RADIO & TELEVISION NEWS

OCTOBER
1954
35 CENTS
In U. S. and Canada

1919 • 1954 35th ANNIVERSARY YEAR

World's Leading Electronics Magazine

IN THIS ISSUE

TONE-COMPENSATING PREAMP

COMMUNICATION SET THE EASY WAY

TV CINDERELLA

ECONOMY MODEL GRID DIPPER

A REGENERATIVE SHORT-WAVE RECEIVER

"BOOTSTRAP" INTERVAL TIMER

TWO-TUBE SQUARE-WAVE GENERATOR

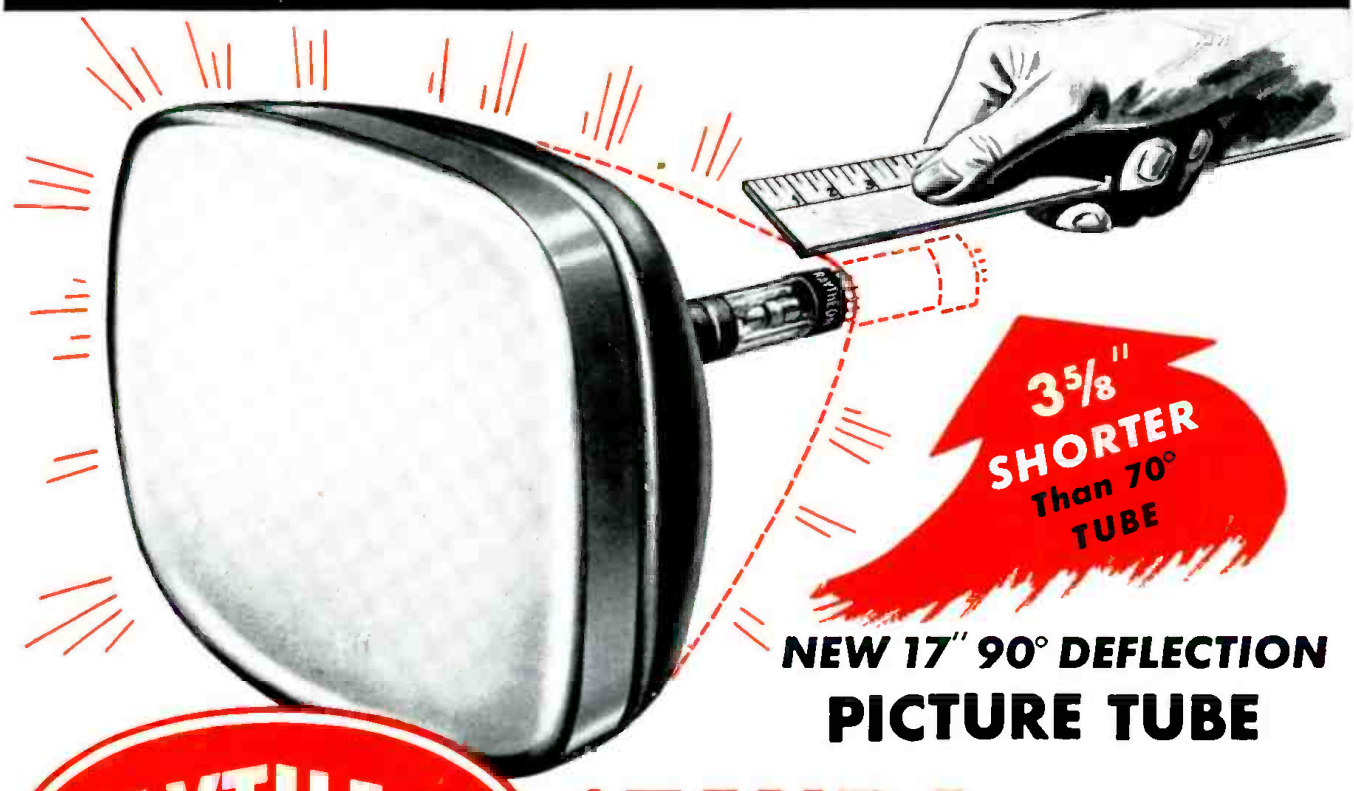
A LOW-POWERED PHONO AMPLIFIER

ECONOMY MODEL TV SETS

MOBILE COMMUNICATIONS CENTER PROVIDES EMERGENCY SERVICE
(See Page 38)

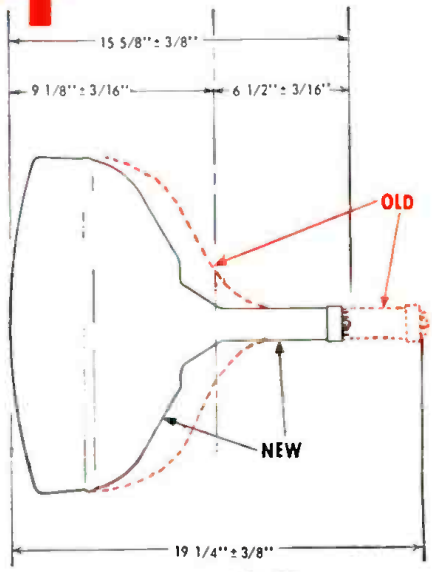
ZIFF-DAVIS PUBLICATION

ANOTHER RAYTHEON FIRST!



NEW 17" 90° DEFLECTION PICTURE TUBE

RAYTHEON 17AVP4



Raytheon leads the way to smaller, light weight, more compact, television receivers with the amazing new 17AVP4 monochrome picture tube. It is 3⅝ inches shorter in overall length and approximately 4 pounds lighter than present 17 inch tubes. The type 17AVP4 incorporates a new 90° deflection angle bulb, a 1 inch shorter neck length and achieves maximum compactness with conventional viewing area. The 17AVP4 has electrostatic focus, magnetic deflection and features the same crisp, clean picture that makes all Raytheon Picture Tubes outstanding for quality.

This important new Raytheon tube, developed and produced at Raytheon's new modern picture tube plant at Quincy, Massachusetts is one more reason why you can standardize on Raytheon Picture Tubes with complete confidence that you are giving your customers the very latest and best.

Remember, Raytheon Picture Tubes are Right for Sight, Right for You, and always New. Buy them through your nearest Raytheon Tube Distributor.

RAYTHEON®

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations

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

RAYTHEON MAKES ALL THESE:

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

I WILL TRAIN YOU AT HOME FOR GOOD PAY JOBS IN RADIO-TELEVISION

J. E. SMITH has trained more men for Radio-Television than any other man. OUR 40th YEAR.

America's Fast Growing Industry Offers You Good Pay—Bright Future—Security

I TRAINED THESE MEN

"Started to repair sets six months after enrolling. Earned $12 to $15 a week in spare time."—Adam Kramlik, Jr., Sunneytown, Pennsylvania.

"Up to our necks in Radio-Television work. Four other NRI men work here. Am happy with my work."—Glen Peterson, Bradford, Ont., Canada.

"Am doing Radio and Television Servicing full time. Now have my own shop. I owe my success to N.R.I."—Curtis Stath, Ft. Madison, Iowa.

"Am with WCOC. NRI course can't be beat. No trouble passing 1st class Radio-phone license exam."—Jesse W. Parker, Meridian, Mississippi.

"By graduation, had paid for course, car, testing equipment. Can service toughest jobs."—E. J. Streitenberger, New Boston, Ohio.

AVAILABLE TO VETERANS UNDER G.I. BILLS

Training plus opportunity is the PERFECT COMBINATION for job security, good pay, advancement. In good times, the trained man makes the BETTER PAY, GETS PROMOTED. When jobs are scarce, the trained man enjoys GREATER SECURITY. NRI training can help assure you more of the better things of life.

Start Soon to Make $10, $15 a Week Extra Fixing Sets

Keep your job while training. I start sending you special booklets that show you how to fix sets the day you enroll. Multitester built with parts I send helps you make $10, $15 a week extra fixing sets while training. Many start their own Radio-Television business with spare time earnings.

My Training Is Up-To-Date

You benefit by my 40 years' experience training men at home. Well illustrated lessons give you basic principles you need. Skillfully developed kits of parts I send (see below) "bring to life" things you learn from lessons.

You Learn by Practicing with Parts I Send

Nothing takes the place of PRACTICAL EXPERIENCE. That's why NRI training is based on LEARNING BY DOING. You use parts I furnish to build many circuits common to Radio and Television. As part of my Communications Course, you build many things, including low power transmitter shown at left. You put it "on the air," perform procedures required of broadcasting operators. With my Servicing Course you build modern Radio, etc. Use Multitester you build to make money fixing sets. Many students make $10, $15 week extra fixing neighbors' sets in spare time while training. Coupon below will bring book showing other equipment you build. It's all yours to keep.

The Tested Way To Better Pay!

Television Making Good Jobs, Prosperity—Even without Television, Radio is bigger than ever. 115 million home and auto Radios to be serviced. Over 3000 Radio broadcasting stations use operators, technicians, engineers. Government, Aviation, Police, Ship. Micro-wave Relay, Two-Way Radio Communications for buses, taxis, trucks, etc., are important and growing fields. Television is moving ahead fast.

About 200 Television stations are now on the air. Hundreds of others being built. Good TV jobs opening up for Technicians, Operators, etc.

25 million homes now have Television sets. Thousands more are being sold every week. Get a job or have your own business selling, installing, servicing.

Radio-TV Needs Men of Action—Mail Coupon

Act now to get more of the good things of life. Actual lesson proves my training is practical, thorough. 64-page book shows good job opportunities for you in many fields. Take NRI training for as little as $5 a month. Many graduates make more than total cost of training in two weeks. Mail coupon now. J. E. SMITH, President, National Radio Institute, Dept. 4KE, Washington 9, D. C. OUR 40TH YEAR.

Good for Both—FREE

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National Radio Institute, Washington 9, D. C.
Mail me Sample Lesson and 64-page Book, FREE.
(No salesman will call. Please write plainly.)

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

Address.....

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

VETS write in date of discharge.....

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COVER PHOTO: One vehicle in the elaborate Mississippi Highway Safety Patrol communications system. The "forest" of antennas shown erected on and around the truck cover all the applicable communications bands. (Ektachrome by Lloyd C. Hawkins)

First in radio-television-audio-electronics

Average Paid Circulation over 246,000

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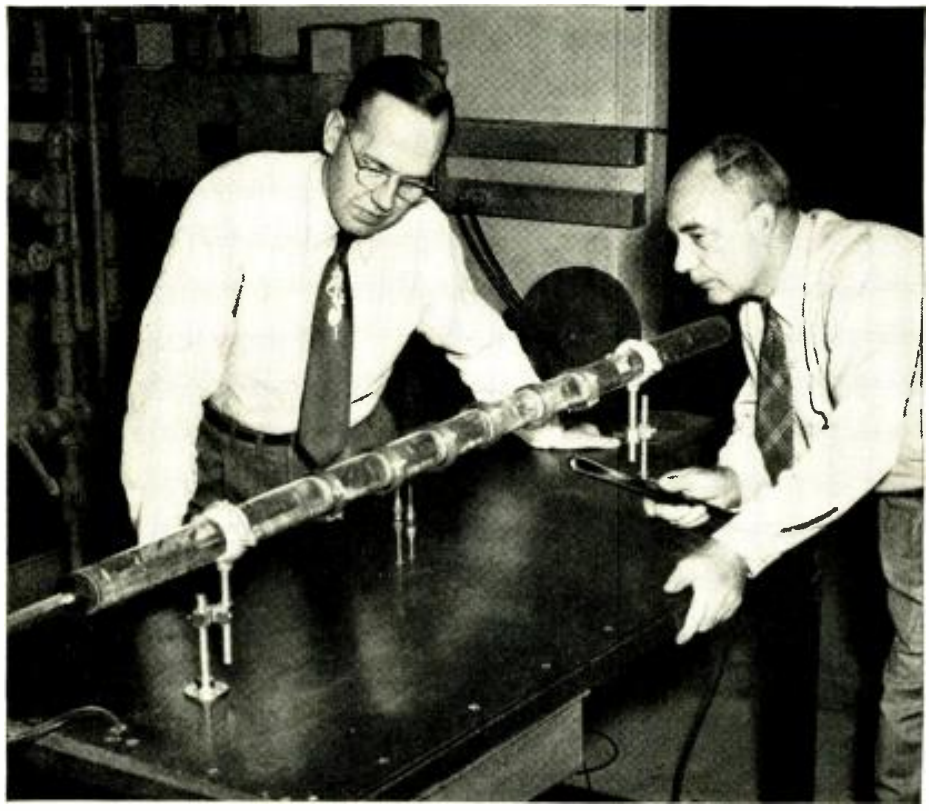

Zone Refining apparatus, showing tube and induction-heating coils. For transistors—tiny electronic amplifiers—germanium is made extremely pure. Then special impurities are added in controlled amounts for best transistor performance.

1 part in 10,000,000,000

To make the most of their revolutionary invention, the transistor, Bell Laboratories scientists needed ultra-pure germanium.

The scientists solved their problem by devising a radically new refining process. The germanium it yields may well be the purest commercially produced material on earth.

It has only *one part in ten billion* of impurities harmful to transistor performance. That's about the same as a pinch of salt in 35 freight cars of sugar.

Yet the new process, Zone Refining, is simple in principle. An ingot of germanium is drawn through a series of induction-heating coils that melt narrow zones of the substance. Since impurities are more soluble in the liquid than in the solid form of a metal, the molten zones collect impurities. They are swept along by the successive melts to the end of the ingot, which is finally cut off.

Zone Refining is also being applied to the ultra-purification of other materials useful to telephony. This single achievement of research at Bell Telephone Laboratories clears the way for many advances in America's telephone system.

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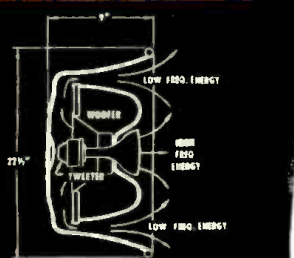
SPECIFICATIONS

Response	70-15,000 cps
Power Capacity	25 watts
Impedance	8 ohms
Dispersion	120 degrees
Mounting	180° adjustable "U" bkt.
Dimensions	22½" diameter, 9" depth



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More Efficient: DUAL RANGE THEATER TYPE SYSTEM permits uncompromising design of the "woofer" and "tweeter" sections for greatest efficiency. Hear it penetrate noise with remarkable fidelity and intelligibility.

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Better Lows: BALANCED "COMPRESSION" TYPE FOLDED HORN, starting with eight inch throat and energized by top quality low frequency "woofer" driver provides *more* lows than other bulky designs.

More Compact: EXCLUSIVE WEATHERPROOF DUAL RANGE COAXIAL DESIGN eliminates wasted space. Depth of BLC is only 9"; can be mounted anywhere, even flush with wall or ceiling.

Better Highs: DRIVER UNIT TWEETER with exclusive patented "reciprocating flares" wide angle horn transmits more highs with greater uniformity . . . high frequency response that you can *hear!*

More Dependable: EXPERIENCED MECHANICAL ENGINEERING AND CAREFUL ELECTRICAL DESIGN meet the challenge of diversified application and environmental hazards. Rugged, and conservatively rated—you can *rely* on the BLC.

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For the RECORD

BY THE EDITOR

TELEVISION AND COMBAT

THE use of TV to lend eyes to the commander of an army field force and make him an actual eyewitness to an amphibious landing or a defensive maneuver has long excited the imagination. We therefore feel fortunate to have been among the few selected guests invited to participate in the first formal demonstration of an actual combat problem executed with the aid of small, portable TV cameras and equipment operated by U. S. Army Signal Corps personnel.

The first portion of the demonstration, held at Fort Meade, Maryland, involved the amphibious invasion by "friendly forces" of a beach which was being held and fortified by "enemy forces." Vidicon cameras, manufactured by *RCA*, were operated by members of the "invading force." The equipment was distributed in much the same manner as "walkie-talkie" radios are dispersed at platoon and at company levels.

Eight monitor TV receivers were set up in the command post of the invading regiment. This command post was a large tent arranged to represent the field headquarters of an armored cavalry regiment equipped with full combat television facilities. (Units of the 3rd Armored Cavalry Regiment were used in this demonstration.) The commanding officer, surrounded by his communications officer and other aides, sat at a long table facing the monitor TV sets. We sat behind the commanding officer and had practically the same view of the TV screens.

Each monitor TV set was hooked up to one of the cameras in the field *via* a microwave link. The vidicon camera sent its signal through a cable to a microwave dish antenna from where it was transmitted to a base station truck. This truck was positioned right outside the tent, and fed the signals it received from all the camera transmitters to the various monitor TV sets in the tent. The eight receivers allowed us to follow the action occurring on the distant field of battle from almost any angle. Since one camera was mounted in an L-20 observation plane flying low over "enemy" territory, we could also see the movement of enemy reserves behind the lines.

Frequently, the commander had one of his aides switch the image from one of the small-screen TV monitors to a large-screen TV set located directly in front of the long table. This allowed him to give detailed study to the picture.

During the course of the problem, we noted that the enemy ground fire directed at our "invading" personnel carriers in the water was rather light indicating that our artillery barrage on the "enemy's" strong points had been effective.

Imagine being at an eight-ring circus. Imagine each ring going at the same time. Imagine that you can see what is going on in the dressing rooms and under the stands also, and you have some idea of how we felt as we sat and watched combat television in operation.

The beachhead was secured and the operation was successful. The speed with which this was effected, the excellent organization of the attack, and the low "losses" in personnel and materiel were, to a great measure, the result of the use of combat TV.

What we saw of combat television was not a finished product in the sense that it could be used today with complete assurance along with the other Army, Air Force, and Navy communications equipment. This, despite the fact that the vidicon cameras were the same as those presently available commercially. There are quite a few problems requiring solution before combat television becomes a part of the ground force commander's communications team.

The land-borne vidicon cameras were restricted in their maneuverability by the fact that they were connected by cable to the microwave transmitter. A single unit capable of being carried on the back needs to be developed to overcome this handicap.

At what level of command should the cameras be used? From the demonstration it was evident that combat TV is more useful to the regimental commander than to the company commander who is usually "right up there" with his troops.

The maintenance problem of this complex TV equipment is one that should not be overlooked. However, experience with combat radio equipment and radar in the last war should assure us that, given the proper training and tools, the GI will be able to maintain this new gear.

The use of color TV should not be expected in military combat in the immediate future. Until commercial color TV equipment attains the high state of reliability and compactness that black-and-white TV has achieved its use must be limited. There is no doubt however, that color TV will be used eventually by the Armed Forces as an important weapon of offense as well as defense. . . . . O.R.

free

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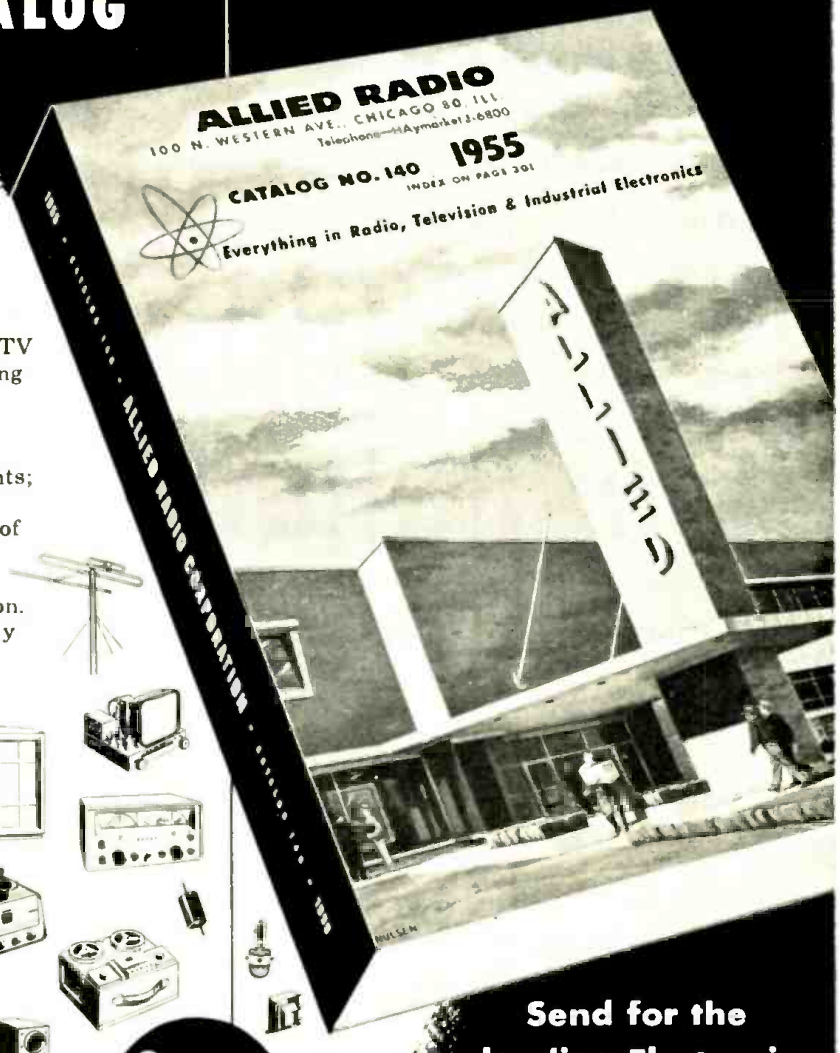

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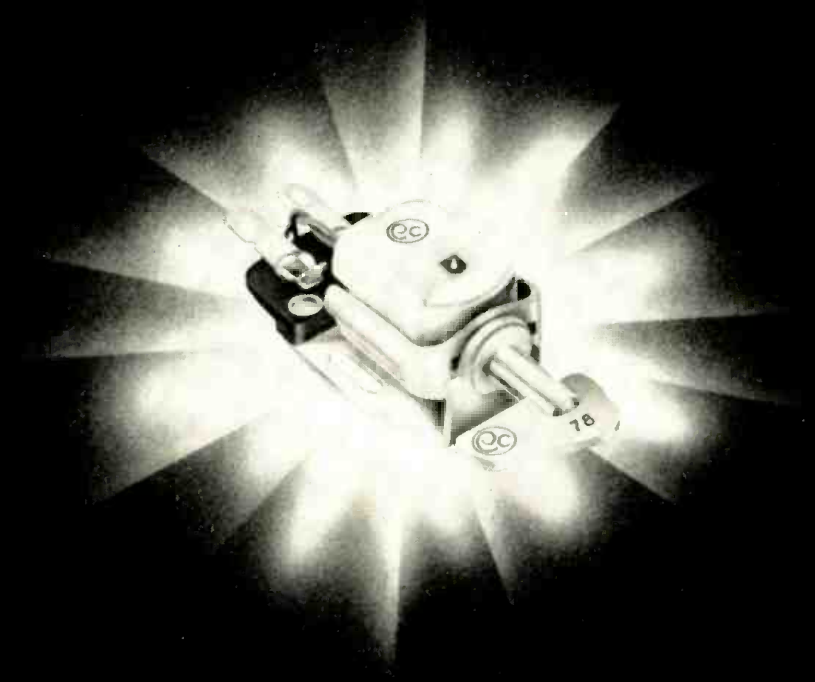

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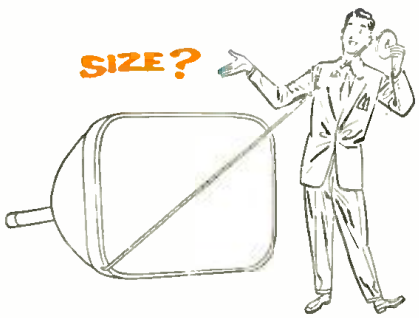

Interested in new sales records? You'll be heading in that direction when you replace old picture tubes with new Sylvania Aluminized Tubes.

Sylvania Aluminized Picture Tubes give terrific performance. They make old sets better and brighter than new by providing whiter whites—blacker blacks . . . a 6-times better picture contrast.

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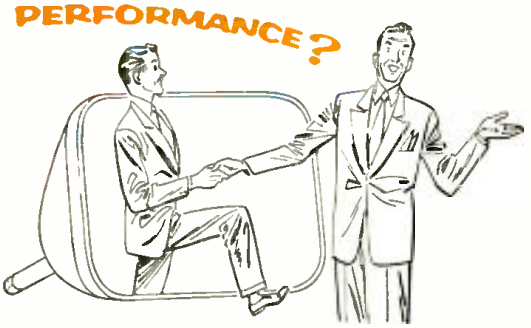
Remember, millions of set owners see and hear about Sylvania Picture Tubes on the nation-wide weekly television show "Beat The Clock." They know that they are famous for quality and dependability. For full details about aluminized tube replacement, write for Sylvania's "Aluminized Picture Tube Replacement Guide." Address: Dept. 4R-3510, Sylvania NOW!



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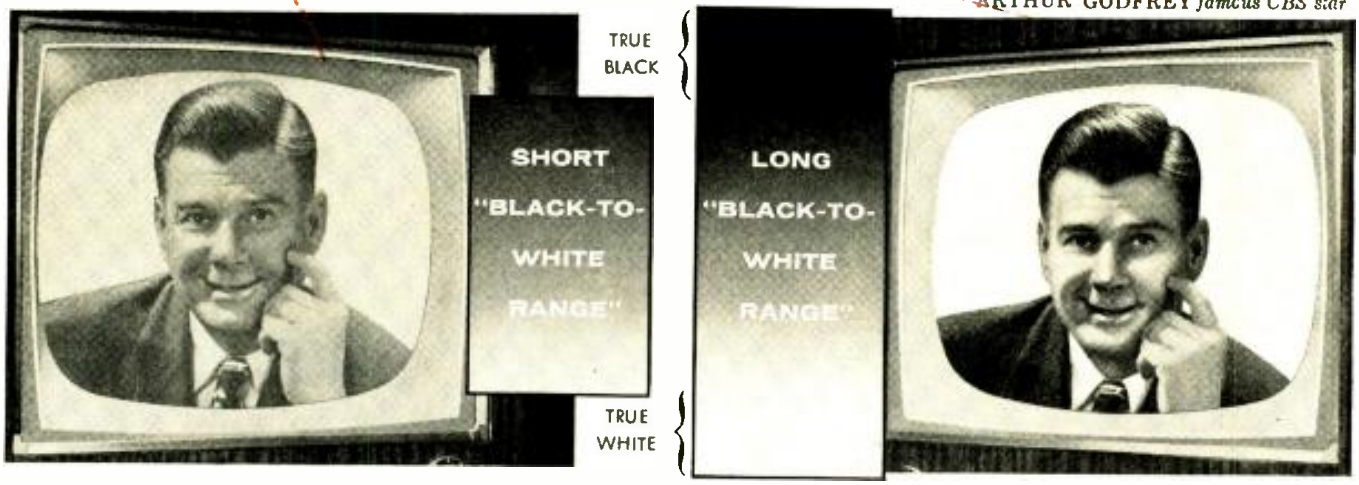
ON YOUR TV SCREEN, *the pictures* are also made by a series of dots (which appear as lines) applied *electronically*. These dots, in both cases, create a variety of tones including black, a range of grays, and white. BUT, it is the LENGTH of this "Black-to-White Range" (the gray scale) that makes the picture excellent, good, fair, or poor.

ARTHUR GODFREY *famous CBS star*



2. **ORDINARY PICTURE TUBES** used in most TV sets made before 1953 produce a *short* "Black-to-White Range." While the picture is good, the picture tube cannot develop enough *light output* for a *long* "Black-to-White Range."

3. **CBS-HYTRON MIRROR-BACK TUBES** produce up to *twice the light output* of ordinary picture tubes. Like the silver backing on a mirror, the *shiny* aluminum backing on a Mirror-Back tube reflects to the viewer *all the light* on the screen. The resulting increased brightness and reduced halation (unwanted spreading of light from one dot to another) is *essential* to give you a *long* "Black-to-White Range." The full range you *must* have for the clearest, sharpest, brightest pictures that are a joy to watch.

TALK LONG "BLACK-TO-WHITE RANGE" PICTURES ...SELL BIGGER-PROFIT

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Talk . . . demonstrate . . . and sell "Long-Black-to-White-Range" clearer, sharper, brighter pictures. It's easier to sell premium-grade, brand-new CBS-Hytron Mirror-Backs . . . with their controlled quality and dependable full-year guarantee. Profit more. Tie in with POST. Get this Mirror-Back Promotion Kit . . . from your CBS-Hytron distributor, or mail coupon.

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3. *Certified* Quality Service decalcomania.

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Featuring the famous Williamson Circuit with superior KT66 Output Tubes. Full 15 watts 20 to 20,000 cps within 1/10 of 1 db. Distortion so low it can hardly be measured.
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3 GARRARD
"TRIUMPH" RC80 AUTOMATIC
3-SPEED RECORD CHANGER

The standard of excellence the world over. Plays all records, 33⅓, 45, 78 rpm records in 7", 10" and 12" sizes. Quiet, smooth-running 4-pole motor, weighted turntable. Automatic shut-off after last record. Muting switch cuts out sound during change cycle. Net $49.50
SPECIAL '45' SPINDLE for Garrard "Triumph" Changer Net $3.50

4 Electro-Voice
12 TRXB TRIAXIAL SPEAKER

Advance design full range easy to mount 12" TRIAXIAL 3-WAY SPEAKER SYSTEM. Electro-Voice laboratory research has combined Woofer, Middler and Tweeter into a near-perfect instrument for sound reproduction. Clearly and realistically reproduces all tones and overtones with unexcelled balance.
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GENERAL ELECTRIC
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VARIABLE RELUCTANCE
MAGNETIC PICKUP

For finest phono reproduction of all types of records. Considered by many engineers and music lovers the finest pickup at any price! Furnished mounted in changer ready for use. Supplied with genuine General Electric Double Sapphire Needle. Net $8.20

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"5-STAR" Hi-Fi BUY!

Complete, Matched PHONO-RADIO SYSTEM

ALL BRAND NEW famous name components • **ALL** current models and production • **ALL** Fully Guaranteed • Supplied with **ALL** TUBES • Warranty Cards • Instructions • Indoor Antenna • GE Dual Sapphire Needle • **ALL** Cables and Plugs • Your '5-STAR' System consisting of ALL ITEMS ILLUSTRATED and DESCRIBED ABOVE . . . comes ready to plug together and play!

This Complete System for
Only $259. f.o.b. our store
Total Regular Net $379.90

OUR BIG BUY YOUR BIG SAVING!

ELECTRO-VOICE *ARISTOCRAT* SPEAKER CABINET WITH KLIPSCH LICENSED FOLDED HORN

Companion Speaker Cabinet for the PEERAGE Equipment Console. Corner enclosure designed to match the characteristics of the Electro-Voice 12TRXB Speaker. The patented KLIPSCH principle provides a full octave of added bass without boominess and greater speaker power handling capacity. 29½" high, 19" wide, 16½" deep.
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COMPANION CABINETS
for '5-STAR' SYSTEM

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(As Shown Here)

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This is the new Sprayberry Training Television receiver, built and tested in sections for greatest instruction value.

New Equipment! New Lessons! Enlarged Course!
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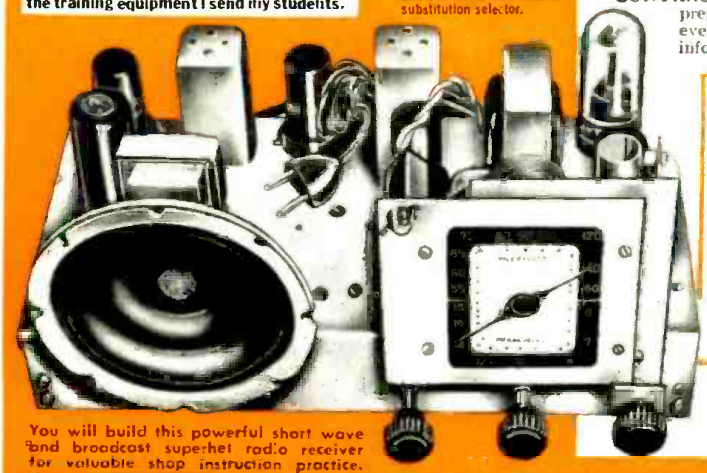
3 NO OBLIGATION TRAINING PLANS

These photos show only a small part of the training equipment I send my students.

You build the new Sprayberry Tester . . . 18-range Volt-Ohm-Milliammeter readings plus output meter and condenser and resistor substitution selector.



You will build this powerful short wave and broadcast superhet radio receiver for valuable shop instruction practice.

Frank L. Sprayberry
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You have NO MONTHLY PAYMENT CONTRACT to sign . . . pay for this outstanding training as you learn!

The complete facts are so big and so important to any man seeking training in Radio-Television that I urge you to mail the coupon below at once for my big all-new 56 page FREE CATALOG and FREE Sample Lesson. Get the full story of this remarkable new and up-to-the-second Training Plan. You'll read about my 3 NO OBLIGATION PLANS or "packaged unit" instruction for both beginners and the experienced man. You'll learn how I can now prepare you in as little as 10 MONTHS to take your place in this fast moving big money industry as a Trained Radio-Television Technician. You'll see that you take no risk in enrolling for my Training because you DO NOT SIGN A BINDING TIME PAYMENT CONTRACT. I have been training successful Radio-TV technicians for 22 years . . . I can prepare you, too, to get into your own profitable Service Shop or a good paying job, even if you have no knowledge of Radio-Television. Mail the coupon . . . I rush full information FREE and without obligation. (No salesman will call.)

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Your training covers U H F, Color Television, F M, Oscilloscope Servicing, High Fidelity Sound and Transistors.

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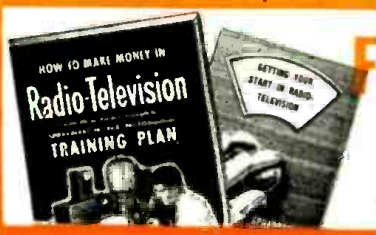

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Spot Radio News

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

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

UPSTAIRS TV, beset by pounding investigations and debates, and economic bewilderment, since the early winter months, has at last received a few words of encouragement from Congress and particularly the Commission, in the form of a proposal for a mild tax relief on ultra-high chassis and permission to set up satellite u.h.f. stations.

The decision to authorize the installation of low-power high-band stations to spread signal coverage was looked on with greater optimism than the tax idea, which it was believed would be of little help; some even felt that it might add confusion to the scene. Originally Senator Potter's subcommittee investigating the higher channels, had suggested removal of the complete 10% excise tax on all-channel receivers, as recommended by Senator Johnson, believing that this would spur sales. When the suggestion reached the Senate, a revision was offered and the net result was a compromise providing a $7-tax credit on chassis which featured a . . . "device for receiving u.h.f. signals"; the credit would obtain on the manufacturing level.

The satellite order will allow a TV broadcaster to re-transmit programs from his master outlet over one low-powered slave station, or possibly several units to increase signal zones; the only limitation to the number of satellites that can be used, it was said, was the extent of multiple-station ownership and relation of the distances covered to zone standards prescribed in the allocation table.

In a lengthy dissent, Madame Commissioner Hennock soundly rebuked her fellow Commissioners declaring that the policy simply . . . "kills u.h.f. TV . . ." because the low-band stations will now be able to embark on a new expansion program and . . . "gobble up the u.h.f. spectrum." She felt that the plan was railroaded through the Commission and now invites . . . "monopolistic control over TV, the most important medium of mass communication ever devised."

In the meantime, the Potter committee felt that the varied problems of the high channels should be studied by a technical *ad hoc* committee and proceeded to arrange for a long-term probe.

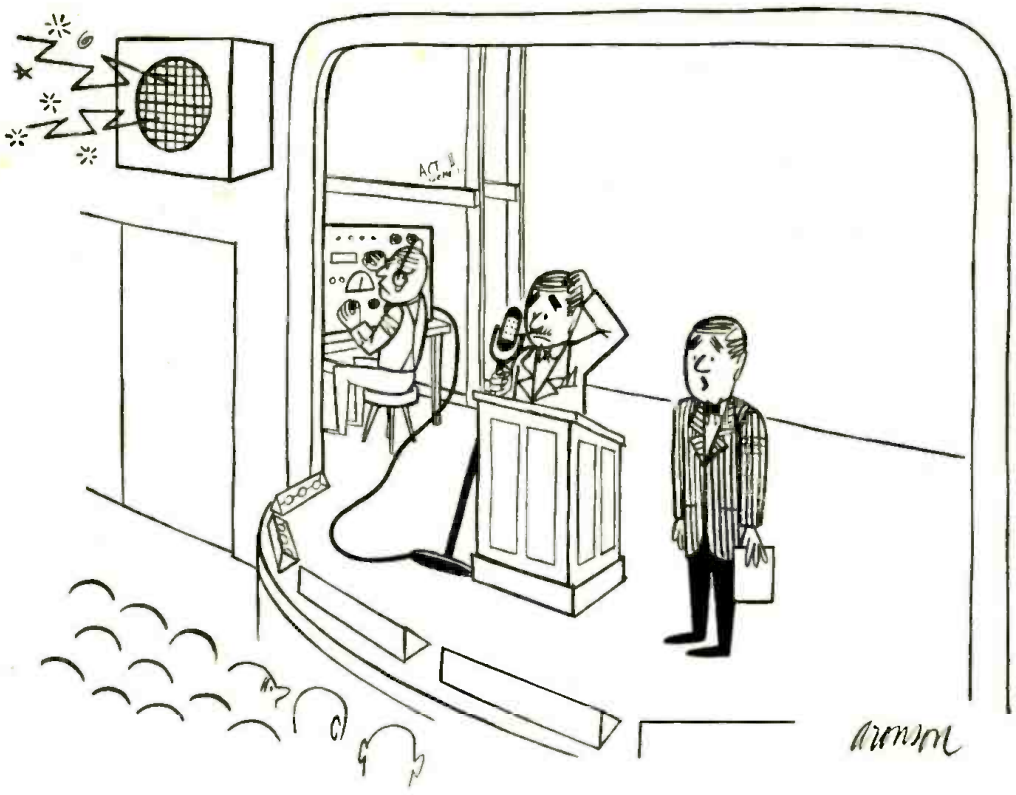
ONCE MORE RADIO has proved how vital it is to our immediate progress. Now, thanks to radio, it has become possible to use a remote-control system to measure automatically radiation intensities and other variables in the vicinity of an atomic explosion and transmit all data to headquarters.

Using a system designed by members of the Bureau of Standards' nucleonic instrumentation lab, at the request of the division of biology and medicine of the Atomic Energy Commission for use in nuclear tests, the radio link and interrogation contact features a frequency-modulated system operating in the v.h.f. band between 162 and 174 megacycles. To insure adequate coverage, repeater stations are located at positions of high elevation. Each repeater, it was said, can handle information from ten data stations and each data station offers a choice of ten different programs, each having several functions, which the operator can select for transmission to the control station. Thus, it was noted, one program might consist of station identification, several calibrations, and radiation intensity readings, while another program might contain weather information.

To conserve battery power, cycle timers are used at the repeater and data stations. The timers operate in conjunction with a coder unit in the control station, which enables the operator at the station to select the desired repeater and data stations. These timers regularly turn the receivers at these stations *on* for two seconds out of every twenty. If, it was reported, during the *on* part of the cycle, the coder unit sends out a properly-modulated signal indicating that the control station desires to communicate with a particular repeater or data station, the receiver at this station will be locked on and no longer will be controlled by the cycle timer. Since the cycle timers are installed at both the repeater and data stations, the control station must transmit its coded signal for about forty seconds to be sure to *capture* the repeater station and also to have the repeater *capture* the data station.

After the repeater and a data station have been captured, the control station operator is then able to direct

(*Continued on page 22*)



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Don't Be Vague...Insist on SPRAGUE

Accept no substitutes. There is a Sprague Distributor in every sales area in the United States. Write for the name of your nearest source of supply today.

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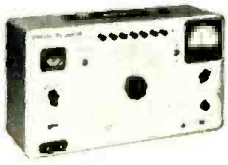
TWIST-LOK☆ 'LYTICS

Sprague TVL's fill the top performance bill in the toughest TV circuits. High temperatures, surge voltages, ripple currents won't faze them. Like all Sprague capacitors, Twist-Lok 'Lytics are your first line of defense against expensive call-backs.



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TEL-OHMIKE®

This capacitor-resistor analyzer is the handiest instrument you can buy! Moderately priced for radio and TV repair shops, the Model TO-4 Tel-Ohmike offers top quality and accuracy for every service need. Priced so you can afford it at **$73.50 NET**

Insist on Sprague
ATOMS®

The smallest TV 'lytics made —and the only small ones for 85°C (185°F) up to 450 volts d-c. Guaranteed for low leakage and long shelf life, they withstand high temperatures, high ripple currents, high surge voltages. From crowded TV chassis to jam-packed portables, Sprague Atoms fit 'em all.

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the data station to transmit the desired program of information. This is done by dialing the proper program number on a control console, which serves to energize the transmitter and modulator at the data station. Then the data station is able to transmit the desired program through the repeater to the control station. This information is transmitted in the form of a variable frequency covering the range of approximately 750 cps to about 4 kc. At the control station, this audio frequency is fed to a frequency counter, where it is counted and displayed in alternate one-second periods and also printed on a digital recorder. Calibration curves of radiation intensity or other quantities as a function of frequency are utilized in interpreting the frequency variations in terms of measured data.

Each data station includes a transmitter-receiver, cycle timer, decoder, program selector, modulator, battery power supply, and detecting instruments. The decoder is a mechanically resonant device that activates the program selector, when it is actuated by the proper incoming frequency. Then the program selector receives impulses consisting of interruptions to the modulated subcarrier signal which are produced by the dialing mechanism in the control-station coder console. These impulses occur at a rate of about ten per second. A stepping relay and associated circuitry are used in the program selector to advance one step for each impulse received. Thus, if an operator dials program number 6, six interruptions occur, causing the program selector stepper in the data station to advance to position *six*.

Bureau spokesmen noted that after the program selector stepping relay has been advanced by the decoder to select the desired detector (for radiation intensity or wind velocity, etc.), the output of this detector is routed to a function-selector stepping relay. The function selector is advanced one position every fifteen seconds by the cycle timer.

The modulator is essentially an oscillator with a variable inductance for controlling the frequency of oscillation. Negative feedback is used to give amplitude stability and to limit the variation of amplitude with frequency.

The repeater station consists basically of a transmitter and receiver, with duplicate standby equipment. It also includes a cycle timer, decoder, and battery box. The repeater station has been so designed that the control-station operator can select either of the two receivers and either of the two transmitters in the instrument. This duplication of equipment was included since complete failure of the repeater could prevent reception from any of the data stations operating through it.

At the control station, there are also duplicate transmitting (30-watt) and receiving setups. The pair of receivers

(*Continued on page* 109)

Step Into a Higher Paying Position Without Giving Up Your Present Income

KEEP YOUR PRESENT JOB AND TRAIN TO BE A TELEVISION TECHNICIAN

L. C. Lane, B.S., M.A. President, Radio-Television Training Association. Executive Director, Pierce School of Radio & Television.

I'll train you at HOME in your SPARE TIME

If you're now working as a Radio Technician, Maintenance Man, or Operator you can keep your job while studying one of my two NEW and UP-TO-THE-MINUTE Courses — FM and Television Technician Course — TV Cameraman and Studio Technician Course.

These Courses — especially prepared for home study—will prepare you for top-paying jobs in the ever-expanding radio-television-electronics industry.

EXPERT FM-TV TECHNICAL TRAINING

My FM-TV Technician Course lets you take full advantage of your previous experience — either civilian or Armed Forces. YOU CAN SAVE MONTHS OF TIME. My FM-TV Technician Course completes your training by providing a thorough background in Frequency Modulation and Television Theory and Practice.

C-W Telephone Transmitter

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You "Learn by Doing", working with parts and equipment I send you. Six large kits of FM and TV parts are given to you as part of the course. You build and keep a professional GIANT SCREEN TV RECEIVER complete with big picture tube (designed and engineered to take any size up to 21-inch).

Upon completion of your training you may — if you desire — take two weeks of shop training at my associate resident school in New York City AT NO EXTRA COST!

PRACTICAL TV CAMERAMAN & STUDIO COURSE

My TV Cameraman and Studio Course is designed to train TV Studio Technicians and TV Cameramen, urgently needed today by Television Broadcasting Stations throughout the nation. New TV Stations are now mushrooming throughout the country. Men who can work as Audio Technicians, TV Cameramen, Microphone Boom Operators, Monitor Operators, Turntable Operators, Control Room Technicians can write their own tickets.

I will train you for an exciting high pay job as the man behind the TV camera. Work with TV stars in TV studios or "on location" at remote pick-ups.

Available if you want it . . . one week of actual work with studio equipment and TV Cameras at my associate resident school in New York City.

This course is a MUST for those who wish to increase their technical knowledge of television operations.

TRAINING FOR BEGINNERS

My Radio-FM-Television Technician Course is especially prepared for men with *no previous experience or training*. I have trained hundreds of men for successful careers in radio-television-electronics. Many of them had only a grammar school education and no previous experience whatsoever in the field.

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Radio Television Training Association

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Important for BETTER PAY JOBS requiring FCC License. You get this training AT HOME and AT NO EXTRA COST. Top TV jobs go to FCC-licensed technicians.

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

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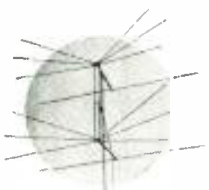
YOUR MONEY and LABOR COSTS BACK!

There's been enough words written about TV antenna performance. Now . . . *see the facts for yourself!* Compare any of the new PHILCO Super-Performance TV Antennas with any equivalent type on the market. If the new PHILCO does not give you the finest picture possible, your money back for the antenna *plus* your labor costs up to $10.00. Ask your PHILCO Distributor for complete details on this amazing offer!



PHILCO VHF SUPER CONICAL

PHILCO TWO-BAY SUPER CONICAL ALL-CHANNEL ANTENNA

Strong signal pickup on VHF channels 2 through 13 . . . UHF channels 14 through 83 . . . ideal for fringe area reception . . . all-aluminum construction with dowelled elements: Part No. 45-3096-2. Rugged single bay design: Part No. 45-3096.

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PHILCO TWO-BAY VHF LOW BAND YAGI ANTENNA

10 elements . . . all-aluminum . . . factory pre-assembled. Top performance on channels 2 through 6 . . . 13 db to 15 db gain on various channels. Single bay Part No. 45-3112-2 through 6. Stacked version harness Part No. 45-3267.

PHILCO GOLDEN YAGI UHF ANTENNA

Designed for 300 ohm operation . . . all metal construction . . . 11 db to 12 db gain on various channels. "Cronak" coated components resist salt air . . . humidity. Six models cover entire UHF spectrum: Basic Part No. 45-1996.

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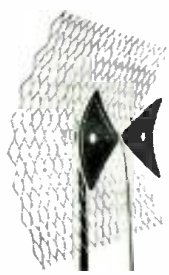
PHILCO UHF GOLDEN YAGI



PHILCO UHF PARAFLECTOR

PHILCO CORPORATION ACCESSORY DIVISION

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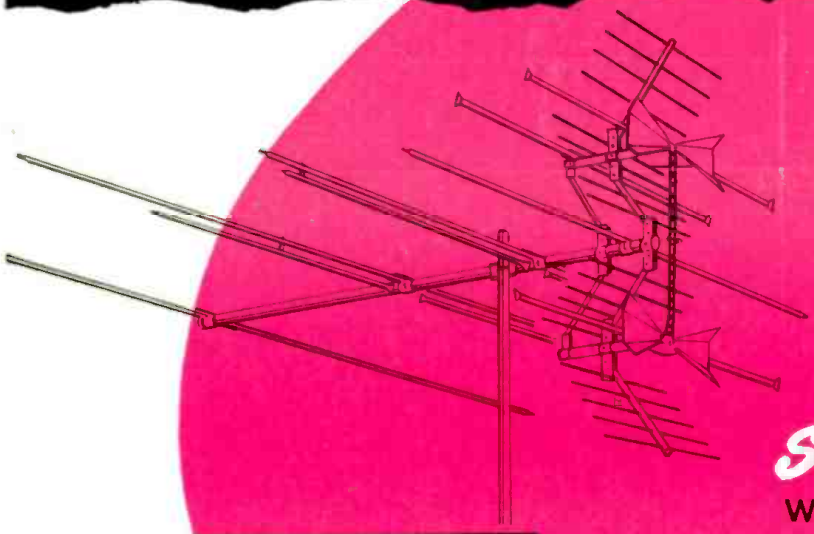
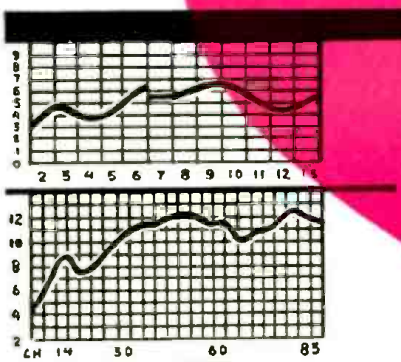
RECEIVE EVERY CHANNEL
NOW AND IN THE FUTURE
TRU-YAGI PERFORMANCE on ALL CHANNELS 2-83 - B & W or COLOR

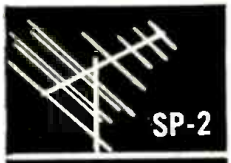


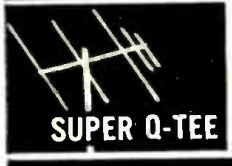
At last, a high gain, low cost antenna everyone wants that meets every need in all sections of the country.

THE VEE-D-X
SUPER CHIEF
WITH "DYNA-PHASE" *



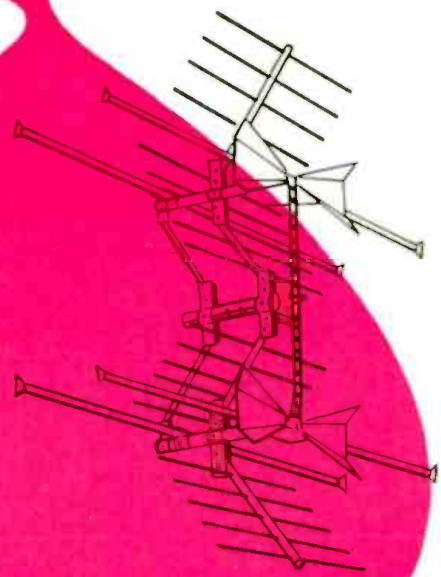
The FIRST all-channel antenna employing Dyna-phase, the sensational development recently released by the VEE-D-X laboratories. This new phasing technique permits extremely high gain over the entire VHF-UHF band with excellent directivity – high front-to-back ratio – all with a single transmission line. Neat in appearance, the SUPER CHIEF is completely pre-assembled. Ruggedized all aluminum construction featuring new VEE-D-X "squeeze lok" tubing on all elements - doubly reinforced at the stress points with a swaged aluminum sleeve and braced to the boom with triad lock hardware for durability plus easy installation.





