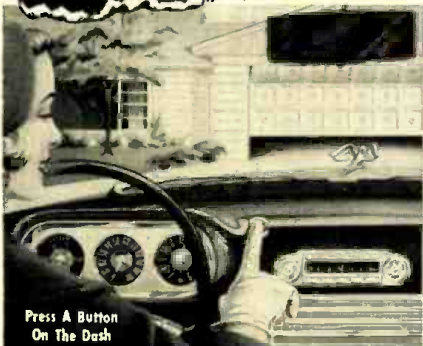
Factories: ERIE, PA. • LONDON, ENGLAND • TRENTON, ONTARIO

Just a touch
of Your Finger

**OPENS and CLOSES
YOUR GARAGE DOOR**

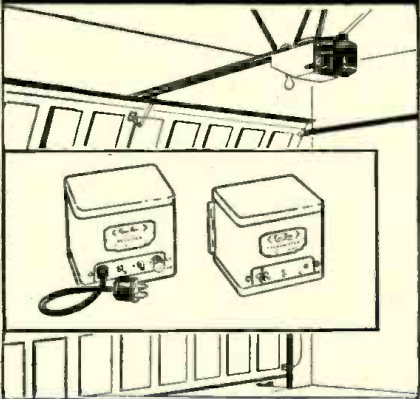
with the

Perma-Power ELECTRONIC
Remote Control
Garage Door Opener



Press A Button
On The Dash

**OPEN AND CLOSE FROM
YOUR OWN CAR**



Everyone can afford this
modern convenience!

- ★ It's really simple to install . . . one man can do it easily!
- ★ Takes just an afternoon with common hand tools; no soldering.
- ★ Complete instructions assure professional-type installation.

Available from electronic parts distributors
Illustrated literature upon request

Perma-Power COMPANY 4277 N. DAMEN AVE.
CHICAGO 75, ILL.
Manufacturers of electronic equipment since 1928

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.

DYNAMOTOR CATALOGUE

Carter Motor Company, 2644 N. Maplewood Ave., Chicago 47, Illinois, is now offering copies of its latest dynamotor catalogue which lists the firm's entire 1955 line.

In 28 pages, the catalogue provides complete electrical and mechanical specifications and is designed both for the counter salesman and service and purchasing departments.

Copies of the new catalogue are available from Dept. 5 of the company upon written request.

TUBE TESTER CHART

Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y., has just issued a new 1955 tube tester roll chart, #625-04, which contains hundreds of listings of the latest tubes just released by all leading tube manufacturers.

Designed to be used with all *Eico* tube testers, the chart is available at \$1.00 from the company's jobbers or may be ordered from the company direct.

TECHNICAL DATA CATALOGUE

Lefax Publishers, Philadelphia 7, Pa. has issued a newly-revised catalogue covering its pocket-size technical library.

Among the books listed in the catalogue of particular interest to those in the radio-electronic field are data books on mathematics, radio, television and FM, a.c. and d.c., a.c. motors and generators, transformers, relays, and meters.

For a copy of the catalogue, write the publisher direct.

TRANSFORMER CATALOGUE

A 20-page catalogue which has been designed to facilitate the custom-specifying of transformers by industrial purchasers and design engineers has been issued by *General Transformer Company*, 18240 Harwood Ave., Homewood, Ill.

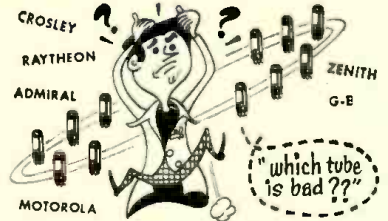
The catalogue illustrates "prototypes" covering the complete range of transformer applications to make it easier and simpler to specify electrical and mechanical requirements.

RMS CATALOGUE

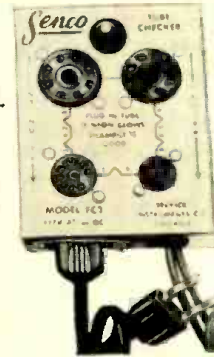
The Catalogue Division of *Radio Merchandise Sales, Inc.*, 2016 Bronxdale Ave., New York 62, New York is now offering copies of its 1955 cata-

HERE'S HOW

to QUICKLY find the BAD TUBE
in New Series Filament
TV Sets



ONLY
TESTER
that will
check ALL
tubes by
merely
plugging
in socket.
If neon
glows —
tube
filament
is good.



POCKET
SIZE
Tester
Weights
only 6 oz.
Continuity
and
picture
tube
tester

Patent
applied for.

\$3.95

DEALER NET

Mfg. by **SERVICE
INSTRUMENTS CO.**

See Your Local
Parts Jobber

422 S. Dearborn St., Chicago 5, Ill.

HERE'S HARDNESS AND KEENNESS FOR YOU!

NIP Spring Steel

-or the finest copper wire

When the need for
cutting spring steel
arises . . . you NIP it
with confidence.

Your cutters can take it!
The feeling of per-
fection they give
. . . is priceless.

The hardness of steel
assures their durable
use - 'tis forever.

You will be proud
to own and use—
**RHINELAND
QUALITY
TOOLS**



Side
cutting
NIPPERS
\$3.95

Satisfaction Guaranteed
Order directly
from

Inquire about
COMPLETE TV,
RADIO TOOL KIT

SOUND APPARATUS COMPANY

IMPORT AND EXPORT DIVISION
STIRLING, NEW JERSEY, U. S.

logue covering the company's line of antennas and accessories.

This handy 25-page catalogue, No. 55A, is punched for insertion in standard ring binders. The publication carries list prices for each item shown and groups the entire line into various sections for ease in ordering. The catalogue is completely indexed.

TRANSISTOR DATA SHEET

General Transistor Corp., 95-18 Sutphin Blvd., Jamaica 35, N.Y. has released a new catalogue sheet covering its line of diffused p-n-p junction transistors.

The data sheet illustrates the company's double sealing process and provides information on absolute maximum transistor ratings and characteristics.

CABINETS AND EQUIPMENT

General Industrial Co., 5725 N. Elston, Chicago 30, Illinois has issued a colorful 24-page catalogue which is available for the asking.

Among the many new items listed in the catalogue is a wireless intercom system which requires no wires and no installation. Also offered are plastic drawer cabinets in a wide variety of sizes and capacities. Office equipment and other industrial items are also pictured and described in detail.

AUTO-RADIO TRANSFORMERS

Chicago Standard Transformer Corporation, Addison and Elston Streets, Chicago 18, Illinois, has issued an 8-page auto-radio transformer replacement guide which is being distributed without charge upon request.

The new publication lists both vibrator power and audio output replacements for over 540 car radios. It includes all models used by the major automobile manufacturers as well as private label brands. More than 40 different manufacturers are listed and cross-referenced for easy use. In addition, information about the year each model was used is also included.

A separate catalogue page lists detailed specifications on 25 vibrator power transformers, including 21 exact replacements, and 19 audio output units used in car radios.

RETMA ANTENNA BOOKLET

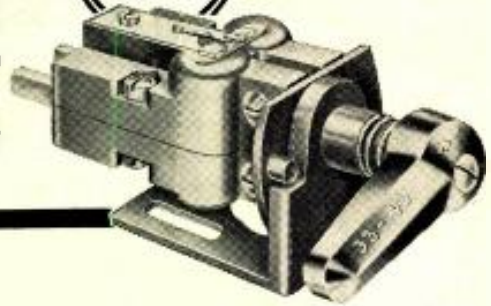
A new consumer education publication, "Your Television Antenna System," has been prepared by the Radio-Electronics-Television Manufacturers Association in cooperation with the National Better Business Bureau.

The booklet is designed to acquaint the public with the importance of antennas for good television reception and the need for keeping an antenna properly serviced. It was prepared by the Antenna Section of the RETMA Parts Division and the Radio-Television Committee of the National Better Business Bureau.

Distribution of this booklet will be made through TV dealers, service technicians, and local BBB's. Bulk orders will be filled through the National Better Business Bureau.

RECOTON

magnetic turnover cartridge



gives you unsurpassed audio performance!

Name your own standards! There is no cartridge made that excels the new RECOTON-GOLDRING.

You can enjoy all the advantages of low output while eliminating hum pickup from changer motor, transformer, etc. The answer is in Recoton's newly developed push pull coil assembly. So thrill to a new experience in listening pleasure with this amazing turnover cartridge. It gives a performance that will satisfy even the most critical hi-fi enthusiast! And its modest price of \$9.90 (including 2 sapphire styli) comes as a pleasant surprise!

Recoton features:

- Replaceable diamond or sapphire styli.
- Frequency response of 20 to 16,000 cps.
- Added shielding
- High compliance and low mass
- Independent safety stylus assembly
- Minimum vertical motion
- Simple installation

Sold by all leading hi-fi distributors. For more detailed literature and name and address of distributor nearest you, write to Dept. R.

RECOTON CORPORATION - 52-35 Barnett Avenue, Long Island City 4, N. Y.
Manufacturers of World Famous Diamond, Sapphire, Osmium Phono Styli

the sensational "QUICK-HOT" SOLDERING GUN

Built-In Spotlight

STEVE-EL "jumped the gun" by introducing the "QUICK-HOT" before anybody else. We have never been so excited about a soldering gun development as we are about "QUICK-HOT" It is without a doubt, the most efficient soldering gun of all 175 watt guns.

- Extra long narrow tip for easy reach.
- Built-in spotlight.
- Lifetime tip.
- Soldering heat in 2 1/2 seconds.

\$ 5⁹⁶ ONLY

EXTRA SPECIAL!
16 RP4
PICTURE TUBE
\$16.49
Brand new. Guaranteed 1 year

FREE!

Write Dept. RN-5 for New BARGAIN BULLETIN

STEVE-EL Electronics Corp.
61 Reade St. New York 7, N. Y.

COLOR TV EXPERIMENTERS!



Look What You Get for the Remarkably Low Price of Only \$99⁵⁰

(See Dec. '54 Radio & Television News article on Color TV Conversion)

A COMPLETELY OPERATING PHILIPS PROTELGRAM TV SYSTEM

BRAND NEW—shipped in original factory sealed container

YOU GET A COMPLETE PACKAGE INCLUDING:

- Chassis completely wired and ready for use, including 23 tubes plus one diode • Protelgram projection unit including picture tube • 25,000 volt power supply • 8" dynamic hi-fi speaker on large baffle • 23" flat viewing screen and full size reflecting mirror.

NOTE: Chassis circuitry includes . . . Automatic beam suppressor . . . High Fidelity sound system . . . Automatic gain control . . . "Standard Coil" tuner, etc. \$400.00 original cost of parts, units and accessories to experiment with.

EDUCATIONAL . . . INTERESTING . . . ENTERTAINING

TERMS: F.O.B. N.Y.C. Full remittance with order or 25% Balance C.O.D.—10 day money back guarantee.

THE GOLDSTAR COMPANY
58 Walker St., N. Y. 13, N. Y. Phone: WA. 5-8187

Your High Fidelity System Will Sound Better with a

GOODMANS Loudspeaker

made in
england

ROCKBAR CORPORATION Dept. HE-5
215 East 37th Street, New York 16, N. Y.

Please send complete description of
Goodmans High Fidelity loudspeakers.

Name.....

Address.....

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

My Dealer is.....

ter Business Bureau, 405 Lexington Ave., New York 17, N. Y. for 3 cents a copy or single sample copies are available free from RETMA headquarters at 777 14th Street, N. W., Washington 5, D. C.

INDUSTRIAL TV DATA

The Engineering Products Division, Building 15-1, Radio Corporation of America, Camden 2, N. J. has issued a new catalogue describing its industrial television equipment.

Catalogue E.51 illustrates and describes the features, applications, and construction details on the ITV-6 closed-circuit television system. Specifications on this gear are also included.

HEATH FLYER

Heath Company, a subsidiary of Daystrom, Inc., Benton Harbor, Michigan has released a 12-page, two-color flyer describing and picturing the firm's line of test equipment, audio gear, and ham items.

Among the new products are a 100 watt phone-c.w. transmitter, a deluxe high-fidelity amplifier, and a TV alignment generator. Complete specifications and pertinent details are provided for each of the units listed.

A free copy of this publication is available for the asking.

"REP" DIRECTORY

The New England Chapter of "The Representatives" of Electronic Products Manufacturers, Inc., has issued a 1955 Directory of its membership which is currently being distributed to the trade and industry in general.

The directory lists, by name, the manufacturers represented by participating members of the New England Chapter as well as the various categories of products these manufacturers offer.

For information on how a copy of the directory may be obtained write to the chairman of the directory committee, Henry P. Segel, 131 Newbury Street, Boston 16, Mass.

GUIDE FOR TECHNICIANS

Astron Corporation, 255 Grant Avenue, East Newark, N. J. has just issued a new 16-page capacitor estimating and pricing guide in handy pocket size for the convenience of service technicians.

The guide contains all essential data on all of the firm's capacitor types for replacement in home radio, phonograph, and television equipment. List prices are given to enable the technician to make on-the-spot estimates and show customers actual costs.

The guide is available through jobbers or from the company direct.

GUARDIAN RELAYS

Guardian Electric Mfg. Co., 1621 W. Walnut Street, Chicago 12, Ill. is now offering copies of its new 72-page catalogue which covers the firm's complete line of basic type relays.

Each relay is fully described as to physical and electrical characteristics

INSIST ON THE GENUINE **NEW INCA QUICKIE** #2

the 10 WAY WRENCH ONLY 98¢
WITH 1,001 USES!

Slightly higher. W. of Miss.

Only the INCA "Quickie" has all the features as listed below:

- Looks like the picture below. Has "INCA," and "Made in Switzerland" imprints! Accept no substitutes.
- Fits and holds firmly, no rounded corners, all squared and precision manufactured—only, this wrench has designed small head to fit into inaccessible places.
- Has 1/4" Hexagon size. Nickel and hard chrome finished.

(This picture is now being used by "Merchants" who misrepresent the product they are selling. They remove "INCA" and "Made in Switzerland" from their illustrations, and sell inferior items with none of the above features).

Some will be fooled by this misrepresentation—will you?

Each INCA "Quickie" is fully guaranteed to be as represented.

Win Free—A

\$250.00 value

INCA "Quickie"

Power Saw

with accessories. See

your jobber!

4" x 1" overall



AT YOUR JOBBER if he cannot supply, write to

J. E. S. CO.

111-51 Lefferts Blvd.

S. Ozone Park 20, L. I., N. Y.

MORE JOBS than graduates

Demand for our engineering graduates exceeds supply. Effective placement. Study in this world-famed college established 1884. Quarters start June, Sept., Jan., March. Approved for Korean Vets.

Bachelor Science degree in 27 months

Complete Radio Eng. course includes TV, UHF and FM. Also Mech., Civil, Elec., Chem., Aero. and Adm. Eng.; Bus. Adm., Acct. Small classes. Well-equipped labs. Modest costs. Prep. courses. Write Jean McCarthy, Director of Admissions for Catalog and Campus View Book.



TRI-STATE COLLEGE

1655 College Avenue, Angola, Indiana

CAMERA OWNERS!

10¢

BRINGS YOU A DIGEST OF SUCCESSFUL COLOR PHOTOGRAPHY the new \$4.95 book by Andreas Feininger

Here is the authoritative, yet easy-to-follow work on color photography you've been waiting for. Written by Andreas Feininger—one of the world's foremost photographers—it's the simplest, yet most complete discussion of color photography ever to appear. This book digest from the pages of Popular PHOTOGRAPHY Magazine is going to save you time, money and temper... and improve your pictures in the bargain. And—while the supply lasts—it's yours for only 10¢. But don't delay. Fill out the coupon below and mail it today!

Popular PHOTOGRAPHY Box RTV
366 Madison Ave., New York 17, N. Y.

Here's my 10¢. Please send me a copy of SUCCESSFUL COLOR PHOTOGRAPHY, a digest of the \$4.95 book by Andreas Feininger.

Name.....

Address.....

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

RADIO & TELEVISION NEWS

with complete operating data and suggested applications also included. In addition to the relays, the book devotes two pages to definitions of engineering and electrical terms and laws.

CAPACITOR CATALOGUE

Good-All Electric Manufacturing Co., Ogallala, Nebraska has announced the availability of a new two-color, 32-page catalogue which describes its entire line of paper and dielectric capacitors for civilian, military, and specialty applications.

Catalogue No. 551 includes line drawings and photographs of all case style mountings, graphs and charts describing electrical and mechanical characteristics, as well as a comprehensive index which facilitates ordering.

ATLAS SOUND DATA SHEETS

Atlas Sound Corp., 1451 39th Street, Brooklyn 18, N. Y. has released two catalogue sheets covering two of its new products, the Model CJ-30 "Cobra-Jector" loudspeaker and the Model BS-37 "Porto-Boom" professional mike boom stand.

Either or both of these data sheets are available without charge upon request.

TV TUBE GUIDE

The second edition of its "Reference Guide for Television Picture Tubes" has been announced by *CBS-Hytron* of Danvers, Mass.