THE VEE-D-X
CHIEF

Small in size but a Goliath in performance, the CHIEF is essentially a high-gain antenna for channels 7-83 that performs satisfactorily on channels 2-6 as well. Same rugged construction as the SUPER CHIEF, this antenna comes pre-assembled for trouble-free installation within minutes.



A COMPLETELY NEW LINE OF VEE-D-X ANTENNAS

LaPOINTE ELECTRONICS INC.
ROCKVILLE, CONN.

MORE SANDING AREA

than any sander in its price class

25 square inches

only **2 15/16"** high . . .
fits under tight places

MODEL 700

$14.95 list

LOWEST SANDER DESIGN

TERRIFIC POWER! We Dare You to Stall It!

The new Weller Sander is as efficient as any rotating motor-driven sander, and offers many practical features for craftsmen who want professional results. It has no equal for combined quality and price. Each Weller Sander comes with 6 sheets of assorted sandpaper and a special polishing cloth. Workmanship and material are guaranteed for 90 days.

POSITIVE STRAIGHT-LINE ACTION— No bucking or twisting. Sands with the grain for smooth surfaces and goes all the way into corners.

POWER-PACKED— Powerful reciprocating type motor gives 14,400 strokes per minute. 110/120 volts AC only. 8 foot power cord.

EXCLUSIVE INSULATION— Rubber insulators between housing and motor minimize vibration and give quieter operation.

PUSH-BUTTON CONTROL— Fingertip action for "on" or "off".

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THE FINEST TOOLS FOR THE FINEST CRAFTSMEN

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SOLDERING GUNS • SOLDERING KITS • POWER SANDERS

Within the INDUSTRY

ARTHUR L. B. RICHARDSON has been elected secretary and general counsel of *Sylvania Electric Products Inc.* He succeeds John S. Learoyd who retired on August 1st.

Mr. Richardson has been general counsel for the company since 1953. He joined the firm in 1945 as patent attorney and in the same year was appointed manager of the patent law department. In 1950 he was named general attorney for the company and in 1953 was elected general counsel.

* * *

JFD MANUFACTURING COMPANY has expanded its facilities to include a new electronic penthouse-laboratory atop its main plant at 6101 16th Ave. in Brooklyn . . . Expansion of facilities and personnel of **OAK MFG. CO.'s** Advance Development Laboratory in Rockville Centre, Long Island has been announced by the firm's Chicago headquarters . . . A new $100,000 building housing offices, studios, and laboratories has been opened by **NORTHWEST RADIO AND TELEVISION SCHOOL** in Portland, Oregon. The modern building contains 7000 square feet of space to help serve the more than 500 new students enrolled each month . . . **BURTON BROWNE ADVERTISING** has opened a branch office at 562 Fifth Avenue in New York . . . **TEMPEL MANUFACTURING COMPANY** has added a new administration building to its facilities at Bryn Mawr and Damen in Chicago. The company now has 14 modern buildings comprising 43,000 square feet on an 8½ acre tract . . . **CHICAGO TELEPHONE SUPPLY CORPORATION** of Elkhart, Ind. has opened a West Coast office at 928 S. Robertson Blvd. in Los Angeles. Robert A. Stackhouse is in charge of the new facility . . . **JEFF MARKELL ASSOCIATES** has moved to 764 Sixth Avenue in New York City.

* * *

WILLIAM W. WEXLER is the new advertising and sales promotion manager of the equipment sales division of *Raytheon Manufacturing Company.*

In his new post he will be responsible for advertising and sales promotion for the industrial and component products groups, reporting to the marketing servicing manager.

Before joining the Waltham firm, he was with *Murray Manufacturing Corporation* of Brooklyn, N.Y. where for the first three years he was responsible for advertising and sales promotion and for the past year for the marketing research programs.

* * *

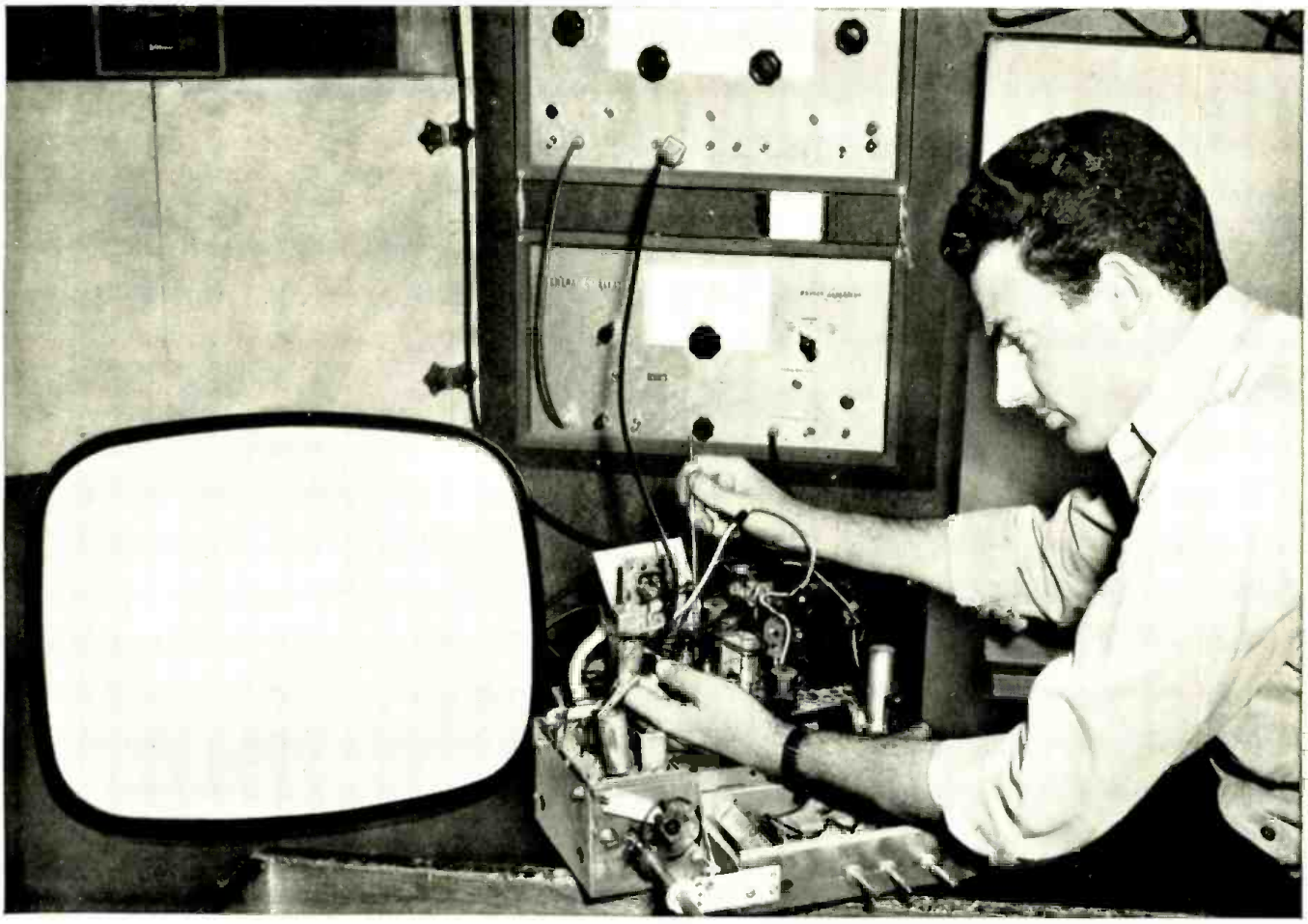
THOMAS M. BLAKE has been named president of *Littelfuse, Inc.* of Des Plaines, Ill. For the past eight years he has been executive vice-president of the firm.

In his new position, Mr. Blake will take over the responsibilities formerly handled by E. V. Sundt, chairman of the board. Mr. Sundt, who will continue as a technical consultant to the company, retains his chairmanship of the board.

Mr. Blake joined the company at its incorporation in 1938. Prior to that time he was with the Chicago office of *General Outdoor Advertising Company* for nine years.

* * *

RICHARD G. BENNETT has joined the *Andrew Corporation* as sales engineer with headquarters in Chicago . . . *Rockbar Corporation* has named **ED STRAW** as national sales and advertising manager for *Collaro* record changers, turntables, pickups, etc. He has been with the company's distribution program since 1951 . . . **MILTON C. PERLMUTTER** has been elected executive vice-president in charge of sales and merchandising for *TeleTone Co. of America.* He will continue his present duties as vice-president of *B & R Electronics,* the parent company . . . **JOHN C. TAYLOR** is the new merchandising supervisor for *Sylvania's* equipment picture tube sales department . . . *Mycalex Corporation* has named **RICHARD A. HUMPHREY** as chief of research and development at its Clifton, N.J. plant . . . **JAMES M. FARRELL,** formerly eastern regional sales manager for *Crosley* radio and television, has been promoted to the newly-created post of field sales manager for the division . . . **ANDREW H. BERGESON,** who recently retired from active duty with the U.S. Navy with the rank of Captain, has been retained by *Stromberg-Carlson* as a consulting engineer . . . The Potentiometer Division of *Fairchild Camera and Instrument Corporation* has named **THOMAS H. BAY** to the post of sales manager. He succeeds **STUART EDGERLY** who resigned recently . . . The appointment of **E. R. SLIGER** to the newly-created post of assistant general sales manager has been announced by the Electronic Tube Division of *Westinghouse* . . . **LAWRENCE J. STRAW** has been named general sales



G-E TV Field Clinics help build volume!

"Our boys attended these General Electric service meetings, and right away we were able to give better service in much less time," says Mr. M. A. Gribin, Universal TV, Los Angeles, Cal.

M. A. Gribin

Mr. M. A. Gribin's experience is typical of dealers throughout the country. Because they give better service faster, they attract a heavier volume of both repair work and new television sales. Satisfied customers come back again, and spread the word to prospects. This gives you the jump on competition in today's tough market.

Free G-E Field Clinics show you latest methods of diagnosing and correcting TV troubles in any make television. They're one of many reasons why millions have confidence in G-E TV, and why your G-E franchise is the most valuable in the market.

Call your G-E Distributor now. Sign up for the next G-E Field Clinic in your area. General Electric Co., Radio & Television Department, Electronics Park, Syracuse, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

manager of *Standard Piezo Company* with headquarters at the company's main plant in Carlisle, Pa. . . . **KEETON ARNETT** has been elected vice-president-administration for *Allen B. Du Mont Laboratories, Inc.* He has been general assistant to the president since 1951 . . . *Chicago Molded Products Corporation* has elected **EDWARD F. BACHNER, SR.** to the post of chairman of the board and elevated **MARCEL F. BACHNER,** formerly vice-president and treasurer, to the presidency . . . **LOWEN H. JORDAN** has been appointed director of sales for *James B. Lansing Sound, Inc.* of Los Angeles . . . **GEORGE BRODLEY** has been named merchandising assistant for *Sylvania's* radio tube and television picture tube divisions . . . *The Goldak Company* of Glendale, California has appointed **EDWIN M. KAUFMAN** chief engineer in charge of research and production.

* * *

LESLIE A. JOHNSON has been appointed vice-president of *Cornell-Dubilier Electric Corporation* by the board of directors of that company.

He has been associated with the company since 1939. Prior to that date he was employed by *Rohm and Haas Chemical Company* of Philadelphia following his graduation from M.I.T. in 1937.

Mr. Johnson has served in the South Plainfield, New Bedford, and Worcester plants of the company and is now manager of the new Sanford, N.C. plant, a post he will continue to fill.

* * *

NATIONAL UNION RADIO CORP. has announced an official name change to **NATIONAL UNION ELECTRIC COMPANY** to more nearly reflect the expanded activity of the company . . . **EECO PRODUCTION COMPANY,** a wholly-owned subsidiary of **ELECTRONIC ENGINEERING COMPANY OF CALIFORNIA,** has been incorporated to manufacture plug-in electronic circuits and other products for the industry. It was formerly a division of the parent company . . . **STANLEY WEBSTER LABORATORIES, INC.** has been incorporated in Illinois to manufacture speech and hearing aid devices and a full line of transistor products. The plant is located in the Elmhurst, Illinois area with executive offices at 229 E. Oneida Ave. in that city . . . **COOK ELECTRIC COMPANY** of Chicago has organized the **PLYMOLD** division with engineering offices and plant at 3415 Belmont Avenue, Chicago 18 . . . **RADIO RECEPTOR CO., INC.** has changed the name of its Seletron & Germanium Division to Semi-Conductor Division . . . Option to acquire **POTTER & BRUMFIELD MANUFACTURING COMPANY, INC.** of Princeton, Ind. has been exercised by **AMERICAN MACHINE & FOUNDRY COMPANY.** No management changes are contemplated for the subsidiary . . . **MONSON**

(*Continued on page* 184)

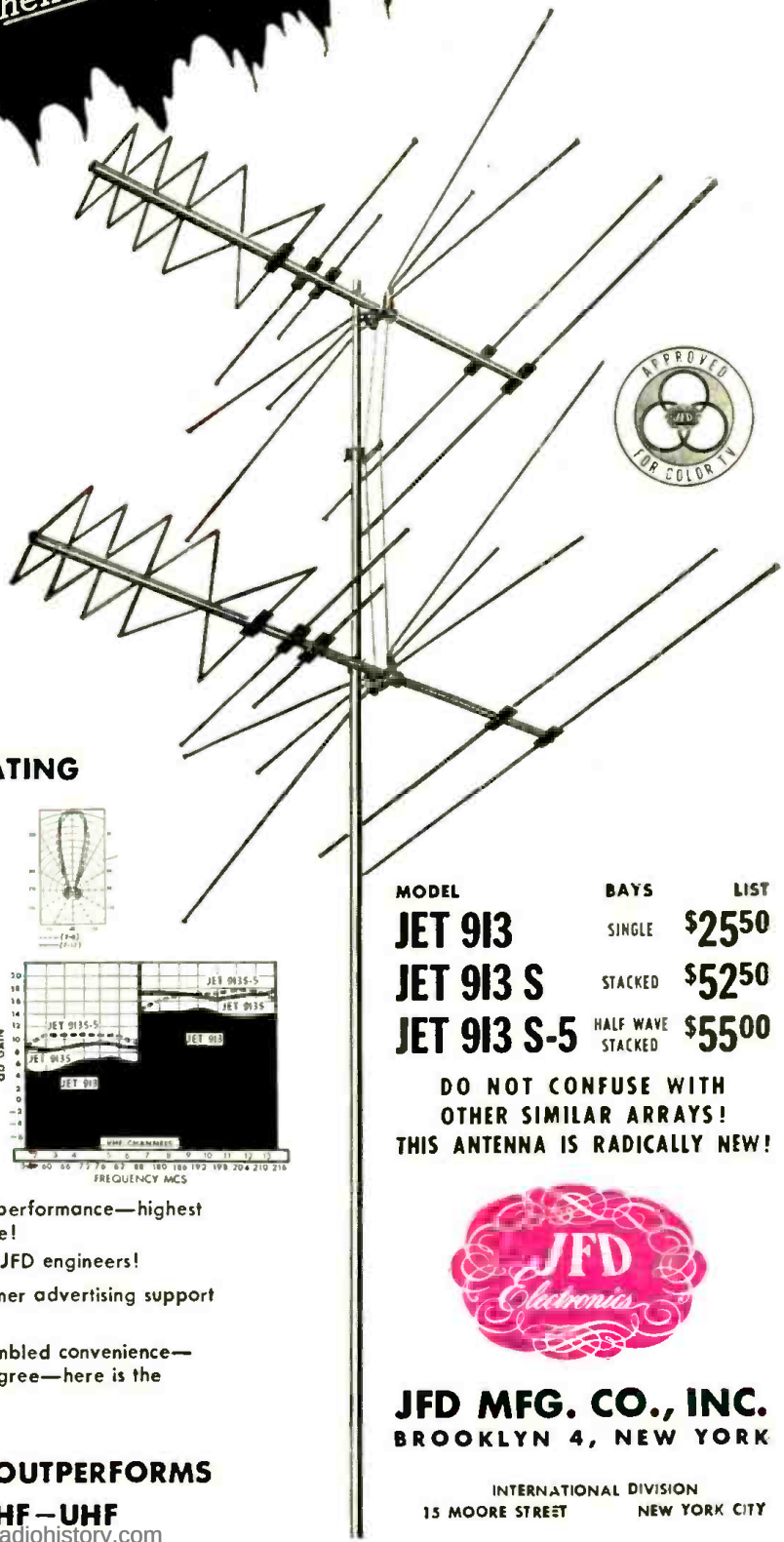
JFD ADVANCED ENGINEERING CREATES A RADICALLY NEW ANTENNA!

INCREDIBLE

is the only way to describe the new JFD

JET-HELIX

a radical new flat plane helical concept for VHF-UHF



INCREDIBLE FEATURES!

delivers highest gain!

outstanding front to back ratio!

sharpest picture clarity!

greatest fidelity color reception!

finest snow-free, trouble-free performance!

INCREDIBLE FACTS!

IT ALL ADDS UP TO A NEW HIGH IN S/N RATING

S/N FIGURE OF MERIT *

JFD JET-HELIX—57.85%

ANTENNA A	ANTENNA B	ANTENNA C
43.15%	31.85%	38.5%

*The S/N Figure of Merit sums up the major individual characteristics of an antenna in one concise value. Write for S/N Figure of Merit engineering folder No. 299 for complete details.

THE JET-HELIX IS BETTER BY AN AVERAGE OF 44.5%

- The Microwave Helix design delivers record-shattering power and performance—highest signal magnitude on all channels with the least possible amplified noise!
- Only the Jet-Helix has been exhaustively pre-tested in the field by JFD engineers!
- Only the JFD Jet-Helix comes to you backed by the greatest consumer advertising support in antenna history—literally pre-selling the Jet-Helix for you!
- Yes, compare its Alcoa Aluminum construction, compare its pre-assembled convenience—compare the JFD Jet-Helix by any standards known—and you *must* agree—here is the New Star of Antennas—the JFD Jet-Helix!

THE JET-HELIX IS THE ONE ANTENNA THAT OUTPERFORMS ALL OTHERS IN FRINGE AREAS ON BOTH VHF—UHF

MODEL	BAYS	LIST
JET 913	SINGLE	$25.50
JET 913 S	STACKED	$52.50
JET 913 S-5	HALF WAVE STACKED	$55.00

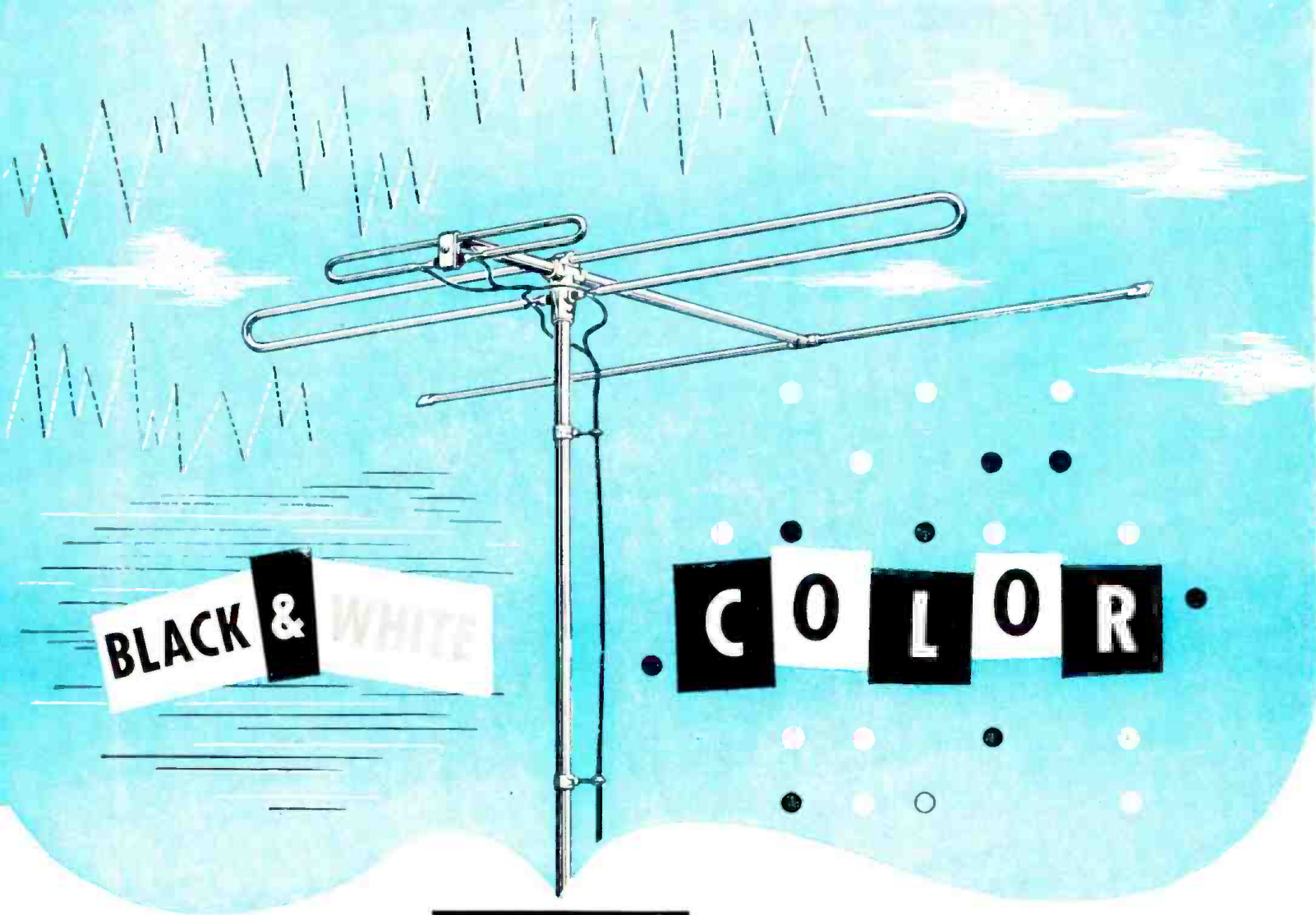
DO NOT CONFUSE WITH OTHER SIMILAR ARRAYS! THIS ANTENNA IS RADICALLY NEW!

JFD Electronics

JFD MFG. CO., INC.

BROOKLYN 4, NEW YORK

INTERNATIONAL DIVISION
15 MOORE STREET NEW YORK CITY



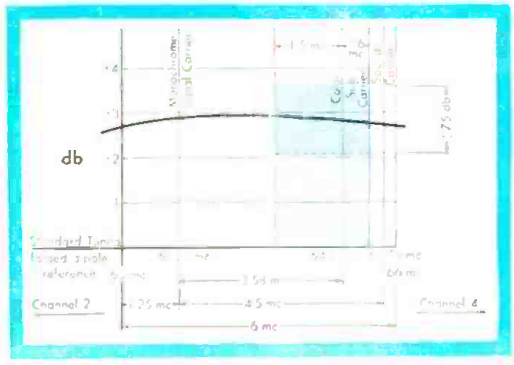
the INLINE* is best!

*Reissue U.S. Pat. No. 23.273

Are you overlooking the sales potential of the color-designed AMPHENOL INLINE antenna? Set owners have their color television antenna *right now* if they buy an AMPHENOL INLINE! In terms of present black & white tv set sales, this puts a tremendous sales weapon into every dealer's hands. Their assurance to customers that there will be *no antenna replacement* when they convert to color can be the important inducement to present sales of black & white sets.

facts on Color TV Reception

Fidelity color reception demands these antenna characteristics: flat antenna gain, no gain or loss greater than ±.75 db within 1.5 mc below and 0.6 mc above the color sub-carrier. *The* INLINE *gain is within this requirement over the color band on every channel.* Antenna gain must be held down across the FM frequencies. *The* INLINE *has been engineered for rejection of FM signals, 88 mc to 108 mc.* Antenna must have a single forward lobe to prevent "scotch plaid" ghosts. *All* INLINE *directivity patterns reveal a single forward lobe.*



Gain chart showing ±0.06 db variation over color modulation band for INLINE, Channel 3

Gain variation over the color modulation band for each VHF channel should not exceed ±.75 db; the following table gives figures for the INLINE on all channels.

Channel	Gain Variation/db	Channel	Gain Variation/db
2	±0.40	8	±0.08
3	±0.06	9	±0.04
4	±0.12	10	±0.03
5	±0.27	11	±0.20
6	±0.20	12	±0.30
7	±0.20	13	±0.30

AMPHENOL

AMERICAN PHENOLIC CORPORATION Chicago 50, Illinois
In Canada: AMPHENOL CANADA LIMITED

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.

MASTER ALL PHASES!

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

We Bring National Schools To You!

Superheterodyne Receiver

Signal Generator — Audio Oscillator — T.R.F. Receiver

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.

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.

APPROVED FOR VETERANS AND NON-VETERANS
Check coupon below

Both Resident and Home Study Courses Offered!

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!

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LOS ANGELES 37, CALIFORNIA • ESTABLISHED 1905
IN CANADA: 811 W. HASTINGS STREET, VANCOUVER, B.C.

GET FACTS FASTEST! MAIL TO OFFICE NEAREST YOU!

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NATIONAL SCHOOLS, Dept. RH-104

4000 S. Figueroa Street, Los Angeles 37, Calif. or **323 West Polk Street, Chicago 7, Ill.**

Send FREE Radio-TV Electronics book and FREE sample lesson. No obligation, no salesman will call.

NAME _____ BIRTHDAY _____ 19___

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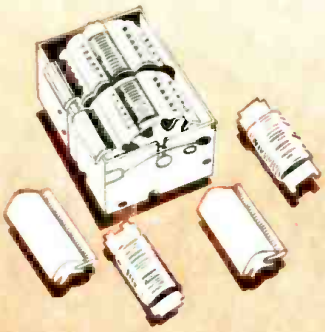
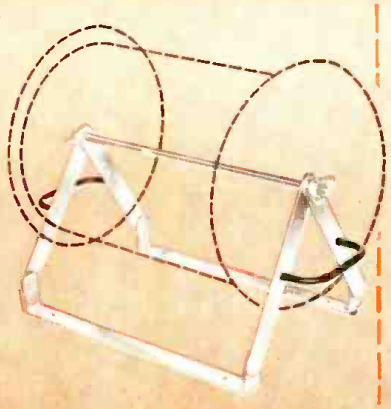
CITY _____ ZONE ____ STATE _____

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



G-C TUNER-KLEEN'R For every Standard Coil tuner. Cleans both stationary and rotary contacts at every twist of the channel selector. Easy to install, means extra profit, better reception.
No. 9132.....Net $1.00

G-C SPRA-KLEEN The original power spray electrical contact cleaner and lubricant. Eliminates noises in TV tuners, contacts, controls, relays and switches. No waste, no need to remove parts.
No. 8666 6 oz. can.....Net $1.00



G-C PORTABLE WIRE REEL New, convenient way to handle wire coiled on spools. Just slip spool onto reel and pull out what you need. No more twisted or tangled wire when you go out on a job!
No. 9111.....Net $2.40

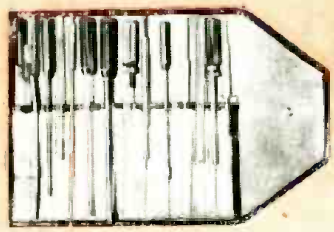
G-C SPEEDEX WIRE STRIPPERS New automatic "766" series has delayed return action to prevent crushing of fine stranded wires. Easy to use, with easy-grip handles for easy operation. Interchangeable blades. Specify wire size.
Series 766 (12 models)....Net $4.95

Save time... Save money... Speed up your service work!

with

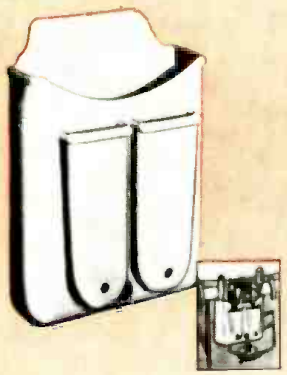
G-C SERVICE AIDS

AT LEADING PARTS DISTRIBUTORS EVERYWHERE



G-C DELUXE ALIGNMENT TOOL KIT Handy roll type case with 16 most-used tools. Tool tips are extra thin, of best grade hardened spring steel for long useful service. Value of tools sold separately $15.00.
No. 8280.....Net $7.74

G-C GENERAL SKRATCH STIK Easy to use, in handy carry-with-you case. Removes scratches on walnut, mahogany, oak—all shades and colors. Avoid embarrassment on the job . . . wipe Skratch Stik on that accidental scratch!
No. 909.....Net $0.30



G-C "TUX" TOOL KIT Made of remarkable new "Alathon" polyethylene. Flexible, tough, will not lose shape. Keep your tools with you, your tape on a chain. Lightweight.
No. 8943.....Net $2.37

G-C ILLUMINATED INSPECTION MIRROR Penlight batteries make this tool independent of cords or connections. Adjustable 1" hinged mirror mounted to 6" transparent lucite rod. No shock. On-off switch. Length 12¼". Bulb, less batteries.
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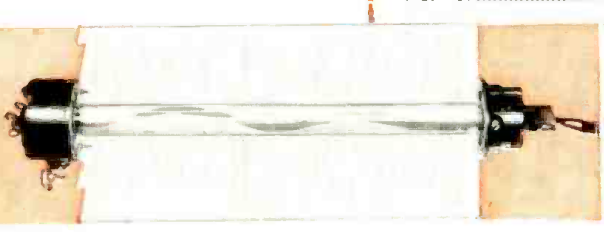

G-C COMBINATION LEAD-IN TUBE AND LIGHTNING ARRESTOR Simplest feed-thru idea you ever saw. Drill ¾" hole, any wall up to 16" and insert. Arrestor on outside, wall plug inside. A new G-C exclusive!
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FREE Your copy of the big, illustrated G-C catalog. Send postcard today!

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Home Study Courses in
TELEVISION SERVICING
offered by
RCA INSTITUTES

Study Television Servicing—from the very source of the latest, up-to-the-minute TV and Color TV developments. Train under the direction of men who are experts in this field. Take advantage of this opportunity to place yourself on the road to success in television. RCA Institutes, Inc. (A Service of Radio Corporation of America), thoroughly trains you in the "why" as well as the "how" of servicing television receivers.

FIRST HOME STUDY COURSE IN COLOR TV SERVICING

Now you can train yourself to take advantage of the big future in Color TV. RCA Institutes Home Study Course covers all phases of Color TV Servicing. It is a practical down-to-earth course in basic color theory as well as how-to-do-it servicing techniques.

This color television course was planned and developed through the combined efforts of instructors of RCA Institutes, engineers of RCA Laboratories, and training specialists of RCA Service Company. You get the benefit of years of RCA research and development in color television.

Because of its highly specialized nature, this course is offered only to those already experienced in radio-television servicing. Color TV Servicing will open the door to the big opportunity you've always hoped for. Find out how easy it is to cash in on color TV. *Mail coupon today.*

SEND FOR FREE BOOKLET

Mail coupon in envelope or paste on postal card. Check course you are interested in. We will send you a booklet that gives you complete information. *No salesman will call.*

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Thousands of men in the radio-electronics industry have successfully trained themselves as qualified specialists for a good job or a business of their own—servicing television receivers. You can do this too.

This RCA Institutes TV Servicing course gives you up-to-the-minute training and information on the very latest developments in black-and-white television.

As you study at home, in your spare time, you progress rapidly. Hundreds of pictures and diagrams, easy-to-understand lessons help you to quickly become a qualified TV serviceman.

There are ample opportunities in TV, for radio servicemen who have expert training. Mail coupon today. Start on the road to success in TV Servicing.

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Without obligation on my part, please send me copy of booklet on:

- ☐ Home Study Course in TELEVISION SERVICING.
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Address _____

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A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.

YOU be the Judge!

Let the Kay-Townes SUPER-KATY prove its superiority over ALL other TV antennas on the market today!

Super KATY-2

AMERICA'S MOST WANTED TV ANTENNA

"THE BEST SET IS ONLY AS GOOD AS ITS ANTENNA"

Here's why the famous KAY-TOWNES

Super KATY

wins in every case!

- FAR REACHING Reception!
- New MOLDED, RIBBED INSULATOR for low water absorption!
- New RIGID Construction to withstand gale-force winds!
- EASY Installation!
- LESS DEPTH on mast!
- Best by *Color-Test!* Super Katy has been proved the best antenna for fine color reception by actual field tests.

Every Super Katy installed will bring *NEW SALES!*

The long reach, long profit antenna

"Fringe area" dealer-servicemen in every part of the country are reporting outstanding sales and service stories . . . and, *mounting TV consumer demand!* The new, revolutionary Super "KATYS" have now *convincingly proved* every quality and performance claim attributed to them.

Kay-Townes' original SUPER KATY design . . . *now amazingly improved* . . . will out-perform any other competitive antenna on the market today, *regardless of type or design principle!*

Manufactured and Distributed in CANADA By DELHI METAL PRODUCTS, LTD., DELHI, ONTARIO

KAY-TOWNES ANTENNA CO.

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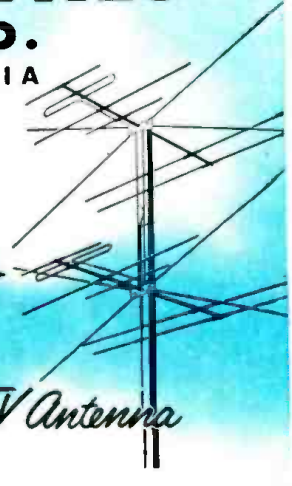

Originators of the **BIG-JACK** *the world's most Copied TV Antenna*

CREI prepares you quickly for success in

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The signs are plain as to the future of the trained men in the electronics industry. It is a tremendous industry, and—at the *present time* there are more jobs than there are trained men to fill them. But—when there's a choice between a trained and untrained applicant, the trained man will get the job. Your biggest problem is to decide on—and begin the best possible training program.

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Since 1927, CREI has given thousands of ambitious young men the technical knowledge that leads to more money and security. The time-tested CREI procedure can help *you*, too—if you really want to be helped. CREI lessons are prepared by experts in easy-to-understand form. There is a course of instruction geared to the field in which you want to specialize. You study at *your* convenience, at *your* rate of speed. Your CREI instructors guide you carefully through the material, and grade your written work personally (not by machine).

Industry Recognizes CREI Training.

CREI courses are prepared, and taught with an eye to the needs and demands of industry, so your CREI diploma can open many doors for you. Countless CREI graduates now enjoy important, good-paying positions with America's most important companies. Many famous organizations have arranged CREI group training for their radio-electronics-television personnel. To name a few: All America Cables and Radio, Inc.; Canadian Aviation Electronics, Ltd.; Canadian Broadcasting Co rporation; Columbia Broadcasting System; Canadian Marconi Company; Hoffman Radio Corporation; Machlett Laboratories; Glenn L. Martin Company; Magnavox Company; Pan American Airways, Atlantic Division; Radio Corporation of America, RCA Victor Division; Technical Appliance Corporation; Trans-Canada Air Lines; United Air Lines. Their choice for training of their own personnel is a good cue for *your* choice of a school.

Benefits Felt Right Away.

Almost immediately, you feel the benefits of CREI training. Your employer, when informed of your step toward advancement (only at your request), is certain to take new interest in you and in your future. What you learn in CREI Home Study can start helping you do a better job immediately.

CREI also offers Resident Instruction

at the same high technical level—day or night, in Washington. D. C. New classes start once a month. If this instruction meets your requirements, check the coupon for Residence School catalog.

INFORMATION FOR VETERANS

If you were discharged after June 27, 1950—let the new G. I. Bill of Rights help you obtain resident instruction. Check the coupon for full information.

Get this fact-packed booklet today. It's free.

Called "Your Future in the New World of Electronics," this free illustrated booklet gives you the latest picture of the growth and future of the gigantic electronics world. It includes a complete outline of the courses CREI offers (except Television and FM Servicing) together with all the facts you need to judge and compare. Take 2 minutes to send for this booklet right now. We'll promptly send your copy. The rest—your future—is up to you.

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Send booklet "Your Future in the New World of Electronics" and course outline.

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NOW . . . 2 SENSATIONAL EICO SCOPE VALUES!

NEW AMAZING FEATURE PACKED

7" PUSH-PULL OSCILLOSCOPE

Only EICO Has All These Features

- VERTICAL FREQ. RESPONSE: flat ± 2 db 10 cps – 1 mc
- VERTICAL SENS.: .01 volts rms/inch
- HOR. FREQ. RESP.: flat ± 0 db 10 cps – 200 kc, –4 db at 500 kc
- HOR. SENS.: .3 volts rms/inch
- SWEEP RANGE: 15 cps-100 kc
- 3-STEP FREQ.-COMPENSATED ATTENUATOR eliminates freq. distortion, overloading.
- CATHODE FOLLOWER inputs to both amplifiers
- PUSH-PULL outputs in both amplifiers
- RETURN TRACE BLANKING
- INT. VOLTAGE CALIBRATOR
- V & H TRACE EXPANSION & CENTERING: 1.5X full screen without distortion.
- DIRECT CONNECTION to vert. CRT plates.
- PHASING CONTROL of internal 60 cps sine wave sweep.
- AT FRONT PANEL: intensity mod. input; 60 cps, sawtooth outputs.

MODEL 470K
KIT $79.95. WIRED $129.50.

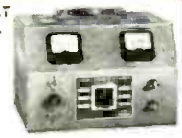
EICO EXCLUSIVE! 5" PUSH-PULL SCOPE, 425K, Amazing feature-packed economy-priced Wired, $79.95. KIT, $44.95.

- PUSH-PULL V & H amplifiers. Sens: 0.5-.1 rms v/in. Useful to 2.5 mc.
- SWEEP. 15 cps-76 kc. Z-axis intensity modulation. Dual trace positioning controls.

SCOPE VOLTAGE CALIBRATOR KIT 495K KIT $12.95. WIRED $17.95.

- Sq. wave output at power-line freq. with full-scale readings of 1, 1, 10 or 100 V. peak-to-peak
- Accuracy ± 5% of full-scale on each range.

6V & 12V BATTERY ELIMINATOR KIT 1050K KIT $29.95. WIRED $38.95.



- DC output: 0-8 V or 0-16 V.
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221K VTVM KIT $25.95 WIRED $39.95

- AC/DC volts: 0-5, 10, 100, 500, 1000 (30 kv with HVP probe)
- Res.: 0.2 ohms—1000 megs, 5 ranges
- DC input R: 25 megs
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- 4-step RF shielded output multiplier: constant output Z.

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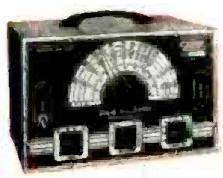

- Complete sine wave coverage, 20-200,000 cps in 4 direct-reading ranges.
- Complete square wave coverage, 60-50,000 cps.
- Cathode follower output circuit.

536K MULTIMETER KIT $12.90. WIRED $14.90.
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- 1000 Ω/V; 31 ranges
- DC/AC volts: Zero to 1, 5, 10, 50, 100, 500, 5000.
- DC/AC Current: 0-1, 10 ma; 0-1, 1 A.
- Ohms: 0-500, 100 K, 1 meg.

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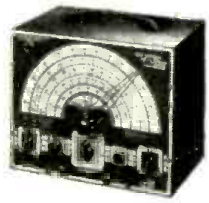
360K SWEEP GEN. KIT $34.95. WIRED $49.95.



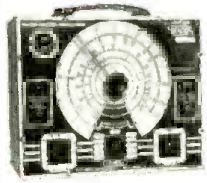
- Continuous coverage of all TV & FM freqs. from 500 kc to 228 mc.
- Sweep width variable 0-30 mc.
- Crystal marker oscillator, variable amplitude.

214K VTVM KIT $34.95. WIRED $54.95.

Large 7½" meter

- Large 7½" meter, can't-burn-out circuit.
- AC DC volts: 0-5, 10, 100, 500, 1000 (30 KV with HV Probe).
- 5 ohms ranges from .2 ohm to 1000 megs.
- DC input R:25 megs.
- 1% mult. resistors.

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



- Measures & tests all resistors; .5 ohm to 500 megohms.
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352K BAR GENERATOR KIT $14.95 WIRED $19.95

- Reliable, accurate, portable, easy-to-use.
- Operates on channels 2-6. 16-23 vert. bars to check H linearity. 13-22 hor. bars to check V linearity.
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- Entirely independent of station-sent signals.

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565K MULTIMETER KIT $24.95 WIRED $29.95.

555K MULTIMETER KIT $29.95 WIRED $34.95. (1% precision resistors)

- 20,000 Ω/V; 31 ranges.
- DC/AC/Output volts: 0-2.5, 10, 50, 250, 1000, 5000.
- DC Current: 0-100 ua; 10, 100, 500 ma; 10 A.
- Ohms: 0-2K, 200K, 20 meg.

145K SIG. TRACER KIT $19.95. WIRED $28.95.

- Audibly signal traces all IF, RF, Video & Audio circuits from ANT to SPKR or CRT in all TV, FM, AM, etc. without switching.
- Germanium crystal diode probe responsive to over 200 mc.
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320K SIG. GEN. KIT $19.95. WIRED $29.95.

- Vernier tuning condenser.
- Stable Hartley RF osc., range: 150 kc to 34 mc, calibrated harmonics to 102 mc.
- Pure or modulated RF & Colpitts oscillator 400 cps sine outputs.

322K SIG. GEN. KIT $23.95. WIRED $34.95. (As above, plus individual calibration of its 5 bands.)

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MOBILE COMMUNICATIONS CENTER PROVIDES EMERGENCY SERVICE

By FRED C. McKAY, WSLIM
Chief Radio Engineer
Mississippi Highway Safety Patrol

Emergency unit set up for full operation. Equipment on table is powered by 110 volts a.c. from gasoline-driven generator in trailer. The various antennas are mounted on the truck and can be used singly or all together, as required by the bands covered.

Of interest to all readers is this description of a highly efficient and well designed disaster communications unit.

ALL departments which operate radio communications networks extending over a wide area such as a state, have need, at times, for a mobile base station which can act, in time of disaster or other emergency, as a temporary net control station. This is nothing new for the Mississippi Highway Safety Patrol and Civil Defense Council, as we have had in service for several years such a station, mounted in a small house trailer.

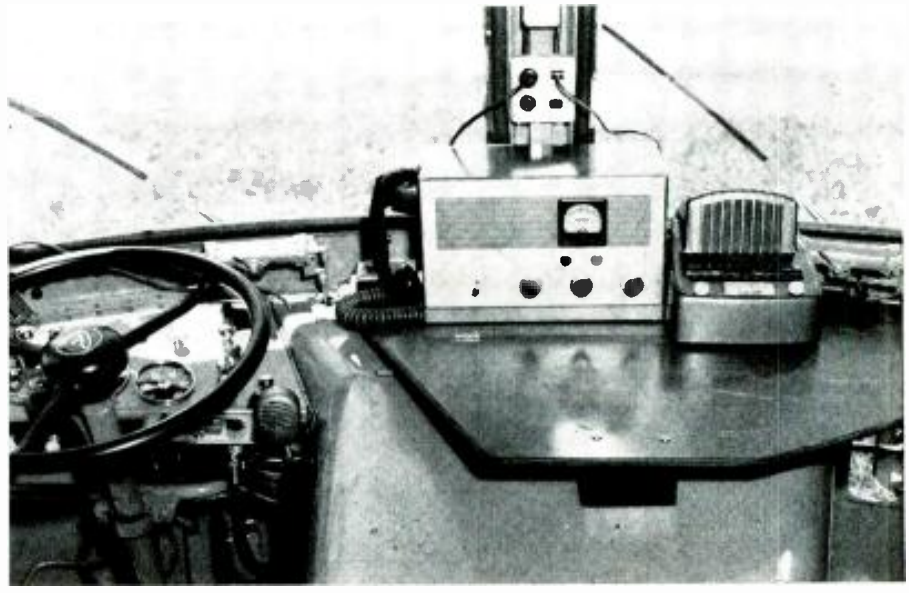
During several disasters in the past years, such as the Gulf Coast hurricane in 1947, the severe ice storm in 1951, and most recently the tornado at Vicksburg in December 1953, we have seen the need for, not only the establishment of efficient and reliable radio communications from such disaster scenes, but also the urgent need for coordination of communication among various agencies involved in this work. It was with the two above purposes in mind that the Communications Department of the Mississippi Highway Safety Patrol set out, in the fall of 1953, to construct and equip such a vehicle as is shown here, with the assistance of the Federal Civil Defense Administration.

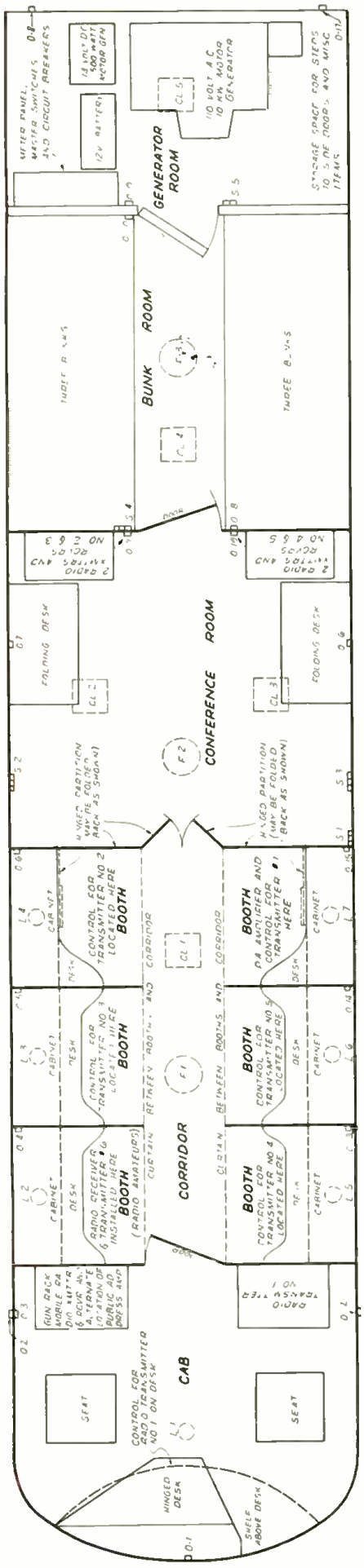
As our basic radio network consists of nine (9) base stations of 3000 watts' output each, located approximately 100 miles apart throughout the state, all of which are equipped with automatic stand-by electric generating equipment both at transmitter sites and control points, most emergencies of a lesser nature than the three referred to above can be handled satisfactorily with existing base station facilities, but in any such disaster as the Vicksburg tornado, more elaborate means must be available to handle the communications necessary thereto. It was with this in mind that this communications unit was actually constructed.

Since the need for communications from disaster scenes is urgent immediately after the disaster occurs, we considered it mandatory that any such mobile unit should be capable of traveling at 60 miles an hour, or better if necessary, in order to reach such point in a minimum of time. Therefore, the unit is completely self contained, that is, all radio, public address, and power generating equipment is built in, and can be used in motion, except, of course, the antennas which lie on top of the vehicle and must be raised, of course, for normal coverage.

Equipment contained in the Center consists of (1) a 250-watt base station type transmitter connected to a 35-foot triangular steel tower which is mounted at the front center of the top platform, to give an antenna height of 48 feet above ground when erected; this transmitter serves as the movable base station on the Highway Patrol network; (2) a 60-watt mobile unit on the Highway Patrol network for use in transit; (3) an amateur

View from behind the driver's seat showing control unit and operating position in cab for the 250-watt base station transmitter on Highway Patrol frequency of 42.02 mc.





Floor plan of the Mississippi Emergency Communications Center. Lights L1, L2, L3, L4, L5, L6, and L7 are 110 volt a.c. and are controlled with a local switch. L1 is in the cab ceiling. The others are attached to the bottom of cabinets over the desk in each booth. Lights CL1, CL2, CL3, CL4, and CL5 are in ceiling and are controlled by wall switches. Each light has one 110 volt a.c. bulb and one 12 volt d.c. bulb. Fans F1, F2, and F3 are in the ceiling and are 110 volt a.c.-operated. They are controlled by wall switches. Outlets O1 through O19 are 110 volt a.c. One 12 volt d.c. outlet (not shown) is located beneath main switches, etc. in generator room. The 110 volt a.c. 10 kilowatt motor generator may be started from the cab or the generator room. Switches S1, S2, and S3 are above the bus-type doors. Door on each side of the cab.

Three of the six bunks comprising the sleeping quarters in Center. They are removable and can do emergency duty as stretcher units.

The amateur radio position in the emergency communications center. It is partitioned off, as are all positions, for privacy.

transmitter, *Johnson-Viking* 2 (CD), and a receiver type NC-125 (*National*); (4) a 60-watt station type transmitter-receiver combination in the 30-40 mc. band (with approximately 25 crystals) for operation on any existing network in the state within this band; (5) a 60-watt station type transmitter-receiver in the 40-50 mc. band (with approximately 25 crystals) for the same purpose; (6) two transmitter-receiver combinations within the 150-170 mc. band, also with a library of approximately 25 crystals each to enable communications to be established with any existing network in the state in that frequency range. This provides a total of 7 transmitter-receiver combinations which can simultaneously be operated at a disaster scene, enough to serve the purpose adequately in any natural disaster.

The equipment is powered by a 10,000 watt, 110 volt a.c. gasoline-driven generator mounted in the rear of the vehicle, which can be controlled from the driver's position. In addition to this unit, a battery-charging type gasoline generator is also mounted near the large unit for use on extended operations wherein mobile operators have difficulty with automobile batteries due to excessive radio usage.

For public address work, the unit is equipped with a 35-watt amplifier and an omni-directional loudspeaker system consisting of four speakers rated at 15 watts each. Provisions have been made for operating the amplifier from two positions within the unit as conditions dictate.

Upon arrival at a disaster scene, two men can erect all antennas on the vehicle in less than 3 minutes, because of special hinged base and side braces.

The interior of the vehicle is finished throughout in Masonite benelex and leatherwood and heavy drapes are provided across each "booth" or operating position for the purpose of sound isolation. Booths are partitioned from ceiling to floor by means of ¾ inch sheets of benelex to assist in this connection. Each booth is equipped with a small air vent which works in connection with three ceiling exhaust fans to provide air circulation in the operating positions and elsewhere. Exterior colors are yellow, trimmed in black; antenna masts are orange and white.

The outside dimensions of the vehicle are approximately 35-feet long, 12½-feet high, and 8-feet wide, and it can operate at any given location for periods exceeding 48 hours without the necessity of refueling the power generator units, as a fuel line switching arrangement is incorporated wherein either the bus motor or the power units may consume all the gasoline available (80 gallons), depending upon which is needed.