This newly enlarged guide lists all magnetically deflected picture tubes—monochrome or color—including those made by other manufacturers as well as *CBS-Hytron*. As an additional aid to the TV technician, bold-face type emphasizes the important characteristics among similar tubes having different suffix letters.

Copies of the guide are available from the company's distributors.

SYLVANIA BROCHURES

Sylvania Electric Products Inc., 1100 Main Street, Buffalo 9, N. Y. has announced publication of three new brochures in the electronics field.

The first is a wall chart which lists the company's complete line of 600 ma. tubes for series-string television receivers. The second brochure lists gas tubes for use in control mechanisms, while the third folder covers crystal diodes.

Any or all of these publications are available from the Central Advertising Distribution department of the company.

METAL HOUSINGS

Premier Metal Products Co., 3160 Webster Ave., New York 67, N. Y. has released its 1955 catalogue covering the firm's complete line of "Precision Built Metal Housings."

Tabbed for easy reference, the 16-page catalogue illustrates over 450 standard stock metal housings for the electronics industry. It includes full details on many newly-designed items not found in previous catalogues. —30—

ARMY AIRCRAFT RECEIVER ... BC-946B

Covers 526 Kc to 1500 Kc Broadcast Band. Tubes: 3-12SK7, 1-12SK7, 1-12A6, 1-12K8. Designed for dynamotor operation; can be easily converted to 110 volt or 32 volt use. Two IF stages. Three-gang tuning cond. BRAND NEW, in sealed carton, with tubes, less dynamotor **\$29.95**
12 volt dynamotor for above \$7.95

A-966 DYNAMOTOR

Can be easily converted to a four speed motor. Approx. 1 1/2" long, 1/20th horsepower, 115 V, 50/60 cycle, AC motor with integral gear box having four 1/4" drive shafts turning simultaneously at the following speeds: 4000 RPM—grinders, buffers, flexible shaft tools, etc.; 150 RPM—wrapping fishing rods, slow speed tools; 25 RPM—dev. tray rocker for photo darkroom; 5 RPM—turning barbecue spits, adv. displays.

A THOUSAND OTHER USES AROUND THE WORK SHOP
with diagram for conversion to AC \$4.95
Already converted, ready to go \$7.95

BC-709 INTERPHONE AMPLIFIER
battery operated, brand new **\$2.95**

Amplifier, pre-amplifier, or 5 station Intercom.
Up to 5 input and output circuits. Requires simple power supply for operation. Complete with tubes in sturdy metal case. Excellent **\$1.95**
3 for \$5.00

25 watt phone—CW 5 tube transmitter. Frequency range 2-9 MC. Two 815 tubes in circuit. One as modulator and one as RF output. Ideal for C. A. P. Mobile. Excellent condition, with tubes. Wt. 2 1/2 lbs.
With tuning unit 2.3-4.3 **\$12.95**

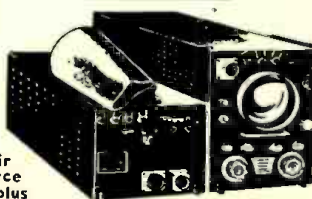
Wavemeter. Containing a 105MC to 127 MC tuneable resonant type resonant cavity and 0-200 Micro Ammeter. Brand New **\$49.50**

Radio Receiver and 12 Volt DC Vibrapak. 3800Kc-6000Kc, 7 tube super-het like new. Less tubes **\$12.95**

Radio Receiver 11-tube UHF tunable 231-258 MC receiver with schematic. Complete with tubes 3 ea. of 6AK5, 7 ea. of 9001, 1 ea. of 12A6. Like new. Control Box, New **\$6.95**
\$1.50

BC-1206 Beacon Receiver Complete with 5 tubes, tunes 195 KC to 420 KC, Volume control—RF gain control. Power supply 24 to 28 volts, Wt. only 4 lbs. Brand new **\$10.95**

TS 258 X band freq. meter, power meter & signal generator. Power measuring bridge pulse or CW freq. 8990 MC-9017 MC. Excellent **\$195.00**



Air Force Surplus

ORIGINAL COST \$2500.00

Marine or Airborne Long Range Navigational equipment! Determine the exact geographic position of your boat or airplane! AN/APNA Loran set. Frequency range 1700-2000 KC. Complete with 1D6B/APNA indicator, R9B/APNA receiver, crystal and plugs. Complete. Brand New **\$129.50**

R-6S/APN-9 LORAN Indicator. LATEST MODEL UNIT. Complete in one light weight case. Accurate on a maximum range of up to 1600 statute miles, within 1% of the distance from the ground transmitter. The finest unit available at any price!! BRAND NEW. Only **\$295.00**

A Sweet Oscilloscope Deal

INDICATOR UNIT. For conversion to test scope, panadapter, analyzer, etc. Double deck chassis. 5CP1 mounted in tube shield. Less small tubes, but complete with 5CP1. Exc. cond. each **\$9.95**
12V DYNAMOTOR OUTPUT 375 V @ 150 MA: complete with filter **\$1.95**
base used, ea. \$4.95
Brand New \$4.95

SOUND POWERED head and chest sets, ea. \$3.95
LIKE NEW 2 for \$7.00

PE120. Used 6, 12, or 24 Volt Power Supply each **\$4.95**

ALL ITEMS F.O.B. CHICAGO
25% Deposits required with orders

WRITE FOR NEW BULLETIN AND PRICES.

R W ELECTRONICS

Dept. N, 2430 S. Michigan Ave., Chicago 16, Ill.
PHONE: CAIumet 5-1281-2-3

Command Equipment (274N-ARC5, ATA)

	As Is	Excellent
190-550 KC	\$4.95	\$7.95
3-6 mc	2.95	6.95
3-Rec. Rcvr.	4.95	1.50
BC 458 Transmitter	4.95	6.95
459 Transmitter	5.95	7.95
456 Modulator	1.95	3.95
Remote Control box and shaft for above, per set.	\$2.50	

BC-457 Transmitter—4 to 5.3 MC \$6.95
1.5 to 3 MC COMMAND RECEIVER new \$14.95
used \$ 9.95

ARC-5/R-28 2 MTR RCVR—2 meter superhet, also-
lately one of the BEST available today! Tunes from
100 to 156 mcs. in four crystal channels. (Easily con-
verted to continuous tuning.) Complete with
10 tubes. Excellent **\$13.95**

T-23/ARC-5 Transmitter. 100-156 MC. **\$22.95**
complete with tubes. Used. Exc. **\$29.50**

APN-1 Magnetic Units. You can build "Versatile
Sweep Frequency Generator." With instructions **\$5.95**

MN-26-C. Remote Controlled Navigational Direction
finder and communications receiver. Manual DF in
any one of three freq. bands, 150 to 1500 KC, 24 V.
Self contained dynamotor supply. Complete installa-
tion, including receiver, control box, loop, azimuth
control, left-right indicator, plugs, loop transmission
line and flex. shafts, oper. & main. manual. Ideal for
use in boats, etc. BRAND NEW \$49.50
MN-20-E Loop, Brand New 6.95
MN-52 Crank drive, New 2.50
MN-26C as is for parts 6.95

MIKES, HEADSETS & MICROPHONES

T-26 Telephone chest unit with F-1 Western Electric
Transmitter **\$2.39**
HS-33 Low Impedance Headset
exc. \$2.95, new \$5.45
HS-23 Headset new 4.50
CD-307 Ext. cord for HS-23-33
Like new \$.79, new 1.29
Throat Mike—T-30 new .98
Lip Mike—Navy Type new .98
CW-49505 High Impedance Headset. 98C
Complete with headband. Used \$29.50
TRANSMITTER HC-373—With one tuning unit. **\$9.95**
TUS, TU26 tuning unit. 2.95
TU9, TU10 1.95



APX-1 IFF EQUIPMENT

This transceiver is a treasure-house of tube sockets,
coaxial fittings, resistors, condensers, microswitches,
amphenol connectors and a raft of other parts. Also
contains 10 motor w/gear train, easily con-
vertible to 110 VAC. Less tubes. ONLY—Special **\$4.95**
APX-1 complete with 28 tubes \$9.95
APX-2 complete with 44 tubes \$14.95

160 METER RECEIVER POWER SUPPLY

Can be easily converted for 110 VAC, 60 cycle opera-
tion, complete with instructions, brand new, 5
less tubes ea. **\$5.95**
100 KC crystal NEW \$4.95 ea.
RL-42 BEAM ROTATOR—Used, good \$1.95 ea; 3 for \$4.25
3" DUAL SCALE PANEL METER—0-1 KV
and 0-10MA **\$1.95**

SURPRISE PACKAGE

20 lbs. of MISCELLANEOUS ELECTRONIC EQUIP-
MENT—WORTH MUCH MORE THAN
this low price of ONLY **\$1.95**