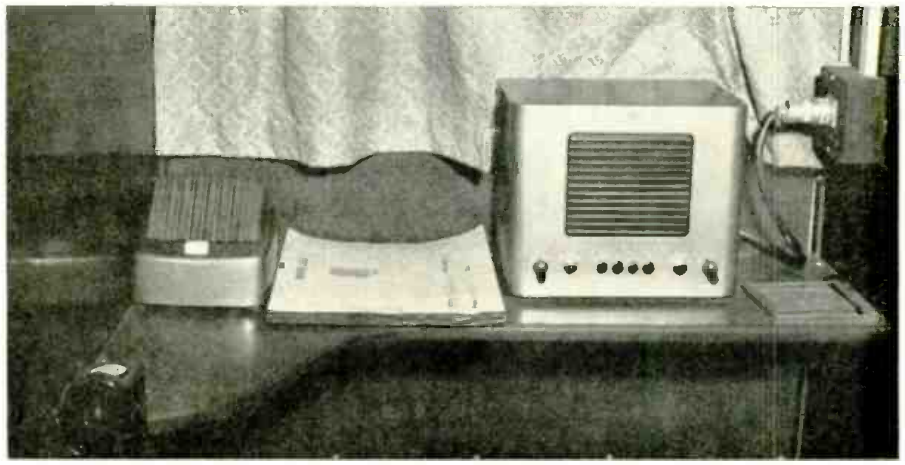
The existing agencies within the state with which this unit will be capable of communicating include Police, Forestry (State and Federal), Power, Petroleum, Forest Products, Taxi, Railroad, Special Emergency and Special Industrial stations and mobile units, in the FM bands, as well as amateur, CAP and others on AM and CW.

It is not the intention of this Department to operate the other equipment in this vehicle, rather, a more workable plan seems to be that once the unit has arrived upon the disaster scene, communications will immediately be established on the State Patrol network. Soon thereafter, since all data as to frequencies and locations of base stations throughout the state, as well as crystals for those frequencies are located in the vehicle, the process of changing frequency of the

Engineering staff of the Mississippi Department of Public Safety's Communications Division. From left to right are: F. C. McKay (the author), J. T. Payne, and W. A. Massey, Jr. with their radio-equipped patrol vehicles. These station wagons serve as highly mobile adjuncts to the larger "Communications Center." They are tied in by means of one of the Center's transmitters.

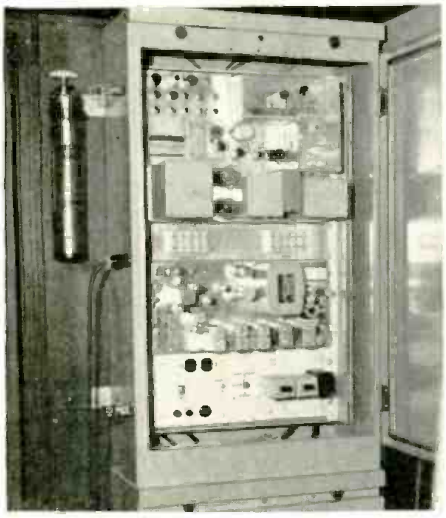
four other FM transmitters to that of existing nearby networks will be undertaken. Upon completion of this, or before, an operator from the particular netork will be assigned by his department to duty in this unit and will remain there until properly relieved. This method will afford a maximum of efficiency throughout, and will serve the purpose, as far as the director of the disaster or rescue operation is concerned, of having within a small "headquarters" a means of obtaining much information from all these various operators as to needed equipment or services, extent of damages, or any other information vital to the efficient handling of such an operation.

The cost of this vehicle was upward of $35,000, and required about 5000 manhours to equip and finish the interior. It stands as "a monument to cooperation," so to speak, as much of the labor and materials was donated by interested citizens who, as we, could realize its potential benefits to the people of this state.



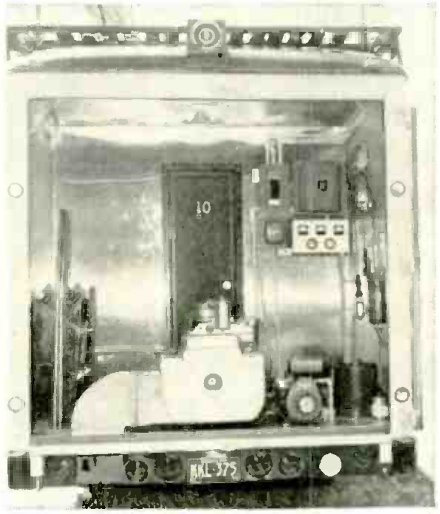
Typical "booth" or control point for one of the FM transmitters in the Center.

(AUTHOR'S NOTE: The present elaborate system of this organization has been due largely to the excellent leadership and cooperation of Col. T. B. Birdsong and Chief L. C. Hicks. Credit is also due to the thirty operators and the three engineers of the Communications Department who keep the nine-station network of 3000-watt transmitters operating 24-hours-a-day to serve approximately 200 mobile units. When disaster strikes, a tenth station, [the Communications Center] can be rapidly dispatched to the scene to serve the mobile unit and five others if needed.)



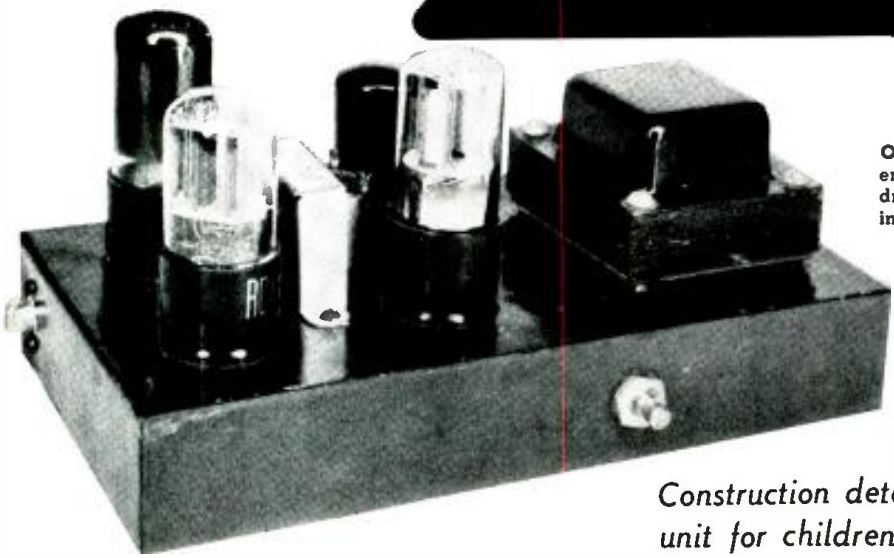
One of the Center's four 60-watt transmitters. The top unit is for operation in the 152-170 mc. band. Note crystal holders mounted on narrow panel separating transmitter and receiver portions. This cabinet rests on a second transmitter rack which houses a unit for operation in the 30-50 mc. band. It also boasts a complete set of plug-in crystals which permit operation at any one of approximately 25 frequencies.

Payne, McKay, and Massey refer to the map showing the base stations in the state with which the Communications Center is equipped to establish contact. Map (right) shows the location of the nine base stations of the Highway Safety Patrol and its mobile units plus the out-of-state police stations and 30 city police stations with which the Center maintains a 24-hr. contact. Lines connecting stations indicate the routing.



Generator compartment of Center. Unit in center is the 10-kw., 110 volt a.c. air-cooled generator. Unit at right is 6-12 volt d.c. generator. Upper right is the 12-circuit breaker box, main switch, the 12-volt lighting switch, and the meter panel containing an a.c. voltmeter, a.c. ammeter, d.c. voltmeter, frequency meter, and running time meter for power unit. Extension trouble lights are shown at right.

A LOW-POWERED PHONO AMPLIFIER



Over-all view of low-powered amplifier for children. It can be installed in record player cabinet.

By **HECTOR E. FRENCH**

Construction details on a simple and inexpensive unit for children. It is safe and easy to operate.

SOONER or later, the question of building an amplifier for a child's record player is bound to come up if there are any children in the family. This can be an extremely rewarding piece of construction, first because it helps develop his appreciation of music, second because it gives him something of his own, and third because if Junior plays his train records through a wide-open *Williamson* at 5:00 a.m. just once more, his little caboose is going to be redder than anything east of the *Atcheson, Topeka and Santa Fe.*

Designing this type of amplifier is productive of a different set of problems from those encountered when designing equipment for adult use.

For example, a child's hearing is usually much more acute than that of an adult. Distortion components which would not be heard by an older person will be clearly apparent to a child. Since his earliest intensive acquaintance with the world of music will be through his record player, it is even more important that the amplifier be as free as possible from all forms of distortion. This distortion-free reproduction is even more essential than a wide frequency range, since the child's appreciation of music must be allowed to expand naturally; this process will be aided if he does not have to learn the adult skill of mentally ignoring the various forms of noise and distortion that are present in a well-worn record, and which are so noticeable when played through a wide-range system.

In addition, the amplifier must be completely shockproof, be reasonably small, be rugged, be quiet (saves wear and tear on adult ears), use conventional tubes, be inexpensive, and be completely safe to operate, all at the same time.

The amplifier shown in the illustration and in the schematic diagram was built to satisfy all these requirements.

By avoiding the transformerless type of power supply, a completely shockproof design resulted. Building on the smallest chassis available resulted in an amplifier which could be tucked away in one corner of the record player, with plenty of room for ventilation, and with no danger of burned fingers from hot tubes.

The equipment was set up for 78 rpm operation for a number of reasons. Some decision had to be reached on one particular speed, since a multi-speed unit would be too complicated for a child to operate. The long-playing records were ruled out since a child will almost always prefer having a large number of individual records to having a smaller number of LP's with the same total amount of playing time—and he'd probably become bored with any one long-playing record before it played through and change it anyhow. The 45 rpm records were found to be too small in size; experiment with a three-year-old revealed a preference for the larger sizes, especially when the record material was colored. With the 78 rpm children's records available in an unbreakable form, it was decided to select this speed, partly to take advantage of the larger, more rugged groove walls of the record, in order to hold up to rough handling.

The economic item appears, too. A single-speed 78 rpm motor and turntable is more apt to be on hand than is its long-playing equivalent, and if purchased, can be less expensive.

The selection of phono pickup is closely associated with the selection of speed. In this case a crystal pickup was used largely because a good rugged unit of this type was on hand. This is obviously a much more likely condition than having an extra magnetic reluctance type on hand. In addition, the crystal pickup was found by experience to be more rugged under rough use. A unit with a permanent needle is required, of course, in the interests of safety. If the only pickup on hand is built for replacement needles, it is recommended that some sturdy permanent needle be installed and fastened in place with a drop of cement, shellac, sealing wax, or some similar substance. The screw which holds the needle in place should be similarly secured, or replaced with one having a screwdriver head.

The first two stages of the amplifier are essentially straightforward, and resemble a conventional equalized preamplifier, as used with a magnetic cartridge. The one-megohm resistance, R_6, across the condenser, C_5, in the feedback loop of these two stages controls the equalization at frequencies below 100 cycles without introducing any significant d.c. unbalance in the cathode biasing of the first stage.

One unusual feature of the first stage is the use of a 10,000 ohm load, R_3, for the crystal pickup. This low value makes the crystal operate on the velocity-responsive characteristic of a magnetic unit rather than on the amplitude-responsive characteristic of a crystal unit. This circuit has the great advantage of providing sufficient electrical damping to the crystal to reduce the effective "Q" of the electromechanical circuit formed by the crys-

tal and its associated mechanical and electrical network. With the crystal operating into a high electrical impedance, there is no electrical damping, and every microscopic irregularity in the record groove can set the crystal into a lightly damped series of transient oscillations near its natural frequency. But with the crystal operating into a low electrical impedance, a considerable degree of electrical damping is provided, and each irregularity in the record groove can no longer throw the crystal into a series of oscillations. This provides a noticeable reduction in the high-frequency record noise, at the expense of a lowered output voltage from the pickup. The value of input resistance may be lowered if necessary to reduce the maximum output level from the amplifier.

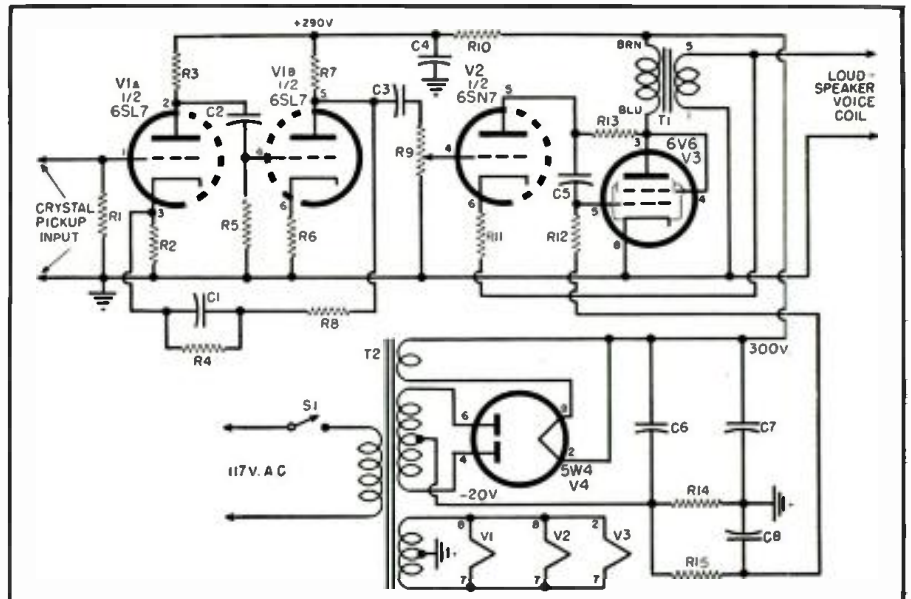
In order to keep the distortion to the lowest possible figure, a special output circuit was required, especially in view of the restriction (for purposes of simplicity) to a single-ended output stage. At the same time, this circuit should be simple, foolproof, and completely stable under all conditions of operation. These requirements were all met by an output circuit having two feedback loops, one inside the other. This circuit is shown in simplified form in Fig. 2 and in the complete schematic diagram, Fig. 1.

Before such a two-loop system could be properly designed, however, it was necessary to reduce the phase shift within the circuit to its lowest possible value. This was done primarily by (1) using tubes having a low plate resistance, to place the high-frequency phase shift beyond the upper limit of the audio range, and by (2) eliminating the conventional cathode-biasing circuit in the output tube and supplying its bias directly from the power supply, to eliminate the low-frequency phase shift in the cathode circuit.

The first feedback loop is introduced by simply returning the plate load resistor, R_{13}, of the half-section 6SN7 to the plate of the 6V6 rather than to the plate voltage supply line. This introduces sufficient feedback on the 6V6 to improve linearity, without the addition of any components in a conventional feedback circuit.

The second feedback loop is introduced by connecting the output voltage of the entire amplifier so that it will be in series with the cathode circuit of the half-section 6SN7. This feedback loop improves the linearity of the entire output circuit, as well as smoothing out its frequency response. In addition, a lower effective output impedance is presented to the speaker for greater speaker damping. This feedback loop also requires no additional components above those required for a conventional circuit.

A number of output transformers of differing power capacities were tried in this circuit, to find if the circuit were critical as regards transformer characteristics. In each case, the circuit was completely stable, and the *Merit* A-2900 four-watt universal output



R_1, R_{10}, R_{11}, R_{15}—10,000 ohm, ½ w. res.
R_2—4700 ohm, ½ w. res.
R_3—270,000 ohm, ½ w. res.
R_4, R_5, R_{12}—1 megohm, ½ w. res.
R_6—2700 ohm, ½ w. res.
R_7—100,000 ohm, ½ w. res.
R_8, R_{13}—220,000 ohm, ½ w. res.
R_9—1 megohm pot (with switch S_1)
R_{14}—500 ohm, 2 w. res.
C_1, C_3—1800 μμfd. mica cond.
C_2, C_5—.02 μfd., 400 v. cond.
C_4—20 μfd., 450 v. elec. cond.
C_6-C_7—20/20 μfd., 450 v. elec. cond.
C_8—20 μfd., 25 v. elec. cond.
T_1—Universal output trans. (Merit 4-2900)
T_2—Power trans. 250-0-250 v. @ 40 ma.; 5 v. @ 2 amps; 6.3 v. c.t. @ 2 amps.
S_1—S.p.s.t switch (on R_9)
V_1—6SL7 tube
V_2—½ 6SN7 tube
V_3—6V6 tube
V_4—5W4 tube

Fig. 1. Schematic of amplifier. Transformer power supply eliminates shock hazards.

transformer, T_1, was finally selected as having the best combination of size, cost, and performance. Transformer connections, as shown in the schematic, were found to provide the proper phasing for the feedback loop. This same set of connections was tested on a number of different speakers with no discernible difference in the reproduction, despite the variation in load impedance from one speaker to another.

When using other output transformers, the proper phasing of the outer feedback loop can be found by the sequence of (1) returning the 220,000 ohm plate load resistor, R_{13}, of the half-section 6SN7 to "B+," and then (2) interchanging the two primary connections (or the two secondary

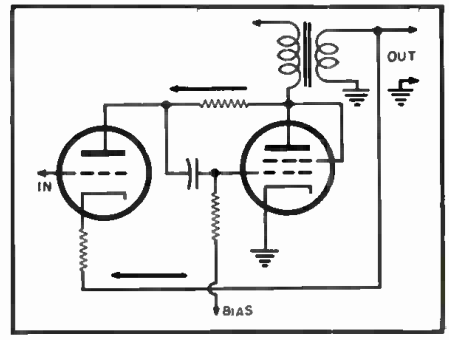
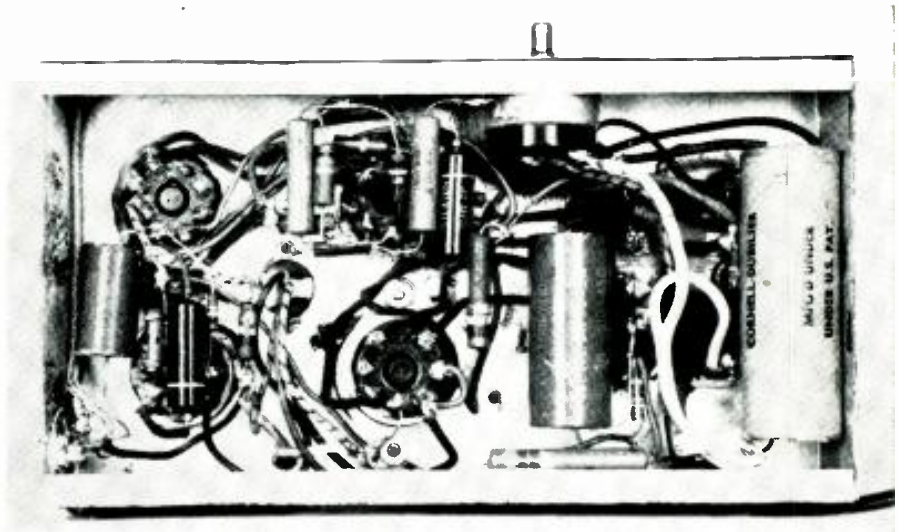


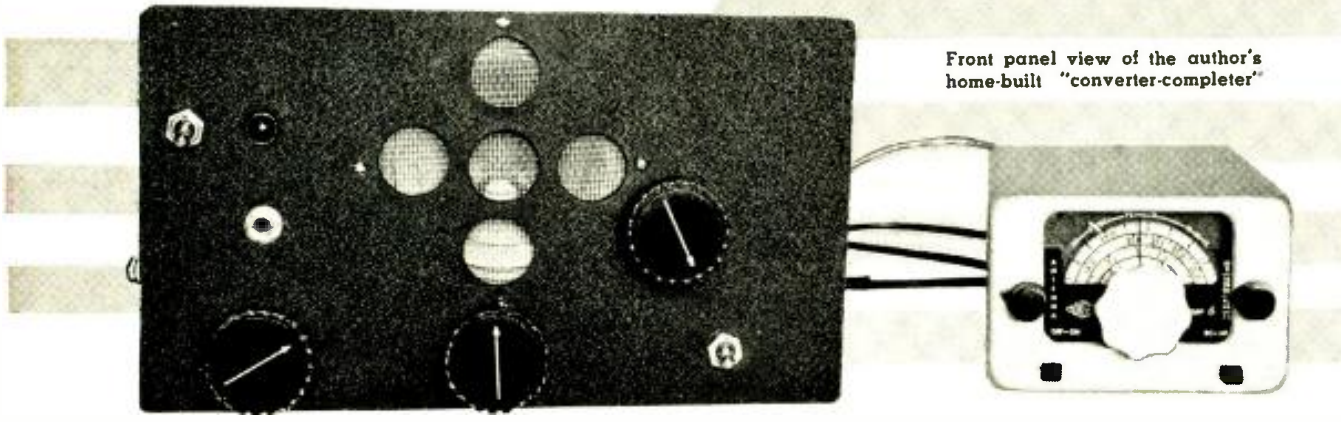
Fig. 2. Simplified schematic of the output circuit with the feedback loops indicated.

(*Continued on page 178*)

Underchassis view of amplifier showing how compact construction can be achieved.



COMMUNICATION SET—THE EASY WAY



Front panel view of the author's home-built "converter-completer"

By **JAY STANLEY**

A "mobile" converter plus this easy-to build unit gives you a good double-conversion receiver at moderate cost.

MANY a ham or would-be ham would like to build a communication receiver—both to save money and to get the experience of working with receiving equipment. But one look at the job of laying out a suitable coil-switching "front end" is enough to scare off all but the most hardy.

Fortunately, there is a ready-made solution: any of the several excellent "mobile" converters on the market—*plus* an easily-built "converter-completer" unit which supplies voltage for the converter, and substitutes for the usual auto radio in the car.

The word "substitutes" does not do the "converter-completer" justice. Actually, since it can be designed for communication work, it can and does run rings around a car radio. For example, it uses a highly selective i.f. system, the kind needed to dig down into the muck on the phone bands. And it provides other necessities for communication work; a stand-by switch; a way of providing a "beat" for c.w. (code) reception; and even a simple noise limiter. Yet it is only a little more difficult to build than an a.c.-d.c. midget radio—and any builder who has successfully tackled equipment like an a.c.-d.c. set can build it with ease.

The cost is modest—careful buying will keep the total under $25.00. The set is worked out in such a way that it can be built and aligned without any alignment equipment, although admittedly it is mighty handy to have some.

When the unit is completed and is tied to a good converter, the combination provides a double conversion receiver which will compare favorably in both over-all sensitivity and selectivity with sets costing well over $100.

The "converter-completer" actually is a refined a.c.-d.c. superhet which tunes the broadcast band—a fact which greatly helps in getting it going, for signals are readily available. It consists of a mixer stage which tunes to the output of the converter; a high-selectivity i.f. stage which uses a rather unique regenerative circuit (credit goes to W3HTF) to provide for c.w. reception; the usual diode detector, a.v.c., and triode amplifier combined in one tube; and a power output stage. A rectifier completes the tube line-up. The unit also has a selenium rectifier power supply to furnish voltage for the converter—a supply entirely separate from the set supply in order to keep 117 volts off the converter chassis—and to avoid disastrous voltage "cross-ups."

In building the "converter-completer" unit the first step, of course, is to round up the various parts. The only parts which are apt to be hard to locate are the 175 kc. i.f. transformers, and since these are of standard manufacture, even they should not be too tough. *Burstein-Applebee Co.* of Kansas City, Mo., stocks these transformers and, undouhtedly, any other firm which handles the *Miller* line can get them for you.

The chassis is a standard 2" x 7" x 11" unit, which is first drilled and punched to allow the layout shown in the photographs. The panel is a crackle-finish Masonite panel—chosen because it is easy to work yet looks like metal.

Since the frequencies involved are fairly low, there is nothing critical about the layout—although following the photos fairly closely will make for easy wiring, as this layout is simple and logical.

Mounting the parts is likewise straightforward—in building the set, there is some advantage to adding the panel *after* most of the other work is done, to avoid having it in the way for preliminary checks and to reduce the possibility of sticking a finger or screwdriver through the speaker cone. If this is done you may have to make some kind of temporary lash-up to include the dial light—and wire across the standby switch S_4.

Before you begin wiring, it is very important that you read this portion of the article carefully—your *life* may be at stake.

All of the "grounds" indicated in the wiring diagram (with certain exceptions noted later) *are not made to the chassis.* The common ground symbols simply mean that those portions of the circuit connect to the "B minus"—and are connected together—which is done with a few strategically placed leads. This is done to keep the 117 volt line *off* the chassis.

The chassis ground connections indicate connection to the chassis. Note that this applies to two variable condensers, (C_1, C_6), the socket for the converter plug, condenser C_7, one end of L_1, and *nothing else.*

In wiring a set of this type, two techniques can save you a lot of grief later—whether you are a beginner or an old timer. The first is to lay a sheet of vellum over the diagram, and scotch tape it down. Then, with a china marking pencil, pencil in each lead as you make it. The idea is to avoid errors—and to prevent "forgetting" to make some connection or other. (You can do the same thing by marking right on the diagram with a colored pencil—but doing so ruins the diagram for later use.)

The other technique is "area" wiring. The idea is simply to build the set section by section—and *to test out each area as you go along.* This means that if trouble develops early there isn't so much to hunt through. Likewise, should trouble develop further along, you *know* about where it is.

In the diagram, you will notice that Area "A" includes the power supplies

and the tube heaters. Completing this portion of the set gives you a nice starting point in that you know that the voltages are all available—from there on you simply provide the parts to make use of them.

Start out by wiring in the switch (on the volume control R_5), tube heaters, and all of the other power supply leads. When this is done, check the wiring carefully to see that it matches the diagram. Then hold your breath and turn the set on.

If the tubes light—and stay lit (!)—and nothing starts to fry or melt you are probably OK.

To make more certain, shut the set *off*.

Then, take a short length of wire—and short across condenser C_{27}. There should be a sharp "snap" of voltage as the condensers in the power supply discharge.

Now do the same thing with condenser C_{21}—and again expect the snap of voltage.

Again, these tests should be made after the set has been turned off. If you short into the power supply with the set on—at best you will burn out a rectifier—and at worst *you will burn out yourself.*

If everything is OK in Area "A," the next step is to wire Area "B" which includes the detector and audio end of the unit.

This set makes use of one of the popular little printed circuits, called the "Audet" (PC_1). Rather than confuse things by showing the many parts which make up the "Audet," it is simply illustrated with proper connections. Using the "Audet" saves time, money, and space.

If you have not mounted the speaker (following the advice given previously) simply set it on the bench and run a couple of leads to it from T_4. Likewise, the headphone circuit, C_{21} and jack, can be omitted for the time being.

Now we'll test Area "B."

In effect, we now have an amplifier unit, complete with power supply. So all we need to do is to supply an audio signal to the top side of the volume control (marked "T" in the diagram) and we should hear it in the speaker.

An audio signal generator is very useful at this point. However, you can do the job with nothing more than your finger—*if you are careful!*

Simply place your finger on point "T" as indicated in the diagram. But be certain that point "T" is the "high" side of the control—not the "ground" side, where 117 volts may be waiting to nail you. If you have any doubts as to which end of the control is which—grab one end of a .1 μfd. condenser and touch the *other* end to the control. The condenser will insulate you from trouble.

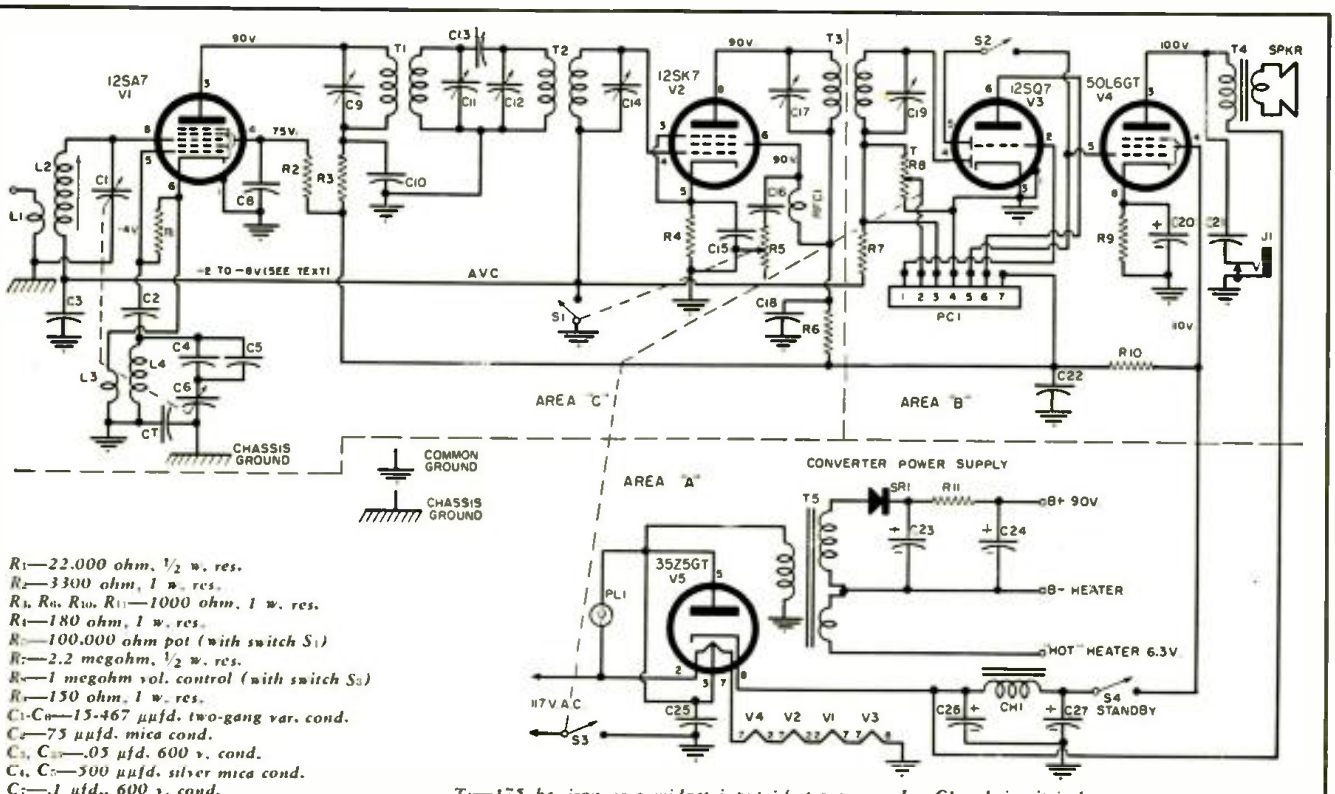
Now, when you apply your finger or condenser to the control, a loud, throaty hum should build up—becoming quite loud as you advance the control. If you do get this effect (what is happening is that your body is picking up enough a.c. from the area so that you become a kind of feeble signal generator) everything is probably OK. If not, start checking back to see where you made a mistake.

If everything is all right so far, we're ready to tackle the only part of the circuit which is the least bit tricky, the mixer and i.f. stage.

Watch the wiring carefully, following the dope sheets with the coils and the markings on the i.f. transformers in order to make proper connections. On T_1 the green lead goes to C_{13} and the black lead to ground. On T_2 the blue lead goes to C_{11} and the red lead goes to ground. Otherwise, everything follows the standard practice for transformers.

The antenna coil is one of the popular "Loopsticks" and can be any an-

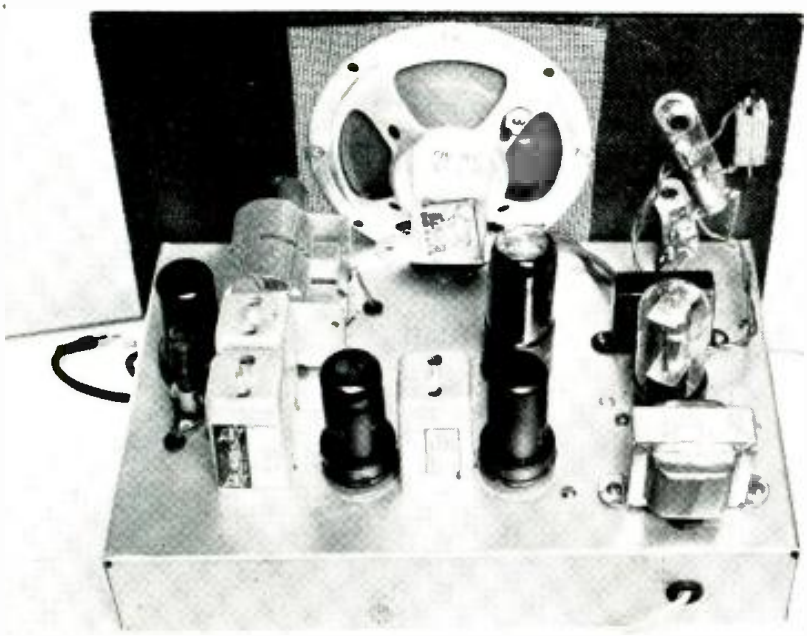
Complete schematic diagram. By following the "Area" construction technique, errors can be avoided. See text.



R_1—22,000 ohm, ½ w. res.
R_2—3300 ohm, 1 w. res.
R_3, R_6, R_{10}, R_{11}—1000 ohm, 1 w. res.
R_4—180 ohm, 1 w. res.
R_5—100,000 ohm pot (with switch S_1)
R_7—2.2 megohm, ½ w. res.
R_8—1 megohm vol. control (with switch S_2)
R_9—150 ohm, 1 w. res.
C_1-C_6—15-467 μμfd. two-gang var. cond.
C_7—75 μμfd. mica cond.
C_8, C_{20}—.05 μfd. 600 v. cond.
C_9, C_{22}—500 μμfd. silver mica cond.
C_{12}—.1 μfd., 600 v. cond.
C_{13}, C_{19}—.002 μfd. ceramic button cond.
C_{10}, C_{11}, C_{12}, C_{14}, C_{17}, C_{18}—Trimmer cond. (part of i.f. trans.)
C_{15}—10 μμfd. ceramic cond.
C_{16}, C_{18}, C_{24}—.01 μfd., 600 v. cond.
C_{25}—16 μfd., 50 v. elec. cond.
C_{21}—.001 μfd. mica cond. (see text)
C_{23}—16 μfd., 150 v. elec. cond.
C_{23}-C_{24}, C_{26}-C_{27}—50/50 μfd., 150 v. elec. cond.
S_1—S.p.s.t. switch (on R_5)
S_2, S_4—S.p.s.t. switch
S_3—S.p.s.t. switch (on R_8)

T_1—175 kc. iron core midget input i.f. trans. (Miller 012-K1)
T_2—175 kc. iron core midget interstage i.f. trans. (Miller 012-K2)
T_3—175 kc. half-wave output i.f. trans. (Miller 012-K3)
T_4—Output trans. to match beam pentode to speaker (2000 ohms)
T_5—Midget power trans. 110 v. @ 20 ma.; 6.3 v. @ 1 amp. (Stancor PA8421 can be used)
RFC_1—2½ mhy. r.f. choke
SR_1—30 ma. (or larger) selenium rectifier

J_1—Closed-circuit jack
L_1-L_2—"Vari-Loopstick" (10 t. #30 en., L_1, added. See text)
L_3-L_4—"Universal" adjustable osc. coil (Miller 71-OSC)
PC_1—Printed circuit (Centralab "Audet" PC-150)
CH_1—10 hy., 50 ma. filter choke
PL_1—No. 47 dial light
V_1—12SA7 tube
V_2—12SK7 tube
V_3—12SQ7 tube
V_4—50L6GT tube
V_5—35Z5GT tube



Top chassis view of unit. The front panel is Masonite, which is easy to work.

tenna coil with an adjustable ferrite coil. L_1 is an extra winding, consisting of 10 turns of #30 enameled wire, wound at the bottom of the coil. One end goes to the chassis—and the other end to the center of the antenna fitting, which is a *Motorola* type connector.

Now we're ready for the final test. Connect a wire a couple of feet long to the "high" end of L_1 and turn on the set. Rotate the tuning condenser. If all is well, you should pick up some of the stronger broadcasting stations in the area.

Next tune the *highest* frequency station you can find (with the variable condenser farthest open). Then adjust the core in the "Loopstick" for the strongest signal.

Now we're ready to line up the i.f. stage. Of course, if you have a 175 kc. signal generator, the job is simple.

Without one, you can do fairly well, anyhow. First of all, plug the converter into the antenna terminal and supply power to the converter from the converter power supply (on the set illustrated a miniature *Jones* plug and socket were used). No antenna should be used on the converter.

See if the converter tubes light. Notice if there is a soft click in the speaker on the unit as the converter is switched on and off.

Now turn the main tuning condenser on the set until you hear a "rushing" noise—the noise level from the converter which, unless things are hopelessly off, should come in with the tuning condenser on the "converter-completer" fairly well open. (If you can't find the noise, mark the adjustment on the oscillator coil L_5-L_6 in some way and try different settings to see if you can tune to the proper frequency with the tuning condenser. The marking is suggested so that you can find your way back if something else is the matter.)

Once you have the "rushing" sound you have a signal you can use to align the i.f. transformers. Fortunately, these are already set at the factory, so very little tuning is needed.

Do this tuning with an insulated alignment tool, starting with T_1 and working your way forward. Very carefully, tune the trimmers for maximum sound in the speaker. After you complete the sequence, do it once more.

This alignment method is not perfect, one of the shortcomings being that the ear is not sensitive enough to changes in sound, but will result in a satisfactory set. If you want to get the most out of the set, and don't have alignment equipment, a technician can do it for you.

Now move back to the antenna coil and again peak up on the rushing sound to get the antenna circuit on the unit tuned to the i.f. output on the converter.

The adjustable oscillator coil will probably be fairly close to being OK as it comes from the factory, exact frequencies are not too important since we are primarily concerned with only one, that the set will tune to the i.f. output frequency of the converter and the tuning condenser allows considerable latitude. However, you may want to tune the broadcast band in odd moments—and, if so, the oscillator coil will need a bit of setting.

First, tune in a station *on another broadcast-band set* on the low end of the band (toward 550 kc.). Then set the tuning condenser on the "converter-completer" so that the plates are meshed approximately the same amount. Then adjust the slug on the oscillator coil (L_5-L_6) so that the station you want comes in.

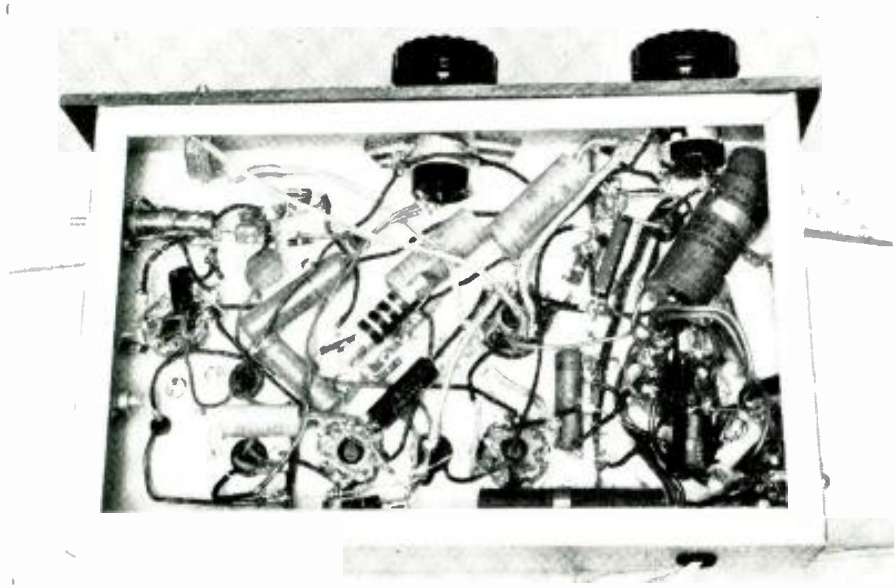
Actually, the "converter-completer" is a poor broadcast-band set because of one of its advantages; it is *very* selective, which is fine for communications, but knocks the spots off music.

If everything is OK up to this point we are ready to do some tuning with the converter so hook an antenna onto it. From here on, the converter takes over as the tuning unit and what you will pick up will depend upon what the converter tunes in.

Phone signals are received with the switch S_1 on R_5 *open* so that the a.v.c. circuit operates and the slider on R_5 is at the point where there is no resistance between C_{16} and ground. (If the control is reversed there will be spurious oscillations in the 12SK7 i.f. stage). To receive c.w. signals, control R_5 is turned, the switch closes and shorts the a.v.c. to ground and after the control is advanced until you hear a soft "plop" in the speaker you are ready to hear c.w. signals as the familiar high pitched whistles. You will also discover that you have to advance the volume control, but don't let this worry you, there is sufficient audio to handle the signals in good shape.

(*Continued on page* 187)

Under chassis view. Since frequencies are low the layout is not critical.



TV CINDERELLA

By **E. D. LUCAS, JR.**

Community TV is a wide open field for profit if you will learn from the mistakes and successes of others.

Service technician on a ladder truck used for repairing and maintaining community TV systems. The technician is checking a pole-mounted amplifier.

WHEN you read that Casper, second largest city in Wyoming, now enjoys television programs piped from Denver, Colorado, 240 miles away, by means of a microwave relay network and a community TV system, you realize that this new form of public utility has made notable progress.

In the early days of the community TV pioneers, a few citizens had planted antenna towers on hilltops and, using relatively primitive electronic equipment and coaxial cable, managed to bring TV to residents of a handful of towns isolated from the wonders of television by either rugged terrain or distance, or both. Community television development in 1951, however, took on many of the aspects of a gold rush or land grab. Entrepreneurs all over the country rushed to get franchises in likely looking towns. They besieged the few manufacturers of equipment. Scores of community systems began construction, and the National Community Television Association was formed. By the end of community TV's first big year, nearly 100 systems in as many cities had been started.

The growth of this new branch of the television industry has continued to be rapid but not quite so fevered. Now there are some 350 major community TV systems serving about 1,000,000 viewers. This includes only systems organized as business corporations, operating like small utility companies to provide TV service to subscribers much as telephone companies serve their subscribers. It does *not* include many hundreds of additional "canyon systems" in which one master antenna, an amplifier or two, and a thousand feet or so of open wire attached to rooftops, trees, and fenceposts bind together a few homes.

The resemblance between a community TV system and a utility such as an independent telephone company is evident. Both use cables strung on telephone or power company poles, and suitable electronic amplifying and distribution equipment to bring a communications service to subscribers. Both make an initial installation charge and then a continuing monthly service charge.

From the construction of the first community TV systems, both the operators of these systems and the manufacturers of equipment have watched warily such regulatory bodies as the Federal Communications Commission and the public utility commissions of the numerous states where community TV flourishes. They have been waiting and wondering whether someone in authority would rule community television to be a public utility. So far nothing official has happened. The FCC has studied community TV like an interested bystander watching Topsy grow. State public utility commissions have generally pursued a similar *laissez-faire* policy, insisting only that the installation of electronic equipment and cable for TV on poles owned by electric power or telephone companies conform to public utility standards.

Community television systems, even those serving as many as 4500 subscribers, continue to operate like utilities without either the benefits or curses of regulation aside from the normally non-rigorous provisions included in city franchises. But the day is coming, in the opinion of many experienced executives, when recognition and regulation as a utility will be useful. Financial, legal, and technical standards will be established to govern the service provided and the rates charged for it. In many cases, this will compel the operating company to be more careful in its business organization, its construction methods, and its selection of equipment. This should result in better TV pictures for subscribers.

Another interesting factor is that some of the major motion picture companies have organized community TV systems and are considering purchasing existing installations. The movie moguls find it easy to consider several hundreds or thousands of homes connected by cable as merely a new and exciting kind of theater—with armchairs before a TV screen instead of the customary rows of seats. *Paramount Pictures*, operators of a community system in Palm Springs, California, and *Video Independent Theatres*, owners of a large movie theater chain and operators of TV systems in Ardmore and Durant, Oklahoma, are examples.

The principal producers of specialized community equipment are such relatively unpublicized firms as *Jerrold Electronics*, *International Telemeter*, *Spencer-Kennedy Laboratories*, *Entron*, and *Blonder-Tongue Laboratories*. Why this is so evidently lies in that word *specialized*. The engineers who design and build successful community TV equipment are wedded to their work. Their best ideas come from field experience, perhaps up on a pole with a soldering iron. It takes actual living with the day-by-day problems of a community system to be able to design and build equipment—and to sell it to others. Many new companies, dependent on the success of community TV for their daily bread, have grown up with this paradoxical non-utility.

Another oddity is the way in which

Left, antenna towers of the community TV system at Cuyama Valley, California. The yagi antennas pick up seven channels from Mt. Wilson, 125 miles away. Right, a typical mobile antenna tower unit for making field strength surveys to find the best antenna site for a community TV system. This tower can be handled by one man and mounts on the roof of the truck after being cranked down into the bottom section.

some television broadcasters have used community (wired) TV to prepare the way for their broadcast service. In general, the broadcasters have been mildly interested in community systems because such systems help to extend the viewing market. As a result, TV stations have been willing to let the operators of community TV systems receive and distribute their programs.

Certain TV station licensees have utilized community TV to build an audience and make a little cash, too, before their stations could go on the air. The *North Dakota Broadcasting Company*, in Minot, for example, built a community TV system and operated their TV station, now KCJB-TV, on a closed-circuit basis during the late freeze. As a result, many residents of Minot bought receivers and enjoyed them and, equally important, the station's personnel gained valuable experience prior to the thaw.

A different technique was and is being used by Rogan Jones and Jim Wallace in the State of Washington. Their community TV system in Bellingham, about 90 miles north of Seattle, was one of the first successful community systems in the United States, receiving programs from KING-TV in Seattle. By the time (over two years later) that they were licensed to go on the air with their own station, KVOS-TV, in Bellingham, their community system had about 500 subscribers and was bringing in a tidy income. During the past year, they started another community system in Wenatchee, Washington, where they operate a radio station, in anticipation of the day when they'll start telecasting from that city.

Another aspect of community TV and its relationship to television broadcasting is the interesting interaction between u.h.f. telecasting and community systems. Before the end of the freeze, some experts in the television industry were predicting the rapid demise of community TV as soon as the hundreds of new u.h.f. and v.h.f. stations went on the air. Nothing even remotely resembling this melancholy prediction has happened. Community TV is flourishing as never before. One reason is that the substantial majority of community systems is to be found in cities or towns too small to support a TV station.

The other reason for community TV's healthy survival is more surprising; apparently, cable systems and u.h.f. (or occasionally v.h.f.) stations can exist side by side in some larger cities. *Perfect TV, Inc.*, in Harrisburg, Pennsylvania, has been operating a community television system since early in 1951, and now has more than 3000 subscribers. Originally, channels 4 and 6 from Philadelphia, and channel 2 from Baltimore were received by *Perfect TV's* antennas atop Fort Hunter Ridge, six miles north of Harrisburg. The only change, made nearly two years ago, has been to substitute the nearer channel 8 station in Lancaster for channel 4. Meanwhile, two stations have gone on the air in Harrisburg. Theoretically, this should have put the community system out of business. Actually, according to the latest reports, *Perfect TV* is continuing to grow and add new subscribers.

Advertising and Public Relations

There are three principal stages in the advertising and public relations program needed by a well-managed community TV company. The first phase occurs when the company has been organized, its corporation papers have been duly recognized by the state of its choice, and applications have been made for a city franchise and for agreements with the electric power and telephone utilities for the use of telephone and power poles for the community TV cables. Incidentally, a corporate entity for the system is required for such dealings.

By the time the city franchise is applied for, the proverbial cat is far out of the bag. Unless news releases are ready for the local newspapers and radio stations, plus paid advertising to tell accurately and in detail the story of what is being planned, the rumors will fly fast and furiously. We have known founders of community TV systems who vow they spent most of their first month in the business answering the phone—at the office and at home, far, far into the night—to tell their story to potential subscribers. The budget for publicity need not be large. Preliminary planning, so that complete, factual stories are available for the press, together with one good large size paid advertisement in the locally-read newspaper giving the company's story of how it is bringing TV to town, will help the company to a good start in its relations with the public.

The second phase of the campaign occurs while construction is under way and before TV can be supplied to the first subscribers. Often the time lag is longer than can be foreseen. Bad weather, delays in obtaining critical materials or pole clearances, and other obstacles may slow construction. Therefore, it is necessary that regular progress reports go to the local newspapers and radio stations. A TV station which will increase its audience, thanks to the community system, will probably cooperate. A paid newspaper advertisement once a month, or oftener, is a good investment.

The third stage in this advertising and public relations program begins when the date can be fixed for the first subscriber connection. The preliminary planning for this great event is vital. First, the cooperation of the wholesale distributors and dealers who handle TV receivers in the area must be enlisted. If possible, tap-offs should be made from the cable to several dealers' stores before the gala opening —"TV Day in Thomasville."

In any community, the TV system's success is so largely dependent upon the good will of dealers and distributors that their cooperation should be cultivated with care. Many systems, as for example the one in Shenandoah, Pennsylvania, have made it easy financially for the dealers to obtain multiple hookups by offering reduced installation rates for *bonafide* merchants of TV receivers. This type of cooperation with dealers has another advantage beyond helping them to make sales which insure subscribers for the system.

Many people find it desirable to finance the purchase of their TV sets and also to finance the installation or connection charge for community TV. This charge averages $125 and, in many cities, is now $150 per home. In cooperation with dealers, both banks and finance companies have worked out financing plans in most communities to handle, as a package, the installment purchase of a TV receiver and the connection to the cable. Some community systems find that one-third of their subscribers make use of such financing. In some cases, the community TV companies, in addition, have offered their own installment payment plans, but the TV dealer is generally the key man in putting such paper through. One interesting sidelight is that the risk in financing connections to community cables has been found negligible; subscribers will make every sacrifice to keep TV coming into their homes.

Still another benefit to community systems from cooperation with distributors and dealers is that these merchants who sell TV sets will be glad, for highly practical reasons, to run a

considerable volume of advertising on the day of the first hookup.

Not everyone can do what the community system in Palm Springs, California, did, heralding the first TV pictures in town by the full Hollywood treatment of movie stars, searchlights, etc., but other communities, including Casper and Laramie, Wyoming; Reno, Nevada; and Wenatchee, Washington, to name but a few recent "premieres," have had the whole town talking about TV, and signed up many subscribers because of well-publicized openings.

Although the job of advertising and public relations never really ends, it is particularly important during the first months of operation when there are apt to be more than the usual number of equipment failures; when a storm disrupts service while apparently every man, woman, and child in town is watching the championship prizefight; or when potential subscribers in one end of town have to be pacified until the TV cable reaches their area.

Legal Problems

There are many legal problems, beyond taxes, which call for legal work. The first step is incorporation of the company which is to own and operate the community system. Then the company must either buy or lease a site, often on a hilltop, on which to erect its master antenna towers; obtain right-of-way for any private pole lines it must construct, or individual poles needed (besides those on which space is rented from the utility companies); rent or purchase office and shop facilities.

Just as the matter of obtaining municipal franchises has become somewhat standardized and hence, simplified, thanks to the growth of community systems, so it has also become much easier to obtain pole rental agreements and other necessary facilities from the utility companies. Most electric power and telephone companies now have standard agreement forms for renting space on their poles or providing power or other services to community TV systems.

In the pioneer days of wired television—a mere three years ago—the idea of community TV was so new that arrangements between the power and telephone companies and the TV entrepreneurs were often informal. This happy state was brief, probably because the utilities recognized that many TV companies were stringing cable unprofessionally and creating hazards. Good wiring practices were rapidly codified and have become part of the standard operating procedures for all properly organized community television systems.

Subscription TV

It is significant that subscription TV is receiving its first prolonged commercial test on the community system in Palm Springs, California. Since the FCC has not seen fit to take jurisdiction over community TV operations, nor to restrict what may be distributed over such cable systems, *International Telemeter* has set up a subscription service on channel "6-plus" (about 91-97 mc.) of its community network in Palm Springs, which is also distributing channels 2, 4, and 5 received from stations in Los Angeles, 85 miles away.

This first experiment with subscription TV in a community system has, despite the usual problems of a pioneering venture such as occasional equipment failures and a high early maintenance cost, been reasonably successful. The company has a studio and transmitter in the center of town, and there "scrambles" the feature motion pictures which it distributes on the pay-channel. In the subscriber's home, there is an unscrambler, an electronic "black-box" attached to the rear of the TV set (but out of sight), and a small coin box and tape recorder designed to be placed on top of the receiver. The user puts a dollar or so in coins into the box when he wants to see the movie, usually a current feature, and the tape recorder marks down this selection and the price. Once a month the coin boxes and recorders are collected, and the record on the magnetic tape indicates to the company how to divide the "box-office" among the various motion-picture producers, the transmitter operator, the service company, etc.

For other community system operators, the idea is intriguing but it should be remembered that the initial investment is high. The transmitter for subscription TV and associated equipment, not including the unscramblers and coin boxes for subscribers, cost about as much as the equipment investment for a small TV broadcasting station. Subscriber equipment represents another very substantial sum. There is also the highly difficult problem of getting satisfactory motion pictures to show. However, this programming source is certainly worth investigation for enterprising community systems with a sizable number of subscribers especially since some equipment manufacturers, notably *Jerrold*, are investigating simpler means of instituting paid TV.

Canyon Systems

Scattered all over the country are small groups of homes connected to a single master antenna by one or two amplifiers and a few hundred feet of open-wire line, usually strung from tree to tree, rooftop to rooftop, or fence post to fence post. For instance, Hollywood hills above the main metropolitan section of Los Angeles has several dozen of these "canyon systems."

Generally, such systems have been installed by an enterprising TV service technician, or by a dealer who wanted to sell sets where reception without a small master antenna system was just plain terrible. Such an informal system may be owned either jointly by the subscribers, or by the enterprising TV service technician or dealer.

The system may consist of a single broadband antenna on the nearest available hilltop where the reception is satisfactory, an inexpensive amplifier which can be obtained for about $160, and a good-quality open-wire line, preferably with copper-clad conductors and wide polystyrene spacers. In such systems there is generally no attempt made to prevent radiation of signals; the open-wire line has low loss but radiates generously. General performance throughout the system may suffer by comparison with a major community TV system, but such a small master system brings moderately viewable pictures to many a home that would otherwise be permanently "snowbound."

In this article there has been an attempt to point out the many similarities between community television and communications utilities like the telephone. Many of the larger community TV systems are now being operated along utility lines. The author believes that this trend toward the adoption of utility standards by community TV operators will continue, even without legal regulation of these TV systems by federal or state government. —30—

Single channel and broadband type line amplifiers for community television systems made by companies specializing in such equipment. The prices run from $150 to $400.

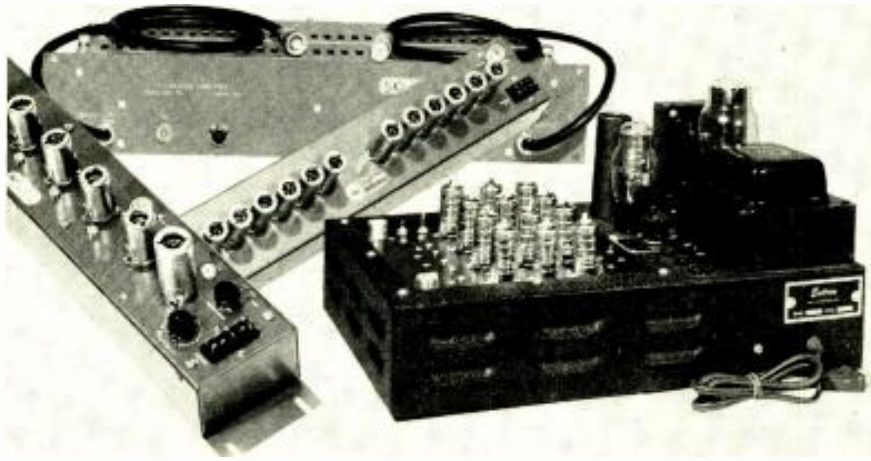


Fig. 1. Front panel view of the home-built two-tube square-wave generator. The power supply may be built on the same chassis.

TWO-TUBE SQUARE-WAVE GENERATOR

By J. GIANNELLI
Electronic Test Technician

Build this unit which features wide frequency coverage, good rise and fall time, and cathode-follower output.

HERE is a square-wave generator which you can build, at a minimum outlay of cash, in one or two evenings. This is just the signal source you'll need to visually check the response of your kit-type oscilloscope or the one you may be planning to build from scratch. It can also be used in service work or to check video and audio amplifier response.

Before describing the construction of this unit, first let's examine the characteristics of this square-wave generator.

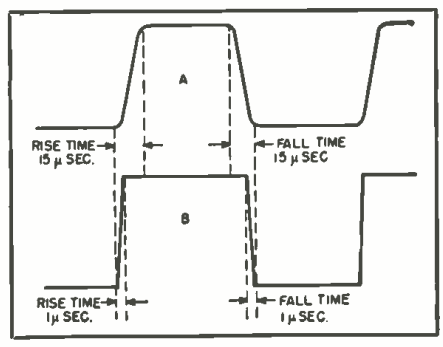
As the rise and fall curve of a square wave approaches the vertical, the high-frequency harmonic components necessary to reproduce these steep sides have to be quite high. See Fig. 2. If we hope to keep the tops of these square waves perfectly flat and perpendicular to the sides, the square wave must then be composed of low-frequency components.

Once we have developed a nearly perfect square wave, we will want to keep it that way so its output must be taken from a low-impedance source to prevent external sources, containing large values of capacitance or low values of resistance, from introducing distortion. These conditions are met by the following characteristics derived from the circuit shown in Fig. 3: Rise and fall time—.05 microsecond; output impedance—260 ohms; output voltage—7.5 volts peak-to-peak; attenuation—7.5 v. to 0 v., continuously variable with no distortion; frequency range—20 cps to 300 kc. in six overlapping ranges with fine-frequency control for intermediate frequencies; and power requirements—30 ma. @ 175 volts and .6 amp. @ 6.3 v.

The circuitry, as shown in Fig. 3, utilizes basic circuits but in a unique combination. V_1 is a symmetrical, free-running multivibrator whose frequency is varied by the choice of condensers to vary the grid time constants in multiples of five, and a fine-frequency control for the intermediate frequencies. The fine-frequency control can be divided into five positions on the panel and by multiplying this indication by the low end of the indicated frequency range, an approximation of the frequency may be obtained.

Direct coupling from the cathode of the multivibrator results in improved frequency response. V_2 is a combination double limiter and cathode-follower output tube. Negative cut-off limiting of the multivibrator pulses is accomplished in the first half of the triode while the positive portion is amplified, inverted, and fed to the grid of the second triode. The second triode is a conventional cathode follower, biased (by the choice of a cathode resistor of approximately 390 ohms) so that large negative-going pulses will cut the tube off. Under these conditions, the cathode-follower has an output impedance of 260 ohms, calculated by using the formula: $R = (E_1\text{-}E_2)/(I_1\text{-}I_2)$ where E_1 and I_1 are the voltage and current at the output with no load and E_2 and I_2 are the voltage and current with added load.

Fig. 2. The high-frequency harmonic content of (A) is lower than in (B). See text.



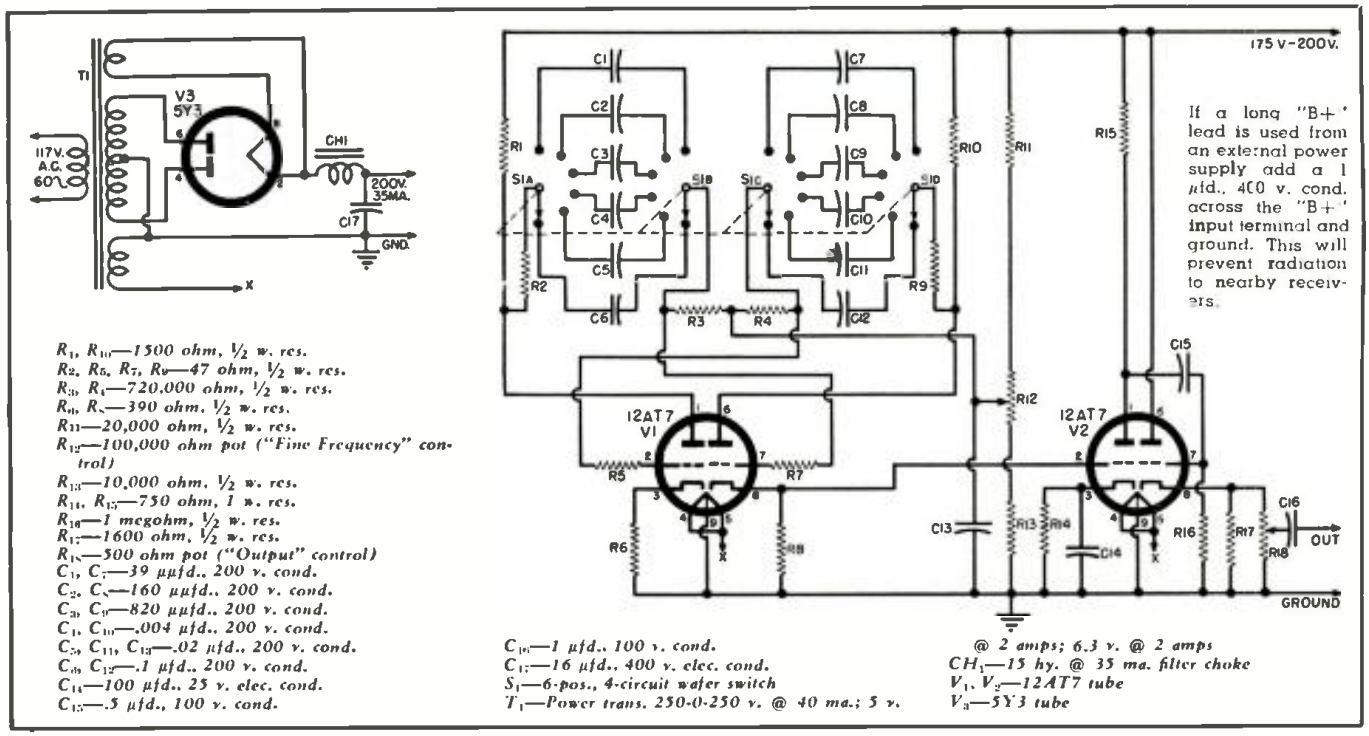
A power supply which can be used with this unit, if the builder does not have a suitable unit available, is shown at the left of Fig. 3. It is a conventional circuit with a choke input filter for improved regulation. It can be placed on the same 5" x 7" chassis as there is plenty of room providing the parts layout of Figs. 5 and 6 is followed closely.

If the square waves produced by this circuit are not symmetrical, V_1 may be substituted for V_2 or R_3 or R_4 shunted with another ½ w. resistor. This resistor can be any value between 1 and 3.5 megohms, the value being determined by the symmetry obtained. Once obtained, symmetry will be retained on all ranges.

Once construction of this unit has been completed, you will do well to acquaint yourself with the interpretation of the scope patterns taken from the output of units under test, having square-wave inputs. One important factor must be borne in mind. Since a square wave is composed of a fundamental frequency and many harmonics of different amplitudes and phases, in order to faithfully reproduce these square waves in the output of an amplifier the amplifier must have a flat frequency response from a few cycles to several megacycles.

Checking Pulse Response

With kit-type oscilloscopes becoming



R_1, R_{10}—1500 ohm, ½ w. res.
R_2, R_5, R_7, R_9—47 ohm, ½ w. res.
R_3, R_4—720,000 ohm, ½ w. res.
R_6, R_8—390 ohm, ½ w. res.
R_{11}—20,000 ohm, ½ w. res.
R_{12}—100,000 ohm pot ("Fine Frequency" control)
R_{13}—10,000 ohm, ½ w. res.
R_{14}, R_{15}—750 ohm, 1 w. res.
R_{16}—1 megohm, ½ w. res.
R_{17}—1600 ohm, ½ w. res.
R_{18}—500 ohm pot ("Output" control)
C_1, C_7—39 μμfd., 200 v. cond.
C_2, C_8—160 μμfd., 200 v. cond.
C_3, C_9—820 μμfd., 200 v. cond.
C_4, C_{10}—.004 μfd., 200 v. cond.
C_5, C_{11}, C_{13}—.02 μfd., 200 v. cond.
C_6, C_{12}—.1 μfd., 200 v. cond.
C_{14}—100 μfd., 25 v. elec. cond.
C_{15}—.5 μfd., 100 v. cond.
C_{16}—1 μfd., 100 v. cond.
C_{17}—16 μfd., 400 v. elec. cond.
S_1—6-pos., 4-circuit wafer switch
T_1—Power trans. 250-0-250 v. @ 40 ma.; 5 v. @ 2 amps; 6.3 v. @ 2 amps
CH_1—15 hy. @ 35 ma. filter choke
V_1, V_2—12AT7 tube
V_3—5Y3 tube

Fig. 3. Complete schematic of the two-tube square-wave generator. A suitable power supply is diagrammed at the left.

increasingly popular, the owner may want data on its performance and thus be in a position to interpret waveshapes observed with it, or he may wish to improve the response of his scope to satisfy his particular requirements, or keep a photographic record of the past condition of his scope in order to make a comparison in case of suspected malfunctioning.

More and more of these scopes are being put into use to examine the complex waveshapes found in television sets. Some of these scopes cannot reproduce all the pulses required. For instance, the rise time of the horizontal sync pulses in a television set is approximately .2 microsecond. By applying the formula $f = .4/t$, where f = frequency in megacycles and t, = rise time of the pulse in microseconds, and .4 = the constant factor, we find that a bandpass flat to 2 megacycles will be necessary to reproduce such a pulse with good fidelity. The bandpass of 4 megacycles (which very few sets have today) is not for the purpose of pulse reproduction alone but for good picture detail, since the horizontal sweep speed of 63 microseconds scanning 250 black vertical lines for its entire sweep length will produce a video signal of 250 cycles in 63 microseconds or approximately 4 megacycles-per-second.

Since we are primarily interested in the reproduction of pulses, the scope should contain video amplifiers capable of a flat response from 30 cps to 1 or 2 megacycles (sine waves). With the square-wave generator described, you can make a quick check of this response by visual analysis of the

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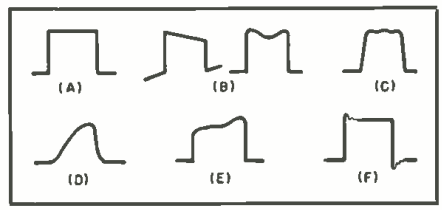


Fig. 4. Distortion of square waves due to improper or insufficient compensation in amplifiers. (A) input square wave. (B) insufficient low-frequency gain. (C) mild case of insufficient high-frequency gain. (D) severe case of insufficient high-frequency gain. (E) unequal phase shift. (F) pattern obtained with overcompensation.

Fig. 5. Under chassis view. There is sufficient room on chassis to allow power supply to be added if desired.

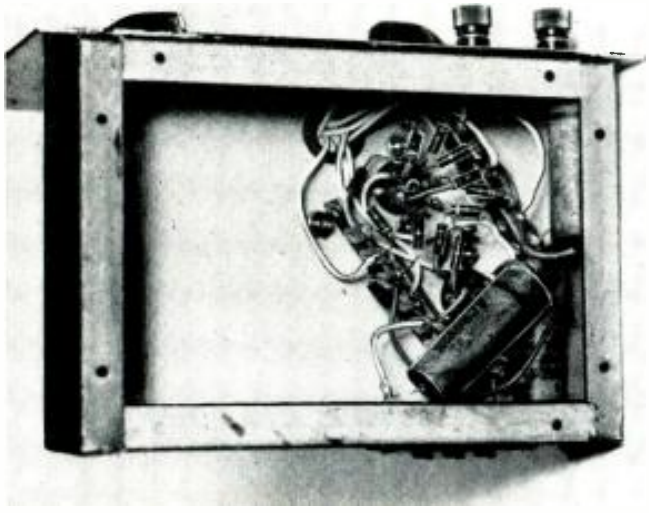


Fig. 6. Rear view of unit showing C_{13} mounted on a terminal strip with resistors R_3, R_4 going to wafer switch.

"BOOTSTRAP" INTERVAL TIMER

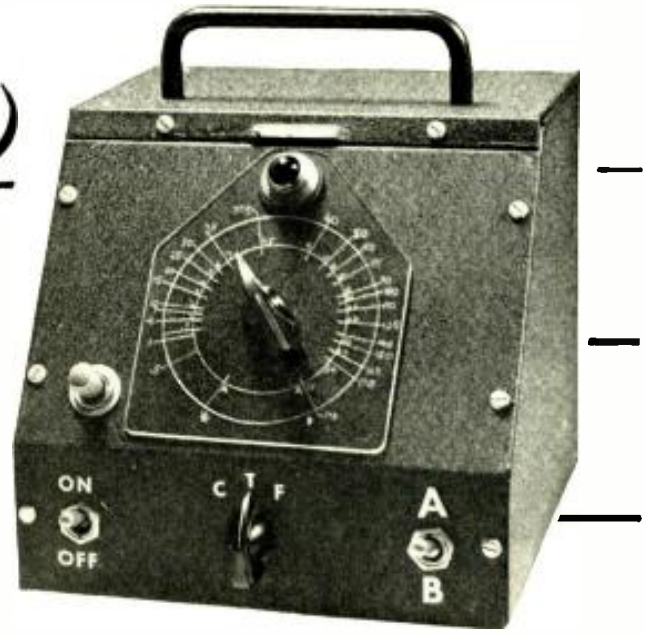


Fig. 1. Front panel view of the interval timer. It is housed in a Bud cabinet. The dial scale was home-made from lucite, with the numerals scribed on the face.

By **MURRAY HILLMAN, W6QHK**

Intervals from .5 to 35 seconds and .5 to 175 seconds can be controlled by means of this two-scale-dial instrument.

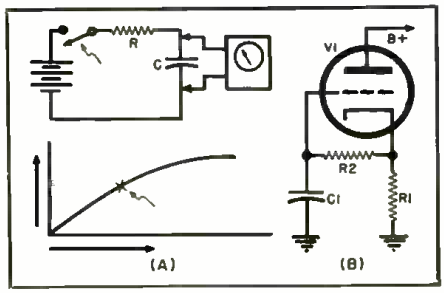
SINCE the first undercooked "hard boiled" egg broke with an unappetizing splash upon the breakfast plate of a disappointed husband, womankind and mankind, too, have searched for more and more exact methods of interval timing. More recently the exact timing of short intervals has taken on new importance as greater numbers of amateur photographers have set up their own developing and printing equipment at home. Interval timing has ranged from the seeping sand of an hourglass to the mechanical marvels whose chromium dials grace the control panels of today's most modern appliances. It is only natural that electronics, with its precision accuracy, should invade this lucrative field.

Most electronic timers are based on the fact that a condenser, charging toward some applied voltage through a series resistance, requires a definite amount of time to build that charge. A typical *RC* circuit is shown in Fig. 2A with an accompanying graph of condenser voltage *versus* time. In this *RC* charging circuit, the time (in seconds) required for the condenser to reach about 63% of the applied voltage is the product of the resistance (in ohms) times the capacitance (in farads) or $T = RC$. This product is the time constant of an *RC* circuit and is a universal index of the timing characteristic of any particular resistor and condenser.

The slope of the condenser's charge path (Fig. 2A) is amost linear up to the 63% point so that a given interval will yield about the same increase in voltage anywhere along this portion of the line. However, as the curve progresses past this 63% point, it begins to flatten out so that the same interval of time yields less change in voltage. Herein lies the limitation of the ordinary *RC* circuit for timing applications.

One of the most successful circuits designed to circumvent this flattening of the *RC* curve is the "bootstrap" circuit used in radar. A basic "bootstrap" circuit is shown in Fig. 2B. With a given voltage existing initially across R_1 due to tube current, the charging condenser C_1 will begin charging, through R_2 toward that voltage. However, as the charge builds up across C_1, the grid of V_1 is going more positive and the tube passes a greater current through R_1, increasing the voltage toward which C_1 is charging. As the condenser charges almost linearly up toward 63% of the applied voltage, the applied voltage (across R_1) continues to increase and the condenser is prevented from reaching the 63% point. Therefore, the charge curve remains almost linear for a longer interval of time. The name "bootstrap" is derived from the fact that the *RC* curve, instead of flattening out, "pulls itself up by its own bootstraps." This circuit is the heart of the "bootstrap" interval timer. Fig. 1 is the front panel view of the timer. The "on-off" switch is a single-pole, single-throw switch connected into one side of the a.c. input power line. The push-button switch directly above it is depressed to start the timing cycle. The three-position switch, marked "C-T-F," is normally in the "T" or "Time" position and the timer delivers 60-cycle line voltage to a standard appliance receptacle, mounted on the rear of the chassis, for a period of time determined by the setting of the time selector dial. This dial has two scales, marked "A" and "B," with the "A" scale calibrated from .5 to 35 seconds and the "B" scale from .5 to 175 seconds. Selection of the "A" or "B" scale is made by the range switch, marked "A-B", in the lower right-hand portion of the front panel. The time selector dial was made from lucite with the calibrating lines and numerals scribed into the front side with a steel scribe. A dial light is inserted through a hole in the lucite and a small window is cut in the under side of the dial light assembly to allow edge illumination of the lucite plate. The light transmitting properties of lucite cause the scribed markings and the edges to glow brightly against the black wrinkle finish of the case, resulting in a readable and decorative dial assembly.

Fig. 2. (A) Typical RC circuit and its graph of condenser voltage vs time. (B) Basic "bootstrap" circuit used in timer design.



When the timer is used to deliver voltage to a photographic enlarger or other equipment requiring initial focusing, the "C-T-F" switch is turned to the "F" or "Focus" position during focusing, thereby applying voltage continuously to the receptacle. The switch is returned to "T" position for timed

operation. Once a timing sequence is begun by depressing the push-button, line voltage is applied continuously to the receptacle until the end of the selected time interval. However, the operator may stop the timing cycle and remove power from the receptacle by turning the "C-T-F" switch to "C" or "Cancel" position, grounding the grid of the "bootstrap" charging tube and immediately establishing the full charge on the charging condenser.

For a complete understanding of the circuit operation, refer to the schematic diagram, Fig. 3. The d.c. power is supplied by two half-wave rectifiers, one delivering plus 150 volts and the other delivering minus 150 volts. The minus 150-volt supply consists of a half-wave rectifier, V_{1A}, resistor R_1, and filter condenser C_1. V_{1A} is half of a 12AU7 dual triode, with its grid and plate connected together to give diode operation. It is used instead of a more conventional rectifier to provide circuit stability and is an important feature in the design. The filter condenser C_1, is a 30 μfd. electrolytic providing adequate ripple elimination. R_1 is a 50 ohm current-limiting resistor which holds the rectifier current to a safe value on demand peaks.

The plus 150-volt supply consists of *Rect.*$_1$ a half-wave selenium rectifier; R_2, a 50-ohm series resistor to safely limit the initial charging current; and C_2, a 30 μfd. electrolytic ripple filter.

V_{1B}, the other half of the 12AU7, and its associated circuitry comprise the "bootstrap" charging circuit. Its plate is returned directly to the positive voltage supply while its cathode returns through R_4 and R_6 to the negative voltage supply, giving a total of about 300 volts across the circuit. This large voltage differential permits long timing intervals with good linearity. S_3 is the range switch and selects a charging capacity of 1 μfd. (C_5 only) in the "A" position or 5 μfd. (C_4 and C_5 in parallel) in the "B" position. These condensers charge through R_3 and R_5 toward the voltage across the cathode resistors, R_4 *and* R_6. R_3 is a 0-2 megohm pot whose resistance is determined by the setting of the timer dial. R_5 is necessary to limit the charging circuit resistance to a safe minimum value. If it were omitted, with a dial setting of zero the circuit would cycle repetitively during the time the push-button is depressed, and would overload the d.c. supply.

The voltage at the cathode of V_{1B} is direct coupled through R_5 and R_7 to the grid V_2, a 2D21 gas tetrode operating as a grid-controlled rectifier. R_7 is a 1 megohm resistor limiting the grid current drawn from the 2D21 when the cathode of V_{1B} goes positive. Since the RC time constant of R_7 and C_6 is only about .1 second, the grid voltage of V_2 will follow the cathode voltage of V_{1B} with no noticeable delay (except at the lower end of the dial). V_2, in series with R_8 and the winding of relay RL_1, is connected directly across the 117-volt, 60-cycle source. If the grid voltage of V_2 is sufficient to allow the tube to fire, d.c. will flow through the winding of relay RL_1 and close its contacts. The 8 μfd. condenser, C_3, across the winding, filters the half-wave pulses to prevent relay chatter. Since the initial surge

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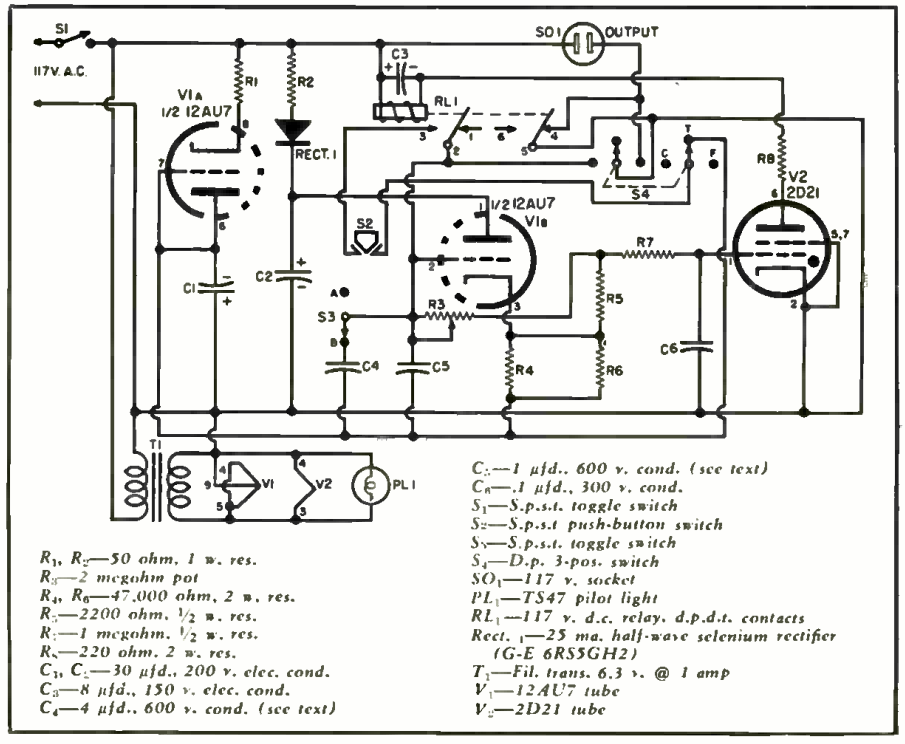
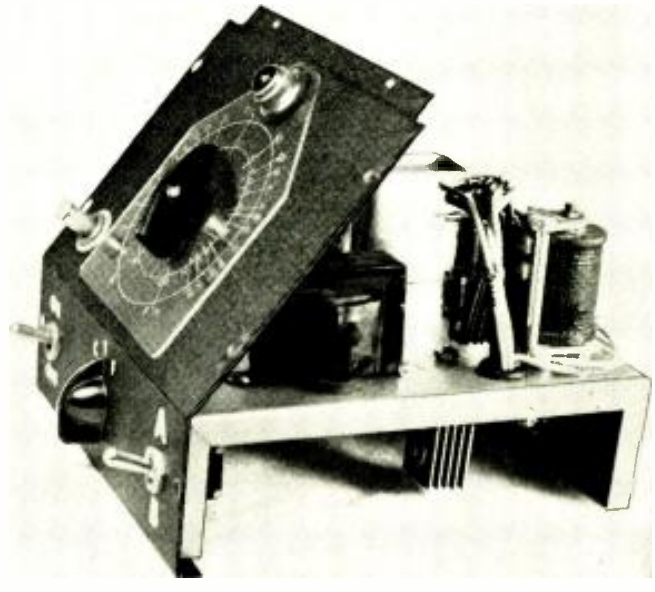


R_1, R_2—50 ohm, 1 w. res.
R_3—2 megohm pot
R_4, R_6—47,000 ohm, 2 w. res.
R_5—2200 ohm, ½ w. res.
R_7—1 megohm, ½ w. res.
R_8—220 ohm, 2 w. res.
C_1, C_2—30 μfd., 200 v. elec. cond.
C_3—8 μfd., 150 v. elec. cond.
C_4—4 μfd., 600 v. cond. (see text)
C_5—1 μfd., 600 v. cond. (see text)
C_6—.1 μfd., 300 v. cond.
S_1—S.p.s.t. toggle switch
S_2—S.p.s.t. push-button switch
S_3—S.p.s.t. toggle switch
S_4—D.p. 3-pos. switch
SO_1—117 v. socket
PL_1—T547 pilot light
RL_1—117 v. d.c. relay, d.p.d.t. contacts
Rect. $_1$—25 ma. half-wave selenium rectifier (G-E 6R55GH2)
T_1—Fil. trans. 6.3 v. @ 1 amp
V_1—12AU7 tube
V_2—2D21 tube

Fig. 3. Complete schematic of "bootstrap" interval timer. See text on special features.

Fig. 4. Underchassis view showing compact parts placement.

Fig. 5. Parts can be accommodated on a 7" x 6" x 2" chassis.



ECONOMY MODEL GRID DIPPER

Fig. 1. Front panel view of grid dipper. It measures 6½" x 3½" x 3¼" over-all.

By **ROBERT D. OLIVER**

Construction details on a useful test instrument which covers range from .8 to 180 mc. by means of six plug-in coils.

FAMILY economics can be a great deterrent to ownership. This is true, even of the inexpensive and versatile grid dip oscillator. All too often the price of coffee and the paucity of the junk box dictate that we must go on jeopardizing neighborly relations by borrowing, rather than owning

Mathematically speaking, if we could integrate components from the junk box, cancel the expense of meter and power supply, and add a trip to the local five-and-dime, we would have an equation that yields a minimum of expense. The assumption proves to be valid, and the heterogeneous concoction looks good and, more important, works good!

The circuit is intriguingly simple, as demonstrated by the circuit diagram. Basically, the GDO is nothing but an oscillator with a grid current indicator. Since the grid current of an oscillator is proportional to the amount of energy generated in its tank circuit, any change in that energy level reflects itself as a drop or dip in grid current. Thus, resonance with an external circuit is indicated by a dip in grid current due to energy transfer.

Being interested in price rather than in propaganda, we shall not go into all the multitudinous uses of the instrument at this point. The reader is referred to the section on operation in this article and to articles that have already appeared in this magazine. [1, 2]

No great amount of originality can be claimed for the circuitry used. Chambers has already solved the problem of our non-existent microammeter by substituting the "ever-popular-for-economic-reasons" magic-eye tube.[3] The versatile 6E5 proves to be an excellent indicator of oscillator operation during the development and testing stages and it is highly recommended that the constructor build this part of the circuit first. The eye closes at approximately −3 volts and adjustment of the potentiometer, R_3, provides a positive bucking voltage from the power supply to adjust its sensitivity or reference level.

Only oscillators of the Colpitts and Hartley variety lend themselves readily to this application. The Colpitts has a distinct advantage since it utilizes a two-terminal oscillator coil; however, it requires a split-stator tuning condenser. Condensers of suitable capacity (50 to 100 $\mu\mu$fd. per section) are as scarce as hen's teeth in the usual spare-parts collection. Several versions utilizing a Hartley oscillator were tried in order to eliminate the expense of the split-stator condenser. However, the added inductance of the cathode tap seriously limited operation above 140 mc. and added enormously to the complications of efficient circuit layout.

After sadly replacing the radio catalogue and the baby's piggy-bank on the shelf, we discovered a motley assortment of old b.c. tuning condensers, saved for some obscure purpose or other. A condenser with two identical sections was selected and two-thirds of the original plates were carefully removed with long-nose pliers, leaving a condenser with about seven plates per section. This later checked on a capacity meter (borrowed) at almost 100 $\mu\mu$fd. per section. This provided a tuning capacity of about 50 $\mu\mu$fd. since the sections are effectively in series. Certain doubts as to its physical size were dispelled when the "now Colpitts" showed a healthy tendency to oscillate at well over 200 mc.

The 6C4 was chosen as an oscillator tube because it was available. A 6J6, 6AB4, 12AT7, or any high-frequency triode would work just as well.

The power supply was not included as an integral part of the design since it seemed expedient to pirate the modest requirements from another piece of equipment. Any supply of from 150 to 200 volts capable of supplying an additional 15 ma. will do. Operating voltage should be within 20% of that used during calibration. The main "on-off" switch is assumed to be on the auxiliary power supply.

The construction of the unit is exceedingly simple. The components are mounted on a "U" shaped bracket which serves as the cover of a utility box, 6½" x 3½" x 3¼". The particular box used was very simple to fabricate from 15 gauge aluminum, using nothing more complicated than two dime-store "C-clamps" with some short pieces of heavier gauge material to serve as bending brakes. Utility boxes of comparable size are available commercially.

As may be seen in the photographs, the parts arrangement is uncomplicated and uncrowded. The only critical placement is that of the oscillator grid and plate circuit components, C_1, C_2, C_3, and the coil socket. The rest of the components are located for accessibility and front panel symmetry.

The upper 2¾" of the panel is occupied by the tuning condenser, C_1, which is mounted at the horizontal center of the panel with stator connections lying in the vertical plane. It is mounted by the simple expedient of tapping two of the holes that con-

denser manufacturers so mysteriously leave in the frame. Metal standoff bushings are used to locate the condenser as far back as its shaft will allow in order that the coil socket may be situated for the greatest utility in use.

The four-prong coil socket is mounted on 1" standoffs; two large terminals located over half-inch holes drilled directly above the upper stator connections of C_1. The socket-to-stator connections are made of ¼" strips cut from sheet copper. The copper strips, stators of C_1, and blocking condensers, C_2, C_3, comprise an integral part of the oscillator inductance. These are an appreciable part of the parallel line tank circuit for high-frequency operation. One of the unused terminals of the coil socket is grounded by means of a soldering lug fastened under the supporting bolt.

The 6C4 oscillator tube is mounted at the upper left hand corner bracket, 1½ x 2 inches, located as close to the lower stator connections of C_1 as the length of the 100 μμfd. blocking condensers will allow. Its one-inch flange is secured by drilling it to pass the bushing of the sensitivity control, R_3. Care must be taken that sufficient clearance is allowed on the panel for the four-inch dial and the knob of R_3.

A three-terminal tie-point is mounted at the bottom of the oscillator tube bracket to provide heater, "B+," and bias connections as well as support for the lower ends of R_1 and R_2. The 1000 μμfd. bypass condensers, C_4, C_5, and C_6, are wired directly from the socket terminals to the nearest ground point on the bracket. These should be of the ceramic type although, physically, small micas will do.

The switch, phone jack, and indicator tube are mounted symmetrically on the lower portion of the panel.

The tube shield serves the dual purpose of light shield and tube support, fitting snugly in the 1⅛" hole cut in the panel. The base of the 6E5 is secured by means of a tube clamp fastened to the chassis. The leads to the 6-prong tube socket are left long enough to facilitate removal.

Data for winding the coils is given in the parts list. The high-frequency coils, L_1 and L_5, are wound on 1" diameter forms. A hairpin of ⅜" diameter copper tubing is force fit over screw-terminal banana plugs to serve as L_6. Its length, including plugs, is 2" and its width is dictated by the spacing of the coil socket terminals. The coils, L_1, L_2, and L_3 are wound on 1¼" forms, which were originally 4-prong tube bases. If the constructor desires, he may wind the low-frequency coils, tapping them, to utilize the grounded terminal on the coil socket, thus converting the circuit to a Hartley oscillator. This is necessary to supply adequate excitation on the lower frequencies.

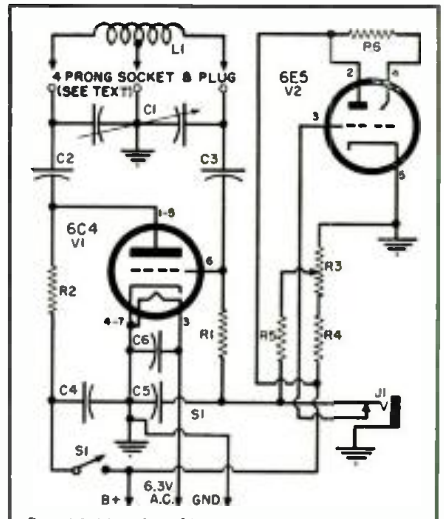
The local dimestore can provide a number of the items needed for the GDO. For ten cents you can get a plastic hardware container that may be utilized with banana plugs for the 1" diameter coil forms. (And, you'll probably be able to use the miscellaneous nuts and bolts found around the house.) The plastic dial once served as the top of a ten cent food container. It was drilled for a ¼" shaft and marked with a sharp scribe. Equi-spaced holes were drilled along the hairline to facilitate calibration of the various ranges. The dial may be fastened to a standard knob by small self-tapping screws or by a plastic cement. In case the tuning condenser has a shaft diameter larger than ¼", it may be tapped to support the dial directly; or, if the shaft is splined for a drum, the plastic may be under-cut and press-fit, after heating the shaft with a soldering iron.

Black construction paper is used under the plastic dial and final calibration put on with white marking ink. (A moistened nail-white pencil is less messy.) The dimestore also supplies the dull black enamel for the panel layout and colorless nail lacquer for protecting the lettering.

Testing the completed oscillator is simple with the inclusion of the grid voltage indicator. An appreciable closing of the eye when S_1 is closed indicates proper oscillator operation. The eye should open when the oscillator coil is grasped with the hand. On the lower frequency coils it may be necessary to back off the sensitivity control to allow for opening of the eye. Generally speaking, the degree of closing is an indication of the strength of oscillation; sharpness and the amount of opening an indication of the "Q" of the circuit under test. With a few tuning condensers it may be necessary to add wiping contacts at both ends of the stator to completely eliminate spurious dips at the highest frequencies, although these can usually be eliminated by adjustment of the sensitivity control.

A number of methods may be used for calibration. A heterodyne frequency meter of the "LM type" is nice if you can borrow one; but a communications receiver will serve just as well. Extreme precision in calibration is not necessary. The writer used a number of war-surplus crystals coupled inductively by a few turns of wire to estab-

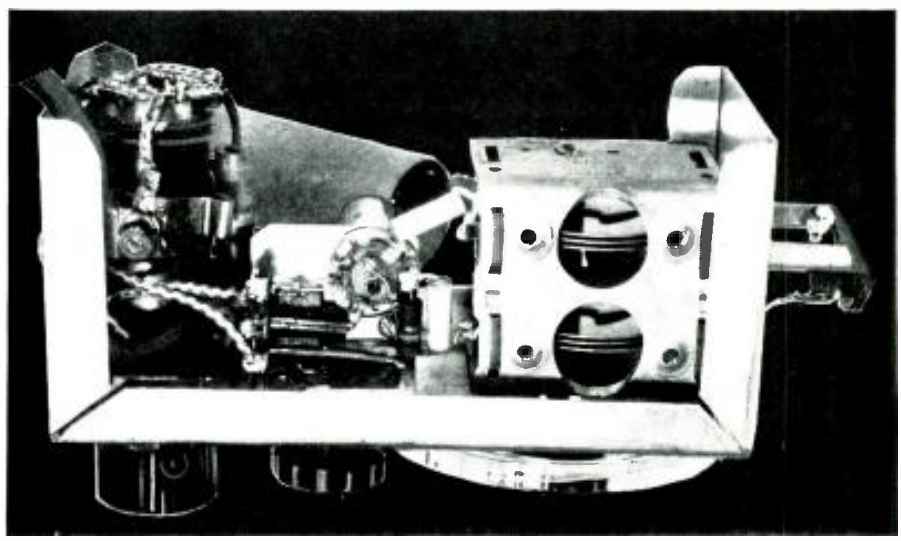
(Continued on page 95)



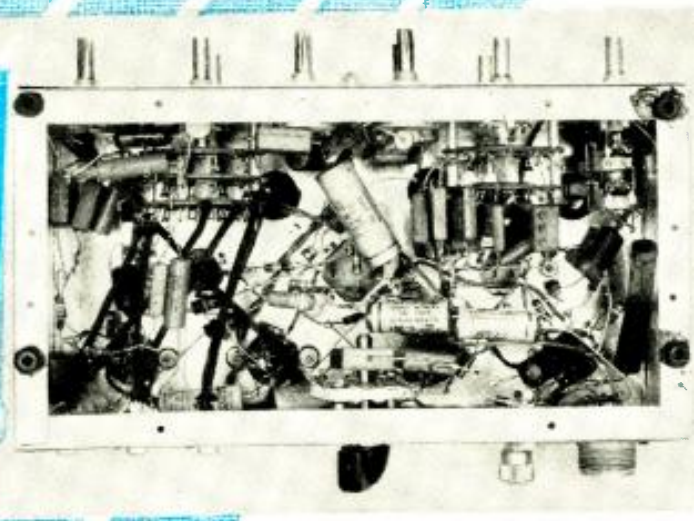
R_1—10,000 ohm, ½ w. res.
R_2—2500 ohm, ½ w. res.
R_3—50,000 ohm pot
R_4—50,000 ohm, 1 w. res.
R_5—50,000 ohm, ½ w. res.
R_6—1 megohm, ½ w. res.
C_1—Two-section var. cond., 100 μμfd. per section (see text)
C_2, C_3—100 μμfd. ceramic cond.
C_4, C_5, C_6—1000 μμfd. disc ceramic cond.
J_1—Closed circuit jack
S_1—S.p.s.t. toggle switch
L_1—.8-2 mc.—150 t. #30 en., center-tapped, scramblewound, 1¼" dia.
L_2—2-5 mc.—63 t. #30 en., closewound, 1¼" dia.
L_3—5-13 mc.—20 t. #30 en., closewound, 1¼" dia.
L_4—12-30 mc.—12 t. #20 en., ⅜" long, 1" dia.
L_5—30-75 mc.—4 t. #20 en., closewound, 1" dia.
L_6—75-180 mc.—2" hairpin loop, ⅜" copper tubing (This length will have to be adjusted if operation to 200 mc. is desired)
V_1—6C4 tube (see text)
V_2—6E5 tube

Complete schematic of economy grid dipper. Other tubes may be used if desired.

Side view of grid dipper. If the builder wishes, the size of the cabinet can be increased slightly to permit inclusion of a power supply to make unit self-contained.



A TONE-COMPENSATING PREAMP



Chassis measures 5 x 9½ x 3 inches over-all.

Author housed his preamp in a standard wood cabinet.

By **JOHN H. DANIEL**

This design incorporates, on a single chassis, almost every conceivable tone compensating network. It includes separate circuits for bass and treble controls, additional bass boost and sharp cut-off high-frequency attenuator, and loudness control.

THE high-fidelity enthusiast who builds his own equipment can find numerous articles to guide (or confuse!) him in (1) selecting a suitable design for a high-quality audio amplifier, (2) converting the electrical output of such an amplifier into relatively undistorted (or at least pleasing) sound, and (3) choosing a preamplifier with appropriate equalization curves to be used with magnetic phonograph pickups. For a summary of the three general types of circuits employed, see "A Preamp for Magnetic Pickups," by William Creviston, RADIO & TELEVISION NEWS, December 1952. While such a combination of an equalizing preamplifier with a flat-frequency-response amplifier and a well designed speaker-baffle system may possibly give all that is desired for the playing of records, it is probably a rare individual who does not desire further tone adjustment and control, even in this case. Such a combination almost certainly will not satisfy a discriminating listener when used (minus the equalizing preamp, of course) with various AM or FM radio programs, or with TV sound.

To obtain the additional tone variation desired, one can refer to numerous articles on the general principles of, and special circuits for, bass and treble "boosts" and "cuts." However, it appears that somewhat less attention has been devoted to the problem of integrating these ideas and circuits into a satisfactory over-all system.

The system presented in Fig. 1 is a preamplifier designed to work from the equalizing preamp of the record player, the AM or FM tuner, or the TV discriminator output, into the input of the audio amplifier. It is not intended to be the simplest arrangement that might give a desired tone control, but was made as simple as possible while still furnishing nearly every type of control for which the author has heard a desire expressed by several high-fidelity experimenters. It can be said to be "versatile" not only because of the large number of tonal effects which may be incorporated, but also because it furnishes a basic framework which lends itself to the substitution of alternative circuits to accomplish certain results, as will be discussed in the section on "Modifications."

Features

The schematic of Fig. 1 incorporates the following general features:

1. "Primary" tone controls consisting of continuously variable amounts of bass and treble "boosting" or "cutting" on either side of a middle audio frequency (800 cycles-per-second), with flat frequency response resulting when all controls are in "zero" position.

2. Additional tone controls consisting of a bass boost and a treble boost which can be switched in at any desired frequency (or frequencies, resulting in several steps of boost) and for various amounts.

3. A separate gain control and loudness control, allowing the former to be set for various inputs so that the latter operates on the proper Fletcher-Munson curve, and avoiding the likelihood of saturation in any stage for high level inputs.

4. A sharp treble cut which may be set at various frequencies, as desired, to eliminate record scratch or high frequency noise.

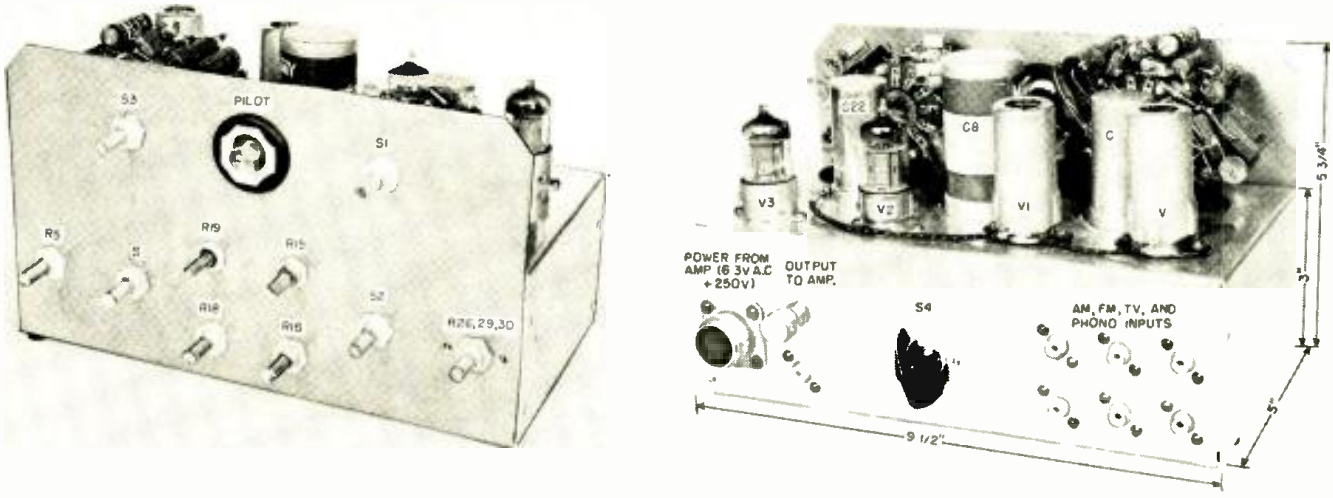
5. A sharp bass cut to be used with record players or programs having excessive turntable rumble or 60 cycle hum.

Primary Tone Controls

The primary tone controls (Feature 1) are realized by the network between the two halves of the 12AU7 tube, V_2, as indicated in Fig. 1. Because the impedance of this network is low for certain frequencies at certain potentiometer settings, it is driven by a low-impedance cathode-follower source which, with its high input impedance, serves as a buffer between the network and the high impedances associated with the output of the 5879 tube, V_1. The frequency response curves for this section are shown in Fig. 3. The four potentiometers, one each for bass boost, bass cut, treble boost, and treble cut, are arranged so that the boosts turn clockwise from the zero or flat position, and the cuts counterclockwise from that position.

Additional Tone Controls

The adjustable treble boost of Feature 2 is accomplished by shunting networks such as R_1, R_2, C_1, C_2 (Fig. 1) across the 0.47 megohm resistor R_{10}. With no shunt, this resistor, in series with R_{11}, cuts the gain of the preamp



Front and rear views of the tone-compensating preamp. See Fig. 1 for identification of controls and parts.

to about a fifth. Shunting R_{10} partially restores the gain for those frequencies for which the shunting impedance is low. Examples of the effect of several network parameters R_1, R_2, C_1, and C_2 are shown in Fig. 2, curves 1-5.

The adjustable bass hoost of Feature 2 is accomplished by feedback networks R_3, R_4, C_3, C_4, etc. (Fig. 1) which feed the output of the second half (V_{3B}) of the 12AX7 back to its grid input. Its operation may be understood if it is remembered that the gain of this stage is approximately equal to the ratio of the total feedback impedance between plate and grid to the resistance R_{15}. For flat response, network R_3, C_3, R_4, C_4 becomes a direct short (position 1 of switch S_3), giving a constant gain and a low output impedance of approximately 3000 ohms. This low output impedance is desirable if the preamplifier is to be cabled any distance to the amplifier proper, both from the standpoint of reducing 60- or 120-cycle pick up, and of preserving the high frequencies.

To boost the bass below a given frequency, a network, R_3C_3, having a higher impedance below this frequency, is switched in place of the short. The higher impedance results in less feedback and therefore greater gain below this frequency. Examples of several choices of parameters R and C are given in the frequency curves of Fig. 2, curves 6-14.