1-70 "S" METER—New **89c**

AN/APR5A Airborne superhet radar search
rec. Freq. range 1000 to 6200 MC. Rec.
has a 10 MC IF band width operating from
80/115 VAC, single phase 60 to 2600
cps. and one amp. at 26 VDC complete
with tubes **\$250.00**
like new

BC 654 TRANSMITTER-RECEIVER

This medium power transmitter and the accompany-
ing 7-tube very sensitive receiver are naturals for 80
or 40 meter operation (phone or CW), on either fixed
stations or mobile applications. These units are used
ext. and come complete with 17 tubes, key, micro-
phone, 200 KC calibrating crystal and diagrams for
use with up to 100 watts input to the final stage on
40 or 80 meters for either phone or CW. **\$29.50**
using vehicle or 110 Volt power supply.
PE103 6 or 42V Power Supply for above. Ex-
cellent 18.95
PE104 Vibrator Supply 9.95

4 for \$1000

2 Meter Converter—Easily converted to two meters
—Used—Excellent, complete with conversion in-
structions ea. **\$3.95**
2 METER OUTBOARD AMPLIFIER—Easily
converted to 2 meters—Used—Excellent, complete with
conversion instructions ea. **\$3.95**

RT/34 APS 13 TRANSCIVER—Used as a tail
warning radar on 415 MC. Containing a 30 MC
IF strip, RF section and various other parts, are
an excellent buy if only for parts and IF strip.
Complete with 17 tubes New **\$14.95**

BC 1033, 75 Mc RECEIVER, less tubes, ea. **\$3.95**
BC-455, Rec., 6-9MC—as is **\$3.95**

MOBILE HEAVY DUTY DYNAMOTOR: 14 V. INPUT-
output: 1030 VDC 250 MA. Tapped 515 V, 215 MA.
use @ 6 V DC INPUT—500 V, 175 MA.
While they last—DM-42—Excel. Condition **\$8.45**

SELF-POWERED

McIntosh



C8-PM
with cabinet \$107.50

\$99.50
C8-P
without cabinet

Professional AUDIO COMPENSATOR AND PRE-AMPLIFIER

Now self-powered, the McIntosh C-8P is easily connected to any system to provide the most advanced in high fidelity compensation control. Abundant flexibility is possible with five bass (turnover) and five treble (roll-off) switches, an aural compensator, a rumble filter, separate wide-range bass and treble controls, and a five-program-source selector for tuner, tape recorder, microphone, and two phonograph cartridges. The McIntosh assures greatest listening pleasure from any sound source.



Small separate power supply (not shown) brings maximum convenience of installation. Rear panel (shown above) features five inputs, three outputs, equalization switch for amplitude and magnetic cartridges, variable load resistor for magnetic cartridges.

Write for Details and FREE
Record Compensation Guide

McIntosh

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Switching for Hi-Fi (Continued from page 50)

relay RL_1 which, in turn, removes power from the amplifier.

It is desirable to connect the circuit exactly as shown by tracing through the FM power circuit with an ohmmeter or voltmeter. This keeps the 115-volt line voltage from appearing directly across contacts B to C , and E to F of relay RL_1 , which can happen if the wiring polarities are not observed. The relay used here, operated satisfactorily under these adverse conditions, but good engineering practice decrees that the wiring, as shown, should be followed. The plugs and outlets are numbered or color coded so that they are always connected up the same way if the units are disconnected for any reason. The use of plugs and outlets allows the units to be connected and disconnected in a matter of minutes.

In addition to the basic circuit shown in Fig. 2, it was found that in some amplifiers a switch is included to switch the audio circuit from radio to phonograph. This switching can also be done automatically by incorporating the circuit of Fig. 3. Relay RL_2 is a 115-volt, 60-cycle s.p.d.t. relay connected as shown. However, this switching refinement is on the order of "gilding the lily," and although desirable is not strictly necessary.

The writer also found that his television antenna worked very satisfactorily as an FM aerial. The automatic switching for this changeover is readily accomplished with the circuit of Fig. 4. RL_3 is a d.p.d.t. 115-volt, 60-cycle relay. When the FM set is turned "on," relay RL_3 is energized which switches the television antenna

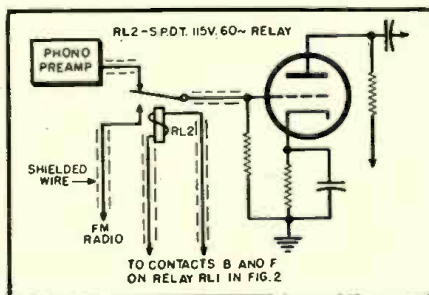
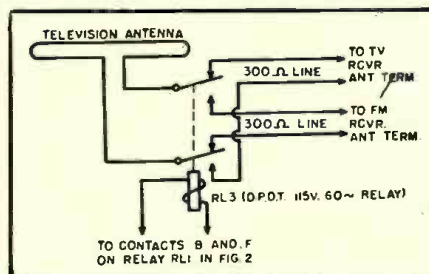


Fig. 3. Setup for use with amplifiers incorporating a switch to transfer the audio circuit from the radio to phonograph.

Fig. 4. Automatic arrangement for switching a TV antenna for use with FM tuner.



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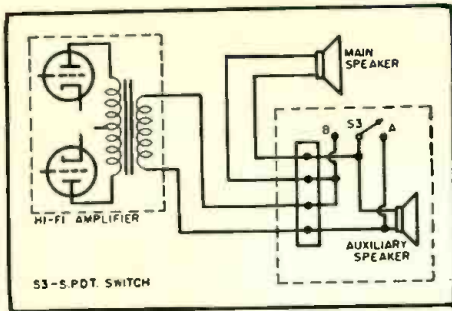


Fig. 5. Setup for controlling a remote loud-speaker used with the high-fidelity system.

from the TV set to the FM receiver. When the FM set is turned "off" the TV antenna is switched back to the TV receiver. This relay is mounted on the back of the TV receiver, and a piece of 300-ohm line used to connect this relay to the antenna posts of the FM receiver.

After the foregoing switching circuits were installed it was decided that one other addition was wanted. As in many homes, the man of the house has a workshop in the cellar. It seemed desirable to have an extra speaker located there, and so connected that either or both speakers could be connected to the amplifier with a simple switch circuit. This allows for maximum flexibility in a house "wired for sound." The switching circuit of Fig. 5 was designed so that the speakers could be switched without opening the voice coil circuit. This prevents the build-up of voltages that might possibly harm the output transformer of the amplifier. With the switch in the A position the main speaker is in the circuit and the auxiliary speaker is shorted out. When switch S_3 is in the B position the auxiliary speaker is in the circuit, and the main speaker is shorted out. When the switch is in the center or open position, both speakers are in series in the circuit. It was found that with the two speakers used in series that the audio load divided equally between them. No traces of distortion were noticed during the time the speakers were so operated. If desired, the auxiliary speaker can be provided with a shunt volume control of 0-25 ohms to adjust local volume if needed.

The system of automatic switching has been in use for some months, and has proved completely reliable, fool-proof, and has more than paid for itself in the ease of operation of our high-fidelity equipment, plus the added advantage of guaranteeing automatic phono-amplifier shut-off when a stack of records is played.

HUDSON DIVISION MEET

THE Hudson Division ARRL Convention and Amateur Radio Equipment Show will be held June 3, 4, and 5 at the Hotel Adelon, Long Beach, N. Y.

A varied program has been planned. Persons desiring to attend should contact Barbara F. Werner, KN2JHQ, 200 Elsie Ave., Merrick, N. Y., for reservations or further information on the program of events.