Feature 2 furnishes an ideal means of properly equalizing the acoustic output between a woofer and a tweeter. It is not unusual for the high damping factor of a good amplifier-speaker system to be nullified to a large extent (usually for the tweeter) by the insertion of a resistance-type equalizer in the dividing network for the speakers. Feature 2 avoids this by making an equalizer in the dividing network unnecessary. (Theoretically, our method, since it uses essentially a single element in the feedback loop to produce a 6 db-per-octave slope, is perfectly suited only to a dividing network having a 6 db-per-octave roll-off, such as is produced by a single capacitance in series with the tweeter and inductance in series with the woofer. In practice, however, it seems to work equally well with the 12 db-per-octave networks, probably because the transition region is small, and the departure from flatness within it usually less than 2 db for the equalizations normally required), besides providing additional possibilities for obtaining tonal effects at frequencies other than the one selected for the primary tone control of Feature 1 (and other than the crossover frequency of the dividing network).

Loudness and Gain Controls

The loudness control shown between V_2 and V_3 in Fig. 1 is the one advocated by Johnson[1] with the addition of a 0.1 megohm resistor R_{28}. This addition gives less emphasis on the high frequencies at low volumes, which seems desirable, at least in the author's opinion.

To use the loudness control properly, the operator must associate a given position of the control with its corresponding (and unique) loudness level, preferably choosing the position corresponding to the level at which he is accustomed to listen. With the control in this position, the gain control R_5 is varied to obtain this accustomed loudness level. From this point on, any desired "loudness" change is made with the loudness control, so that proper tonal balance is maintained at all levels.

It is quite properly argued that such tonal balance can usually be maintained by adjustment of the primary tone controls; however, this requires (for finicky listeners) a new "experimental" balance each time the loudness is changed, instead of the one initial balance. Occasionally also the range of the primary controls may be found insufficient to take care of both the primary tone adjustment and the Fletcher-Munson effect.

Sharp Treble Cut

When record scratch or high-frequency noise is reduced by means of a treble cut-off (Feature 4) such as is introduced by switch S_2 in Fig. 1, the sharper the cut-off the more effective the noise elimination before it interferes with quality of reproduction. The high plate impedance of the 5879 pentode as a constant-current source is somewhat more effective in producing a steep slope than a triode would be. In addition, a two-section, low-pass filter is used. The frequency characteristics are given in Fig. 2, curves 15-17.

Sharp Bass Cut

The bass cut (Feature 5) introduced by switch S_1 in Fig. 1 is obtained by means of a two-section, high-pass filter whose characteristics are given in Fig. 2, curves 18 and 19. Should the input impedance of the amplifier driven by this preamp be other than 0.47 megohm, the 0.47 megohm resistor R_{10} of the filter should be changed to equal it. The cut-off frequency, of course, varies inversely as the product of this resistor and the value of the two equal condensers switched in.

The undesirable hum or rumbling which would lead to the use of this feature should, if possible, be eliminated at their sources. However, the expenditure required to produce an amplifier and speaker system which reproduces well at such low frequencies may sometimes be such that the financial limit has been reached without including the considerable amount necessary to replace a hitherto perfectly acceptable record player or

tuner with one meeting the new and more stringent requirements of extended low-frequency coverage. In addition, there are, at times, radio and TV programs with objectionable hum over which the listener has no other means of control.

Layout

The finished unit is shown in the photo on page 57. In its final form the unit includes an equalizing preamplifier[2] for reluctance pickups and a selector switch (for various equalization curves as well as different inputs) in addition to the elements of the circuit of Fig. 1. The plate supplies of 130 and 160 volts for the first and second halves, respectively, of the preamp tube were obtained by cascade decoupling filters from the 180 volt supply of the 5879 tube (V_1).

A chassis measuring 5"x9½" allowed easy access to all components with a soldering iron when metallized condensers were used for values of .05 to .25 μfd. Paper condensers would make access more difficult.

With usual judicious placement of leads, no compartmental shielding was found necessary if the input leads to the equalizing preamp and to the 5879 grid were shielded, and tube shields used on the preamp and 5879 tubes. The 250-volt plate and 6.3 volt filament supplies were taken from the main audio amplifier. With the filament supply connected as shown in Fig. 1, 60-cycle hum can be adjusted to a negligible value.

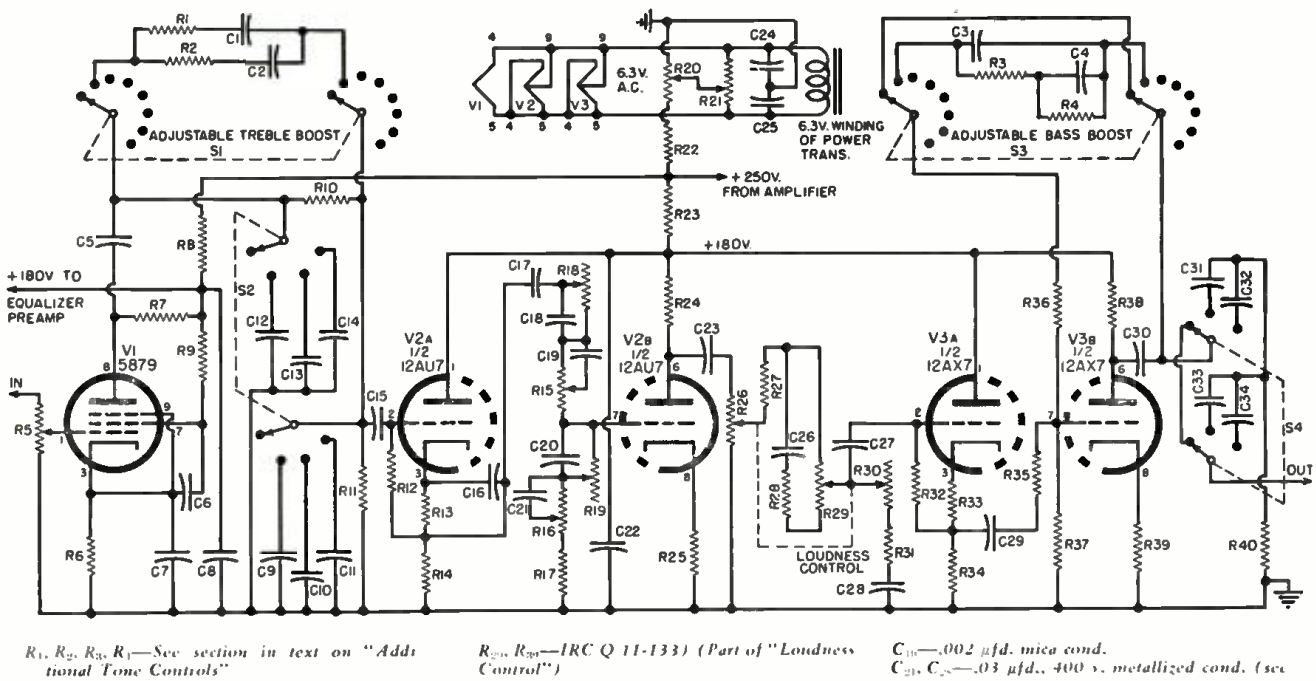
Modifications

It is a fair assumption that no two people will agree on what effects are desirable from a preamplifier as described here nor the best way to produce any effect they do happen to agree upon as desirable. Consequently, the preamp has been designed to allow substitutions of other types of circuits with minimum disruption.

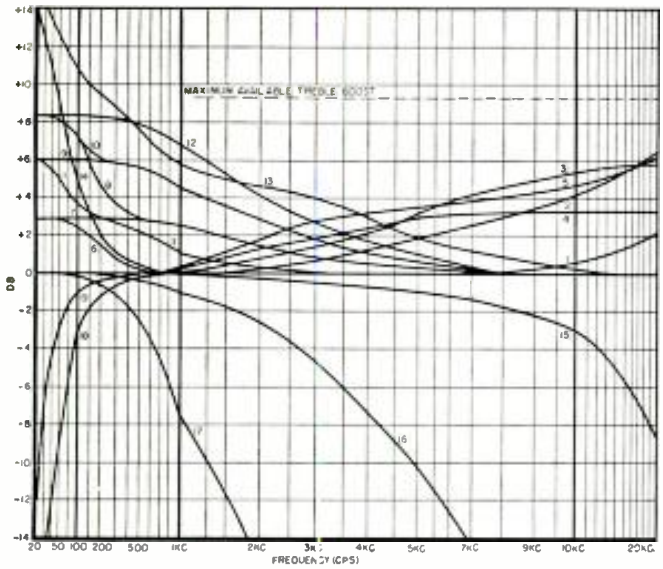
For example, if it is desired to use a different circuit for obtaining the Fletcher-Munson curves than that shown in Fig. 1, it can undoubtedly be inserted as a direct replacement, since it is driven by a fairly low impedance and works into the high impedance of a cathode follower.

Similarly, if it is desired to use a primary tone control which has bass and treble controls in series, with each driven separately by a triode section, the two sections of the 12AU7 may be used for this purpose. The Fletcher-Munson circuit may then be inserted between the two halves of the 12AX7. If it requires more than the 0.27 megohm impedance, R_{15}, shown in Fig. 1, this can easily be obtained by increasing the value of both R_{15} and R_{16} to the desired impedance, and increasing the grid resistor R_{17} by the same factor (or not less than ½ this factor). This will, of course, require larger values of R_1R_{11}, etc., and smaller values of C_1C_{11}, etc., by the same factor. It may also be desirable to insert between resistors R_{13} and R_{14} a condenser of appropriate value (such that the product of its capacity and resistor R_{14} gives a time constant of at least 0.025 second) to avoid possible leakage of plate voltage to the grid.

Fig. 1. Circuit diagram and parts list covering the tone-compensating preamplifier. It offers unusual circuit flexibility.



R_1, R_2, R_{31}, R_{11}—See section in text on "Additional Tone Controls"
R_3—500,000 ohm audio taper pot ("Gain Control")
R_4—100 ohm, ½ w. res.
R_5, R_{11}, R_{13}—120,000 ohm, ½ w., res.
R_6—39,000 ohm, ½ w. res.
R_7—560,000 ohm, ½ w., res.
R_8, R_{12}, R_{32}, R_{10}—470,000 ohm, ½ w. res.
R_{13}, R_{33}—10,000 ohm, ½ w., res.
R_{14}—82,000 ohm, ½ w., res.
R_{15}—750,000 ohm reverse audio taper pot (Clarostat M-48, 75,000-V) ("Treble Boost")
R_{16}—5000 ohm audio taper pot ("Treble Cut")
R_{17}—560 ohm, ½ w. res.
R_{18}—500,000 ohm reverse audio taper pot ("Bass Cut")
R_{19}—500,000 ohm audio taper pot ("Bass Boost")
R_{20}—50,000 ohm linear taper pot
R_{21}—200 ohm linear taper pot
R_{22}—150,000 ohm, ½ w., res.
R_{23}—22,000 ohm, ½ w., res.
R_{24}—47,000 ohm, ½ w. res.
R_{25}—1200 ohm, ½ w. res.
R_{26}—500,000 ohm linear taper pot (ganged with R_{27}, R_{28}—IRC Q 11-133) (Part of "Loudness Control")
R_{29}, R_{30}, R_{34}—100,000 ohm, ½ w. res.
R_{31}—1 megohm audio taper pot (ganged with R_{30}, R_{29}—IRC M 13-137) (Part of "Loudness Control")
R_{35}—100,000 ohm audio taper pot (ganged with R_{36}, R_{37}—IRC M 13-128) (Part of "Loudness Control")
R_{38}, R_{39}—1800 ohm, ½ w. res.
R_{36}, R_{39}—270,000 ohm, ½ w., res.
R_{40}—2.2 megohm, ½ w. res.
C_1, C_2, C_3, C_4—See Table 1 and section in text on "Additional Tone Controls"
C_5, C_{20}, C_{28}, C_{30}—.05 μfd., 400 v. metallized cond. (see text)
C_6—2 μfd., 200 v. metallized cond. (see text)
C_7—50 μfd., 25 v. elec. cond.
C_8—20 μfd., 250 v. can-type elec. cond.
C_9, C_{12}, C_{29}—100 μμfd. mica cond.
C_{10}, C_{19}—250 μμfd. mica cond.
C_{11}, C_{21}—500 μμfd. mica cond.
C_{13}, C_{14}, C_{22}, C_{31}, C_{33}—.01 μfd., 400 v. cond.
C_{16}—25 μfd., 25 v. elec. cond.
C_{17}—.5 μfd., 200 v. metallized cond. (see text)
C_{18}—.002 μfd. mica cond.
C_{23}, C_{26}—.03 μfd., 400 v. metallized cond. (see text)
C_{24}—40 μfd., 250 v., can-type elec. cond.
C_{25}, C_{27}—.1 μfd., 400 v. paper cond.
C_{32}—.1 μfd., 400 v. metallized cond. (see text)
C_{34}, C_{35}—.005 μfd., 400 v. cond.
S_1, S_3—2-gang, 11-pos. rotary switch (Mallory 176C or equiv. Author used 5 pos. on S_1, "Treble Boost" and 9 on S_3, "Bass Boost")
S_2—2-gang, 4-pos. switch (Sharp "Treble Cut")
S_3—2-gang, 3-pos. switch (Sharp "Bass Cut")
V_1—5879 tube
V_2—12AU7 tube
V_3—12AX7 tube
The following parts are shown in the photograph on page 57. They make up an equalizing preamplifier used by the author which feeds into the preamp discussed. This equalizing preamp is not covered in the article nor shown in the schematic.
C—30-30 μfd. decoupling cond.
S—Selector switch (AM, FM, TV, equalizing curves for phono)
V—12AX7 tube



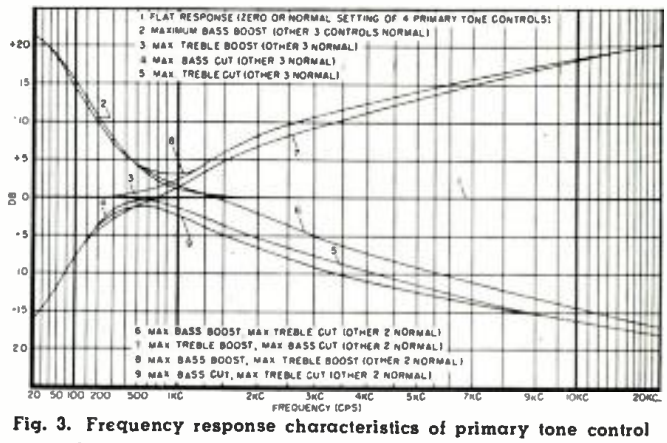


Fig. 3. Frequency response characteristics of primary tone control network. Network shown between halves of 12AU7, V_2, in Fig. 1.

Fig. 2. Response curves of the additional controls. The curves correspond to the network component values shown in Table 1.

It might be pointed out that the primary tone control scheme of Fig. 1, if it is considered to include the entire 12AU7, has the advantage over any scheme with separately driven bass and treble circuit elements of being able to drive another type of circuit (such as the Fletcher-Munson) directly from its output because of its constant and comparatively low output impedance. It has the possible disadvantage of requiring a cathode bias condenser and a 0.5 μfd. coupling condenser. Both schemes are equivalent in providing roughly unity gain at the mid-frequencies.

For those who desire step rather than continuous controls, no change in basic design is necessary; the burden of the problem is to provide switching facilities with the desired resistance steps. A simpler means for obtaining essentially the same result is to use calibrated dials on the panel so that the continuous controls can be set accurately and reproducibly to the desired step value.

To effect a slight economy, a type 6AU6 may be used for the pentode in place of the 5879, using circuit component values recommended in the *RCA* "Receiving Tube Manual," and maintaining the ratios of the resistances in the two-section, low-pass filter to the plate resistor.

For those who have a satisfactory equalizer for their woofer-tweeter dividing network, or who are satisfied with a single speaker, and who do not feel the need for frequency control of bass boost other than that provided by the primary tone control, a simple arrangement is given by merely omitting the 12AX7. The price of the treble boost control and the treble sharp cut-off is that of the *RC* components and switches, since no tubes can be omitted by leaving them out, although an increase in gain (which is not needed) may be obtained.

It is worth noting that the type of primary tone control used in Fig. 1, when considered as not including the second half of the 12AU7, still has an output impedance not exceeding 5600 ohms for the treble and 75,000 ohms for the bass (except for bass cuts). This is suitable for driving the Fletcher-Munson circuit directly. Thus, probably the most economical version of a preamp with all the features listed would have the primary tone control driving the Fletcher-Munson circuit, which then drives the last half of the 12AU7 in a circuit like that of the last half of the present 12AX7. Alternatively, the 12AX7 can be used with its first half connected as a cathode follower to drive the tone control. This version has less gain than the present arrangement. If more gain were necessary for inputs other than the record player, it could be provided by a switching arrangement which would place these inputs on the equalizing preamp of the record player and provide it with a flat characteristic. Or, the gain could be increased for the record player as well by omitting the additional treble boost feature and using a single-section filter for the sharp treble cut-off.

Try constructing this unit for good, reliable performance.

REFERENCES

1. Johnson, E. E.: "A Continuously Variable Loudness Control," *Audio Engineering*, December 1950.
2. Goodell, John D.: "Problems in Phonograph Record Reproduction," RADIO & TELEVISION NEWS, November 1950.

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Table 1. Component values for the additional tone controls and bass and treble sharp cut-offs. Refer to Fig. 2 for the various response curves obtained from the above listings (Curves 1-19). Only one set of values for R_1-R_2-C_1-C_2 and R_3-R_4-C_3-C_4 are shown in the schematic diagram of Fig. 1. Additional controls may be added at the discretion of the builder. Switches S_1 and S_2 have added contacts as shown in the diagram and may be used for this purpose. The condensers involved in C_9-C_{12}, C_{10}-C_{13}, C_{11}-C_{14}, and C_{31}-C_{33}, C_{32}-C_{34} are intended to be substituted for those used by the author. They can be added if the switches S_2 and S_1 are changed to provide the additional contacts required.

CURVE	R_2	C_2	R_1	C_1		
1	0	18 μμfd.	open			
2	0	50 μμfd.	open			
3	100,000	75 μμfd.	open			
4	560,000	75 μμfd.	open			
5	560,000	75 μμfd.	0	50 μμfd.		
	R_3	C_3	R_4	C_4	R_n	C_n
6	120,000	.01 μfd.	0		0	
7	120,000	.001 μfd.	0		0	
8	120,000	.001 μfd.	390,000	.003 μfd.	0	
9	270,000	.0005 μfd.	0		0	
10	270,000	.0005 μfd.	220,000	.009 μfd.	0	
11	120,000	.0025 μfd.	180,000	.016 μfd.	0	
12	470,000	.0003 μfd.	0		0	
13	270,000	.002 μfd.	560,000	.001 μfd.	1.2 meg.	.005 μfd.
14	1.8 megohm	.005 μfd.	0		0	
	C_9, C_{12}	C_{10}, C_{13}	C_{11}, C_{14}			
15	.0001 μfd.					
16		.0005 μfd.				
17			.002 μfd.			
	C_{31}, C_{33}	C_{32}, C_{34}		R_n and C_n is an additional parallel combination in series with R_t.		
18		.005μfd.				
19	.01 μfd.					

By **BERT WHYTE**

THIS month might be described as the "official" opening of the "audio season." Chicago will have had its Fair by the time you read this and the New York Audio Fair will just be getting its exhibit rooms ready for the annual riot. All across the land hi-fi fans will be tuning their beloved systems to still further perfection and consulting their budgets on record expenditures. I hope you have been saving your pennies during the summer, because there is such a plethora of fine LP's that most budgets will require a drastic revision . . . upwards. If you're going to indulge yourself, you may as well have as wide a choice as possible. So once again, I'm going to review more recordings than is usual. Naturally the reviews will be shorter, but that can't be helped if we're to cram in all the good LP's that have made their appearance this summer and early fall. Incidentally, speaking about the N. Y. Audio Fair, I am reminded to tell you that I shall be at the Fair and can usually be tracked down at the RADIO & TELEVISION NEWS exhibit room. If I can be of any possible help to you in your record or equipment problems, drop in for a chat and we'll see what we can resolve.

As promised last month, this issue will inaugurate reviews of tape recordings. I managed to obtain three of the new *RCA Victor* prerecorded tapes and these will constitute the first review with more to follow in the coming months.

Equipment used this month: Fairchild 280 arm and 215a cartridge, *Rek-O-Kut* t12H turntable, *McIntosh* C-108 audio compensator two 30-watt *McIntosh* amplifiers, *Jensen* Triaxial in *Karlson* enclosure, *Jensen* Triaxial in *Jensen* folded horn, *Magnecord* PT63 tape equipment

TSCHAIKOVSKY
SYMPHONY NO. 5
Leopold Stokowski and his orchestra.
DVORAK
SYMPHONY NO. 5
NBC Symphony Orchestra conducted by Arturo Toscanini.
BRAHMS
PIANO CONCERTO NO. 2
Artur Rubenstein, pianist with the Boston Symphony Orchestra conducted by Charles Munch. RCA Victor "Red Seal" pre-recorded tapes. 7½ ips, half-track, $14.95 each. (Tapes courtesy of Sam Goody, New York City.)

It seems kind of funny and it gives me an odd thrill to be writing a review on prerecorded tape! After all the wishful thinking and the drum-beating for this medium it's sort of hard to realize the dream has come true at last. Are the results worth all the trouble and the waiting? Decidedly, yes! I will not go into the musical values represented here, since they have long since been evaluated on the discs, which preceded these tapes. Suffice it to say the performances are excellent, which might be expected of the conductors and orchestras of such formidable reputations. I am sure you are more interested in the technical quality of these tapes, since this was the stumbling block of all previous efforts with pre-recorded tape. Oh, there have been a few decent tapes prior to these. Some of the late *AP Tape Library* material is fairly good, but the quality is offset by the poor repertoire, and orchestras and conductors of considerably less luster than those on the *Victor* tapes. These *Victor* tapes were played back on *Magnecord* PT63 machines fed into the main system. At 7½ in.-per-second, the tapes exhibited good wide range, although it was obvious that the wide range was obtained through pretty heavy treble equalization. This minor defect would only be noticeable on very fancy high-priced equipment and would sound "normal" on the average home machine. Background tape hiss, long a bug-a-boo of previous tapes, while not completely absent, was at such a level that you have to consciously listen for the hiss against the music. For all practical purposes then, hiss is no problem. It was with the dynamic range where the tapes really shone! What a difference from the discs! At last it is possible to hear a piece of music in its proper perspective. Pianissimo passages are *really super-quiet* and the fortissimo passages will positively blow your head off! Even with the tromped-up equalization, this great dynamic range gives you a balance that is fabulous. In other words all the elements which are needed to make a good tape are present in these new *Victors*. Wide range, wide dynamics, quiet background—no more snap, crackle, and pop! The pleasure of listening to tape is also found in the stunning clarity of the individual instruments. Strings are, at last, edgeless and smoothly silken. Brasses have that bright impact which is peculiar to their reproduction on tape, and the uninhibited transients of the percussion are incredibly "live." The tapes themselves were nicely packaged, with the leaders plainly marked with the name of the selection and the speed and which track to play. Pretty rough price you say? Well, there is no use denying that $14.95 is pretty steep. Remember this though, you're getting a truer representation of the music, without the annoyance of record noise, and which (given reasonable care) can be played thousands of times without significant deterioration of quality or increments of noise. Remember too, that this is after all, the pioneer effort by a major record company. Even better quality will come, along with greatly reduced prices, as the market develops. However, it should be pointed out at this time, that it is extremely doubtful if a tape recording will ever be sold as cheaply as discs. To give you but one of many reasons consider this: a vinylite blank on which an LP is pressed costs no more than 5 to 10 cents at the outside. The same record manufacturer has to start with a 7" reel of raw tape to duplicate his recording and the cheapest reel available these days is about $1.90! I think you will agree this is a whopping difference. Take this large basic price and add on all the usual costs such as duplicating, packaging, distributor discounts, etc., and it's easy to see why tape is high priced at the present time. Patience my friends, patience! At least we've actually got pre-recorded tapes and of good quality, too! Many years from now, these tapes may well become collector's items, much the same as the first phonograph cylinders and discs. So a salute to *Victor* for their pioneering and I'll review some more of their output next month.

HANDEL
THE MESSIAH
The London Philharmonic Orchestra conducted by Sir Adrian Boult, The London Philharmonic Choir, Jennifer Vyvyan, soprano; Norma Proctor, contralto; George Maran, tenor; Owen Brannigan, bass. London LLA-19, RIAA curve. Price $23.80.

It is hard to realize that with this edition, *six* versions of this great work are available. Now I'm going to strike out boldly and say that further recording of the "Messiah" would accomplish nothing. In other words, this is a definitive edition as far as I'm concerned. The soloists are all splendid, the choir magnificently trained, the orchestral playing a perfect accompaniment, and Sir Adrian's conducting of the original Dublin score a marvel to the ear. Sir Thomas Beecham's reading I have always greatly admired, but this takes you one step further in the direction of clarity and understanding. The sound is fabulous, with perfect balance maintained between orchestral and vocal forces. String tone is some of the most beautiful on record, the all important trumpets sharp and bright. The famous "Hallelujah Chorus" is simply overwhelming in its cleanly delineated power. 'Nuff said! Listen to the other "Messiahs" if you can, then listen to this great recording. The choice should be obvious and easy. The RIAA curve was better with a couple of db bass boost. Quiet surfaces.

TCHAIKOVSKY
ROMEO AND JULIET
1812 OVERTURE
MARCHE SLAVE
CAPRICCIO ITALIEN
Vienna State Philharmonia conducted by Jonel Perlea. Vox P18700, NARTB curve. Price $5.95.

Here is another of those super "bonus" discs that *Vox* has been putting out lately. This quartet of warhorses gives you well over an hour's playing time, a real bargain for your money. Of course mere length alone is no criterion of the worth of a recording. Happily, there are other virtues combined in this disc, not the least of which is the vigorous and forceful readings of Perlea. His "1812" is especially noteworthy for balance and precision coupled with plenty of fire. Most people will probably buy this disc for the "1812," which is here afforded for the first time on LP, the authentic performance which includes the scoring for cannon, brass band, etc.! As you can imagine, this is productive of some mighty sounds, and even this tired old warhorse perks up when *real cannon* are booming away, along with the great bells, etc. String tone a little strident in spots, but generally a good recording. A solid satisfying buy, especially for beginning audiophiles. The NARTB curve was adequate and surfaces were moderately quiet.

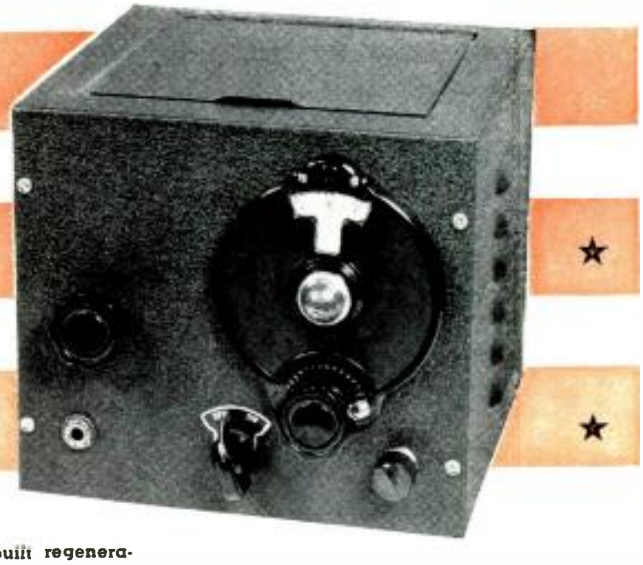
KHATCHATURIAN
VIOLIN CONCERTO
Igor Oistrakh, violinist with Philharmonia Orchestra conducted by Eugene Goossens. Angel 35100. RIAA curve. Price $5.95.

For all those audio martyrs who like this music and the artistry of David Oistrakh, and who have had to endure the miserable recording on *Mercury*, this disc will be welcome indeed. I don't think the *Mercury* people knew at the time they contracted for this work, that what they would receive was the music from an old film track! Even present day Russian material is far from good and the film track was just plain awful. However, the Oistrakh playing and tone and technique was so phenomenal, it was decided to release the work. The disc sold remarkably well, a tribute indeed to this superb artist. In this *Angel* disc we have Igor Oistrakh, son of David, and in nearly every respect an artist as gifted as his father. His technique is simply fabulous as witness a cadenza of his own invention halfway through the first movement. He has a huge soaring tone that is shown off to great

(*Continued on page* 157)

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.

A REGENERATIVE SHORT-WAVE RECEIVER



Over-all view of the home-built regenerative short-wave receiver. It is housed in a cabinet which measures 8 x 8 x 7 inches.

By **WILLIAM C. STOECKER**

A simple, battery-operated receiver that features a tuned r.f. stage. It covers short-wave and three amateur bands.

THE regenerative type of receiver has always been popular. Many of the earliest broadcast sets were regenerative, commercial and home constructed alike, and the regenerative detector was a favorite of radio amateurs for many years. Nearly every old timer in radio has had experience with this type of receiver, and can remember long hours spent in getting the "tickler coil" of his one-or two-tube set adjusted to give the proper amount of regenerative feedback. Although long obsolete as a practical commercial circuit, the regenerative detector is often used by experimenters and beginners interested in building a sensitive and useful receiver without undertaking the rather difficult job of building a superhet. Many articles have appeared on the subject in recent years, and many manufactured kits are sold today to simplify still further the project of building a simple regenerative receiver.

One of the simplest forms of the regenerative receiver for student construction is a regenerative grid circuit detector (triode or pentode) followed by a stage of a.f. amplification (usually a pentode) for headphone reception. A circuit of this type was described by the author in the October 1953 issue of RADIO & TELEVISION NEWS. Sensitivity is good, and selectivity is also fairly good when the regeneration control is advanced, but there is a tendency for very strong signals to "tail off" over a considerable space on the dial and interfere with weaker signals. The use of a single tuned circuit makes construction simple, and avoids the somewhat tricky alignment problems encountered with multiple tuned circuits.

A number of advantages may be gained, however, by using a stage of tuned r.f. amplification ahead of the detector. Not only are sensitivity and selectivity increased, but the isolation of the detector from the antenna circuit eliminates or minimizes several inherent difficulties often present in the regenerative detector. One difficulty sometimes encountered at high frequencies is "body capacity," or the tendency of the detector to change its tuning or regeneration setting slightly as the hand is brought near the receiver or phone leads. This results from the fact that the body becomes part of the antenna circuit and changes its electrical characteristics. This change is then reflected in the tuned circuit of the detector. Other changes in antenna constants, such as physical movements of the antenna or changes of current in adjacent power lines, are likely to detune the detector circuit slightly unless an r.f. stage is used. Another inherent characteristic of the regenerative detector is its tendency to "dead spots," or spots on the tuning dial where the detector cannot be made to oscillate by advancing the regeneration control. It results from resonance effects in the antenna or other circuits which may be coupled to the detector. The use of a tuned r.f. stage reduces this tendency, but may not eliminate it altogether.

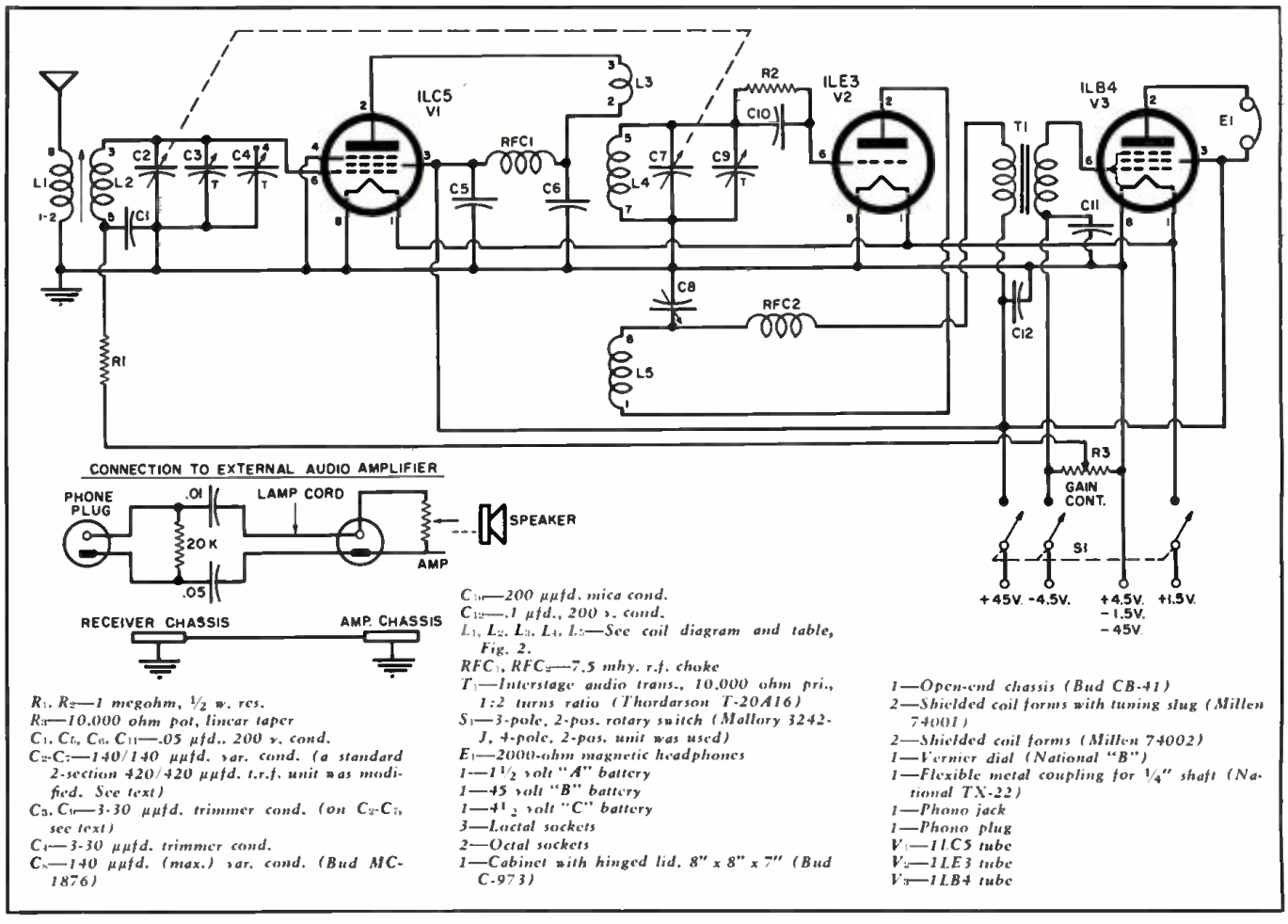
The set described here has three tubes, a pentode r.f. amplifier, a triode detector, and a pentode a.f. amplifier. It is battery operated, requiring a 1½-volt "A" battery, a 45-volt "B" battery, and a 4½-volt "C" battery. The output circuit is designed for headphone reception, but a connection may be made to an external amplifier and speaker if so desired (see Fig. 1). Two sets of plug-in coils are used to cover the desired frequency ranges. Range 1 covers 3.3 to 8.1 megacycles, and range 2 covers 7.7 to 19.9 megacycles. Thus the set includes the 16-, 19-, 25-, 31-, 41- and 49-meter international broadcast bands as well as the 20-, 40-, and 80-meter ham bands. The antenna may be an outside antenna or an indoor wire of any convenient length. The present installation uses a wire about 30-feet long attached to the moulding on two sides of a room.

The receiver has been used chiefly for short-wave broadcast reception. Foreign stations in all parts of the world have been heard; some come in at good headphone volume fairly consistently over periods of weeks or months. There are no dead spots in either of the two ranges used, although there are a few points where the setting of the regeneration control must be increased somewhat as compared with adjacent points. No significant tendencies to body capacity have been observed, and physical movements of the antenna are without effect. Power line changes do have a slight effect on regeneration at one or two places on the high-frequency range, however, since the location of the receiver is somewhat unfavorable in this respect.

Construction is not difficult, and the only electrical equipment required is a standard signal generator to aid in alignment.

Circuit Design

Fig. 1 shows the circuit diagram of the set. It is conventional and most of its features have been used many times before in regenerative receivers. Battery operation was chosen in order to avoid any difficulty due to hum pick-up to which the sensitive regenerative detector would be particularly susceptible, and also to provide a stable plate voltage supply. Unless a voltage-regulated supply were used, a.c. line operation would not provide a sufficiently constant voltage for the detector plate, and the regeneration control would have to be reset frequently.



R_1, R_2—1 megohm, ½ w. res.
R_3—10,000 ohm pot, linear taper
C_1, C_6, C_9, C_{11}—.05 μfd., 200 v. cond.
C_2-C_5—140/140 μμfd. var. cond. (a standard 2-section 420/420 μμfd. t.r.f. unit was modified. See text)
C_3, C_8—3-30 μμfd. trimmer cond. (on C_2-C_5, see text)
C_4—3-30 μμfd. trimmer cond.
C_7—140 μμfd. (max.) var. cond. (Bud MC-1876)
C_{10}—200 μμfd. mica cond.
C_{12}—.1 μfd., 200 v. cond.
L_1, L_2, L_3, L_4, L_5—See coil diagram and table, Fig. 2.
RFC_1, RFC_2—7.5 mhy. r.f. choke
T_1—Interstage audio trans., 10,000 ohm pri., 1:2 turns ratio (Thordarson T-20A16)
S_1—3-pole, 2-pos. rotary switch (Mallory 3242-J, 4-pole, 2-pos. unit was used)
E_1—2000-ohm magnetic headphones
1—1½ volt "A" battery
1—45 volt "B" battery
1—4½ volt "C" battery
3—Loctal sockets
2—Octal sockets
1—Cabinet with hinged lid, 8" x 8" x 7" (Bud C-973)
1—Open-end chassis (Bud CB-41)
2—Shielded coil forms with tuning slug (Millen 74001)
2—Shielded coil forms (Millen 74002)
1—Vernier dial (National "B")
1—Flexible metal coupling for ¼" shaft (National TX-22)
1—Phono jack
1—Phono plug
V_1—1LC5 tube
V_2—1LE3 tube
V_3—1LB4 tube

Fig. 1. Complete schematic diagram of the regenerative short-wave receiver. See Fig. 2 for details on winding the plug-in coils.

The r.f. and a.f. pentodes were chosen from the low-voltage line of battery-operated tubes in order that "B" battery requirements might be held to a minimum. The current drain is 150 ma. from the "A" battery, 3.9 ma. from the "B" battery (42 volts), and 0.5 ma. from the "C" battery. The load is light and batteries last many months.

The r.f. amplifier is an r.f. pentode (1LC5) having a semi-remote cut-off characteristic. The r.f. gain is controlled by means of a variable resistor, R_3, across the "C" battery, and is greatest at the clockwise limit of the control where the voltage applied externally to the grid is zero. Bypass condensers are used at the usual points in the circuit in order to block d.c. voltages and at the same time provide a path for free flow for r.f. currents. In order to realize maximum r.f. gain, the impedance of the plate load has been made quite high by winding a large number of turns on the detector primary, L_3.

The detector is a triode (1LE3) and uses the familiar grid-leak and condenser method for rectification of the modulated r.f. signal in the grid circuit. An r.f. component of current exists in the plate circuit, and is fed back in proper phase into the tuned grid circuit by the tickler winding of the detector coil, L_3. Regeneration is controlled by means of a variable by-pass condenser, C_8, in the ground return of L_5. This method of controlling regeneration works exceedingly well. It is smooth and quiet in operation and permits a very close control over the entire tuning range. Also, the detuning effect of the control is very slight and, usually, is not noticeable. As in all regenerative detectors, however, the regeneration control must be reset whenever the tuning condenser is varied over more than a very small range. In receiving c.w. signals, the detector functions as a tuned-grid oscillator, producing an a.f. note by heterodyning with the incoming signal. The grid circuit detector, considered apart from the regenerative feature, is one of the most sensitive methods of detection ever devised, and was used extensively in the early era of radio. A detailed explanation of its operation may be found in any of the older books on radio, and, as a matter of interest, the constructor is strongly advised to consult one of them.

The audio frequency amplifier is a power output pentode (1LB4) capable of producing 35 milliwatts of power in its plate load. The 1LB4 requires a load impedance of 20,000 ohms, and the usual pair of magnetic headphones (2000 ohms d.c.) has an impedance of this order. Fixed bias was used in preference to self bias since use of the latter would have meant dropping the entire plate voltage supply by 4½ volts (the over-all value of the grid bias).

The detector plate was transformer-coupled to the a.f. amplifier grid using an interstage audio transformer having a 10,000 ohm primary impedance and a 1:2 turns ratio. The advantage of transformer coupling over resistance coupling lies in the fact that the voltage on the detector plate is reduced only slightly from the "B" battery terminal voltage. The detector plate is, therefore, operated at its optimum voltage of approximately 45 volts.

Construction

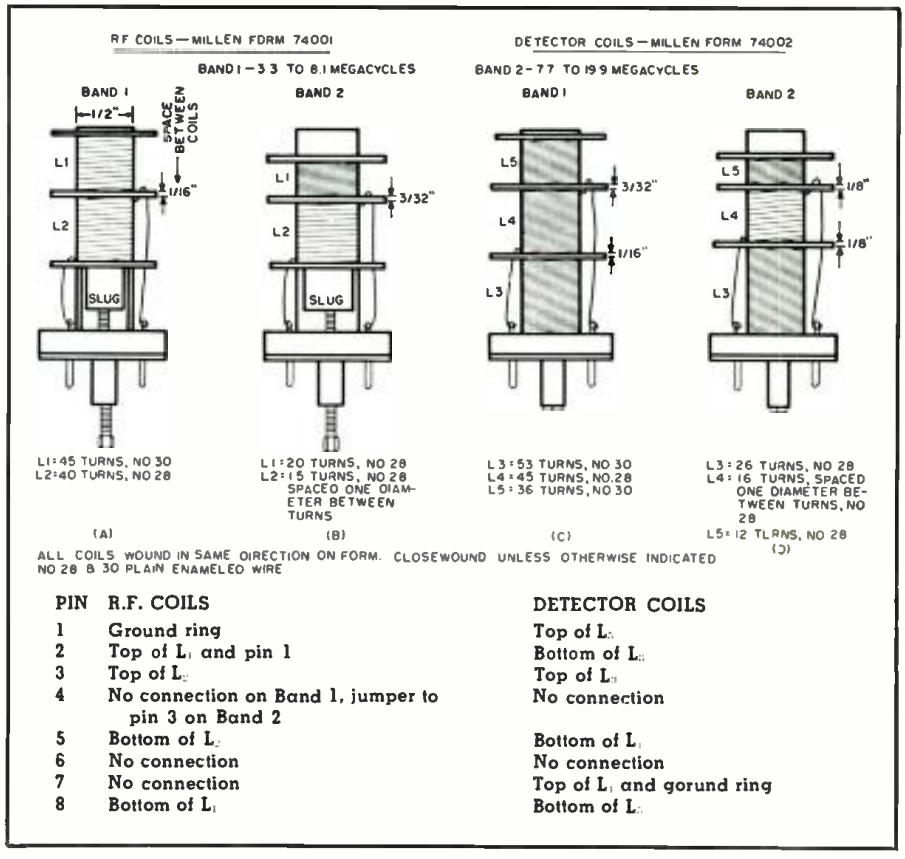
The receiver was built in a standard metal cabinet 8" x 8" x 7" equipped with a hinged lid. A 7" x 7" x ½" open-end chassis was attached to the panel so that the panel and chassis could be removed as a unit. The phone jack, switch, and gain control mountings extend through the panel and chassis front and thus serve to attach the two parts. Since the lower front edge of the cabinet has a flange, two wooden strips were attached to the floor of the cabinet running front to back and extending slightly above the flange to form a support for the chassis. A tray for the batteries 2¾" x 7" was attached to the rear of the chassis in order to keep the batteries from sliding into other parts as the receiver is moved. It was formed by bending an aluminum sheet in the manner shown

in the photographs. Battery, antenna, and ground connections were made to a fiber binding post strip attached to the back end of the chassis. Holes were drilled in the chassis under each terminal large enough to clear the binding post and an attached terminal lug, so that the fiber strip could be mounted flush. The under chassis photo shows this construction. A rectangular window $1\frac{3}{4}$" x $6\frac{1}{4}$" was sawed in the rear of the cabinet 1" from the bottom to provide access to the terminal strip.

The chassis layout was planned to conserve space and at the same time provide the shortest possible leads for the critical coil, condenser, and grid connections. The receiver is compact, and considerable care should be given to the placement of parts, particularly if parts of different manufacture from those of the parts list are used. Begin by mounting the phone jack, switch, and gain control. Then, with panel and chassis attached, place the other parts in their intended location and check to see if the arrangement is satisfactory before drilling holes. See that the variable condensers are mounted far enough apart to give a spacing of at least $\frac{1}{2}$" between the detector coil shield and the plates of either condenser. Wire with No. 20 solid hook up wire and make all leads (except d.c. leads) as short and direct as possible. Ground connections are best made to soldering lugs attached to the chassis with 6-32 machine screws. It is essential that ground leads be short and direct. A punch was used for socket holes in this receiver, but if machine screws are used to mount the sockets, the grounding lugs could conveniently be attached to the mounting screws.

The tuning condenser has two identical 140 μμfd. sections for simultaneous tuning of the r.f. and detector coils. Since no such unit of sufficiently small physical size was available, it was made by removing rotor plates from a 420 μμfd. standard broadcast t.r.f. condenser. Of the fifteen rotor plates on each section, all but the five closest to the dial end were removed. This is easily accomplished by cutting away the spacer to free one plate at a time, bending the plate to the side with a pair of long-nose pliers, and pulling. The condenser was mounted on a steel right-angle bracket secured to the chassis by two screws. The dial was mounted first, and the condenser bracket was then positioned accurately to make the condenser shaft line up properly with the dial. A flexible metal coupling between the condenser and the dial serves the two-fold purpose of correcting any small mechanical misalignment, and preventing stresses applied to the dial or panel

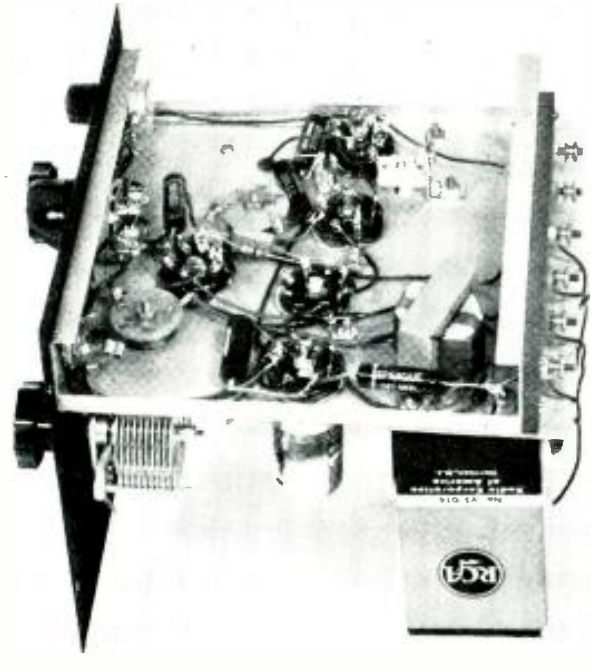
(*Continued on page 76*)



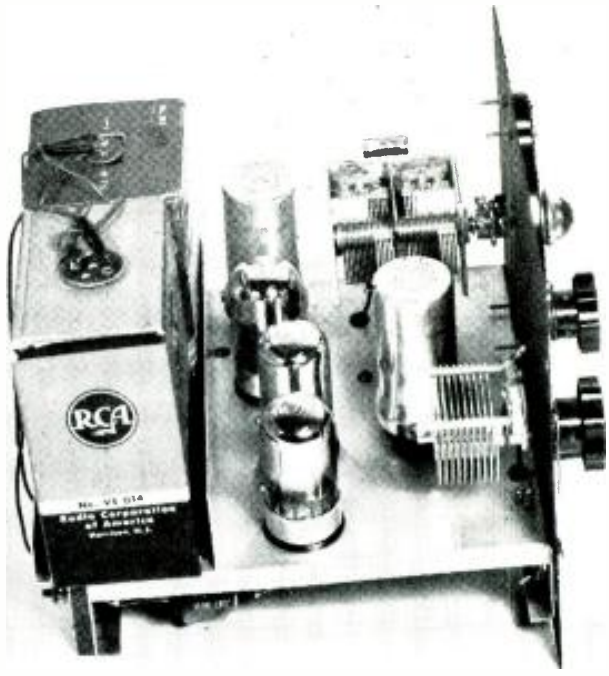
PIN	R.F. COILS	DETECTOR COILS
1	Ground ring	Top of L_3
2	Top of L_1 and pin 1	Bottom of L_3
3	Top of L_2	Top of L_3
4	No connection on Band 1, jumper to pin 3 on Band 2	No connection
5	Bottom of L_2	Bottom of L_3
6	No connection	No connection
7	No connection	Top of L_3 and gorund ring
8	Bottom of L_1	Bottom of L_3

Fig. 2. Coil winding data on the plug-in coils and correct internal coil connections.

Under chassis view of receiver. Parts are not unduly crowded.



Top view showing construction of the battery "compartment."



FUNDAMENTALS OF COLOR TV

DEFLECTION AND HIGH VOLTAGE

By **MILTON S. KIVER**
Author. "Television Simplified"

The new CBS-Hytron 19-inch color TV picture tube. This type 19VP22 tube uses three guns and a curved shadow mask with the phosphor-dot pattern on the curved face plate.

Part 8. The deflection and high-voltage systems of typical color TV sets using the tri-gun tube.

THE deflection system of a tri-gun color television receiver possesses a marked similarity to the deflection system of a monochrome receiver. This is best illustrated by an examination of the deflection system of a color television receiver.

In the vertical section, Fig. 1, there is an integrating network, a blocking oscillator, and an output amplifier. Application of the deflection voltage is made in the normal manner (*i.e., via* transformer) to the two windings of the deflection yoke. The only significant change from monochrome practice is the addition of a vertical convergence amplifier control which evidently supplies some voltage to a special amplifier. More on this presently.