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0A3/VR75	.97	1X2	.55	6AV6	.36	6F6	.30	6S7GT	.50	6X4GT	.45	6AV6	.36	6F6	.30	6S7GT	.50	6X4GT	.45
0A4G	.60	2A3	.90	6AX4GT	.77	6F7	.30	6S7GT	.50	6X4GT	.45	6AX4GT	.77	6F7	.30	6S7GT	.50	6X4GT	.45
0B2	.74	2A5	.49	6B7	.87	6F8	.69	6S7GT	.50	6X4GT	.45	6B7	.87	6F8	.69	6S7GT	.50	6X4GT	.45
0B3/VR90	.90	2A6	.49	6B8G	.29	6G6G	.63	6S7GT	.50	6X4GT	.45	6B8G	.29	6G6G	.63	6S7GT	.50	6X4GT	.45
0C3/VR105.95	2A7	.60	6B8A	.38	6H6	.38	6S7GT	.50	6X4GT	.45	6B8A	.38	6H6	.38	6S7GT	.50	6X4GT	.45	
0C3/VR150.85	2B7	.62	6B7	.87	6J5	.38	6S7GT	.50	6X4GT	.45	6B7	.87	6J5	.38	6S7GT	.50	6X4GT	.45	
0Z4	.58	2K2	.39	6B8C5	.49	6J6	.50	6S7GT	.50	6X4GT	.45	6B8C5	.49	6J6	.50	6S7GT	.50	6X4GT	.45
1A4P	.35	2X2A	1.14	6B8E	.37	6J7	.49	6S7GT	.50	6X4GT	.45	6B8E	.37	6J7	.49	6S7GT	.50	6X4GT	.45
1A5GT	.40	3A4	.44	6B8F5	.69	6J8G	.49	6S7GT	.50	6X4GT	.45	6B8F5	.69	6J8G	.49	6S7GT	.50	6X4GT	.45
1A7GT	.45	3A5	.90	6B8G	1.16	6K6GT	.39	6S7GT	.50	6X4GT	.45	6B8G	1.16	6K6GT	.39	6S7GT	.50	6X4GT	.45
1A85	.38	3A8GT	.59	6B8H6	.45	6K7G	.38	6S7GT	.50	6X4GT	.45	6B8H6	.45	6K7G	.38	6S7GT	.50	6X4GT	.45
1B3GT	.67	3B7	.39	6B8J6	.58	6K8G	.64	6S7GT	.50	6X4GT	.45	6B8J6	.58	6K8G	.64	6S7GT	.50	6X4GT	.45
1C5GT	.40	3D6	.38	6B8K7	.89	6L6G	.99	6S7GT	.50	6X4GT	.45	6B8K7	.89	6L6G	.99	6S7GT	.50	6X4GT	.45
1C7G	.37	3L4	.71	6B8Q6GT	.75	6Q7	.49	6S7GT	.50	6X4GT	.45	6B8Q6GT	.75	6Q7	.49	6S7GT	.50	6X4GT	.45
1D7GT	.75	3Q4	.48	6B8T	.88	6R7	.49	6S7GT	.50	6X4GT	.45	6B8T	.88	6R7	.49	6S7GT	.50	6X4GT	.45
1E7GT	.35	3Q5GT	.65	6C4	.35	6S4	.39	6S7GT	.50	6X4GT	.45	6C4	.35	6S4	.39	6S7GT	.50	6X4GT	.45
1F4	.40	3V4	.46	6C5	.39	6S7G	.55	6S7GT	.50	6X4GT	.45	6C5	.39	6S7G	.55	6S7GT	.50	6X4GT	.45
1F5G	.44	3V4	.50	6C6	.54	6S7G	.55	6S7GT	.50	6X4GT	.45	6C6	.54	6S7G	.55	6S7GT	.50	6X4GT	.45
1H4G	.40	5T4	1.25	6C7	.85	6S7G	.55	6S7GT	.50	6X4GT	.45	6C7	.85	6S7G	.55	6S7GT	.50	6X4GT	.45
1H5GT	.38	5U4G	.49	6C8	.42	6S7GT	.38	6S7GT	.50	6X4GT	.45	6C8	.42	6S7GT	.38	6S7GT	.50	6X4GT	.45
1J6G	.59	6V6G	.76	6C8B	.85	6S7G	.38	6S7GT	.50	6X4GT	.45	6C8B	.85	6S7G	.38	6S7GT	.50	6X4GT	.45
1L4	.45	5Y3G	.38	6C8C	.42	6S7GT	.38	6S7GT	.50	6X4GT	.45	6C8C	.42	6S7GT	.38	6S7GT	.50	6X4GT	.45
1L6	.61	5Z3	.33	6C8D6G	1.05	6S7GT	.45	6S7GT	.50	6X4GT	.45	6C8D6G	1.05	6S7GT	.45	6S7GT	.50	6X4GT	.45
1LA4	.59	6A6	.45	6D8	.67	6S7	.40	6S7GT	.50	6X4GT	.45	6D8	.67	6S7	.40	6S7GT	.50	6X4GT	.45
1P6	.59	6V6	.80	6D8G	.95	6S7	.40	6S7GT	.50	6X4GT	.45	6D8G	.95	6S7	.40	6S7GT	.50	6X4GT	.45
1L8A	.77	6A8	.65																
1L8C5	.59	6A8B4	.42																
1L8G	.75	6A8F	.89																
1L8H	.75	6A8G	.89																
1L8J	.75	6A8H	.89																
1L8K	.75	6A8I	.89																
1L8L	.75	6A8J	.89																
1L8M	.75	6A8K	.89																
1L8N	.75	6A8L	.89																
1L8O	.75	6A8M	.89																
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1L8U	.75	6A8T	.89																
1L8V	.75	6A8U	.89																
1L8W	.75	6A8V	.89																
1L8X	.75	6A8W	.89																
1L8Y	.75	6A8X	.89																
1L8Z	.75	6A8Y	.89																
1L9A	.75	6A8Z	.89																
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1L9D	.75	6A9C	.89																
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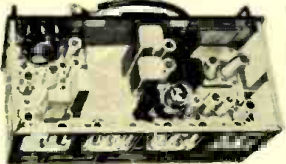
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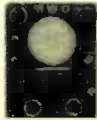
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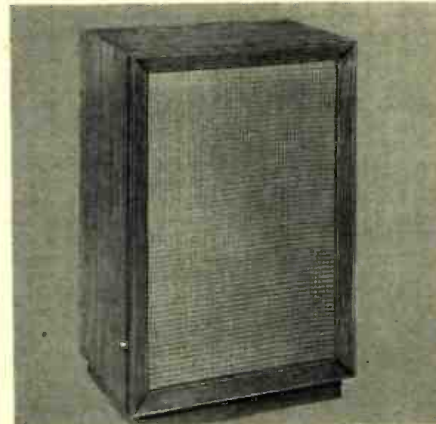
New Audio Equipment

"TUNE-A-PORT" CABINET

Standard Wood Products Corp., 47 W. 63rd Street, New York 23, N. Y., is now in production on a new speaker cabinet, the "Tune-A-Port".

The unit has a baffleboard adjustable from the outside—the port can be enlarged or reduced by means of two small external knobs. This feature makes certain that the speaker and enclosure resonance will be at optimum balance for maximum brilliance.

The cabinet will accommodate 12 in. or 15 in. single, coaxial, or triaxial speaker systems. It has a sound enclosure of 10,000 cubic inches and a high power-handling capacity. The cabinet is constructed of 3/4 in. genuine mahogany veneer stock and has inte-



rior acoustical padding. It is currently available in mahogany, blonde, or walnut finishes and measures 36 in. high, 24 in. wide, and 17 in. deep.

MINIATURE CARTRIDGES

Pickering and Company Incorporated, Oceanside, Long Island, N.Y. has developed two new miniature cartridges for the professional and the audiophile.

The 220 series is designed for use with standard 78 rpm records and is available with either diamond or sapphire styli. The 240 series is for micro-groove records, both 33 1/3 and 45 rpm. It is equipped with a diamond stylus.

A simple clip-type universal adapter is packaged with each cartridge to permit easy installation of the cartridge in all standard makes of changers and tone arms. The adapter can be permanently mounted in any arm by two 3-48 screws which are also provided. Once the adapter is installed the individual cartridges can be snapped into the clip.

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NEW PRINTED-CIRCUIT HIGH-PASS FILTER

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Stops TV or FM interference below 45 mc. Signals above 54 mc. pass through filter without loss. Eliminates whistles, herring bones, jitters, sound bars, snow, etc. Easy to install. The Capcon High-Pass Filter is GUARANTEED to stop your picture interference problems.

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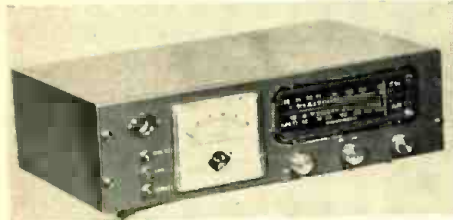
25 Willet Street, Oapt. R-5, N. Y. 2, N. Y.

RADIO & TELEVISION NEWS

ducing a new FM-AM tuner which has been tradenamed the "Custom Special."

A cascade front end gives a sensitivity of 3 μ v. with 30 db of quieting on FM. A 4 1/2" lucite tuning meter is employed for FM tuning. The meter may also be used to read field strength of the FM signal directly. A tuning eye is used on AM. The AM circuit is a t.r.f. of special design with a four-gang tuning capacitor.

The tuner is housed in a gold cabinet with gray and chromium panel and ac-



cessories. It measures 5 1/4" high, 19" wide, and 12" deep. It may be had in light mahogany cabinets, gray ham-mertone cabinets, with black or gray panels at extra charge.