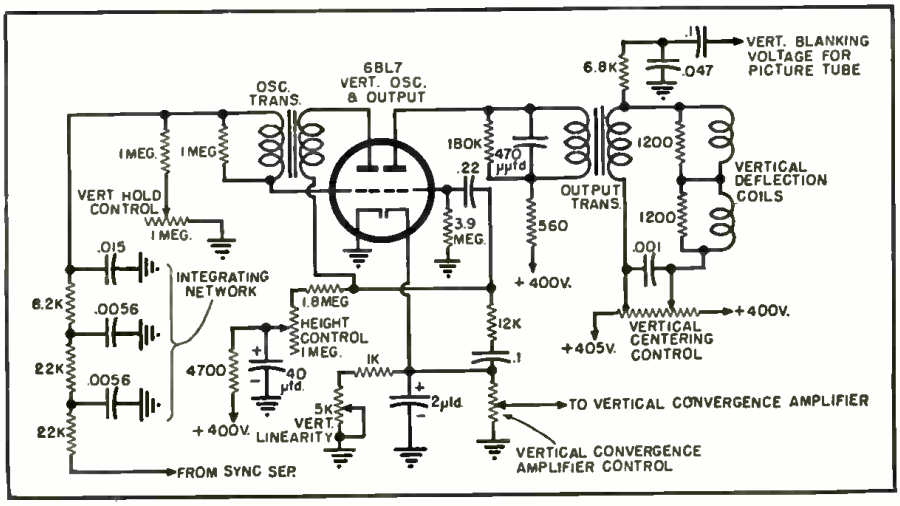
In the horizontal system, Fig. 2, there is a 6SN7 synchroguide horizontal oscillator and control tube, followed by a 6CD6 power output amplifier. The power requirements of the horizontal output stage in a color receiver are greater than for a comparable monochrome receiver because, first, three beams must be deflected instead of one, and second, a 20,000 volt accelerating voltage is required by the tri-gun color picture tube. In addition, there is also a special focus rectifier in the high-voltage system and it, too, must be supplied with power.

The horizontal output transformer contains one main winding and several auxiliary windings. The principal winding provides connections for the plate of the 6CD6, the high-voltage rectifiers, the deflection yoke, and the 6AU4 damper tube. The auxiliary windings provide positive and negative triggering pulses for the various a.g.c. and chrominance circuits, and heater power for the high-voltage rectifiers.

In the circuit of Fig. 2, three high-voltage rectifiers are employed to develop the 20,000 volt accelerating potential required by the tri-gun picture tube. The circuit is apparently unlike any we have ever seen in monochrome receivers although the labeling on each tube does provide some clue as to its function. The first tube is labeled as the high-voltage rectifier, the second tube is called a diode coupler, and the final tube is the high-voltage doubler.

To understand how this section operates, let us examine a high-voltage doubler that was used for a time in monochrome sets. The circuit is shown in Fig. 3. In brief, it operates as follows: During the retrace interval, the voltage developed across the full primary-secondary winding of the output transformer rises sharply to, say 11,000 volts. This causes V_1 to conduct, and C_1 charges to 11,000 volts (after the first few cycles) with the polarity as indicated. In the longer interval between retraces, C_1 and C_2 are seen to be essentially in parallel with each

Fig. 1. The vertical sweep system of an RCA color set for a 15-inch tube. Aside from the voltage made available for a vertical convergence amplifier, the circuit is identical to the vertical stages found in many black-and-white television receivers.



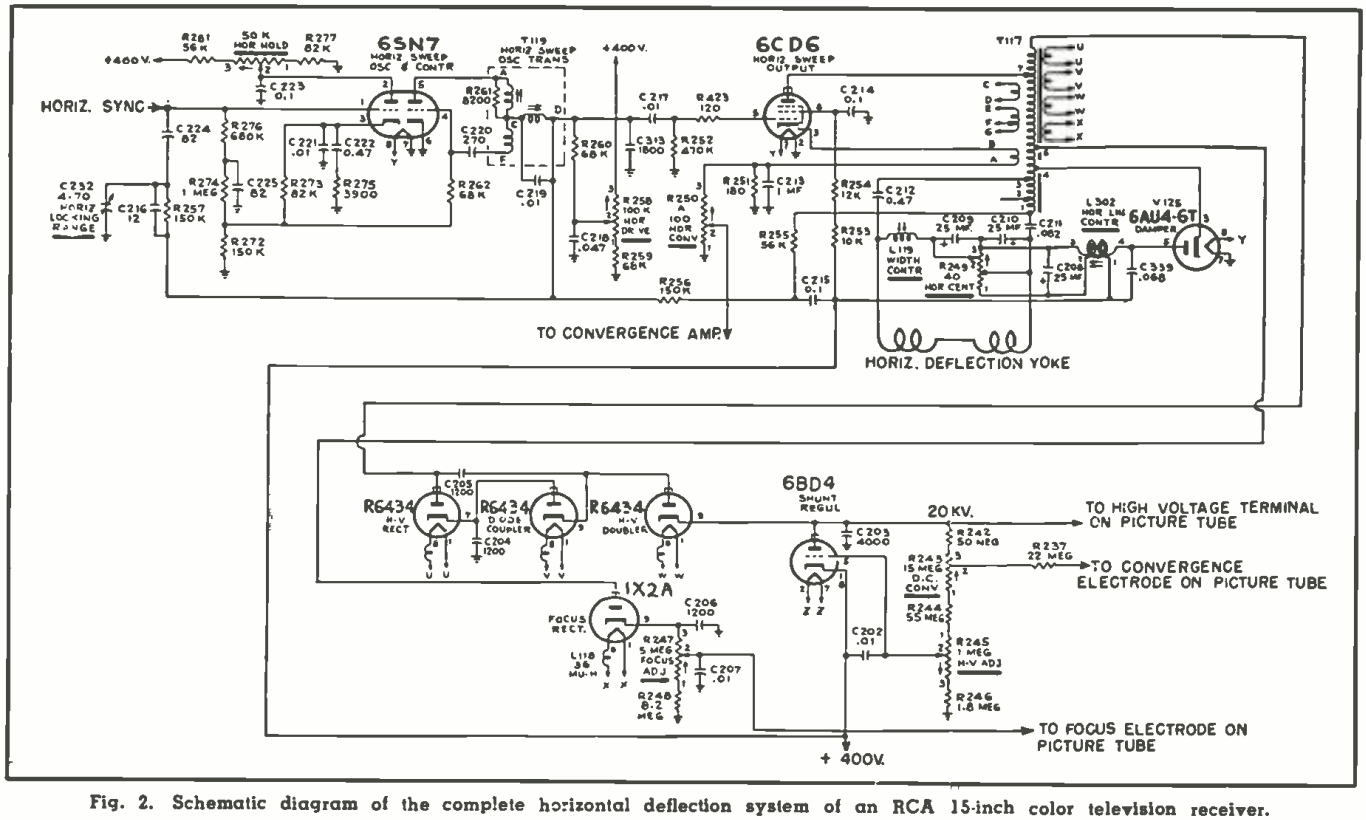


Fig. 2. Schematic diagram of the complete horizontal deflection system of an RCA 15-inch color television receiver.

other through the primary-secondary winding of T_1 and R_3, R_4, and R_5. Hence, C_2 also charges up to the full 11,000 volts.

At the next retrace interval, 11,000 volts once again appears across the transformer. If we pause at this moment and add up the voltages existing between point "A" and ground, we see that the transformer voltage and the voltage across C_2 are equal to 22,000 volts. This potential is applied to V_2, causing this tube to conduct, and C_3 charges to 22,000 volts with the polarity indicated. Losses in the circuit plus the current drain on the power supply by the picture tube usually reduce the output voltage to some value less than twice the peak applied pulse, say 20,000 volts.

It can be seen from the preceding discussion that the purpose of the resistive network of R_3, R_4, and R_5 is to help transfer the charge from C_1 to C_2 and thereby assist in the voltage doubling action. The same job can be accomplished more efficiently (*i.e.*, with less high-voltage power loss) by substituting a diode for the resistive network. When this is done, the circuit of Fig. 3 becomes equivalent to that of Fig. 2.

Within the same high-voltage supply of Fig. 2 is a special triode (6BD4) labeled a shunt regulator. The purpose of this tube is to maintain a constant load on the high voltage power supply so that changes in picture contrast will not cause the high voltage to change, with corresponding variations in brightness, focus, and deflection (*i.e.*, picture size). What the regulator tube does, in essence, is vary its internal resistance in a manner opposite to the current drawn by the picture tube. For example, when a bright element is being traced out on the screen, picture-tube current is high and the drain on the high-voltage power supply is increased. During this interval the drain of the regulator tube is reduced by a proportionate amount.

Conversely, when a darker portion of the picture is being traced out, the current requirements of the picture tube are reduced. This reduction would

EDITOR'S NOTE: Part 1 of this series, which appeared in the March, 1954 issue, explained color mixing and its application in color TV. Part 2, appearing in the April issue, described the NTSC color signal. The block diagram of a typical color TV receiver was described in the May issue. The June article in this series described the tuner, sound, and some of the video circuits of a color receiver. Typical chrominance circuits (demodulator, matrix, adders, etc.) were analyzed in the July article. The formation and composition of the color signal were explained in August. Color synchronization circuits including the subcarrier oscillator were analyzed in September.

In view of the many requests received, RADIO & TELEVISION NEWS will publish this series in reprint form. The first three parts are in a single unit (50 cents), the balance will be reprinted in individual parts at 20 cents each. For quantities of 50 or more, write for quotations. Address your inquiries to RADIO & TELEVISION NEWS Reprint Editor, 366 Madison Ave., N. Y. 17, N. Y.

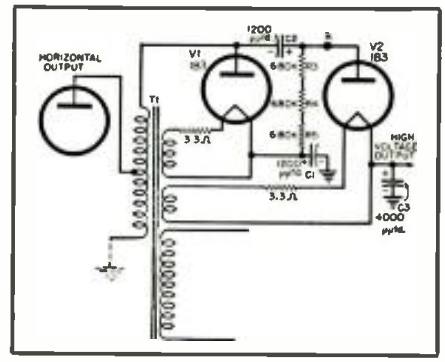
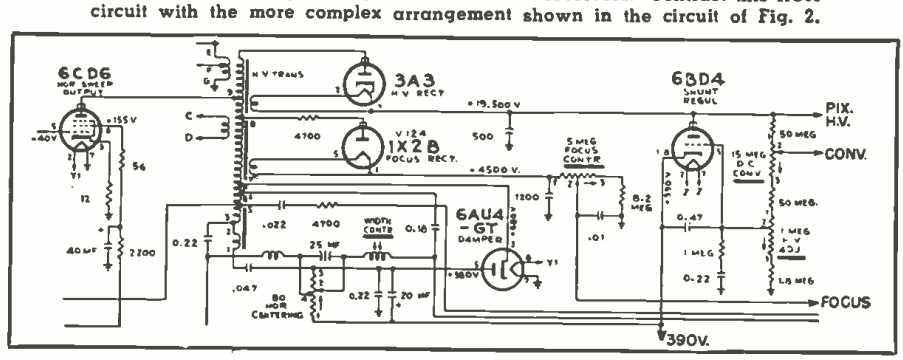


Fig. 3. A voltage-doubler circuit of the type used in monochrome sets for high voltage. The bottom of the primary of T_1 appears grounded to the 15,750-cycle horizontal retrace pulses.

Fig. 4. Color TV high-voltage supply using a type 3A3 rectifier, especially developed for the high-voltage circuits of color receivers. Contrast this RCA circuit with the more complex arrangement shown in the circuit of Fig. 2.



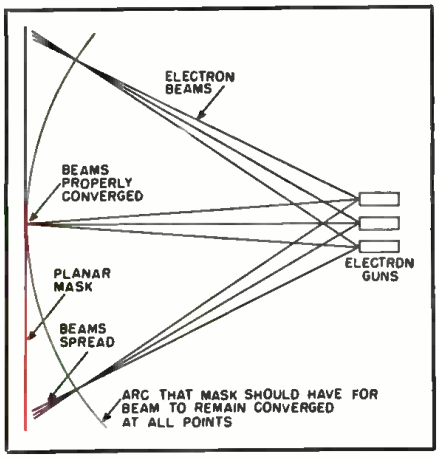


Fig. 5. Electron beams are not converged at edges of flat screen because it does not conform to the arc of focus points.

tend to cause the high voltage to rise were it not for the fact that now the regulator tube increases its current drain, thereby maintaining a constant over-all load on the power supply. And this, in turn, keeps the high voltage constant.

The shunt regulator accomplishes its purpose in a relatively simple manner. The tube is shunted across practically all of the high voltage bleeder. The plate of the tube goes to the top of the bleeder network while the cathode is returned to a positive potential point, in this instance about 400 volts. The grid is then tapped into the bleeder network at a point which will provide it with the necessary bias voltage with respect to the cathode.

The circuit is now ready to function. If the high voltage rises, due perhaps to less current drain by the picture tube, then this increase, in part, will be transmitted to the grid of the regulator triode because of the grid tap on the high-voltage bleeder string. A more positive grid means increased tube current flow and if the circuit has been properly designed, this increased current will just take up the slack shed by the picture tube and bring the high voltage down to its correct level.

On the other hand, when the picture tube draws more current, the high voltage has a tendency to drop. This lowers the voltage across the bleeder, providing less positive voltage for the shunt regulator and thereby driving its grid more negative. This reduces the current drawn by the regulator and tends to counteract the increased picture tube current. Again, the high-voltage system sees a fairly constant load and its voltage value remains stable.

The focus rectifier, a 1X2A, is connected to a lower point on the output transformer winding than the high-voltage rectifier and, in consequence, develops a lower output voltage. The voltage ordinarily required by the focus electrode in the tri-gun picture tube is in the neighborhood of 2500 to 5000 volts. The need for a separate rectifier stems from the appreciable amount of current that the focus electrode draws.

The convergence electrode of the picture tube must also have a high voltage, between 8500 and 10,500 volts, but since the current drawn by this element is practically nil, the voltage can be obtained directly from the 20,000 volt line by simply inserting a resistive divider network between the 20,000 volt line and chassis ground. This is the procedure followed in the circuit of Fig. 2.

The damper tube in the output circuit absorbs whatever excess energy is developed during the horizontal retrace interval and converts this into an equivalent amount of voltage which is then combined with the receiver "B+" to provide a boosted "B+" voltage. In the circuit of Fig. 2, this boosted "B+" is employed only by the plate of the 6CD6 horizontal output amplifier.

Electrical centering is usually employed with the tri-gun color picture tube. For this purpose there are vertical and horizontal centering potentiometers, each with enough d.c. potential difference across it to achieve the picture centering variation.

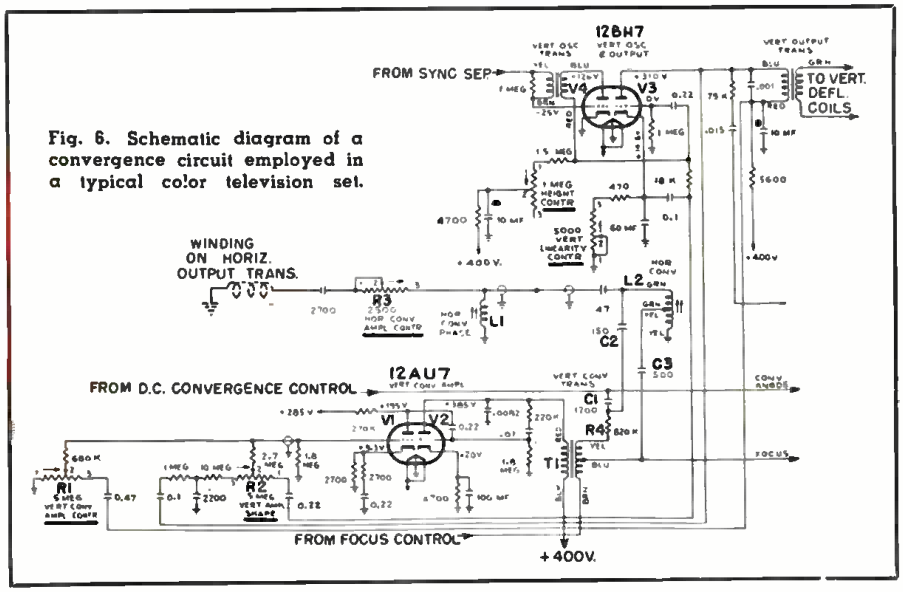


Fig. 6. Schematic diagram of a convergence circuit employed in a typical color television set.

While many of the initial receivers employed three high-voltage rectifiers, subsequent models functioned satisfactorily with a single high-voltage tube. The circuit shown in Fig. 4 uses a newly-designed 3A3 high-voltage rectifier. 19,500 volts are developed directly and this value is maintained by a 6BD4 shunt regulator. Aside from this change, the rest of the circuit is similar to that of Fig. 2.

Also used to some extent instead of the 6BD4 is a 6353 gaseous regulator. The unit is shaped in the form of a long, narrow cylinder which is filled with hydrogen gas. Operation of this rectifier is similar to VR tubes where the current drain is dependent on the applied voltage. As the voltage attempts to rise, the current drain increases and this keeps the voltage from rising. The 6353 may be considered as a passive regulator in that the applied voltage must exceed a certain level before the unit will begin to function. Electronic regulators, such as the 6BD4, are capable of providing more effective control. Their cost, however, is higher now.

Convergence Amplifiers

The one remaining section of a color television receiver still to be examined is the convergence amplifiers. It was probably noted in some of the previous diagrams that there were voltage take-off points in the output stages with the notation, "to convergence amplifier." A typical circuit to which these voltages are fed is shown in Fig. 6, but before we undertake an examination of how these stages operate, it may not be amiss to review briefly what they do and why they are needed.

The scanning surface of the fluorescent screen in the picture tube is either flat or slightly curved. The same is true of the shadow mask which is positioned slightly in front of the phosphor dot screen. Now, in order to obtain an image which possesses the correct colors and is properly focused, two independent actions must occur. First, to have each of the three electron beams strike only one color, it is necessary that the beams pass through the same hole on the shadow mask at the same time and strike individual phosphor dots.

When the beams are in the center of the screen, we can cause them to converge properly by adjustment of the d.c. voltage which is applied to the convergence electrode in the picture tube. This adjustment, however, is effective only in the center of the screen. As the beams move away from the center, they tend to converge at points in front of the mask because the distance from the flare of the tube to the center of the screen (or mask) is less than the distance from the flare to the ends of the screen or mask surfaces. See Fig. 5.

A similar situation exists for beam focus (at the phosphor dot screen). That is, a beam properly focused at the center of the screen will move progressively out of focus the farther it swings from the center.

To correct both of the foregoing conditions, we need a special parabolic voltage (shown in Fig. 7B) which, when added in series with the d.c. focus and convergence voltages, causes them to change (*i.e.*, increase) as the beam moves away from the center of the tube. It is the purpose of the convergence amplifiers to provide such a correcting voltage.

A 12AU7 dual-triode amplifier in Fig. 6 functions as the vertical convergence amplifier. The input to the first triode, V_1, is obtained from the vertical output amplifier. One line, from the vertical amplifier V_3 plate, develops a parabolic wave across R_1. This is the "Vertical Convergence Amplitude Control" and it controls the amplitude of the parabolic wave reaching V_1. The variation extends from 0 to 200 volts peak-to-peak.

A second control in the input circuit of V_1 is the shape control, R_2. This varies the tilt of the parabolic wave by introducing either a positive or a negative saw-tooth voltage. The latter is obtained from either the plate or cathode of the vertical output amplifier, depending upon the position of the center arm of the shaping control. (R_2 has one end connected to the plate of V and the other end to the grid. The signal shift between these two circuits is 180° and by altering the position of the movable arm of R_2, we can add positive or negative saw-tooth voltage to the parabola appearing across R_1. At some intermediate point on R_2, zero saw-tooth voltage is applied to V_1.)

The voltage reaching the grid of V_1 is amplified, first by V_1 and then by V_2. After that it is transferred to T_1 where it combines with the horizontal convergence voltage. The latter signal is developed by tapping off a negative pulse from a winding on the horizontal output transformer and feeding this pulse to two series-tuned resonant circuits, L_1 and L_2. The waveform present across L_2 is shown in Fig. 7D. It is essentially a sine wave but with enough parabolic curvature to adequately perform its function. R_3 controls the amplitude of the horizontal convergence waveform. The movable slug in L_1 controls the phase of the waveform at minimum setting of R_3 while the slug in L_2 controls the waveform phase at maximum setting of R_3.

The horizontal and vertical convergence circuits combine their output voltages *via* C_2, C_3, and R_3, producing the resultant waveform shown in Fig. 7E. This voltage is then appropriately combined with the d.c. focus and convergence voltages and applied to the corresponding electrodes in the tri-gun picture tube.

In monochrome receivers, the picture tube has a single brightness control which is used to vary the background or over-all screen illumination. All other d.c. potentials on the tube are fixed at certain specified values. In the tri-gun color picture tube, we are dealing with three separate electron guns and three separate phosphors. Not all the phosphors possess the same efficiency: red, for example, has the lowest efficiency and hence requires the highest beam current. Failure to provide for this will give the screen a bluish-green tinge. In consequence, the screen and control grid voltages for each of the three electron guns are individually adjustable. See Fig. 8.

The controls in the cathode leg of the picture tube determine control-grid bias. The higher the arms move up on the controls, the more negative the control grids become. The green and blue guns possess the same bias as the red gun only when their potentiometer arms are at the bottom of the controls (maximum counterclockwise position). For all other settings of these two controls, the blue and green guns have a more negative grid, hence less gun current.

A sample procedure indicating how these six controls are adjusted is as follows. (The control-grid potentiometers are frequently called the background controls.)

1. Set the three screen-grid controls to maximum.
2. Set the background controls to produce a grey picture at low brightness.
3. Turn up the brightness control. (Note that this is the red background control. It is the only one of the group that extends to the front panel.)
4. As the brightness is increased, note which color becomes dominant and the screen-grid voltage on the gun associated with this color.
5. Reduce the brightness and reset the background controls.
6. Repeat steps 3, 4, and 5 until no color tinting can be observed over the normal range of brightness levels.

The proper setting of the background and screen-grid controls to produce a black-and-white picture is also the proper setting for color reception.

(To be continued)

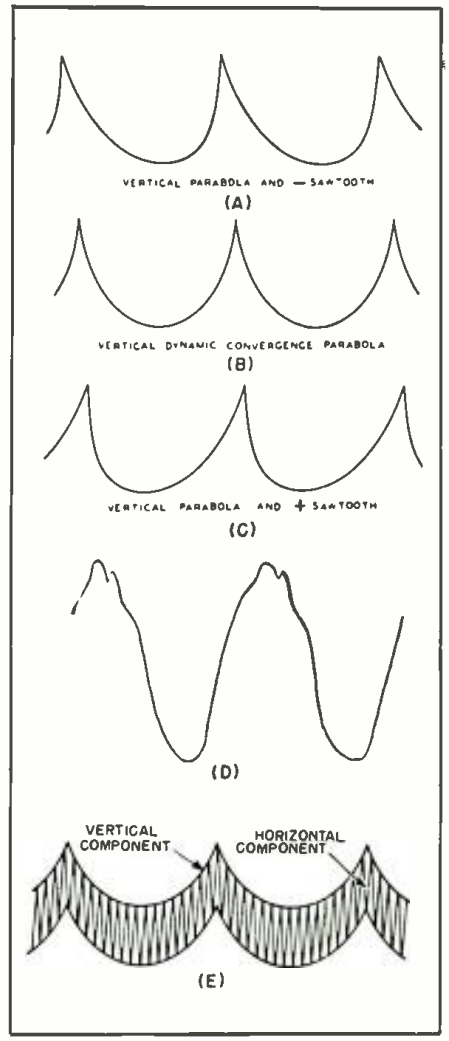


Fig. 7. (A), (B), and (C) show the vertical dynamic convergence waveforms employed in the circuit of Fig. 6. (D) is the convergence waveform in the horizontal circuit, and (E), the resultant parabolic waveform which is combined with the d.c. focus and convergence voltages.

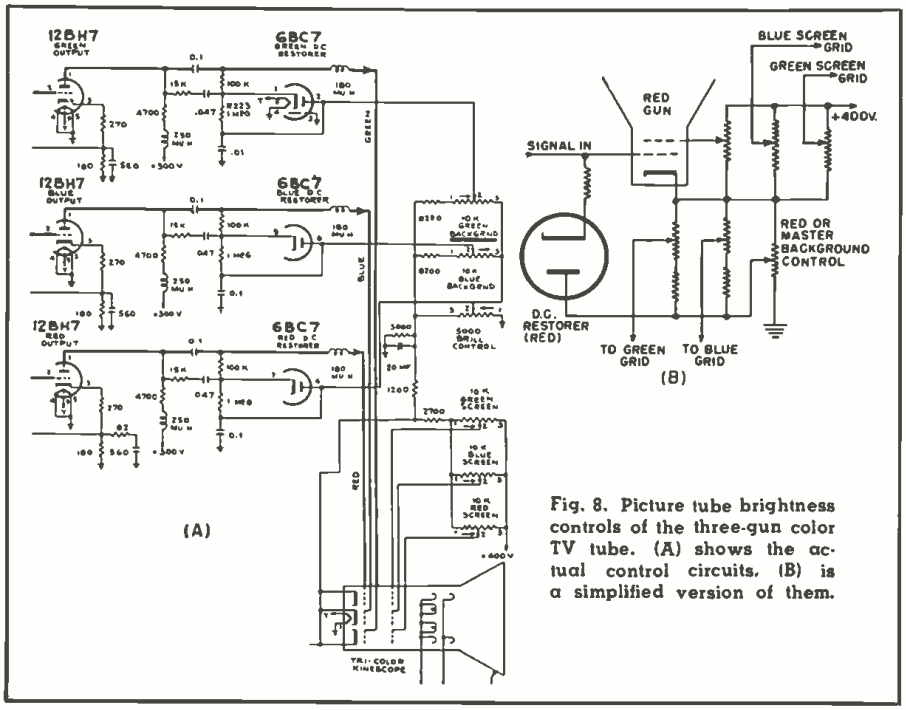


Fig. 8. Picture tube brightness controls of the three-gun color TV tube. (A) shows the actual control circuits. (B) is a simplified version of them.

ECONOMY MODEL TV SETS

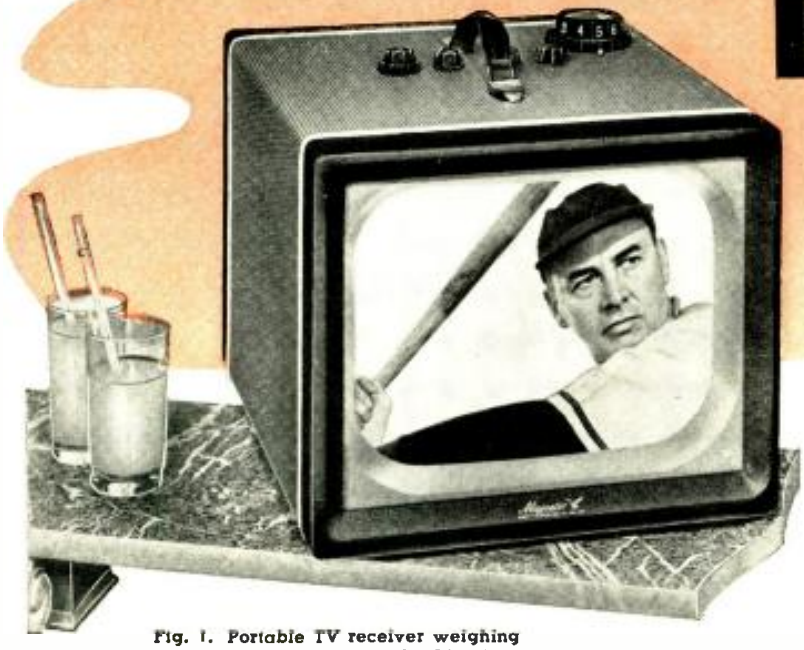


Fig. 1. Portable TV receiver weighing 39 pounds and using only 14 tubes.

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

Here's how TV manufacturers are using fewer tubes in their new, inexpensive, lightweight TV sets.

JUST as the radio industry simplified and improved home radios until the 5-tube a.c.-d.c. superhet became a standard receiver, so is the television industry striving for a streamlined, minimum-expense set. While price is, of course, the major consideration, optimum performance and good serviceability are also essential features since they influence customer acceptance in the long run. All major manufacturers now offer a line of low cost, good performance receivers which incorporate many new features. New tubes, new components, and different chassis layouts deserve the service technician's close attention.

Performance

The important thing about the new economy TV sets is the fact that, although the number of tubes is reduced, the operation of each section and the over-all performance are as good as in earlier models. Every one of the receivers described here has a regular, two-tube r.f. tuner, at least three i.f. stages, a diode detector, pentode video amplifier, good intercarrier sound, and conventional sync and sweep circuits. Picture tubes of 14-, 17-, and 21-inch rectangular screen sizes are used, and anode voltages up to 16 kv. are provided. Conventional components such as resistors, condensers, coils, and transformers are still used, although some manufacturers employ more printed circuit sections and some even use printed wiring in certain subassemblies. The author has checked sensitivity and bandwidth of several typical economy sets and found them to be quite acceptable even for intermediate fringe operation. For extreme fringe locations the gain of three i.f. stages and the noise figure of a pentode r.f. stage is not sufficient. A cascode tuner and four i.f. stages with good noise immunity in the sync section are required for a real fringe location or where a particularly noisy signal is received.

Deflection and high voltage sections in the new models are generally well designed and operate as well or better than the older, more complex circuits. A simple autotransformer flyback is used almost universally. The increased efficiency of the transformer core material as well as better winding techniques permit high voltage circuits to be built which supply 16 kv. and 90 degree deflection, all on only 250 volts "B+."

The relatively low "B+" input power required for the more efficient flyback sections makes it possible to simplify the power supply and use selenium rectifiers in a doubler circuit. This is not a new feature, but previously, the selenium voltage-doubler power supply was rarely used for large screen sets.

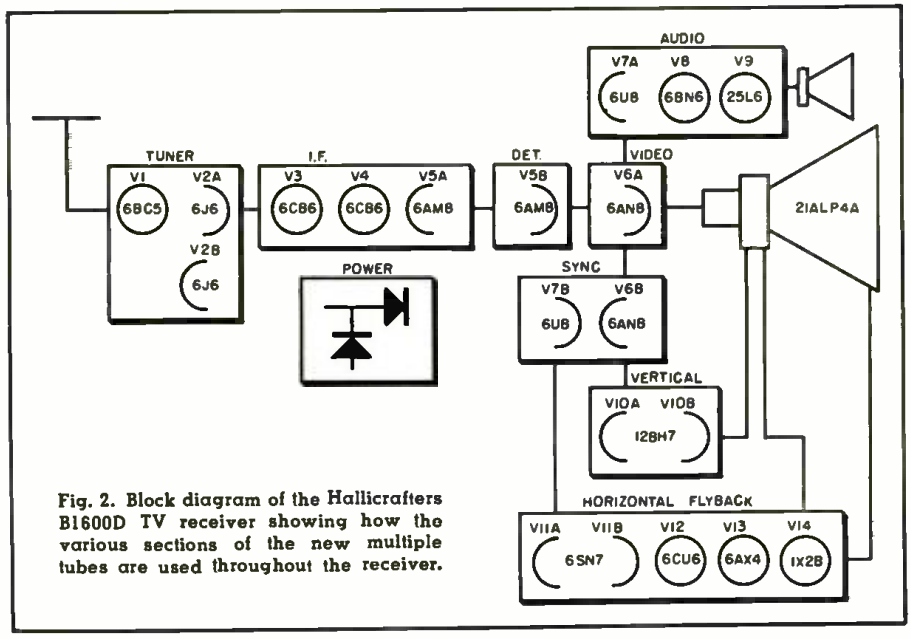


Fig. 2. Block diagram of the Hallicrafters B1600D TV receiver showing how the various sections of the new multiple tubes are used throughout the receiver.

Typical Receivers

The photograph in Fig. 1 shows the *Majestic* model 40 portable TV set which weighs only 39 pounds, uses a vertical chassis, and employs 14 tubes —many of them multi-purpose types. Similar in appearance, but slightly larger and heavier is a 17-inch model having the same basic chassis and performance features. The *Olympic* 14-inch portable receiver also uses a vertical chassis, 13 x 13 inches, and employs only 13 tubes. Other manufacturers offering vertical chassis models with multi-purpose tube circuits are *Crosley* ("Super V" series), *Hallicrafters*, *Emerson*, *Raytheon*, and *CBS-*

Columbia. *Admiral* and *RCA* have not announced vertical chassis for their fall line, but their circuitry is based on multi-purpose tubes.

Admiral has initiated the use of printed wiring in some audio i.f. subassemblies and expects to eventually employ this technique for most of the wired portions of the TV receiver. The printed wiring system used here replaces only the wires and uses conventional components, mounted on terminals on the insulating board. The individual resistors and condensers are mounted by their leads on the terminals and the solder connections are made by dip-soldering the entire subassembly.

To see how multi-purpose tubes are used in a typical receiver, refer to Fig. 2, the functional block diagram of the *Hallicrafters* model B1600D. Although other sets use some of the same multisection tubes, this diagram shows the greatest variety and includes most of the latest receiving tubes and features. Note that an inexpensive, pentode r.f. amplifier type v.h.f. tuner is used here. Although this tuner does not offer the extreme in low noise and high gain, it is satisfactory for good, and even for fairly weak signal areas. The 6J6 dual triode employed as mixer and oscillator was one of the first multi-purpose tubes used.

In the i.f. section three pentode amplifiers are used, the last of which is a new type tube, the 6AM8. This is a miniature 9-pin tube which contains an r.f. pentode and a separate diode section in the same envelope. The pentode serves as an i.f. amplifier and the diode is used here as second detector. A single heater connection serves both tube sections and if either section should become defective, the entire tube must be replaced.

The next multi-purpose tube is the 6AN8 which contains a pentode and a triode section in a single, miniature 9-pin, tube envelope. The pentode section of the 6AN8 is used as a video amplifier while the triode section serves as a sync separator. In the audio i.f. section the 4.5 mc. signal extracted from the plate of the video amplifier is amplified again by the pentode section of the 6U8, another 9-pin dual-purpose tube. Instead of the ratio detector and voltage amplifier circuit, FM detection is accomplished by the 6BN6, a gated-beam tube. A 25L6 is used as audio output tube.

In the sync clipping and separating section the two triodes usually used are replaced by the triode sections of the 6U8 and the 6AN8. As will be shown later, the characteristics of these triodes are very similar to those of the medium-mu types usually used.

In the vertical sweep section of Fig. 2, a 12BH7 dual triode is used as the blocking oscillator and output amplifier, a circuit found in many of the 1952, 1953, and 1954 TV models. The only novel aspect of the horizontal sweep and high voltage section is the appearance of the 6CU6, a more rugged version of the familiar 6BQ6.

The power supply of this receiver deserves some consideration since a number of "streamlined" portions can be found there. Fig. 3 is the schematic diagram of the *Hallicrafters* model B1600D power supply. At first glance the diagram appears somewhat too simple for a receiver driving a 21-inch rectangular tube, but the improved receiver circuitry makes the use of such a supply quite possible.

Transformer T_1 is a special heater transformer with a separate winding for the 6AX4 damper tube and taps on the primary for the heater power for the other tubes. The 6.3 volt tap provides the heater voltage for all tubes, including the picture tube, except the 25L6 which has a separate tap at the 25-volt point. This transformer is unique with the *Hallicrafters* set since other manufacturers use either series heater arrangements or else employ a standard type heater transformer.

The selenium voltage-doubler circuit in Fig. 3 is not new, but the use of large size, cardboard-cased electrolytic filter condensers is some improvement in that it provides better a.c. filtering. Since both 260- and 150-volt "B+" points are used in the receiver, the 25L6 audio output tube is used in place of a bleeder resistor. The plate of the 25L6 is connected to the 260-volt bus while the cathode of this tube goes to the 150-volt point. The 25L6 passes sufficient current for all the 150-volt circuits.

Another improvement in the power supply is the inclusion of R_1, a fusible resistor, which serves as a series limiting resistor to protect the selenium rectifiers from voltage surges. It also acts as a fuse in case a short occurs in the power supply.

While the selenium voltage-doubler circuit used by other receiver manufacturers is essentially the same, the

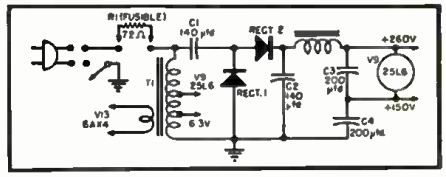


Fig. 3. Schematic of the low-voltage power supply of the Hallicrafters TV receiver model B1600D. Note the rather unusual heater transformer and the use of the 25L6 as a voltage divider.

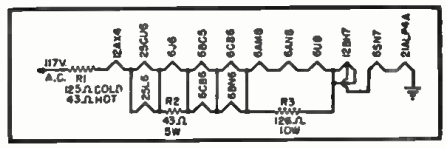


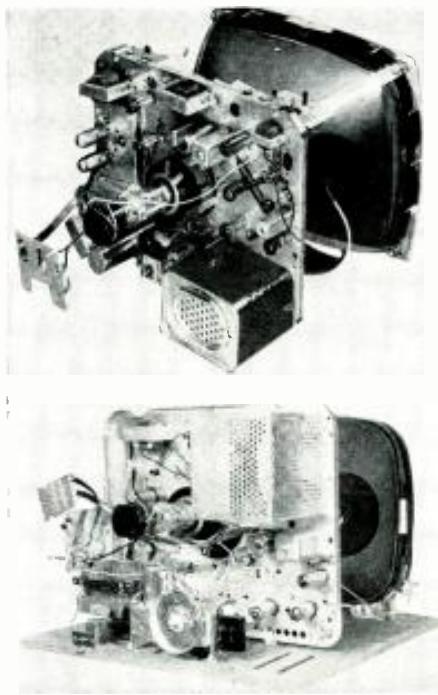
Fig. 4. Series heater connection used in the Crosley model 431 TV set.

heater string arrangements vary with different models. Fig. 4 shows a typical series heater circuit as used in the *Crosley* model 431 TV set with a 21-inch picture tube.

One of the drawbacks of a series heater arrangement like the one shown in Fig. 4, is the fact that the resistance of each tube heater changes as the tube warms up. At the start, with the heaters cold, the series resistance of the entire combination is low, causing more than the rated current to pass through each heater. Eventually, this will burn out one of the heaters, usually the weakest one in the string. If, in the circuit of Fig. 4, the 25L6 or any of the other parallel-connected tubes burns out, the second parallel heater (the 25CU6) would have to carry too much current and consequently would also burn out. Replacing each tube individually will not help, for the new tube will burn out again. The only correct trouble-shooting procedure in a defect of this type is to check the entire heater string carefully for continuity and, if a paralleled pair of tubes has burned out, replace both at the same time.

The temperature sensitive resistor R_1 in Fig. 4 prevents the full 117 volts a.c. from appearing across the heater

(*Continued on page* 175)



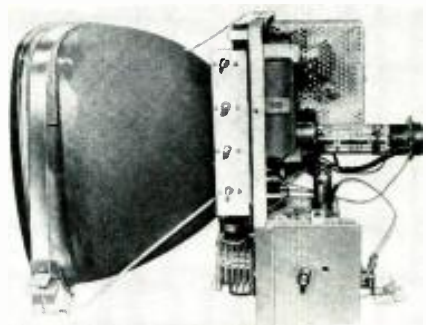
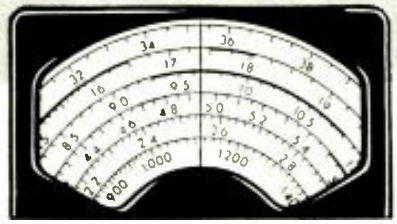


Fig. 5. Upper left, Raytheon "Challenger" 17-inch set. Right, side view of the Hallicrafters PT-17 chassis. Bottom left, rear view of the Crosley "Super V" 17-inch TV chassis shown with the optional u.h.f. tuner at the bottom. This tuner is connected via a dial cord arrangement to the set's u.h.f. channel selector on the left.

International SHORT-WAVE



Compiled by KENNETH R. BOORD

BY THE TIME you read this, some stations may have gone to *winter* schedule (and/or frequencies); in such cases, some schedules may now be *one hour later* than listed herein.

Afghanistan — Kabul Radio, 9.975, noted in Japan opening 1213, at 1230 announced in *English*, R3, S6-8. (JSWC)

Alaska — ALF, 9.740, announcing "Alaskan Communications System, Juneau," noted *testing* 2220, good level, "squeezed" by other stations. (Niblack, Ind.) KLE heard *testing* on 5.970A at 0517-0620, QRM from CBNX; announces continuously, "This is KLE, broadcasting in Central Alaska from Ketchikan." (Reidler, Pa.)

Albania—Radio Tirana, 7.850, noted 1700-1715 in *English*, weak level, heavy QRM. (Hill, N. H.) Uses 6.570 in parallel. (ISWC, England) Should also have *English* 1400.

Algeria—Radio Algerie, 6.160, heard in Sweden with news in Arabic 1650-1720. (Etersvep, Sweden)

Angola—Luanda, 11.862, noted 1030 with chimes, call in Portuguese, then light music. (Kristiansand S. DX Club, Norway)

Argentina—SIRA (the international service) terminated broadcasting "permanently" at the end of last December. Of the SIRA channels, *Radio Splendid* uses 11.88; *Radio El Mundo* uses 15.29, and *Radio del Estado* uses 15.345, 9.690. (Cody, Ireland) *Radio Splendid*, 9.310A, is excellent around 2000. (Rugel, Kans.)

Australia — VLW9, 9.610, Perth, Western Australia, good level around 0245 with classical music. (Kapp, Calif.) VLM4, 4.917, Brisbane, Queensland, noted 0630. (Koch, Ore.) VLA15, 15.200, is good signal 2300. (Mast, N. Y.; Grosman, D. C.; O'Brien, N. Y.) And closing 2315. (Kirby, Mo.) VLB9, 9.58, noted 0020-0110 at good level parallel with 15.32, 17.84. (Ashworth, N. C.) *Radio Australia* now has *experimental* transmission to Europe with French 0100-0145, 7.280, and *English* 0145-0315; for South Pacific Service 2330-0315 now uses 11.760 replacing 9.580. (Radio Australia)

Austria — Radio Oesterreich, 9.664, Vienna, tuned 0245 with light musicals. (Pearce, England) *Blue Danube Network*, 5.080, Salzburg, S6-7 at 1735. (ISWL, England)

Azores—CSA92, 11.925, Ponta Delgada, still noted 1400-1500 but may be on *winter* schedule of 1500-1600 soon. (Niblack, Ind., others) CSA93, 4.845, heard 1758 with closing announcements in Portuguese, closed 1800 with "A Portuguesa," good level. (Hill, N. H.) In *winter* should run to 1900.

Belgian Congo — OTC, 9.655, Leopoldville, noted with relay of ORU, Brussels, to North America 2000-2200. (Collins, Iowa, others)

Belgium—Brussels, 11.85, noted 1937-2000 with music. (Grosman, D. C.)

Bolivia—CP38, La Paz, lists current channel as 9.440. (Oskay, N. J.) Seems closer 9.445. (Stark, Texas) Heard closing 2130 in Spanish. (Ferguson, N. C.)

Brazil—Radio Record, 9.505, noted identifying in Portuguese 1935; the 11.965A channel which previously announced as "Radio Record" now announces *only* as "Radio Sao Paulo." (Niblack, Ind.) PSH, 14.690, noted 1730-1800. (Sutton, Ohio)

British Borneo — Radio Sarawak, 4.870, is a *newcomer*, parallel m.w. 850 kc., both 5 kw., with *English* 0530-0630 and 0830-0840A; *fortnightly* at 0600 on *Thurs.* has "Thursday Forum" when a prize is awarded for best question submitted for discussion; QRA is Radio Sarawak, Kuching, Sarawak, British Borneo. (Malmo Short-Wave Club, Sweden) Noted closing 0840A with "God Save the Queen." Heard opening 0430. (Balbi, Calif.) Chief Engineer says poor signals heard in N. Z. mean the antennas are doing their intended job of providing good coverage over Sarawak at high-angle radiation. (Cushen, N. Z.) Verified via airmail with QSL letter. (Hardwick, N. Z.)

British Guiana—Radio Demerara, ZFY, 3.255, noted 2015-2100 at good level with popular music, commercials; heavy QRM. (Hill, N. H.)

British Honduras — Radio Belize, 3.300, noted with news 2000. (Saylor, Va.) Heard 2200-2230 with songs, heavy CWQRM. (Jones, N. C.)

British New Guinea—VLT6, 6.130, Port Moresby, noted 0600 with ABC news. (Ferguson, N. C., others)

Canada—VE9AI, 9.54, Edmonton, Alta., noted at good level 1000-1500, slight QRM; CBUX, 6.160, noted 2300 announcing "CBU, Vancouver, British Columbia." (Waltz, Washington State) Latter noted at good level 1400A, news 0200; definitely announces call of "CBUX" and *not* "CBRX." (Frederick, Washington State) CKFX, 6.080, Vancouver, noted 1545 at strong level; CFVP, 6.030, Calgary, Alta., heard 0000. (Deuring, Alta.) CJCX, 6.010, Sydney, N. S., noted around 0645. (Reidler, Pa.) CKLO, 9.63, CHOL, 9.72, excellent in *English* 2130 to Latin America. (Huss, Calif.)

Ceylon—Radio Ceylon, 7.190, good level 2200-2230. (Ray, Pa.) Opens 0830 on 7.110, 11.875 with VOA relay. (Radio Australia, others) Commercial Service noted on 9.520 to 1730A closedown in *English*. (Koch, Ore.) Good around 0930 with popular music.

Chile—Radio Corporation, CE1515, 15.150, Santiago, heard in Sweden from 1600. (Isacsson)

China—Radio Peking, 15.385, replacing 11.960, has weak to fair level 2200 with news. (Balbi, Gay, Calif.) Latest schedule for *English* news sessions are 2200-2230, 11.690, 15.060, 15.385; 0400-0430, 700 kc., 6.100, 7.500, 9.040, 10.260, 11.690, 15.060; 0930-1000, 11.690, 15.060. (Radio Sweden, others) *Radio Peking* is heard in Japan around 1715 on 11.930 parallel 11.890, 11.830, and other channels; program differs from that on 11.650, 15.250A at same time; opens on 12.202 parallel 13.750A, 10.255A, and other frequencies 0600. (JSWC)

Cook Islands—A station was established recently at Raratongo, at present radiates on 6.180 on Wednesdays 2330-2400, also on Tuesdays and Thursdays 2000-2100; hopes soon to extend transmissions in the near future with an "evening" broadcast; tests have shown 6.180 gives best coverage in daylight while 3.390 is best at night. (Radio Australia). *N.Z. DX Times* says operates with only 100 watts.

Costa Rica—TIFC, 9.647, noted with religious session in *English* 2320 tune-in. (Faulkner, W. Va., others) TIDCR, "La Voz de la Victor," 9.615, San Jose, noted closing 2300A in Spanish, good level in Ore. (Koch)

Cyprus—Limassol, 6.790, 11.720, heard with news in Arabic 1330, good level. (Hardwick, N. Z.)

Czechoslovakia—Prague noted with *English* to North America 2300-2330 over 9.650 (new) parallel 9.550. (Morgan, Calif., others) At 1930-2000 on 9.550 and 11.760. (Stanley, Conn., others)

Denmark — Copenhagen's 9.520 is

(*Continued on page* 125)

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock, has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.) The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

NEW MULTICHANNEL MIXER

Front panel view of the new Berlant Model MCM-2 unit. It mixes four different channels.

Rear view of mixer showing input and output jacks.

Details on a new audio accessory designed to be used with professional-type tape recorders.

THE widespread use of portable professional tape recorders has necessitated a compact, versatile mixer having essential inputs for tape, high- or low-impedance microphones, and phonograph pickups. Developed by E. Berlant of *"Concertone"* fame, this new Model MCM-2 has been designed expressly to meet this demand for a high-gain, high-level mixer-preamplifier having the required versatility and noise-free performance.

The basic mixer, without accessories, provides for the amplification and mixing of four high-impedance, low-level microphones. To convert one or more of the four channels to low-impedance microphone use, it is only necessary to add the desired number of plug-in input transformers. Microphone signals, together with high-level signals such as those from tape recorders, crystal phono cartridges, radio tuners, and similar sources, are preset when necessary by adjustable plug-in "losser" pads. Low-level signals from variable reluctance phono pickups are fed directly into a channel by using a plug-in phono equalizer.

The mixer can be modified to low-impedance, 600-ohm balanced line operation for feeding telephone lines, etc. by plugging in a special matching output transformer.

The self-contained power supply consists of a transformer-fed voltage doubler, selenium rectifier, and an *RC* filter to remove all trace of ripple from the output. The heaters of the tubes are operated on filtered d.c. and are connected in a series arrangement across the output of a selenium bridge rectifier.

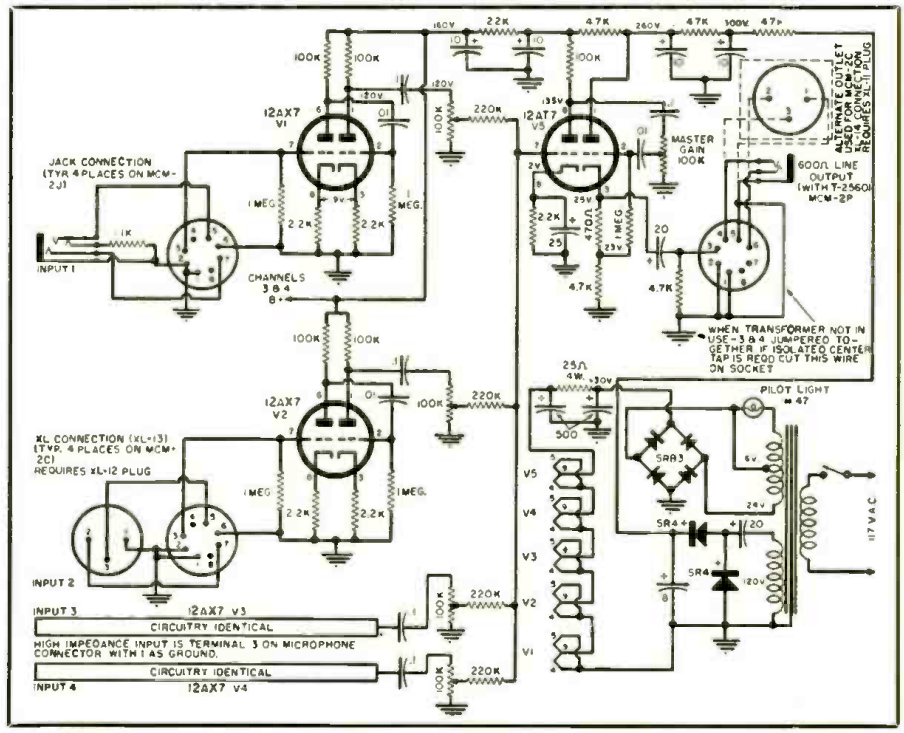
Each channel has a cascaded 12AX7 between the input and the mixing network. A master gain control is placed in the control grid immediately ahead of the cathode follower output.

This new mixer is available with either the MCM-2J connector or, for professional or broadcast use, may be ordered with the standard XL type of connector. The unit matches, in appearance and finish, the new *Berlant* BR-1 tape recorder, now in production.

An added feature is the carrying case which permits the new mixer to be used as a companion item with portable tape recorders currently available.