"3-WAY RECORD FILTER"

The Special Products Division of General Electric Company's radio and television department has developed a unique high-fidelity "Three-Way Record Filter" which contains two independent filter controls and one compensator control in a single unit.

This triple filter is designed for use with any high-fidelity system having a G-E variable reluctance cartridge or other cartridges with the same inductance and impedance. It consists of a low-frequency cut-off filter, a record compensator, and a high-frequency cut-off filter, all housed in a plastic cabinet. The unit can be built in, if preferred, without the cabinet.

Known as the Model A1-901 record filter, full details on this new unit are available from the company in Syracuse, N. Y., or its distributors.

PREAMP KIT

Precise Development Corp., Ocean-side, New York is now offering a pre-amplifier which is available in either kit or factory-wired form.

The Model UPA-1 is housed in a mahogany cabinet with brushed brass panel and incorporates separate controls for bass boost, volume, record



compensation, and separate treble boost and roll-off. The unit also has a main selector switch connecting to phono, microphone, radio-TV, and an auxiliary position. Four separate input jacks are mounted on the rear chassis.

May, 1955



Recording at Low Cost
CROWN
Portable Tape Recorder

3 models
meet all
NARTB
broadcasting
standards

FEATURES

- Three speeds: 15", 7 1/2", 3 1/4"
- 3 motor mechanism, 2 inputs
- ± 2 db 40-11000 cps at 7 1/2" /sec.
- Less than .2% flutter and wow
- 20-watt hi-fi amp. built in
- 8" 10-watt speaker built in
- Nylon bearings eliminate oiling.

For the expert, Crown offers the finest in high fidelity recording, immediate playback, plus a public address system in one compact, portable unit . . . and at pleasingly low cost. Unexcelled for broadcast studio, home, church, school or business use. Full P. A. facility even while recording. Exceptionally low amplitude modulation. Forced air cooling allows continuous service operation. Three models. Net prices: Crown Deluxe, \$349.50; Crown Broadcaster, \$399.50; Crown Imperial (10" reels), \$449.50.

Write today for free brochure. Dealer inquiries invited

INTERNATIONAL RADIO & ELECTRONICS CORP., Elkhart 35, Ind.
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- Lists ALL Popular TV & Radio Types.
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Write for our complete listing on XMTG, Industrial, Special-Purpose and Crystal Grids. We stock over 2,000 types at excellent prices.

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- Immediate shipments on all types of CBS C.R. Tubes direct from factory-to-you! Only 1st quality new six tubes shipped. Write for complete price list. New low prices.

3,000 VOLT POCKET MULTITESTER

AC: 0-15, 150, 750, 3000 volts.
DC: 0-15, 75, 300, 750, 3000 volts.
DC MA: 0-15, 150, 750 ma
Resistance: 0-10,000, 100,000 ohms.
Complete with battery, test leads. Only 3 1/2" W x 4 1/4" H x 1 1/4" deep. Brand New @ only \$9.95.

TWO-COLORED TUBE CARTONS, with new Safety Partitions. Prevents Tube Breakage. This Super-Gloss Red and Black Carton is the Most Distinctive Box Available Today! Minimum: 100, only one size. Quantity prices on request. Boxes F.O.B., N.Y. N.Y.

SIZE EACH
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GT (6SN7, 6W4, etc.) \$.0125
LARGE GT (1B2, 6BQ6GT, etc.) \$.015
LARGE G (5U4C, 6BQ6G, etc.) \$.02

NEW! Same tube cartons as above, but in glossy white . . . Same prices apply. Specify white . . .

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0B2	.90	6BZ7	.90	12BA7	.60
0C3	.72	6C4	.40	12BD6	.45
0D3	.70	6C5	.39	12BE6	.51
0Z4M	.65	6C6	.51	12BF6	.59
1A5	.49	6C8B	.54	12BH7	.63
1A7GT	.61	6CD6	1.11	12B77	.65
1AB5	.54	6CF6	.64	12BZ7	.65
1AX2	.62	6CS5	.58	12C06	.98
1B3GT	.73	6D6	.59	12H6	.56
1C5	.43	6E5	.48	12J3	.42
1C6	.29	6F8GT	.39	12J7	.49
1H4	.30	6F8	.98	12K7	.59
1H6GT	.49	6G6	.42	12K8	.59
1H6	.39	6H6GT	.42	12L6	.51
1L4	.46	6J5GT	.48	12Q7	.67
1LA4	.69	6J6	.52	12S8GT	.62
1LA6	.69	6J7	.42	12S47GT	.65
1LC5	.59	6K6GT	.45	12SC7M	.63
1LC6	.79	6K7	.50	12SP5	.67
1LE3	.69	6L5	.79	12SP7	.69
1LM4	.69	6L6	.84	12SQ7	.51
1LN5	.59	6L7M	.47	12SR7	.40
1NSGT	.87	6N7M	.63	12S7M	.67
1QS8	.59	6Q7	.45	12SK7GT	.63
1R5	.62	6R7	.69	12SL7GT	.57
1S4	.59	6S4	.48	12SN7GT	.59
1S5	.59	6S7M	.70	12SR7	.40
1T4	.58	6S7	.46	12V6GT	.46
1T5	.59	6T8	.80	12X4	.38
1U4	.57	6U4	.70	14A3	.59
1U5	.43	6U6	.59	14A7	.63
1V2	.59	6U7	.48	14A7P	.59
1X2A	.68	6V6GT	.50	14B7	.63
2A3	.80	6V8	.86	14C7	.79
3A3	.80	6W4GT	.57	14E6	.73
3A4	.85	6X4	.37	14E7	.88
3A5	.82	6X5GT	.37	14F7	.65
3AL5	.82	6X8	.48	14G7	.69
3AU6	.46	6Y8G	.63	14H7	.89
3B7	.24	7A4	.47	14X7	.89
3BC5	.74	7A5	.59	19B6	1.39
3BN6	.74	7A7	.69	19T8	.69
3CB6	.54	7A8	.68	20A	.79
3C6	.27	7AD7	.79	24A	.39
3LE4	.59	7AG7	.69	25A5GT	.83
3Q4	.59	7AH7	.79	25B06GT	.98
3Q5GT	.69	7B4	.44	25L6GT	.51
3S4	.58	7B5	.44	25Z5	.66
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4BQ7	.90	7B7	.49	26	.45
4BZ7	.96	7C4	.59	27	.39
5AM8	.75	7C5	.59	3217	.89
5AN8	.75	7C6	.59	35A5	.52
5AT8	.75	7C7	.59	35B5	.52
5AZ4	.91	7E3	.59	35C5	.51
5E6	.59	7E4	.59	35E7	.51
5T4	.69	7E5	.59	35F7	.47
5U4G	.55	7E6	.59	35V4	.54
5U8	.78	7E7	.59	35Z3	.59
5V4	.50	7F6	.79	35Z4	.47
5V6	.50	7G7	.89	35Z5GT	.47
5W4GT	.50	7H7	.59	36	.39
5X8	.75	7J7	.79	37	.46
5Y3GT	.37	7K7	.69	42	.46
5Y4	.51	7L7	.59	43	.55
5Z3	.45	7M7	.59	43Z3	.49
6A7	.89	7N7	.59	46	.69
6AB4	.69	7P7	.79	50A5	.55
6AC5	.69	7Q7	.66	50B6	.49
6AC7M	.86	7R7	.59	50Y7	.50
6A97	.89	7S7	.69	51A	.62
6AF	.90	7T7	.59	51A	.62
6AG5	.56	7U7	.89	76	.44
6AG7M	.99	7V6	.54	77	.57
6AH4	.67	7X7	.70	80	.49
6AH6	.73	7Y4	.69	83V	.68
6AK5	.75	7Z4	.59	84/6Z4	.48
6AK6	.59	12A4	.60	85	.52
6AL5	.42	12ABGT	.61	85	.52
6AM8	.78	12AH7	.86	117L7	1.89
6AN4	.95	12AL7	.37	117P7	1.89
6AN8	.78	12AL5	.57	117Z6	.69
6AQ5	.54	12A65	.52	807	1.39
6AQ6	.46	12A76	.41	866A	1.39
6AQ7	.70	12A77	.72	1274	.30
6AR5	.49	12A78	.46		
6AS5	.50	12A79	.60		
6AS6	1.49	12A8	.54		
6AT6	.41	12A8GT	.61		
6AU4GT	.68	12AHT	.86		
6AUGT	.82	12AL5	.57		
6AU6	.46	12A65	.52		
6AV5GT	.83	12A76	.41		
6AV6	.40	12A77	.72		
6AX4GT	.65	12A78	.46		
6BA6	.49	12A79	.60		
6BA7	.57	12A8	.54		
6BC5	.54	12ABGT	.61		
6BC7	.82	12AH7	.86		
6BD5	.59	12AL5	.57		
6BD6	.45	12A65	.52		
6BE6	.51	12A76	.41		
6BF6	.41	12A77	.72		
6BG6	1.25	12A78	.46		
6BH6	.53	12A79	.60		
6BJ6	.49	12A8	.54		
6BK5	.80	12A8GT	.61		
6BK7	.80	12AHT	.86		
6BL7GT	.91	12AL5	.57		
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		12A77	.72		
		12A78	.4		

tivity and permits instant location of any portion of the reel, high speed forward and rewind, and dynamic type microphone. The instrument comes complete with microphone, attachment cord, two reels (one with tape), and a carrying case.