Another model, known as the MCM-2R, has a push-pull output with line transformer providing + 15 vu and 600 ohms for line service. —30—

Complete schematic diagram of the Model MCM-2 multichannel mixer.



THE "MARK 12"

Fig. 1. Front view of the "Mark 12" amplifier.

By **VICTOR BROCINER**
Brociner Electronics Laboratory

An "etched circuit" is combined with an unusual chassis design to provide an integrated preamp-power amplifier.

THE amplifier to be described, the *Brociner* "Mark 12," represents an interesting departure from conventional methods of design and construction.

In order to achieve compact size and good performance at moderate cost, some degree of mechanization of assembly was imperative. The etched wiring technique was adopted for as much of the circuit as possible. In this method, the wiring actually consists of a pattern of thin copper applied to an insulating plate, as shown in Fig. 2. The tube sockets, condensers, and resistors are mounted on the plate from the reverse side (Fig. 3) with their leads making contact with the circuit pattern through holes in the plate. After the components are assembled, the plate is dipped into a large solder pot and, in about one minute, more than 150 connections are soldered at once. In addition to saving time, there are other advantages with this method: incorrect or omitted connections are impossible; lead locations are uniform and definitely determined—the latter feature insuring uniform performance in production; and compactness is achieved.

Since the tube sockets are, in effect, integral with the circuit plate, the only functions left for the chassis are to mount the heavy components and controls and to act as an enclosure and shield.

For greatest efficiency, beam-power tubes were selected for the output stage. While this type of output tube can be made to perform in a manner comparable to triodes, by means of negative feedback, as far as distortion at full output is concerned, the distortion does not drop rapidly enough as the power is reduced. It was found entirely feasible to eliminate this condition by means of a special, multiple-loop feedback system and to obtain minimum distortion at all power levels.

The amplifier schematic is shown in Fig. 4. The over-all feedback loop consists of R_{27} and C_{2a} from the output transformer secondary to the cathode of the voltage amplifier tube, V_{2a}, producing 20 db of feedback. The split-cathode resistor R_{2a}-R_{2b} provides additional local feedback and helps minimize low-level distortion. Both tone control stages, V_{2a} and V_{2b}, have plate-to-grid negative feedback *via* R_{14}-C_{15} and R_{21}-C_{14} respectively. These feedback loops insure low distortion in the tone control stages irrespective of the tone control settings. The cathode resistors of V_{2a} and V_{2b} provide further local feedback. In all, negative feedback is applied at six points in the circuit.

The volume control is bass-compensated to provide automatic equalization for the Fletcher-Munson curves, as required at low listening levels. Provision is made for the elimination of this feature, if desired, by means of a simple jack and shorting plug on the rear apron of the amplifier.

A tape take-off jack is connected just ahead of the volume control for recording program material on tape. This is designed to permit adjustment of loudspeaker volume without affecting the level fed to the tape recorder. The tone controls are effective at this point, permitting corrections to be made as required by the quality of the program material.

The phonograph preamplifier is conventional in design but great care was exercised to keep distortion at a minimum. This point is often neglected on the assumption that because signal levels are low, distortion will automatically be negligible. This is definitely not the case. It should be borne in mind that while power amplifiers are normally operated at a small fraction of their rated output, preamplifiers and all the other stages ahead of the volume control operate at maximum level all the time. Careful design in this section of an amplifier pays big dividends in terms of listening quality.

Two phonograph inputs are provided: one for magnetic or dynamic (constant velocity) pickups and one for ceramic, crystal, or capacitance (con-

Fig. 2. Side view of etched wiring plate before mounting.

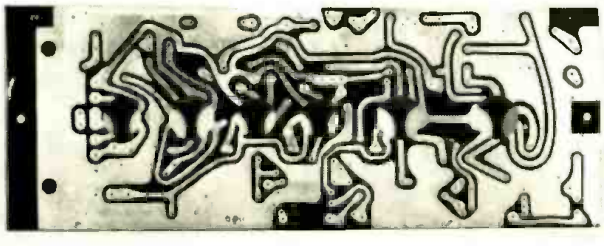
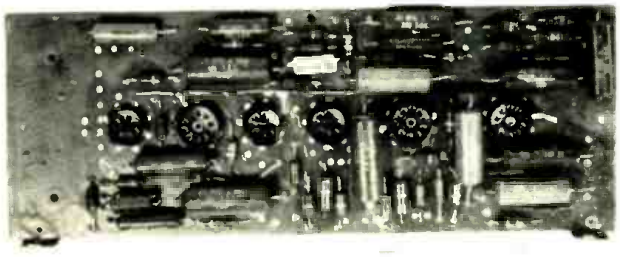
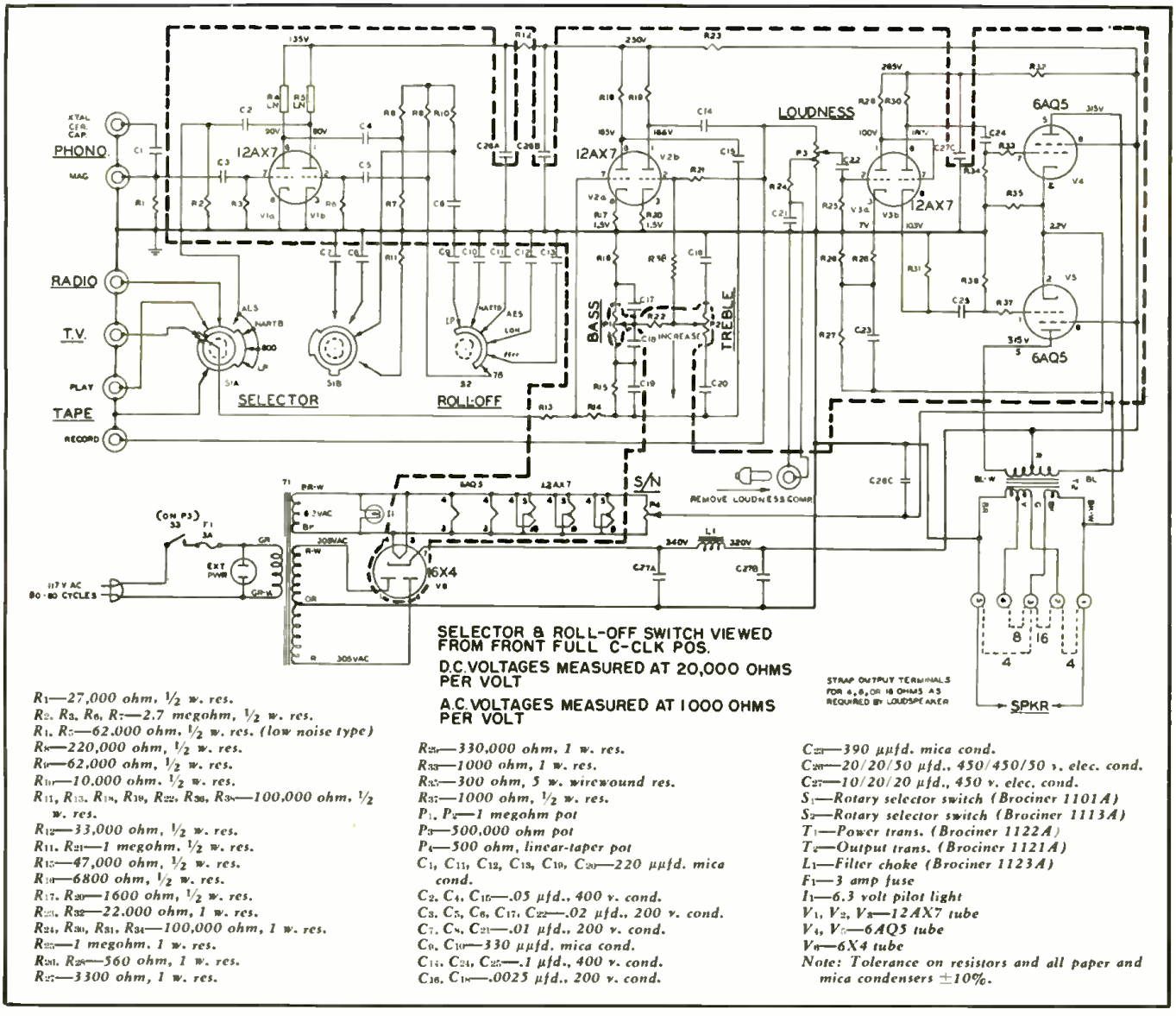


Fig. 3. Opposite side of plate with components mounted.





R1—27,000 ohm, ½ w. res.
R2, R3, R6, R7—2.7 megohm, ½ w. res.
R4, R5—62,000 ohm, ½ w. res. (low noise type)
R8—220,000 ohm, ½ w. res.
R9—62,000 ohm, ½ w. res.
R10—10,000 ohm, ½ w. res.
R11, R13, R14, R19, R22, R36, R34—100,000 ohm, ½ w. res.
R12—33,000 ohm, ½ w. res.
R15, R21—1 megohm, ½ w. res.
R16—47,000 ohm, ½ w. res.
R18—6800 ohm, ½ w. res.
R17, R20—1600 ohm, ½ w. res.
R23, R32—22,000 ohm, 1 w. res.
R24, R30, R31, R34—100,000 ohm, 1 w. res.
R25—1 megohm, 1 w. res.
R28, R26—560 ohm, 1 w. res.
R27—3300 ohm, 1 w. res.

R28—330,000 ohm, 1 w. res.
R33—1000 ohm, 1 w. res.
R35—300 ohm, 5 w. wirewound res.
R37—1000 ohm, ½ w. res.
P1, P2—1 megohm pot
P3—500,000 ohm pot
P4—500 ohm, linear-taper pot
C1, C11, C12, C13, C19, C20—220 μμfd. mica cond.
C2, C4, C16—.05 μfd., 400 v. cond.
C3, C5, C6, C17, C22—.02 μfd., 200 v. cond.
C7, C8, C21—.01 μfd., 200 v. cond.
C9, C10—330 μμfd. mica cond.
C14, C24, C25—.1 μfd., 400 v. cond.
C16, C18—.0025 μfd., 200 v. cond.

C23—390 μμfd. mica cond.
C26—20/20/50 μfd., 450/450/50 v. elec. cond.
C27—10/20/20 μfd., 450 v. elec. cond.
S1—Rotary selector switch (Brociner 1101A)
S2—Rotary selector switch (Brociner 1113A)
T1—Power trans. (Brociner 1122A)
T2—Output trans. (Brociner 1121A)
L1—Filter choke (Brociner 1123A)
F1—3 amp fuse
I1—6.3 volt pilot light
V1, V2, V3—12AX7 tube
V4, V5—6AQ5 tube
V6—6X4 tube
Note: Tolerance on resistors and all paper and mica condensers ±10%.

Fig. 4. Complete schematic of the "Mark 12" amplifier. Components within dotted box are on the etched circuit plate.

stant amplitude) types. Network R_1-C_1 simply converts the latter type pickups to a constant-velocity characteristic and simultaneously reduces their high output voltages to avoid overloading the preamplifier. With this arrangement, the adjustable record compensation controls work with all types of pickups.

The performance specifications of the amplifier are as follows: Power output is 12 watts (24 watts peak) at 1 per-cent distortion; frequency response is given in Fig. 7 along with a curve showing the undistorted power capability of the amplifier over its frequency range. The high power rating at 20,000 cycles as well as the ample reserve at 30 cycles is accomplished by means of a somewhat unconventional output transformer using split secondary windings and grain-oriented core material. The large amount of negative feedback results in a damping factor of 15. The source impedance of the amplifier is well below the d.c. re-

(*Continued on page* 154)

Fig. 5. Rear view with cover removed showing etched circuit plate.

Fig. 6. Rear view of the compact 4¼" x 11" x 8" preamp-amplifier.

MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE

SOME NEW PROBLEMS

"HEY, MAC," Barney addressed his employer working beside him at the service bench, "I got a letter from a cousin of mine in the service game down south, and he says the most dependable TV station in his fringe area is about to boost its power. He knows that our best station in Center City did the same thing about a month ago, and he was wondering if I could cue him on the real difference a boost in power makes and the kind of new service problems such a change produces. He says having this information would sort of give him the edge on his competition."

"Get out your little notebook," Mac commanded. "I'm really loaded on that subject. At least I'm loaded on the subject of the change that was produced *here*. In another location, things might not work out the same."

"He understands that," Barney replied, "but he thinks the two cases are similar enough so that he can learn a lot about what will happen in his town from what did happen in ours."

"Okay, then. First, he should know what changes actually were made at the channel 6 transmitter in Center City. A complete new transmitter and antenna were installed at a new location. The old antenna was about 500 feet high, while the new one is exactly 1019 feet tall; but in addition the new antenna is situated on higher ground so that the total increase in antenna height above sea level is exactly 660 feet. Moreover, the new antenna is about ten miles closer to us than the old one. That means a reduction in transmitter distance from seventy-five to sixty-five miles. Finally the video power was boosted from 30.8 kilowatts erp to 100 kw., and the audio power was upped from 18.1 kw. to 50 kw. All three factors—the increase in power, the higher antenna, and the lessening of the distance from us—work together to improve our signal."

"And being down in a valley like we are, that signal could stand a lot of improvement," Barney broke in. "Can we give him facts to gnaw on?"

"We sure can. On the night the changeover took place, I had a pretty elaborate setup to measure the difference. The tape recorder was running off the TV speaker to show the difference in sound. My camera was set up on a tripod in front of the screen so that I could take pictures of that screen just before and immediately after the changeover. One signal strength meter was tuned to the audio carrier, and another was set on the video carrier. Just before the switch was thrown, I snapped the camera shutter and readings were taken of both signal strength meters. Directly after the change, the screen was photographed again, and another reading was taken of each meter."

"Well, what happened?" Barney demanded impatiently.

"Fortunately the old station was coming in very poorly that night; so the difference was all the more marked. Just before the change the sound was somewhat noisy and the picture was so snowy figures on the screen could barely be made out. The pointers of the field strength meters were moving restlessly up and down on the very bottom of their most sensitive scales."

"And after the change?"

"The sound became absolutely quiet. The picture was wiped entirely free of snow, and fine detail and gleaming highlights appeared. All tendency to jitter and lose sync was gone. The video field strength meter jumped from 9 to 150 microvolts and held steady. The audio field strength meter, which was not calibrated directly in microvolts, indicated a ten times gain in signal strength."

"How did the pictures come out?"

"Fine. Upon being developed, they faithfully recorded a startling difference. In fact, since the station management asked for reports on the effect of the changeover, I mailed in the pictures and they were shown on one of the 'TV Mailbag' type of programs as evidence of the improvement in reception at a considerable distance from the station."

"That ought to zero Cousin Jethro in as to what he can expect in the way of improved reception," Barney said as he scribbled in his notebook; "now what shall I tell him about the new service problems this stronger signal brings on?"

"Well, right off the bat he can expect a small rash of calls from customers owning sets with manual adjustments for different signal strengths. The a.g.c. threshold controls, sync-locking circuits, local-distance controls, etc., that have been set to handle only an extremely weak signal will have to be reset to prevent excessive contrast or picture tearing. As a matter of fact, though, there will probably not be too many of these. In the first place, a great many sets are designed to take care of an extremely wide range of signal strength automatically. Those with such manual controls have normally not been set for too weak a signal because even with the old station the signal received often peaked up, under the influence of a thermal inversion, to several hundred microvolts. Service technicians quickly found out that these controls had to be set to take care of these wild excursions of signal strength that take place in a fringe area; so most of the sets here were able to take the increased power in stride.

"An important thing is that the increase in power cuts down on 'nuisance calls.' Before, every time we had a period of poor reception in this area, we got several calls from customers who wanted us to come out and check over their sets because they felt something must be wrong. This presented a rather delicate situation. From observing our own reception we felt reasonably sure nothing was wrong with the customer's set and that quite likely it would not perform a bit better after we checked it over and collected our service charge than it did before; yet to tell him this was to belittle his own judgment and to leave the impression we were not eager for his business. While we naturally were paid for making these calls, they were not conducive to creating good will, and the reputable service technician sincerely means it when he labels them 'nuisance calls.' Now, though, when we get a complaint, it usually means something is really wrong."

(*Continued on page 82*)

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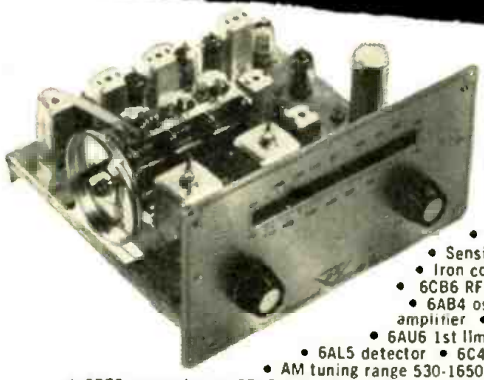

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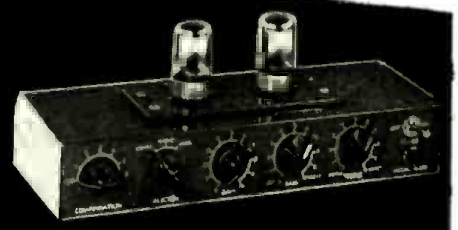
- Band width—200 kc
- Tuned RF stage
- Tuning Range 88-108 mc
- Sensitivity 5-10 u/v, 20-30 db
- Iron core tuned I.F. disc. trans.
- 6CB6 RF amplifier
- 6AB4 mixer
- 6AB4 oscillator
- 6AU6 1st I.F. amplifier
- 6AU6 2nd I.F. amplifier
- 6AU6 1st limiter
- 6AU6 2nd limiter
- 6AL5 detector
- 6C4 cathode follower output
- AM tuning range 530-1650 kc
- 6BA6 RF amplifier
- 6BE6 converter
- 6BA6 1st I.F. amplifier
- 1N34 or 1N60 crystal diode detector
- Tuned RF stage
- Chassis dimensions: 9¾" long, 5" high, 8" w.

Complete kit of parts including tubes, pictorial and schematic diagrams **$37.50**

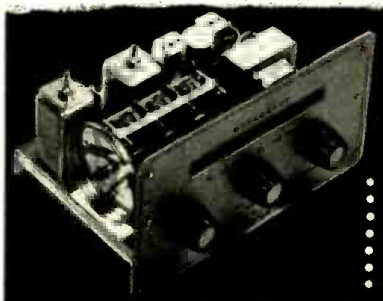
Wired and tested. $5.00 additional

New Model A-800 Pre-Amp kit



- Floated tubes to prevent tube microphonism
- 3 input connectors—magnetic, crystal, radio
- Input selector switch
- Overall gain control
- 6 position equalizer switch for GE and Pickering cartridges
- High-low tone controls approx. 15 db
- Tubes: 2-7F7
- Power required: 6.3v AC or DC, .6 amp., 180-220v DC at 7 milliamps

Kit with complete, illustrated instruction book **$15.95**



New V-5 AM Receiver Kit

- Self-contained AC power supply
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- 6BA6 RF Amplifier
- 6BE6 converter
- 6BA6 1st I.F. amplifier
- 6AL5 detector
- 6C4 cathode follower output
- #65 selenium rectifier
- 3 section variable cond.
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- Sensitivity 5 microvolts
- Iron core tuned coils throughout
- Dimensions 9¾" x 5" x 5⅞"

Complete kit of parts, including AC power supply, tubes, pictorial and schematic diagrams..... **$24.50**

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- 6AB4 mixer
- 6AB4 oscillator (temp. compensated)
- 6AU6 1st I.F. amplifier
- 6AU6 2nd I.F. amplifier
- 6AU6 1st limiter
- 6AU6 2nd limiter
- 6AL5 detector
- 6C4 cathode follower output
- #65 selenium rectifier
- Dimensions 9¾" x 5" x 5⅞"

Complete kit of parts including AC power supply, tubes, pictorial and schematic diagrams..... **$29.50**

New A-465 Field Strength Meter 0-100 Microvolts Full Scale

- 12 Channel High Gain (standard coil) cascode turret tuning front end
- 6BQ7—RF
- 6J6 oscillator-mixer
- 6CB6 high gain 1st I.F.
- 6AU6 high gain 2nd I.F.
- 1N34 crystal diode (meter rectifier circuit) 2nd detector
- 6AU6 amplifier (for earphone or scope use) picture carrier only
- Signal indicator, 6" large face, 0-500 microammeter
- Self-contained power supply 115 volts, 60 cycles
- Calibrated in relative microvolts—2 scales: 0-100 microvolts and 25-30,000 microvolts
- UHF calibrated reference scale
- Panel mounted "Off-On" indicator
- 300 or 72 ohm output
- UHF strips available on order

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New A-900 UHF Signal Generator 450-900 MC on Fundamentals

- Power supply: 115-125v, 60 cycles
- 3" calibrated output meter, 1 volt
- 1 volt minimum across the band
- 50 ohm terminated output cable
- Large 6" dial, accurately calibrated in megacycles and spot channels
- Stable operation—low leakage
- RF attenuator 0-120 db total
- Drift after warmup negligible
- 400 cycle internal modulation
- Separate modulation control
- Cavity tuning system
- Dimensions: 12" x 10" x 8"

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Short-Wave Receiver

(*Continued from page 63*)

from being transmitted directly to the condenser and detuning it.

Millen plug-in coil forms were used for winding the coils. They consist of a ½" o.d. polystyrene tube mounted on a low-loss octal base and fitted with polystyrene spacers and an aluminum shield. The r.f. coil was wound on a form (Millen No. 74001) having a powdered iron tuning slug to permit easy alignment of the r.f. circuit. No. 28 and No. 30 plain enameled magnet wire was used, as indicated, and all coil elements were wound in the same direction on the form. Fig. 2 shows the pins to which the coil elements are connected, the corresponding socket connections being indicated on the circuit diagram. Before starting to wind the coils, about six holes were drilled around the outside edge of each spacer. In winding an element of the coil, the wire was passed through a convenient hole and anchored temporarily by twisting it to a base pin. After winding, the end of the wire was similarly anchored. Then, after judging the correctness of the spacing, the coil element was coated with polystyrene dope before winding the next element. The leads were not soldered to the pins until the coil was completely wound and doped.

The trimmers which form a part of the variable tuning condenser were used for making the alignment adjustments on range 1. It was found, however, that additional trimmer capacitance was required in the r.f. circuit of range 2. To provide this, a separate trimmer was mounted under the chassis and connected to pin 4 of the r.f. coil socket. A jumper between pins 3 and 4 of the range 2 r.f. coil automatically connects it across the r.f. tuning condenser when the range 2 coil is plugged in.

It is suggested that only one set of coils be made at first so that the various adjustments can be mastered before winding the other set. With a little experimenting, coils can be wound for other ranges, if desired.

Adjustment and Operation

After checking the wiring, connect the batteries, and check the voltage between pins 1 and 8 of each tube socket before inserting the tubes. Use a voltmeter or a 1½" volt flashlight bulb. If the filament voltage is correct, insert the tubes, and connect the antenna, ground, and phones. Turn on, and advance the regeneration control (increase capacitance). The receiver should go into oscillation at some setting of the regeneration control with a soft hiss, or a click if the control is turned rapidly. Signals should be heard on turning the tuning dial.

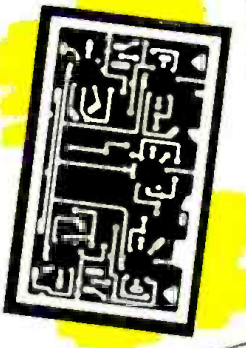
If the receiver does not oscillate, it is more than likely that the feedback coil (L_5) connections have been made

NEW 1955

Heathkit Engineering Features

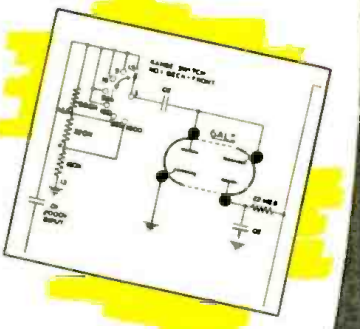
New PRINTED CIRCUITS

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 areing. Another definite example of continuing Heathkit design leadership in the kit instrument field.

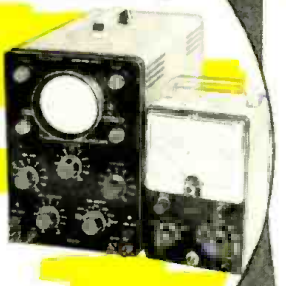


New HIGH READABILITY PANELS

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.

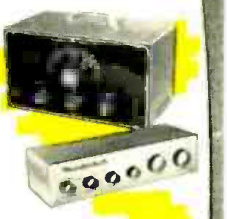
New 3" UTILITY SCOPE

The new 3" Scope is a "natural" for the well rounded line of Heathkit instruments. Small in size, $11\frac{3}{4}$" deep, $6\frac{1}{2}$" wide, $9\frac{1}{2}$" high, yet lag in performance. Just think of the value, an Oscilloscope for $29.50. Brilliant intensity, sharp focusing, wide positioning range. An ideal portable Scope for the TV serviceman—a second shop scope—modulation monitor for you hams (deflection plate terminals in rear of cabinet). Performance to spare for all general scope applications. See specifications on following page.



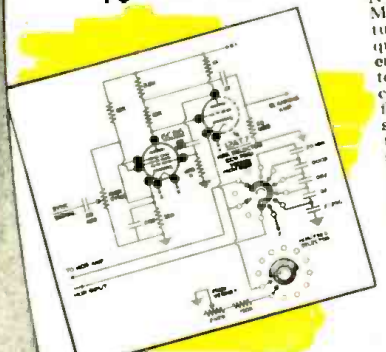
New STYLING New COLOR

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



New SCOPE SWEEP CIRCUIT 10 CYCLES — 500 KC

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



Continuing PROGRESS FUTURE LINE EXPANSION

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

SEE THE INSTRUMENTS ON THE FOLLOWING PAGES

HEATH COMPANY • • Benton Harbor 15, Mich.

incorrectly. Check the connections, and reverse if necessary. If the receiver cannot be made to oscillate at the low-frequency end of the range (condenser plates in), the number of turns on L_5 may be too small, and if it cannot be made to stop oscillation at the high-frequency end, the number of turns may be too large. However, unless the number of turns on L_5 appears to be grossly incorrect, it is better to proceed with alignment before making the final adjustments on L_5.

A standard signal generator is needed for the proper alignment of circuits. With the antenna and ground connected, couple the signal generator loosely to the antenna by means of an unshielded lead from the signal generator placed near the receiver. Turn the gain control to maximum (zero bias) and allow it to remain there throughout the alignment operation. Set the detector trimmer near the mid-point of its capacitance adjustment and then do not change this setting. Set the tuning condenser near maximum capacitance and the regeneration control well below oscillation. Tune the signal generator until its signal is heard. Adjust the receiver tuning dial and then the r.f. coil slug for maximum signal, and repeat. It should be possible to turn the slug in either direction and reduce signal strength. If this is not the case, the detector is too near oscillation. Now set the tuning condenser near minimum capacitance, retard regeneration, and again tune the signal generator until its signal is heard. Adjust first the receiver tuning dial and then the r.f. trimmer for maximum signal, again noting that turning the screw in either direction reduces signal strength. Now turn again to the low-frequency end and repeat the entire process. Continue until no further changes are required in going from the high-frequency end of the range to the low-frequency end.

In adjusting range 2, leave the trimmer on the r.f. section of the tuning condenser set for range 1 (assuming range 1 has been adjusted first), and adjust the auxillary trimmer. If it is found that range 1 requires the greater r.f. trimmer capacitance, the jumper between pins 3 and 4 on the range 2 r.f. coil should be removed and placed on the range 1 r.f. coil.

Final adjustments may now be made on L_5. Increase or decrease the number of turns, as required, to provide more or less feedback. It should be possible to find an adjustment of turns on L_5 which will permit the receiver to be put in or out of oscillation over the entire tuning range at some setting of the regeneration control. If this is not the case, try the following steps in order: check alignment, check connections of L_5, and reverse if necessary, change the length of the antenna, change the number of turns on L_5 slightly, detune the r.f. circuit slightly, reverse L_5.

It is not necessary for the frequen-

NEW *Heathkit* 5" PUSH-PULL OSCILLOSCOPE KIT

PRINTED CIRCUIT

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

New 5UP1 CR tube

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

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

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

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

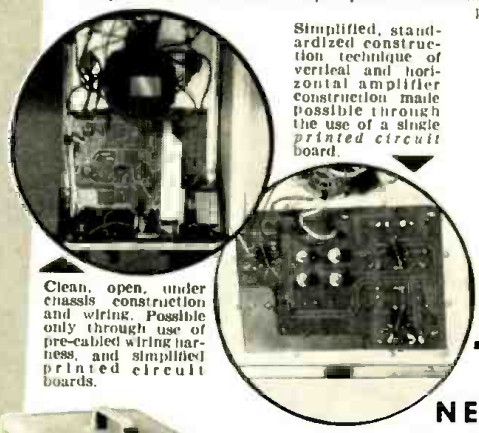
The new 1955 Heathkit Model O-10 is the first truly color television kit oscilloscope with necessary high sensitivity and bandwidth. Outstanding instrument appearance is the result of new modern styling and color harmony. The **first** kit constructed oscilloscope to offer a labor-saving printed circuit board. New sweep generator with frequency range five times greater than previous models. Additional major improvements are a new high voltage power supply, improved vertical and horizontal electronic positioning control action, extreme horizontal amplifier sensitivity for trace magnification over three times CRT face width.

NEW SWEEP GENERATOR: The first sweep generator outside of expensive Laboratory units to go above 100 KC. Yet this new Heathkit has five times the frequency range with stable, locked-in traces. Complete range 10 cycles to 500,000 cycles. The generator has such excellent synchronization characteristics, that the results closely approximate a triggered sweep and under most conditions, the trace is locked to a multiple of sync frequency throughout the entire control range. Sweep multi-vibrator is direct coupled pentrode-triode and frequency determining capacitors are not part of multivibrator circuit.

MODEL O-10

$69.50

Shpg. Wt. 27 lbs.



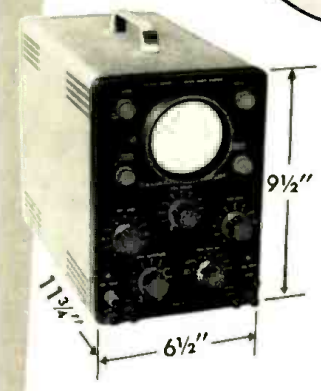
Simplified, standardized construction technique of vertical and horizontal amplifier construction made possible through the use of a single *printed circuit* board.

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

SENSITIVITY AND BANDWIDTH: Operating characteristics of the newly designed vertical amplifier provide a high degree of sensitivity (25 millivolts per inch) and excellent bandwidth characteristics 5 cycles to 5 MC (down only 5 db). Only the new Heathkit Oscilloscope has the necessary sensitivity for full 5 megacycle bandwidth for color servicing. Uniformly high level operation with a high degree of stability is assured through the use of new printed circuit board construction. Printed circuits reduce the assembly time, error possibility, and provide rigid mounting for all components.

New horizontal amplifier provides trace width three times the diameter of the CR tube. This new amplifier together with DC positioning, allows greater magnification of trace for observation of small transients and step portions of TV sync pulses.

OTHER OUTSTANDING FEATURES: Retrace amplifier—Z axis modulation—peak-to-peak voltage calibrating source with calibrated grid—all plastic molded condensers for long trouble-free life and drift elimination—voltage regulated power supply—new wiring harness for neat professional appearance—new cabinet styling and color harmony. Combinations of design and performance features available only in the new Heathkit O-10 Oscilloscope.



NEW *Heathkit* 3" PRINTED CIRCUIT OSCILLOSCOPE KIT

MODEL OL-1

$29.50 Shpg. Wt. 15 lbs.

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

Deflection plate terminals—ideal for ham transmitter modulation monitoring.

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

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

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

Here is the newest addition to the line of Heathkit Oscilloscopes. Just the instrument you servicemen, hams, students, and experimenters have been asking for. A general purpose low priced utility scope to be used in everyday work. Through the use of a 3" 3GP1 CRT it has been possible to reduce the cabinet size and weight so that the instrument is a compact portable unit especially useful for TV servicemen to carry on home service calls and as an extra shop utility scope. At this low price every ham can afford an oscilloscope for transmitter modulation monitoring. Convenient slide switch controlled terminals at rear of scope cabinet.

PRINTED CIRCUIT: This new Heathkit uses a prefabricated printed circuit board to standardize amplifier and sweep generator assembly. Cuts building time in half, eliminates major portion of wiring, and insures exact duplication of engineering pilot model. Condensers, resistors, and tube sockets are mounted directly on the board and soldered in place.

DESIGN FEATURES: Cathode follower input circuits in both vertical and horizontal amplifier—electronic positioning control for wide range of vertical or horizontal spot deflection—Heath twin triode sweep generator—provisions for external and internal sync—external and internal sweep—60 cycle line sweep—Chicago power transformer—4 section electrolytic filter condenser—plastic molded bypass and coupling condensers. Tube lineup 4—12AU7 horizontal and vertical amplifiers, 12AX7 sweep generator, 6X4 low voltage rectifier, 1V2 high voltage rectifier, 3GP1 CRT. Cabinet size 11¾" deep x 6¼" wide x 9½" high. A terrific instrument value at $29.50.

NEW *Heathkit* 5" PRINTED CIRCUIT OSCILLOSCOPE KIT

MODEL OM-1

$39.50 Shpg. Wt. 24 lbs.

Printed circuit board construction for accurate trouble-free assembly.

Twin triode Heath sweep generator 15–100,000 cycle range.

By popular request we are again offering a 5" full sized general purpose Oscilloscope using a 5BP1 CRT. All of the necessary design features for servicemen, students, experimenters, hams, etc. This fine oscilloscope value features printed circuit board construction for easy assembly and reduced wiring time. Also features the new Heathkit styling and color harmony with the charcoal gray panel and white lettering for high readability.

SWEEP GENERATOR: Sweep generator range using Heath twin triode circuit 15–100,000 cycles in four positions. Provisions for external as well as internal sweep and external or internal sync in addition to 60 cycle line sweep. Easy positive synchronization.

Heavy duty power supply using TV type 1V2 high voltage rectifier assures adequate accelerating potential for good trace definition. Deflection plate direct terminal connections available on rear of cabinet. Useful in transmitter modulation checking.

Good performance, simplified operation, and easy assembly are all characteristics of this new model Heathkit Oscilloscope.

HEATH company

BENTON HARBOR 15, MICHIGAN

cies at the end of the ranges to coincide exactly with the values given in Fig. 2. The two ranges should have a small overlap, however. The frequency ranges may be adjusted by varying the detector trimmer or changing the number of turns on L_5, depending on whether the adjustment is desired at the high or low frequency end. Remember that changing the detector trimmer changes the high-frequency limit of *both* ranges. Preferably do not change L_5 by more than 1 turn on range 2, or 3 or 4 turns on range 1 since other adjustments on the coils might then be required. The set must be re-aligned, of course, after any changes are made in the detector circuit.

The number of turns given for the antenna coil, L_1, will probably be found satisfactory, but for optimum results the constructor may wish to adjust this coil for the particular antenna and location used. Changing the number of turns apparently did not affect alignment appreciably, although it would be well to check the alignment after any such adjustments are made.

It should be noted that a somewhat more straightforward method of alignment could have been used if it were possible to attach a separate trimmer to each r.f. and detector plug-in form to tune its grid coil (L_2 and L_4). As it is, one detector trimmer adjustment serves both ranges.

Actually, the alignment of the circuits is not difficult, and could be repeated quickly after the constructor has once learned the significance of the adjustments. Nor is alignment highly critical. Since the r.f. circuit tunes rather broadly, the set will function quite well even if the r.f. circuit is slightly out of tune with the detector.

In operation, the gain control is usually allowed to remain at its maximum setting, and volume is controlled by means of the regeneration control. The gain control is used mainly to reduce very strong signals. Put the receiver in oscillation and tune until a squeal is heard. Then reduce regeneration until oscillation just stops, tune for maximum response, and adjust the regeneration control until the signal reaches the desired volume. Strong signals, or signals whose location is known exactly, may be tuned with the receiver not in oscillation. In tuning for c.w. signals, the set is kept in oscillation so that the detector may produce its beat note with the signal. The pitch of the beat note is controlled by careful adjustment of the tuning dial, and its volume is controlled by advancing the regeneration control beyond the point where the detector starts to oscillate, which is the most sensitive point for c.w. reception.

The receiver is well adapted to experimenting if the constructor is so inclined. The use of plug-in coils makes it comparatively easy to adjust coils without disconnecting leads or working in inaccessible places. If coils

NEW *Heathkit* VACUUM TUBE VOLTMETER KIT

PRINTED CIRCUIT DESIGN

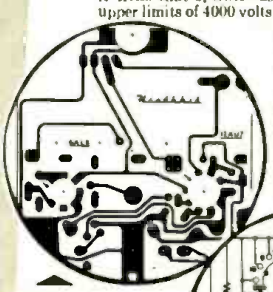
New charcoal gray baked enamel panel with high readability, white lettering. New soft feather gray cabinet, subdued pilot light indicator.

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

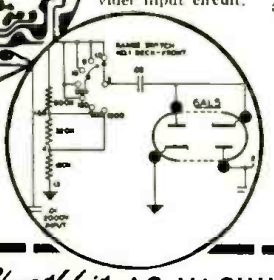
Another outstanding example of continuing Heath Company pioneering and leadership in the kit instrument field. A new **printed circuit** VTVM. New peak-to-peak circuit—new styling and new panel design. A prewired, prefabricated printed circuit board eliminates chassis wiring, cuts assembly time in half,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

CIRCUIT:

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



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



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

RANGES:

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

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

IMPORTANT FEATURES:

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

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

MODEL V-7

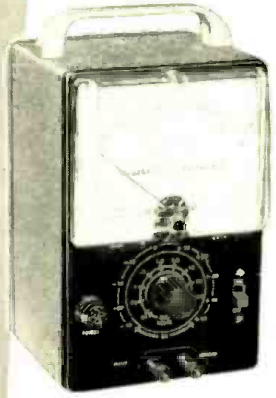
$24.50

Shpg. Wt. 7 lbs.

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

Heathkit AC VACUUM TUBE VOLTMETER KIT

MODEL AV-2



$29.50 Shpg. Wt. 5 lbs.

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

Heathkit 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.

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.

HEATH company

BENTON HARBOR 15, MICHIGAN

for other ranges are wound, alignment changes could be made by merely resetting the r.f. trimmer screw slightly when plugging in the new set of coils. A scratch or mark will enable resetting the screw to a predetermined position with sufficient accuracy. It is suggested, however, that the receiver be adjusted to perform as described before making significant design changes.

The regenerative receiver requires a little more skill to operate than the more familiar superhet since the regeneration control must be reset continuously as the receiver is tuned. With a little patience, however, the operator will be getting good results in a very short time. In all probability, he will find a great deal of enjoyment in listening to short-wave and ham transmissions for some time to come. —30—

Mac's Radio Service Shop

(Continued from page 74)

"I noticed something else," Barney remarked. "Remember how you kept trying to tell the people here in town that their reception trouble was caused by weak signals rather than excessive noise? Since the new station came on, all that Television Interference Committee movement seems to have simply faded away. That should make you a prophet with honor, even in your own country!"

"Don't bet on it," Mac replied with a chuckle. "You might want to tell your cousin, too, that he can brace himself for several kinds of complaints he is not accustomed to hearing. Before now he and his customers have probably been chiefly concerned with getting a picture—almost any kind of a picture. Once the signal comes up, however, he is going to be surprised at how quickly his customers become critical of the pictures on their screens. With the snow wiped away, such things as incorrect focus, bad linearity, poor interlace, smearing, and ringing become major annoyances. He will find himself dusting off and using all that information he has learned about the effect of i.f. alignment and video bandpass characteristics on picture quality."

"He was wondering if having one strong station in the area would have much effect on the nature of new antenna installations."

"Judging from our own experience and what other technicians say, I do not believe the effect is as great as he may imagine. While reception of channel 6 is now dependable and ordinarily much better than reception obtained on other channels, few people here, after being accustomed to reach out for half a dozen stations, are satisfied to be tied down to one. People are still putting up all-channel antennas and using rotors. They reason that if one station can achieve that much of an improvement, who knows how many

NEW *Heathkit* TV ALIGNMENT GENERATOR KIT

Controllable inductor sweep oscillator with output entirely on fundamentals.

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

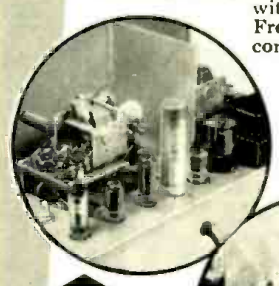
Electronically operated, smooth continuously variable sweep circuit. No vibration, hum or noise.

Frequency coverage: 4 MC—220 MC continuous including FM spectrum. RF output well over .1 volt.

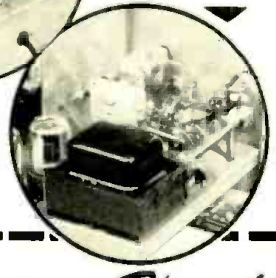
Here is the most radically improved Sweep Generator in the history of the TV service industry. The basic design follows latest high frequency techniques which result in a combination of performance features not found in any other sweep generator.

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

MARKER:

The same instrument incorporates a triple marker system with a crystal controlled reference. A variable marker provides accurate coverage from 19 to 60 MC on fundamentals, and 57 to 180 MC on calibrated harmonics. A separate fixed crystal controlled 4.5 MC marker can be used for checking IF, bandpass, calibration, reference, etc. Provisions are also made for external marker use. A 4.5 MC crystal is supplied with the kit.

POWER SUPPLY:

The transformer operated Power Supply features voltage regulation for stable oscillator operation. Three sets of shielded cables are furnished with the kit. Sweep range is completely and smoothly controllable from zero up to a maximum of 50 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.

MODEL TS-3

$44.50

Shpg. Wt. 18 lbs.

NEW *Heathkit* SIGNAL GENERATOR KIT

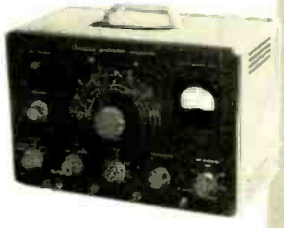
MODEL SG-8

$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

BENTON HARBOR 15, MICHIGAN

others will do the same thing? On top of that, we still have frequent thermal inversions that cause stations ordinarily weak to come in as though they were locals if you have the proper antenna to take advantage of these conditions.

"There are some exceptions to this, of course. A channel 6 yagi fastened to a chimney can now be sold very cheaply with the guarantee that good single-station reception will be had ninety per-cent of the time. This appeals to people on very limited budgets and to elderly people who do not like to bother with antenna switches, boosters, rotor controls, etc. There is, I believe, a falling off in demand for extremely high towers, although the sale of stand-alone towers is still going great guns in this community."

"In general, would you say that servicing is easier or harder since the new more powerful transmitter went on the air?"

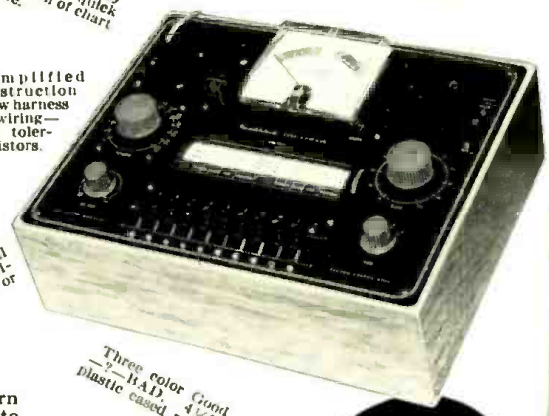
"Infinitely easier!" Mac said promptly. "It means everything to the technician to have a good dependable signal with which to work. You know how we used to bat our brains out trying to decide whether there really was something wrong with a set or if the signal was just weak in that particular location on that particular day. A technician may be able to interpret test patterns as easily as Tonto can track an elephant through soft mud, but that does him a fat lot of good when he can't see the test pattern for snow. Happily, those days are gone forever.

"Another angle is the fact that receivers in this area now have a slight range of efficiency in which they can operate and deliver good reception. Before, they did not have this. Every circuit in the set had to be operating in perfect condition to get any kind of reception at all. The slightest falling off in performance would cause a fading of the picture, a disappearance of the sound, or a loss of sync. It is extremely difficult to maintain any apparatus in *perfect* operating condition all the time, and it is a great relief to know this is no longer necessary. Now, if an i.f. amplifier tube falls off in emission ten per-cent, there is a sufficient surplus of signal so that the a.g.c. system operates to deliver exactly the same picture as before. A slight variation in line voltage no longer requires readjustment of a vertical hold control rendered super-critical because of the feeble sync pulses delivered to the synchronizing circuits."

"That's enough," Barney interrupted as he closed his notebook. "After all, we don't want to tell Cousin Jethro *everything* we know. Let him discover a few surprises for himself. That's what makes service work so fascinating," he concluded as he clutched his throat and gave a realistic pretense of gagging on his words.

Mac gazed sympathetically at his red-haired nemesis, shook his head sadly, and walked slowly over to the service bench. —30—

Heathkit TUBE CHECKER KIT



The Heathkit TC-2 Tube Checker was primarily designed for the convenience of radio and TV servicemen and will check the operating quality of tubes commonly encountered in this type of work. Test set-up procedure is simplified, rapid, and flexible. Panel sockets accommodate 4, 5, 6, and 7 pin tubes, octal and loctal, 7 and 9 pin miniatures, 5 pin Hytron, and a blank socket for new tubes. Built-in neon short indicator, individual 3-position lever switch for each tube element, spring return test switch, 14 filament voltage ranges, and line-set control to compensate for supply voltage variations, all represent features of the TC-2.

Results of tube tests are read directly from the large 4½" Simpson 3-color meter. Checks emission, shorted elements, open elements, and continuity. Wiring procedure has been simplified through the use of multi-wired color coded cable providing a harness type installation between tube sockets and lever switches. This procedure insures standard assembly and imparts a "factory built" appearance to the instrument. New Construction Manual furnishes detailed information regarding tube set-up procedure for testing of new or unlisted tube types. No delay necessary for release of factory data.

MODEL TC-2
$29.50
Shpg. Wt. 12 lbs.

Heathkit PORTABLE TUBE CHECKER KIT

The portable model is supplied with a strikingly attractive two-tone cabinet finished in rich maroon proxylin impregnated fabric covering with a contrasting gray on the inside of the detachable cover.

MODEL TC-2P
$34.50
Shpg. Wt. 15 lbs.

Heathkit REGULATED POWER SUPPLY KIT

MODEL PS-2
$33.50
Shpg. Wt 15 lbs.

Here is a source of regulated D.C. voltage for circuit development work. Power supply voltage and current drain to the circuit under test are constantly monitored by the 4½" panel mounted meter. Separate 6.3 volt at 4 ampere A.C. filament source available. The regulated and variable output voltage will be constant over wide load variations, and hum ripple will not exceed .012% at 250 volts under a 50 MA load. Completely isolated circuit, standby switch, and other desirable features, make the Model PS-2 extremely useful in a wide variety of applications.

Heathkit TV PICTURE TUBE TEST ADAPTER

The Heathkit TV Picture Tube Test Adapter used with the Heathkit Tube Checker Kit, will quickly check picture tubes for emission, shorts, etc. and determine tube quality. Consists of standard 12-pin TV tube socket, four feet of cable, octal socket connector, and data sheet.

No. 355
$4.50 Shpg. Wt. 1 lb.

Heathkit DECADE RESISTANCE KIT

MODEL DR-1
$19.50
Shpg. Wt. 4 lbs.

Twenty 1% resistors are decaded in 1 ohm steps to provide any value between 1 ohm and 99,999 ohms. Sturdy ceramic switches with silver plated contacts insure reliable service. Use the Decade Resistance in bridge circuits, meter multipliers, calibrations, or any application requiring a wide range of precision resistance values.

Heathkit AUDIO GENERATOR KIT

Here is an Audio Generator with features generally found only in the most expensive instruments. Sine wave coverage from 20 cycles to 1 Megacycle—response flat ±1 db from 20 cycles to 400 Kc—continuously variable and step attenuated output. Because the output voltage is relatively constant over wide frequency ranges, the AG-8 is ideal for running frequency response curves in audio circuits. Once set by means of the attenuator, this voltage may be relied upon for accuracy within ± 1 db. Instrument features low impedance 600 ohm output circuit and distortion less than .4 of 1% from 100 CPS through audible range.

MODEL AG-8
$29.50
Shpg. Wt. 11 lbs.

Heathkit DECADE CONDENSER KIT

The Heathkit Decade Condenser provides a ready source of capacity values from 100 mmf to .111 mfd inclusive in capacity steps of 100 mmf. Silver plated contacts on husky ceramic switches, assure positive contact for each switch position. Precision silver mica condensers ±1% accuracy for close tolerance accurate work.

MODEL DC-1
$16.50
Shpg. Wt. 3 lbs.

HEATH company
BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* HIGH FIDELITY

PREAMPLIFIER KIT

Here is the exciting new Heathkit Preamplifier with all of the features you Audiophiles have asked for and at a down-to-earth price level. Beautiful satin gold baked enamel finish, striking control knobs and arrangement, attractive custom appearance and entirely functional design.

DESIGN:

Uses three twin triode tubes in a shock mounted chassis. 2-12AX7 and 1-12AU7. Features tube shielding, plastic sealed color coded capacitors, smooth acting controls, good filtering, excellent decoupling, low hum and noise level, and all aluminum cabinet. Special balancing control for absolute minimum hum level. Cathode follower, low impedance output circuit for complete installation flexibility.

SPECIFICATIONS:

Provides five switch selected inputs, 3 high level, and two low level, each with individual level controls—4 position LP, RIAA, AES, and early 78 equalization switch—4 position roll-off switch, 8, 12, 16 with one flat position. Separate tone controls, bass 18 db boost and 12 db cut at 50 CPS, treble 15 db boost, and 20 db cut at 15,000 CPS. Power requirements from Heathkit Williamson Type Amplifier power supply 6.3 volts AC at 1 ampere, and 300 volts DC at 10 MA. Over-all dimensions 12 9/16" wide x 5 3/4" deep x 3 3/4" high.

APPLICATION:

The new Heathkit WA-P2 Preamplifier has been designed to operate with any of the Heathkit Williamson Type Amplifiers and is directly interchangeable with the previous Model WA-P1 Preamplifier unit. Order your kit today and enjoy completely smooth control over the operation of your Hi-Fi system. Obtain the exact tonal balance of bass and treble with the precise degree of equalization you want. Note that the design of the WA-P2 accommodates the newly established RIAA curve.

MODEL WA-P2
$19.75
Shpg. Wt. 7 lbs.