RCA TAPE RECORDER

A new hi-fi magnetic tape recorder-reproducer chassis which covers the audible range from 50 to above 10,000 cps and is designed for simple plug-in connection to home-assembled high-fidelity music systems is now available



from the Engineering Products Division of Radio Corporation of America, Camden, N. J.

The unit, SRT-1, is electrically matched for use with all combinations of the company's intermatched hi-fi electronic components; utilizes all types of standard magnetic tapes; and is designed for half-track recording for maximum tape economy.

The recorder-reproducer chassis measures 10 $\frac{1}{2}$ " high, 19" wide, and 11" deep. It weighs 27 pounds.

"LARGO 12" SPEAKER

Permoflux Corporation, 4900 West Grand Ave., Chicago 39, Illinois has released a "big brother" to its "Largo 8," the "Largo 12." The new two-way speaker system features the company's "Super Royal" 12-inch speaker and the 32KTR "Super Tweeter."

The design of the cabinet permits the use of the cabinet base to horn-load the speaker backwave. The cabi-



net is scientifically matched, octave-by-octave, to the woofer and tweeter. According to the company, peak-free reproduction over the full range of 30 to 16,000 cps is obtained. Power handling capacity is a full 20 watts.

Over-all size of the cabinet is 23 $\frac{1}{2}$ "

May, 1955

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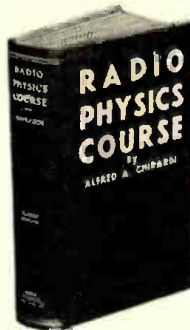
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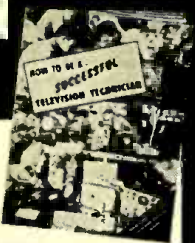
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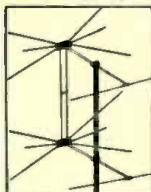
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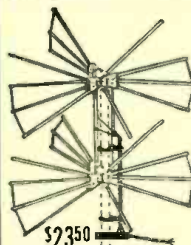
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high, 27½" wide, and 15½" deep. It is available in mahogany or Korina blonde finishes. Impedance of the system is 8 ohms.

NEW TONE ARM

Hi-Fidelity, Inc., 420 Madison Ave., New York, N.Y. has been licensed to manufacture and market the new British "B-J" tone arm in the Western Hemisphere.

The new arm has two arms of different lengths, spaced to form a link motion which keeps the head closely aligned to the ideal tangential setting, irrespective of groove radius. According to the company, the measured error amounts to less than ± 1 degree on a 12-inch record.

The cartridge shell will accept almost any standard U.S. high-fidelity cartridge.

For full details on this new arm, write to the U.S. licensee direct.

LAFAYETTE AMPLIFIER

Lafayette Radio, 100 Sixth Avenue, New York 13, N.Y. is currently introducing a new power amplifier which retails in the moderate price class.

Designated as the LA-54, the amplifier is a 12-watt unit with a frequency response of 20-20,000 cycles. It includes a record equalizer with separate adjustable bass turnover and treble roll-off; sixteen different playback charac-



teristics; phono preamplifier; input for crystal and ceramic cartridges; special recording tape take-off jack; capacitance input; and good power output at both the very-low and very-high frequencies.

For full details on this amplifier, write the company direct.

FME TAPE RECORDER

Federal Manufacturing and Engineering Corporation, 211 Steuben Street, Brooklyn 5, New York is now marketing a new popular-priced, two-speed, dual-track tape recorder, the Model 37C.

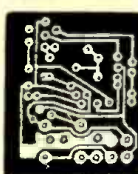
A two-belt system eliminates the possibility of wear and squeal, according to the company. The recorder is housed in a two-tone gray luggage-type carrying case while the controls are streamlined and modern looking.

CRYSTAL CARTRIDGE

The Astatic Corporation of Conneaut, Ohio has introduced another high-compliance crystal phonograph cartridge, the Model 28.

The company claims that this cartridge provides greater clarity and richness of tone as well as an absence of

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needle talk and surface noise due to its high compliance and the resultant improvement in tracking ability.

Output is 3.5 volts and the cartridge is said to be suitable for all-groove use. For full details and price on the Model 28, write the company direct.

NEW NATIONAL ITEMS

National Company Inc., 61 Sherman St., Malden 48, Mass. has added five new items to its "Horizon" line of audio equipment.

Among the units are four new hi-fi speaker systems including the "Cate-



noid" four-way corner horn with cross-over network; the "Copley," a three-way corner system; the "Wellesley," a deluxe version of the "Copley"; and the "Fantasia," an end table type with dual speakers and wrought iron legs, which is shown in the photo.

All of the cabinets are offered in blonde, mahogany, and walnut, both hand-rubbed and Formica finished.

All of these new items are currently on display at the firm's authorized distributors.

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43 (top center, lower right), 59 (far left, second from left), 60, 61	Radio Corporation of America
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59 (top right)	Allen B. DuMont Laboratories
59 (right, center left)	Sentinel Radio
59 (right, center right and bottom)	Majestic Radio
62, 63	Sherwood Electronic Laboratories

ADDENDUM

Some of our readers have written us that they are having difficulty in locating the 20/20 μ fd. variable capacitor specified in the parts list (C₁, C₂, C₃) accompanying the article "Midget FM Tuner" (December 1954 issue). Three of the Millen 20015 "ultra-midget" capacitors may be ganged and will fit the allotted space on the chassis.

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Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
OB2	.79	6BE6	.49	6SF7	.59	7W7	.85	14A5	.59
OZ4	.54	6BG6G	1.24	6SG7	.49	7Z4	.49	14B8	.65
1A7GT	.53	6BH6	.48	6SH7	.60	12A6	.59	14F7	.67
1AX2	.69	6BJ6	.49	6SH7GT	.50	12AL5	.49	14F8	.95
1B3GT	.69	6BK5	.69	6SJ7	.50	12AT6	.41	14H7	.59
1D8GT	.77	6BK7	.96	6SK7	.49	12AT7	.73	14N7	.69
1G6GT	.54	6BL7GT	.89	6SL7GT	.59	12AU6	.45	14Y4	.69
1HSGT	.43	6BQ7A	.95	6SN7GT	.59	12AU7	.58	19BG6G	1.35
1L4	.49	6BQ7GT	.95	6SQ7	.45	12AV6	.44	19T8	.79
1LA4	.59	6BQ7A	.92	6SR7	.45	12AV7	.72	25AV5GT	.84
1LA6	.79	6BZ7	.92	6SS7	.60	12AX4GT	.68	25BQ6GT	.89
1LCS	.59	6C4	.41	6ST7	.49	12AX7	.63	25L6GT	.49
1LD5	.52	6C5	.39	6T4	.95	12AY7	.89	25Y5	.85
1LE3	.78	6C6G	.57	6T7G	.79	12BA6	.49	25Z5	.64
1LN5	.57	6C8C	.85	6T8	.79	12BA7	.59	25Z6GT	.48
1PSGT	.56	6CB6	.57	6U7G	.45	12BD6	.49	26	.44
1QSGT	.57	6CD6G	1.49	6U8	.79	12BE6	.49	27	.38
1R5	.54	6CF6	.64	6V6GT	.47	12BH7	.65	32L7GT	.98
1S4	.58	6CS6	.51	6W4GT	.51	12BY7	.69	35B5	.49
1S5	.45	6D6	.69	6W6GT	.56	12BZ7	.65	35C5	.48
1T4	.55	6E5	.48	6X4	.39	12C8	.34	35L6GT	.49
1U4	.53	6F3	.39	6X5GT	.37	12F5GT	.35	35W4	.43
1U5	.69	6F6	.45	6X8	.79	12H6	.45	35Z3	.43
1V	.69	6F8G	.99	7A4	.54	12J5GT	.45	35Z5GT	.47
1X2A	.69	6G6G	.85	7A5	.59	12J7GT	.58	41	.41
2A6	.49	6H6	.49	7A6	.69	12K8	.58	43	.55
2A7	.64	6J5GT	.40	7A7	.69	12Q7GT	.59	45Z3	.21
2A7	.39	6K5	.59	7A8	.59	12SA7GT	.64	46	.49
2X2A	1.85	6K6GT	.45	7B5	.59	12SF5	.49	47	.89
3A4	.44	6K7	.39	7B6	.59	12SG7	.75	50A5	.55
3A5	.90	6L7G	.59	7C4	.58	12SH7	.75	50B5	.49
3A8GT	.60	6N7	.98	7C5	.59	12SJ7	.59	50C5	.49
3AL5	.43	6R7	.49	7C7	.65	12SK7	.62	50L6GT	.61
3AU6	.47	6S4	.49	7E5	1201	12SL7GT	.57	56	.49
3B7	.39	6S7G	.59	7H7	.59	12SN7GT	.58	57	.55
3BC5	.55	6SA7	.54	7J7	.75	12SQ7GT	.56	58	.58
3BN6	.75	6SB7Y	.89	7L7	.59	12SR7	.49	70L7GT	1.00
3CB6	.55	6SC7	.79	7R7	.65	12T3	.39	71A	.54
3D6	.39	6SF5	.45	7V7	.91	14A4	.69	75	.49
3FL4	.79							76	.43
3Q4	.55							77	.55
								78	.45

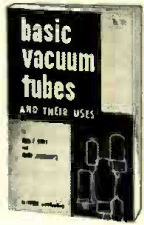
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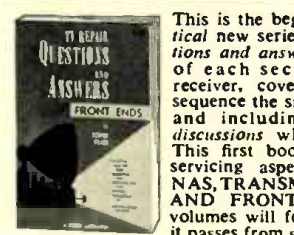
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KWS-1 consists of 32W-1 Exciter with its power supply replaced by a 367A-1 Linear RF Power Amplifier, plus a 428A-1 High Voltage Supply and 429A-1 Low Voltage Supply housed in supporting cabinet. Covers 80, 40, 20, 15, 11 and 10-meter bands. Pi-L tank circuit designed for continuous tuning over entire frequency range. RF amplifier employs 4X150A tubes operating push-pull AB₁. Other features identical to those of 32W-1.

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BC221 with power supply \$70. S. Erst, 1010 Hartzell St., New Haven, Ind.

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COMPLETE VHF Radio Terminals. These are designed for telephone service in the 72-76 mc. band, and are ideal for setting up a communication system along a pipeline, railroad, or in mountainous or bush country. Each terminal consists of the following: 1—Link Radio Type 1498T Transmitter; 1—Link Radio Type 1498P Power Supply; 1—Link Radio Type 1498R Receiver; 1—Budelman 200 watt Power Amplifier; 1—Type P113 Power Supply; 1—Federal Type 101B V-F Ringer; 500 ft. Type RG 8U Coaxial Cable; 2—Welded steel Yagi Antennas—5 element; 1—Lister Diesel-Generator set, 2 KW. P. J. Fishner, 550 Fifth Avenue, New York City.

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.

CONDENSERS and Resistors 10 lb. assortment \$7.95. Ham Radio Parts Assortment 10 lb. \$4.95. 300 M.A. Selenium rectifiers 99¢ each. "Tinys," 1000 W. Pembroke, Hampton, Va.

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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.

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FOR Sale—Geiger counter Kits \$38.50. Geiger Counter & Scintillator Diagrams \$1.00. Free Catalog. "R. F. Chambers," 13833 San Antonio Dr., Norwalk, Calif.

T.V. Camera, 525 Line for Ham Use with spares all tubes and instructions. \$75. Walker, 519 N. Neilson, Arlington, Virginia.

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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, 431 Patterson Rd., Dayton 9, Ohio.

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WANTED—ART-13 transmitters, parts, and components, DV-12 and DV-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.

WANTED: All types receivers, transmitters, test equipment, power supplies, teletype. Cash or trade for New Hallcrafters, Johnson, Gonset, National, or other. Need ART-13, APR-4, ARC-1. Alltronics, Box 19, Boston 1, Mass. (Richmond 2-0048).

30-50, 152-172mc. FM crystal controlled receivers. Box 8136 Kansas City, Missouri.

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TELEVISION Jobs—Names and addresses of companies to contact. \$1.00. Fitzgerald, Dept. A-14, 815 Countryside Drive, Wheaton, Illinois.

ELECTRONICS. Nationwide job opportunities. Company addresses \$1. J. Trilletti, Dept.-A, Box 1236, New York 17, New York.

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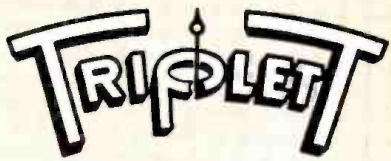
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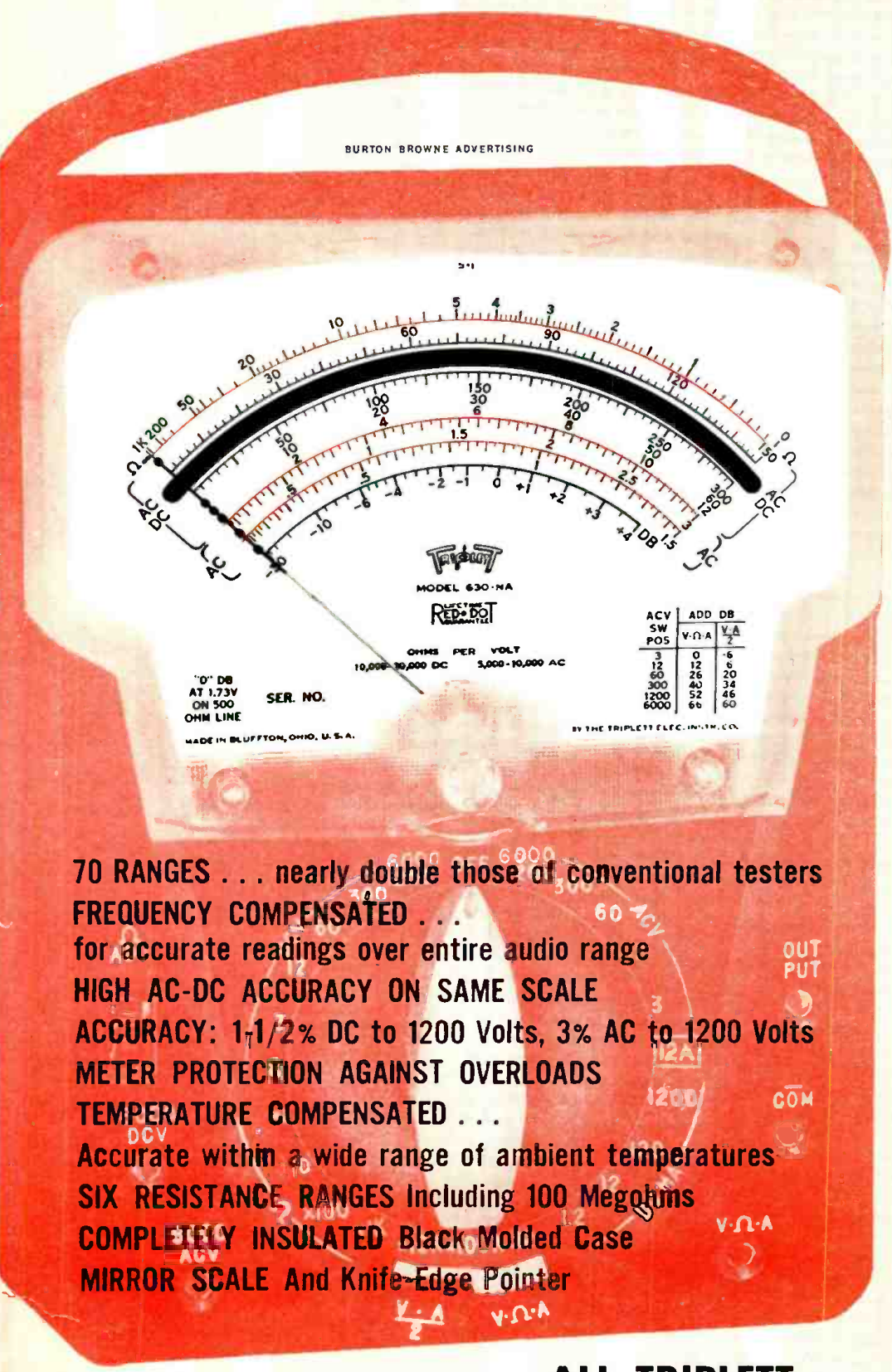
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