HAM EQUIPMENT

Heathkit
AMATEUR
TRANSMITTER KIT

The Heathkit AT-1 Transmitter has established a high reputation and has been enthusiastically accepted by hundreds of experienced operators as well as beginners. Power input up to 35 watts for the novice and suitable as a standby exciter for your higher powered rig later on.

Model AT-1 can be crystal or VFO excited and operates on 80, 40, 20, 15, 11 and 10 meters. The pre-wound coils with the oscillator and amplifier are switched simultaneously by the rugged band switch. Meter switch allows a reading of the final grid and plate current on the panel mounted meter. Modulator input and VFO power sockets are provided as well as a key jack for CW operation. Other features include a crystal socket, standby switch, key click filter, AC line filter, good shielding and a 52 ohm coaxial output. The 425 volt, 100 milliampere power supply and 5U4 rectifier are more than adequate for the 6AG7 oscillator multiplier and 6L6 amplifier doubler.

MODEL AT-1
$29.50
Shpg. Wt. 16 lbs.

Brand NEW
HEATHKIT
VFO KIT

Smooth acting illuminated and precalibrated dial.

The new Heathkit VFO is the perfect companion to the Heathkit Model AT-1 Transmitter and it has sufficient output to drive any multi-stage transmitter of modern design. Good mechanical and electrical design insures operating stability. Coils are wound on stable, heavy duty, ceramic forms using Litz or double cellulose wire coated with Polystyrene cement and baked for humidity protection. Variable capacitor of differential type construction, especially designed for maximum bandspread. Kit is furnished with a carefully precalibrated scale which provides well over two feet of scale length. Smooth acting vernier reduction drive and illuminated dial provides easy tuning and zero beating.

Power requirements 6.3 volts AC at .45 amperes, and 250 volts DC at 15 mils. Just plug it into the power receptacle provided on the rear of the AT-1 Transmitter. Seven band coverage 160 through 10 meters with 10 volt average RF output. Uses 6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.

Seven band coverage 160 through 10 meters at 10 volt RF output.
6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.

MODEL VF-1
$19.50
Shpg. Wt. 7 lbs.

Heathkit
GRID DIP METER KIT

The invaluable instrument for Hams, servicemen and experimenters. Useful in TV service work, for alignment of traps, filters, IF stages, peaking compensation networks, etc. Locates spurious oscillation, provides a relative indication of power in transmitter stages. Use it for neutralization, locating parasitics, correcting TVI, measuring CL and Q of components, and determining RF circuit resonant frequencies. The variable meter sensitivity control, headphone jack, 500 microampere Simpson meter, continuous frequency coverage from 2 MC to 250 MC. Prewound coil kit and rack included.

LOW FREQUENCY COILS:

Low frequency range extended to 355 KC by the use of two additional coils. Complete with dial correlation curves. Set 341-A for GD-1B and set 341 for GD-1A. Shipg. wt. 1 lb. Price $3.00

MODEL GD-1B
$19.50 Shpg. Wt. 4 lbs.

Heathkit ANTENNA
IMPEDANCE METER KIT

MODEL AM-1
$14.50
Shpg. Wt. 2 lbs.

Determine antenna resonance and resistance, transmission line surge impedance, and receiver input impedance. Works with one-half and one-quarter wave lines, half wave and folded dipoles, harmonic mobile and beam antennas. Resistance type SWR bridge —100 microampere meter—frequency range 0-150 MC—impedance range 0-600 ohms.

MODEL AC-1
$14.50
Shpg. Wt. 4 lbs.

Heathkit
ANTENNA COUPLER KIT

For the Heathkit AT-1 Transmitter or any comparable Amateur Transmitter. Will handle power up to 75 watts at its 52 ohm coaxial input. Matches a wide range of antenna impedances with its L type tuning network and neon indicator. A tapped inductance provides coarse adjustment and a transmitting type variable condenser sets it "right on the nose." Will operate on the 10 through 80 meter bands.

HEATH company
BENTON HARBOR 15,
MICHIGAN

New LOW PRICED HEATHKIT SINGLE UNIT Williamson Type *High* Fidelity AMPLIFIER KIT

Here is the newest Heathkit Hi-Fi Amplifier at the lowest price ever quoted for a complete Williamson Type Amplifier circuit. The W-4 Model has been designed for single chassis construction, and only for the new Chicago Transformer Company Model BO-13 "super range" high fidelity output transformer. This transformer, a new development in the Hi-Fi field, is being offered at substantial saving over transformers of comparable quality. It is outstanding in performance and on the basis of our tests, we find it equal in every respect to transformers used in the W-2 and W-3 Heathkit series.

LOW PRICES:

Through utilization of a single chassis with resultant economy obtained through elimination of duplicate sheet metal fabrication, connecting cables, plugs, sockets, and a new Chicago "super range" output transformer, a 20% price reduction has been made possible without sacrificing kit quality.

COMPONENTS:

The new Heathkit W-4 uses the same heavy duty power transformer and choke. It has all of the features of previous models including individual jacks and a wire wound control to balance the output tubes—plastic high quality capacitors and the exact circuitry previously utilized in Williamson Type Amplifiers. Intermodulation distortion and harmonic distortion are both at the same low level as in the W-2 and W-3 models.

CONSTRUCTION:

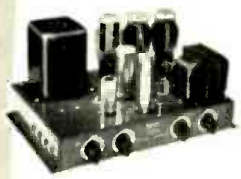
Here is the opportunity for even the economy minded Hi-Fi enthusiast to enjoy all of the advantages offered through Hi-Fi reproduction of fine recorded music. Simplified step-by-step Construction Manual completely eliminates necessity of electronic knowledge or special equipment. Assemble this Amplifier in a few pleasant hours.

COMBINATIONS AVAILABLE

W-4M with Chicago "super-range" transformer only. Single chassis main amplifier and power supply. Shipping weight 28 lbs. Express only **$39.75**

COMBINATION W-4 with Chicago "super-range" transformer only includes single chassis main amplifier and power supply with WA-P2 preamplifier kit. Shpg. wt. 35 lbs. Express only **$59.50**

NEW *Heathkit* 20 WATT High Fidelity AMPLIFIER KIT



MODEL A-9B

$35.50

Shpg. Wt. 24 lbs.

In keeping with the progressive policy of the Heath Company, further improvement has been made in the already famous Heathkit High Fidelity 20 Watt Amplifier. Additional reserve power has been obtained by using a heavier power transformer. A new output transformer designed and manufactured especially for the Heath Company, now provides output impedances of 4, 8, 16 and 500 ohms. The harmonic distortion level will not exceed 1% at the rated output.

FEATURES:

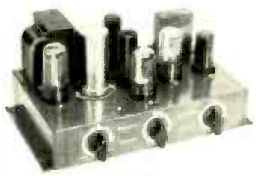
Outstanding features of the Heathkit 20 watt Amplifier include frequency response of ±1 db from 20 CPS to 20 KC. Separate (boost and cut) bass and treble tone controls. Four switch selected input jacks and a special hum balancing control. Flexibility is emphasized in the input circuits and proper equalization for all input devices is incorporated.

TUBE LINEUP:

12AX7 magnetic preamplifier and first audio amplifier. 12AU7 two stage amplifier with tone controls. 12AU7 voltage amplifier and phase splitter. Two 6L6 push-pull beam power output and 5U4G rectifier.

The Heathkit Model A-9B is excellent for custom installation and is designed for outstanding service at a very reasonable cost.

Heathkit SIX WATT AMPLIFIER KIT



MODEL A-7B

$15.50

Shpg. Wt. 10 lbs.

An outstanding value, this economically priced 5 watt Amplifier is capable of performance expected only in much more expensive units. Only 2 or 3 watts output will ever be used in normal home applications and Model A-7B will be more than adequate for this purpose.

SPECIFICATIONS:

Two switch selected inputs are available for crystal and ceramic phono pickups, tuner, TV audio, tape recorder, and carbon type microphone. Model A-7B features separate bass and treble tone controls, push-pull balanced output stages, output impedances of 4, 8, and 15 ohms, and extremely wide frequency range ±1½ db from 20 CPS to 20 KC. Not just a souped up AC-DC job. Full wave rectification, transformer operated power supply and good filtering, result in exceptionally low hum level.

MODEL A-7C

Provides a preamplifier stage and proper compensation for the variable reluctance cartridge and low level microphone. $17.50

Heathkit WILLIAMSON TYPE AMPLIFIER KIT

Here is the famous kit form Williamson Type *high fidelity* Amplifier that has deservedly earned highest praise from every strata of Hi-Fi music lovers. Virtually distortionless, clean musical reproduction, full range frequency response, and more than adequate power reserve.

OUTPUT TRANSFORMERS:

This outstanding Williamson Type Hi-Fidelity Amplifier is supplied with the famous Acrosound TO-300 output transformer. This quality transformer features the popular "ultra-linear" output circuit for clean maximum power level. Separate chassis for amplifier and power supply.

SPECIFICATIONS:

Frequency response within 1 db from 10 cycles to 100,000 cycles. Harmonic distortion at 5 watt output less than .5% between 20 cycles and 20,000 cycles. IM distortion at 5 watts equivalent output .5% using 60 and 3,000 cycles. Output impedances of 4, 8, or 16 ohms. Overall dimensions for each unit 7" high x 5½" wide x 11½" long.

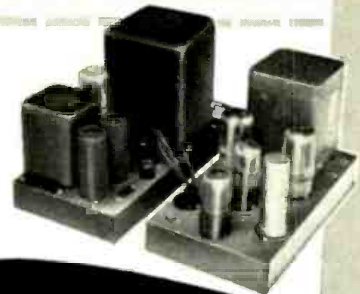
CONSTRUCTION MANUAL:

This fine kit is supplied with a completely detailed step-by-step Construction Manual and the only effort required is the assembly and wiring of the pre-engineered kit. Even the complete novice can successfully construct this Amplifier and have fun building it.

COMBINATIONS AVAILABLE:

W-3 Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer, Power Supply and WA-P2 Preamplifier.) Shipping weight 37 lbs. Shipped express only..... **$69.50**

W-3M Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer and Power Supply.) Shipping weight 29 lbs. Express only **$49.75**



HEATH company
BENTON HARBOR 15, MICHIGAN

Heathkit COMMUNICATIONS RECEIVER KIT

Separate BFO oscillator tube and circuit.

Continuous coverage 550 KC—35 MC on 4 Bands.

MODEL AR-2

$25.50

(Less Cabinet)

Shpg. Wt. 12 lbs.

Phone—standby—CW panel switch.

RF gain control with AGC on-off switch.

Electrical band-spread tuning with logging scales.

An excellent example of typical Heath Company ability to produce top quality kit merchandise at ridiculously low prices, is the AR-2 Communications Receiver. Here is a transformer operated all-wave receiver with all of the desired features and none of the disadvantages commonly encountered in so-called "economy sets."

Receiver employs high gain miniature tubes and IF transformers, chassis mounted 5½" PM speaker, headphone jack, slide rule dial with Ham Bands plainly identified, and easy tuning with direct planetary drive. Continuous frequency coverage from 550 KC to 35 MC on 4 Bands, with electrical bandspread tuning and logging scales. Other features are RF gain control with AGC on-off switch—phone-standby-CW panel switch—prewound coils in a shielded turret assembly and copper plated chassis and shielding.

Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector-first audio, 12A6 beam power output, 12BA6 BFO oscillator, and 5Y3 rectifier. A lettered control plate is provided for the cabinet of your choice or you can order the optional Heathkit cabinet featuring the full size aluminum panel.

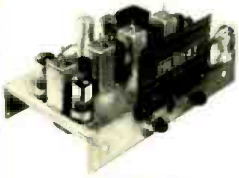
RECEIVER CABINETS

Proxylin impregnated fabric covered plywood cabinet available for BR-2 and AR-2 receivers. Includes aluminum panel, flocked reinforced speaker grill and protective rubber feet.

For BR-2 Receiver, Cabinet 91-9
Shipping weight 5 lbs. **$4.50**

AR-2 Receiver, Cabinet 91-10
Shipping weight 5 lbs. **$4.50**

Heathkit FM TUNER KIT



MODEL FM-2

$22.50

Shpg. Wt. 8 lbs.

Here is an FM Tuner that can be operated with your Hi-Fi Amplifier or through the "phono" section of the ordinary radio. Completely AC operated to eliminate problems usually encountered in "economy type" AC-DC tuner circuits. Features 8 tube circuit with separate mixer and oscillator, 3 double tuned IF stages followed by a limiter discriminator providing maximum sensitivity and selectivity across the full FM frequency band of 88 MC to 108 MC. The tuning unit is factory assembled and adjusted, thus eliminating tedious critical "front end" alignment problems. The attractive slide rule dial and vernier tuning combine to make the Heathkit FM-2 Tuner simple to operate.

Heathkit BROADCAST BAND RECEIVER KIT

MODEL BR-2

$17.50

(Less Cabinet)

Shpg. Wt. 10 lbs.

The Model BR-2 Broadcast Band Receiver is designed especially for the beginner without any sacrifice of quality. This receiver features a transformer operated power supply, high gain miniature tubes, sharply tuned IF transformers, new rod type built-in antenna, and a trouble-free planetary tuning system. Exceptional performance with unusually high sensitivity, good selectivity, and excellent tone quality from the 5½" PM chassis mounted speaker. Can be used either as a receiver, tuner, or phono amplifier. Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector, 12A6 beam power output, and 5Y3 rectifier.

HEATH COMPANY · Benton Harbor 15, Mich.

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HEATH COMPANY
BENTON HARBOR 15, MICHIGAN

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ON PARCEL POST ORDERS insure postage for weight shown.

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A PHOTOELECTRIC CONTRAST CONTROL

Fig. 1. Back and front views of the contrast control. The filament transformer is not required if the TV set has a source of about —90 volts.

By

PETER J. VOGELGESANG

Build this automatic control for adjusting the TV picture to various room lighting conditions.

IN the early days of television, the family set was usually turned on only in the evening because the daytime hours afforded poor program material if, indeed, they afforded any programs at all. Now, however, the television set is apt to be turned on at dawn, be left on through the hours of the day, and turned off only after the National Anthem has been heard. Obviously, the set is viewed through a variety of lighting conditions. The purpose of the photoelectric contrast control is to adjust the picture contrast to the surrounding lighting conditions automatically.

The contrast of a picture is determined principally by the amount of video signal fed to the picture tube. A high video signal produces a picture with high contrast and a low video signal produces a picture with low contrast. It follows that an automatic contrast control must in some way control the amount of video signal fed to the picture tube, and that the amount of video signal must be proportional to the amount of illumination in the room.

Manual contrast control is accomplished in almost all television sets by changing the gain of the video amplifier. Sometimes it is done with a variable bias on all the i.f. amplifiers, and sometimes it is done with a variable bias on a single stage as shown in Fig. 2. No matter how the gain is varied, the amplifiers are almost always pentodes, and this makes controlling the contrast of the picture with a phototube a comparatively simple problem.

Fig. 3 shows the circuit of the photoelectric contrast control. The circuit is connected to the screen grid of the final video amplifier. Normally, the screen grid voltage would be at some comparatively high d.c. potential (about 100 to 250 volts) but with one half of the 12AT7 drawing current through the screen resistor, the screen voltage is dropped considerably lower, thereby reducing the gain of the tube. This reduces the amount of video signal to the picture tube and lowers the contrast. Now, when light strikes the 868 phototube a minute current flows through the 20 megohm resistor, R_3, and causes the grid of the V_{1b} to become negative. This reduces the plate current which, in turn, raises the screen grid voltage of the video amplifier. More video signal is fed to the picture tube and the contrast increases. The change in contrast is nearly proportional to the amount of light striking the phototube.

If the room happened to be illuminated with fluorescent lights the phototube would place a 120-cycle voltage on the grid of V_{1b}. This would appear also on the screen grid of the video amplifier—something that would be very undesirable. Condenser C_2 filters any a.c. component that might be present and smooths the operation of the circuit so the picture contrast will not flutter. About two seconds are required for the circuit to make complete adjustment to a change in room illumination.

The television set in which this circuit was installed did not have a negative voltage supply to operate the phototube so one had to be devised. A filament transformer was connected in reverse to supply the high voltage negative a.c., and the unused half of the 12AT7 tube was used as a half-wave rectifier. The maximum anode voltage for an 868 phototube is 90 volts and since the power supply delivers about 150 volts peak, the voltage is divided by resistors R_1 and R_2. Resistor R_2 is a potentiometer, so the sensitivity of the phototube can be varied. If the picture contrast is too high for a given amount of room light, the wiper of the potentiometer can be moved toward the ground end to reduce the sensitivity of the circuit. If the circuit is installed in a television set with a negative power supply the filament transformer power supply will not be required. However, the phototube should be provided with at least —60 volts for satisfactory operation.

The unit was constructed on a piece

(*Continued on page* 95)

Fig. 2. Typical video amplifier circuit of many TV receivers. The automatic contrast control circuit is connected to the screen of this tube.

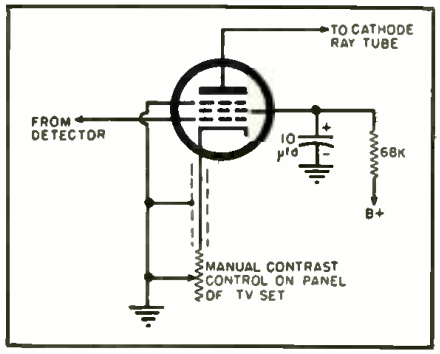
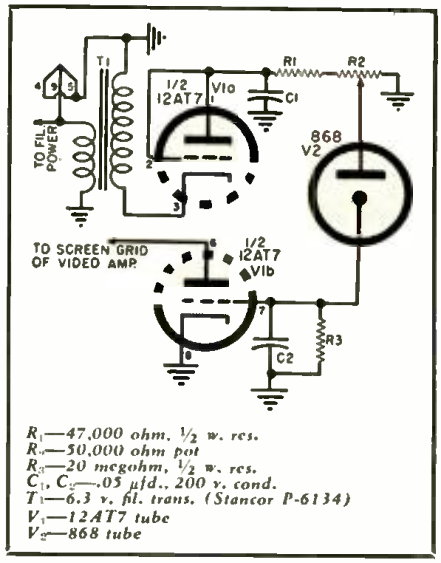


Fig. 3. Circuit diagram and parts list of the photoelectric contrast control.



R_1—47,000 ohm, ½ w. res.
R_2—50,000 ohm pot
R_3—20 megohm, ½ w. res.
C_1, C_2—.05 µfd., 200 v. cond.
T_1—6.3 v. fil. trans. (Stancor P-6134)
V_1—12AT7 tube
V_2—868 tube

ANTENNA ANTICS

By **ART MARGOLIS**

Orienting a TV antenna for best reception. Portable phones are used as a means of communication between man on roof and partner at set.

Some interesting experiences from the daily rounds of a TV antenna installation technician—while a few are amusing, they all point up the need to be careful.

EVEN the jokers read the newspaper account with a grim shaking of their heads. He worked for a different company. None of us knew him personally, but still the news was greeted as if he was one of us. The story told of his being a novice at climbing ladders and installing antennas. It was only his second day on the job. He and his crew partner were installing an antenna on a chimney which was located on the peak of a suburban mansion roof. They had put the complete rig together on the ground. The new antenna installation man took the assembled aerial and held it aloft. Balancing it in a standup position, like a circus performer, he began a slow torturous climb up the fully extended aluminum ladder. After many gasps for air he reached the top and raised the mast high to insert it into the open mouth of the steel-strapped chimney mount. Then the end of the reflector, ever so gently, came to rest against a worn electric wire. The sparks flew and a full-grown man tumbled down forty feet of extended ladder. The antenna rig remained, mutely pointing into the sky at a bizarre angle from between the top two rungs.

Somehow the victim was spared his life. However, he was lying quietly in a hospital with a broken leg and a severe case of shock.

At that time I was an antenna service technician. Rather than installing new aerials, I went around and did the troubleshooting on antennas that went bad. I shuddered that day because of a similar experience I had only a week or so prior to this tragic accident.

My working partner and I went to service a condition that was occurring in a 16" *RCA*. Most of the time the pictures would be fine, but just as the viewers would be lulled into a state of enjoyment, it would happen. A snow blizzard would descend in the middle of the program. Our inspection of the set revealed the snow occurring on all three Philadelphia stations; channels, 3, 6, and 10, although 10 seemed the least hard hit.

We put up our ladder and grumbled at its weight. Our aluminum ladder was being repaired and we had drawn the spare—a heavy wooden one. Then we clambered up onto the roof. The trouble was located in a jiffy. One of the eyelets on the dipole connection had broken loose. It would intermittently touch the connection point and vary the pictures from a beautiful clarity to a heavy snowfall. Channel 10 was not affected too severely because the transmitter was very close and its signal strength was extremely high.

We made the repair and began to take down the ladder. One gets careless with a wooden ladder. While we wouldn't dream of resting a metal ladder on current-carrying wires, we nonchalantly allowed the wooden stairway to the stars to enjoy the wire's softness. The heavy ladder when moved, pushed the supporting cables into the drain pipe that ran from the roof to the ground. A white "whoosh" came from the puddle of water at the bottom of the pipe as high voltage pumped heavy current into it.

Automatically, we grabbed the ladder and disengaged the wire from the pipe. When the ladder was once more safely on the truck top we walked into the house and investigated. No one was hurt, no fuses blown, and everything was OK. We were lucky, but serious repercussions could easily have resulted from such careless antics.

Wires can be dangerous for other reasons besides the electric death that lies crackling inside them. We were on a call in Germantown. Channel 6 was perfect but 3 and 10 were terrible. All types of weaves and ghosts gave the pictures an unwatchable appearance. The customer told us that pictures had been excellent.

We went outside and threw up our ladder. Once on the rooftop we agreed that this should be our last job for the day since it was beginning to get dark. Visual inspection of the antenna system revealed that the ribbon-type, 300-ohm lead-in wire had snapped off neatly at the base of the antenna mast, where it was forced to make a 90-degree turn through a stand-off insulator. This had rendered the aerial itself useless and only the wire lead was acting as the antenna system. Channel 6 had remained strong for we were only about forty blocks away from its transmitter in nearby Roxborough.

The wire was spliced and soldered and my partner went down to check the pictures. He yelled up OK, and I started for the ladder. Something sharp and taut hit my ankles and I fell flat on my chest with my face and neck peering over the roof edge. In the dimness, a low strung wire had tripped me and I had come gosh-awful close to a nasty fall.

My co-worker and I walked into a

(*Continued on page* 115)

Simpson TECHNICIAN'S TIMESAVER

PROFITABLE SHORTCUTS TO FASTER TV SERVICING

OCTOBER, 1954 NEXT ISSUE, NOVEMBER, 1954

SAVE EACH ISSUE

HOW TO SERVICE COLOR-TELEVISION RECEIVERS WITH THE GENESCOPE*

By Bob Middleton

The "Technician's Timesaver," formerly mailed to television service technicians, is brought to you as an industry service by Simpson Electric Company. In order that more readers may have access to this technical information by Bob Middleton, we are now publishing it in "Radio & Television News."

Why not write to Bob Middleton at Simpson, and tell him what you would like to see in future issues? He'd like to hear from you.

GENESCOPE or MODEL 479 Must Be Applied Properly in Color Tests

Although the GENESCOPE and MODEL 479 *provide more color-TV test information* than any other instruments of their type which are known to the writer, it is nevertheless necessary to *apply* the instruments correctly to obtain the desired test results.

For example, when the GENESCOPE* or MODEL 479 are used with the CHROMATIC PROBE* to check the response of the chroma or chrominance circuits, a flat FM output from 8 kc to 4.5 MC is available; however, to obtain the benefit of this extended low-frequency sweep, *conventional demodulator probes must be avoided.* Instead, the scope must be used with a low-capacitance probe, or must be applied directly at a suitable low-impedance circuit point. The TV technician finds this extended low-frequency sweep of considerable value in checking the I and Q, or the (R-Y) and (B-Y) channels in a color-TV receiver.

It is also essential to *eliminate noise and interference* voltages from the color circuits when making frequency-response tests. Fig. 1, for example, shows the serious consequence of permitting noise from the i-f amplifier to enter the Y channel during sweep-frequency tests. After the i-f amplifier is *biased off*, the desired curve display is obtained, as shown.

Interference from the horizontal sweep circuit may also be a problem in making a chroma circuit test. For example, Fig. 2 shows the appearance of interference from the horizontal sweep circuit; the entire display is made fuzzy by superimposition of 500 pulses per scan. Technicians sometimes suppose that a bypass capacitor can be shunted across the input terminals of the scope to eliminate such interference, but as is shown in Fig. 2, *this practice leads to curve distortion.* The proper procedure is to eliminate the source of the interfering voltage, by disabling the horizontal sweep circuit.

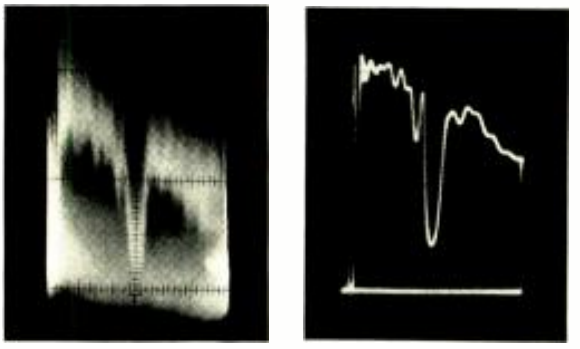


Fig. 1 (Left) Response of Y amplifier, AGC uncontrolled. (Right) Response of Y amplifier, i-f amplifier biased off with —6 volts. Ripple caused by ringing delay line. Dip caused by 3.58-Mc trap.

Sometimes, when the horizontal-sweep circuit is disabled by removing the horizontal-output tubes, the d-c distribution in the receiver circuits is upset because of the decreased load on the power supply. In such case, the operator should use *dummy tubes* to replace the horizontal-output tubes, as shown in Fig. 3. The dummy tubes are constructed from a pair of wire-wound power resistors, octal tube bases, and tube plate caps. The resistance value used should be *equal to the d-c plate resistance* of the horizontal output tube, (e.g., 20,000 ohms).

Another common source of difficulty in chroma circuit tests is caused by applying a demodulator probe or a low-capacitance probe *at an unsuitable point in the circuit under test.* This point is illustrated by the photographs shown in Fig. 4, and the circuit arrangement shown in Fig. 5.

It is sometimes found that more scope deflection is desired in tests of this kind. In such case, the operator may connect the SIMPSON MODEL 406 CHROMATIC AMPLIFIER* *between the output of the circuit under test, and the demodulator probe* which is in turn connected to the input terminals of the scope. This amplifier provides a

* Trade Mark

HOW TO SERVICE COLOR-TELEVISION RECEIVERS WITH THE GENESCOPE* — (continued)

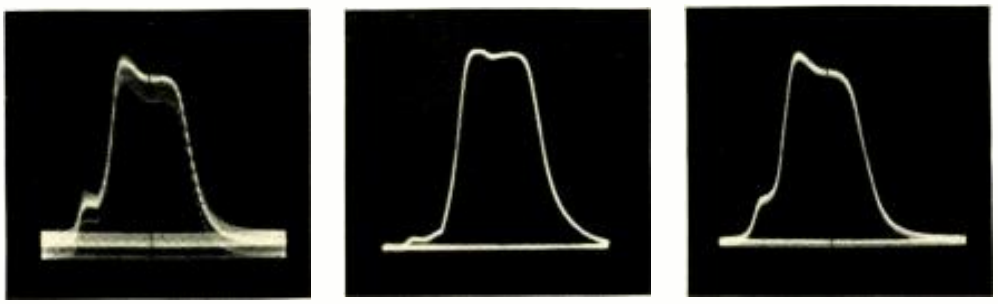


Fig. 2 (Left) Response of chroma amplifier, with cross-talk present from the horizontal-sweep circuit. (Center) Removal of sweep pulses by shunting input terminals of scope with bypass capacitor; excessive capacitance distorts curve shape. (Right) Undistorted curve obtained when horizontal sweep circuit is disabled; no shunt capacitance used across scope input terminals.

gain of approximately 40 times, with a frequency characteristic which is flat within 1 db to 4 Mc. Ample scope deflection can be obtained, even in low-gain circuits and when low-gain scopes are used in the test.

Note that the shielded input cable to a scope may be connected directly at the cathode of the phase splitter circuits, without disturbing circuit operation. Such direct connection affords a gain of ten times over that which is obtained when a conventional low-capacitance probe is used.

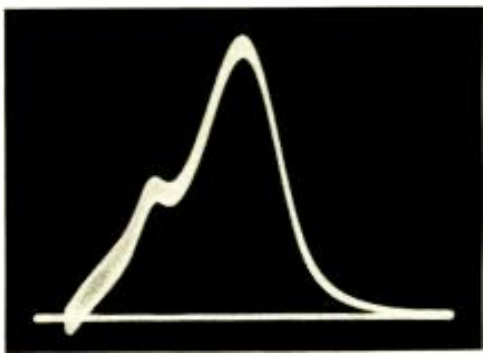
Technicians are becoming well aware of the necessity for utilizing a *flat sweep voltage* to test color-TV circuits. It is advisable to always check the flatness of the sweep voltage, before proceeding with a test. For example, if the operator wishes to check the flatness of the output from the CHROMATIC PROBE*, a suitable arrangement is shown in Fig. 6, bottom of page 3.

The distortion which is introduced into a response-curve display by a generator with output which is not flat is illustrated in Fig. 8. When the generator characteristic is non-linear, the operator *compounds the difficulty* by attempting to misadjust the circuit to compensate for the non-linear generator characteristic. Hence, the value of tests such as depicted in Fig. 7. Since the GENESCOPE* and MODEL 479 are rated to a flatness of *0.2 db per Mc of sweep width*, the operator can use these instruments in tests of color circuits with complete confidence.

Fig. 3 A dummy pair of horizontal output tubes, for replacement of the 6BG6 output tubes during sweep tests of chroma circuits. Dummy tubes maintain normal load on the receiver power supply for proper d-c distribution.

Marking Chroma Response Curves Does Not Require Special Marking Equipment

When using the GENESCOPE* or MODEL 479 to develop a chroma or chrominance response curve, the operator *does not need to use any marking equipment other than the calibrated dials provided* on these instruments. Fig. 9 illustrates the process of determining desired frequency points along a Y channel response. When the FM and AM dials of the GENESCOPE* are set to the same frequency (such as 160 Mc), and the horizontal phasing control of the instrument is properly adjusted, trace and retrace are both visible in the display, as shown in Fig. 9 (A). The zero



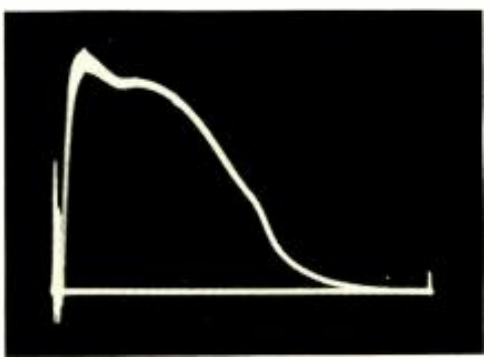


Fig. 4 (Above) Response of Q demodulator, with probe applied at output of demodulator; (Below) Response of Q demodulator, with probe applied at output of Q phase splitter.

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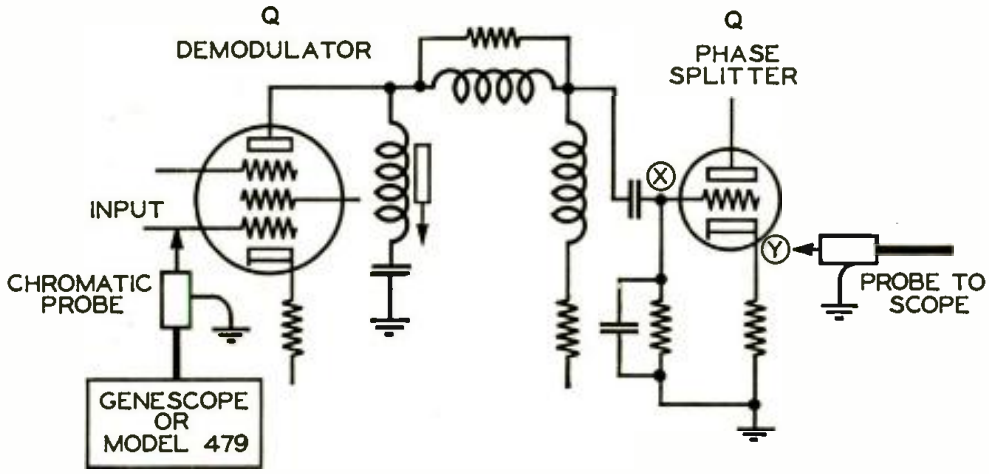

Fig. 5 Typical test set-up for sweep-frequency check of the Q demodulator circuit in a color-TV receiver. The sweep input signal is applied at the grid of the Q demodulator Tube. The scope can be energized through a low-capacitance probe for low-frequency tests, or through a peak-to-peak high-frequency probe for high-frequency tests. (A direct connection or a low-capacitance probe is required to test the circuit response below 100 kc, where conventional demodulator probes become inefficient). It is highly essential to apply the scope probe at point Y in the circuit, instead of point X. Fig. 4 illustrates why.

frequency point in the twinned display appears in the center of the pattern.

The retrace is next converted into a zero —volt reference line, by turning on and phasing the Blanking control properly, as shown in Fig. 9 (B). In the next step, the operator turns either the FM or the AM dial of the GENESCOPE by a suitable amount in order to *bring the zero-frequency point to the left-hand end of the base line,* as shown in Fig. 9 (C).

Frequency determinations of any points along the response curve can then be made as illustrated in Fig. 9 (D), (E), and (F). In Fig. 9 (D), the dial of the GENESCOPE has been moved through 1.65 Mc, to locate the 1.65-Mc point on the Y response curve. In Fig. 9 (E), the dial has been moved through 2.65 Mc, to locate the 2.65-Mc point on the curve. In Fig. 9 (F), *the dial has been moved through 3.58 Mc, to check the trap frequency.*

Many other vital and interesting test procedures are included in color-TV servicing. Watch for the next issue of The Technician's Timesaver!

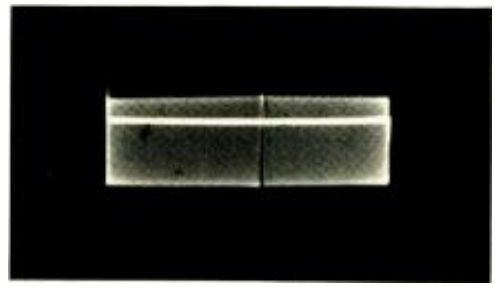

Fig. 7 Result of test depicted in Fig. 6. The sweep width of the Genescope has been reduced to a small value, in order not to exceed the response capabilities of the vertical amplifier in the scope. Zero frequency appears approximately in the center of the pattern. Note the flatness and accuracy of the output, as well as the extremely narrow low-frequency notch. Output from Chromatic Probe extends down to 8 kc.

(Additional Scope patterns are shown on following page, 4)

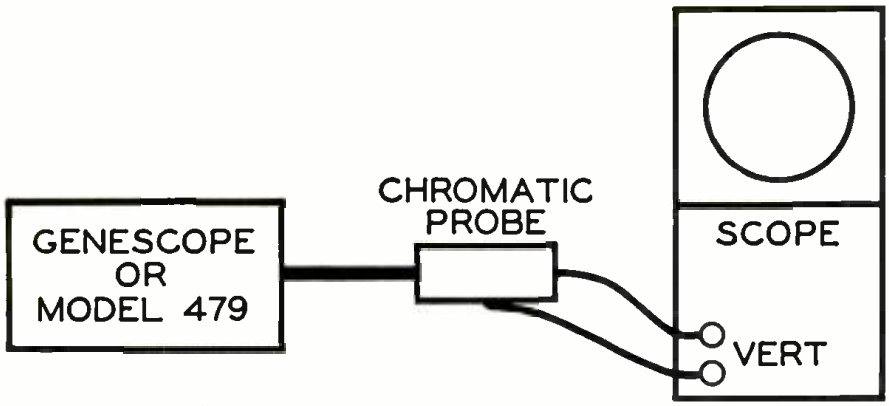

Fig. 6 Suitable method of checking output from Chromatic Probe for flatness. Note that this test is valid only up to the frequency for which the scope response is flat. (See Fig. 7.)

HOW TO SERVICE COLOR-TELEVISION RECEIVERS WITH THE GENESCOPE* (continued)

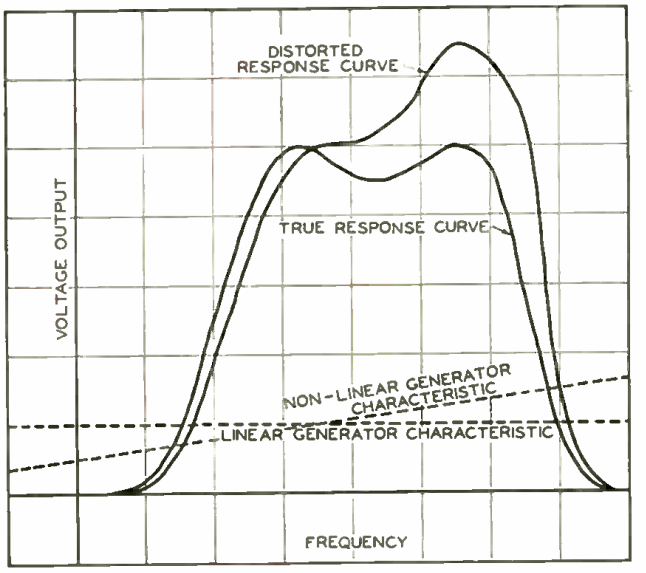

Fig. 8 The non-linearity shown in the sweep-generator output produces the curve distortion indicated. Greater degrees of non-linearity produce correspondingly greater amounts of distortion in the reproduced curve.

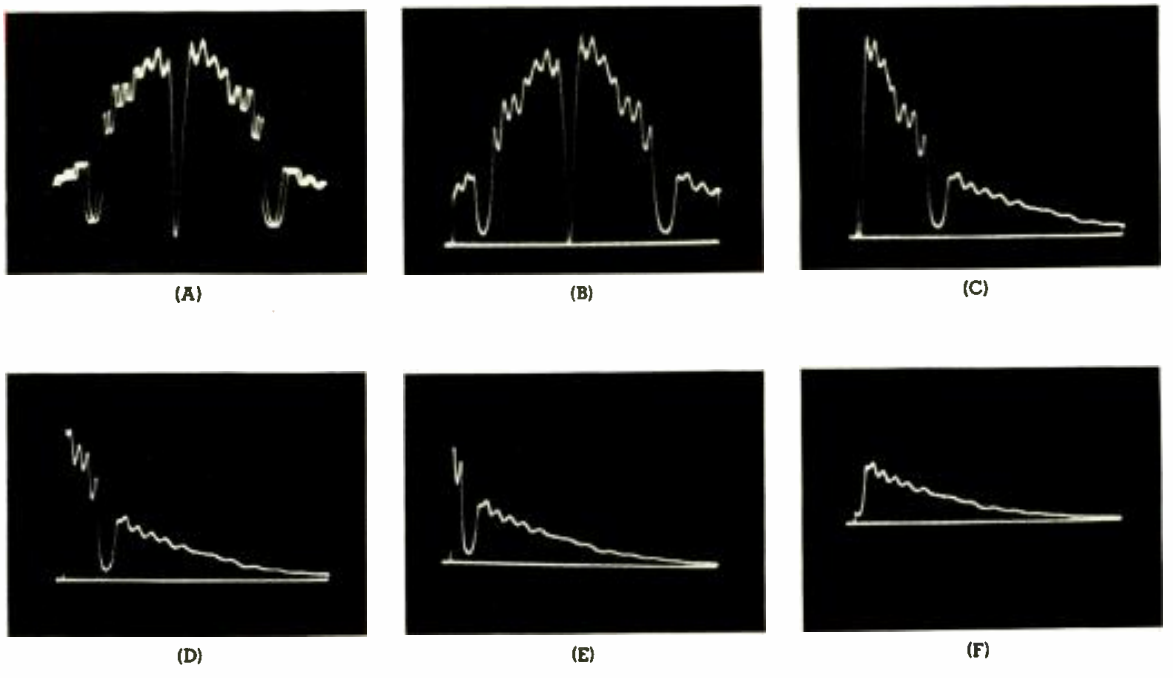

Fig. 9 Progressive steps in check of Y amplifier response curve. (A) Response curve, with retrace unblanked. (B) Retrace converted to zero-volt reference line. (C) Zero-frequency point tuned to left-hand end of base line. (D) Generator dial moved up 1.65 Mc, to locate 1.65-Mc point of curve. (E) Generator dial moved up 2.65 Mc, to locate 2.65 Mc point on curve. (F) Generator dial moved up 3.58 Mc, to locate 3.58-Mc point on curve.

* Trade Mark

Watch for next issue: "Low Frequency Chroma-Circuit Testing with the Genescope." It will be published in the next (November, 1954) issue of Radio and Television News.

Economy Grid Dipper

(*Continued from page 55*)

lish check points. Many of these will give indications up to the fifth overtone in addition to the fundamental. The highest frequency range is best checked on a Lecher wire system if a v.h.f. signal generator is not available although, again, a receiver or even a TV set will suffice.

The basic use of the instrument is, of course, as a resonance indicator being inductively coupled to intended and suspected resonance circuits. In this application it may also be used as a capacity and inductance meter in conjunction with standard condensers or inductances and suitable reactance charts, or by actual calculations. The circuit becomes a wavemeter when the oscillator plate voltage is off and, with the addition of phones, a monitor. If plate voltage and phones are used a heterodyne detector action results. Needless to say, it is an effective signal generator and if audio modulation is applied through the phone jack it becomes a bar generator for TV linearity checks.

The uses of the instrument are many and varied. The reader is tritely referred to his own ingenuity and to the sources cited for additional functions and modes of operation.

REFERENCES

1. *Frye, John T.: "Mac's Radio Service Shop,"* Radio & Television News, *February 1953.*

2. *Rogers, Walter S.: "TV Servicing with Grid-Dip Oscillator,"* Radio & Television News, *October 1950.*

3. *Chambers, C. Vernon: "Miniature Grid-Dip Meter Using a Magic Eye Indicator," QST, March 1953.*

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Contrast Control

(*Continued from page 89*)

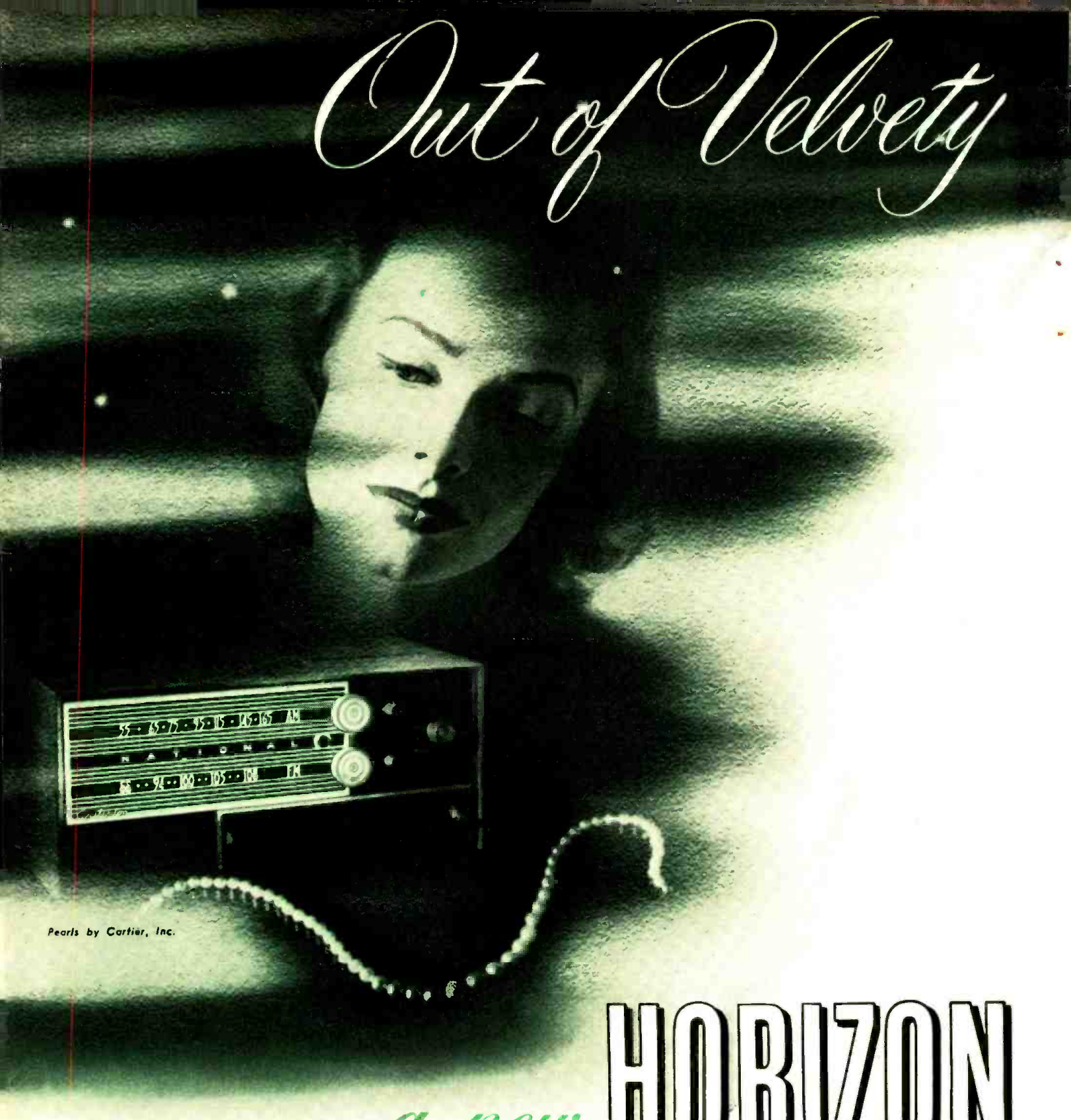
of sheet aluminum 3"x3½" as shown in Fig. 1. Connections to the video circuit are made with an adapter. The contacts were removed from a seven-pin miniature socket and lengths of paper clip wire were soldered to the contacts of a second socket. The wires were pushed down through the holes in the first socket and the two sockets were fastened together with two No. 5-40 machine screws as shown in Fig. 4. Connecting wires were then soldered to the heater and screen pins of the adapter. The adapter can be plugged into the socket of the video amplifier and then the video amplifier tube can be plugged into the adapter. Thus, the unit can be connected to the television set without disturbing any chassis wiring.

The unit was mounted to the picture-tube support and a hole drilled in the back panel of the set to allow the potentiometer shaft to protrude. The phototube should be mounted on the front near the picture tube. A small amount of paint may be scraped off the inside of the front safety-glass panel and the tube taped behind the hole. There are many other ways to mount this tube however.

Adjustment of the unit is very simple. When it has been installed and the television set is turned on, the picture will be very dark because of the low screen voltage on the video amplifier. Adjust the manual contrast and brightness controls on the television set for a normal picture in a dark room. This will require control settings considerably beyond the normal ones. Now switch on a room light and adjust the potentiometer on the unit until the picture accommodates the increase in illumination. The unit is now adjusted and the picture will adjust automatically to a wide range of room illumination. If the picture cannot be brightened sufficiently by the manual contrast and brightness controls, the screen voltage is too low and some resistance must be added between the plate of the 12AT7 tube and the screen grid of the video amplifier. Start with 10,000 ohms and increase the resistance until the picture brightens sufficiently.

Different television manufacturers use different video circuits and there are, no doubt, some sets to which this unit is not adaptable. However, many variations can be made in the phototube circuit. With a little imagination and a few hours spent in experimentation, anyone can create a circuit which will automatically control the brightness of his television picture to his particular desires. —30—

Fig. 4. Complete photoelectric contrast control. The socket adapter for the video amplifier is at left. The phototube must be exposed to room lighting.



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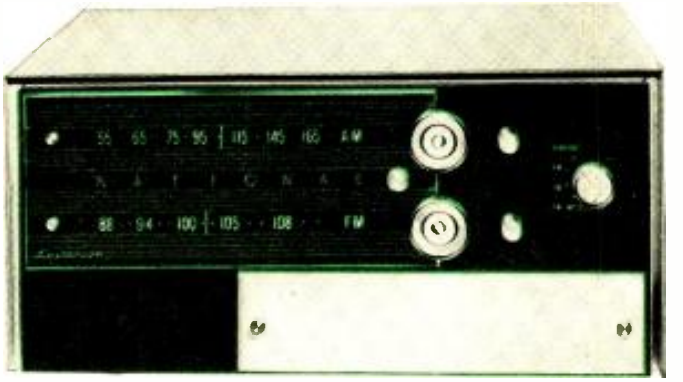
Your mood is safe when the music is played through National's magnificent new audio achievement — the new HORIZON series of intermatched tuner and amplifiers.
Even hiss and noise between FM stations have been conquered by National's exclusive MUTAMATIC tuning. Stations leap in out of velvety silence — stay locked in.
All tube noise, hum and distortion in tuner and amplifier have been reduced to an inaudible minimum.
It's more than high-fidelity . . . It's a wholly new listening experience!

tuned to tomorrow **National** NC

FOR COMPLETE SPECIFICATIONS WRITE DEPT. R AT

Silence

Never before a tuner so versatile!
You can enjoy full-band AM!
You can listen to matchless, drift-free FM!
You can hear *both* at the same time, using dual sound systems!
You can receive revolutionary new binaural broadcasts as they are made available in your area! Two gain controls and separate tuning condensers are provided — one for AM, one for FM!
Exclusive Mutamatic FM Tuning eliminates all hiss and noise between stations, so annoying when tuning conventional tuners! Stations leap out of velvety silence — stay locked in automatically! Unit features new "linear impedance" detection. Superior design eliminates drift.
An exceptional capture ratio rejects all unwanted signals up to 80% of the strength of the desired signal. The FM sensitivity proves the name — "the Criterion" — by which all other tuners are judged.



HORIZON *Criterion*
AM-FM TUNER $169.95 (SIZE: 16½" x 7")

To surpass the present high level of amplifier design, National proudly introduces new power amplifiers with a revolutionary new output circuit employing unity coupling.
With unity coupling, the output transformer is no longer required to supply the coupling between output tubes for distortion cancellation as in normal push-pull circuits. Instead, the transformer supplies only the impedance matching between the tubes and the speaker system, thus eliminating impulse distortion created by transformers. Music is reproduced with an unclouded transparency — at all listening levels — never before achieved!
The HORIZON 20 is a 20-watt amplifier with a total harmonic distortion of less than .3% and total intermodulation distortion of less than 1% at full rated output. Frequency response is ± .1 db 20 cps to 20 kcs; ± 1 db 10 cps to 100 kcs. Power response at rated output is ± .15 db, 20 cps to 20 kcs. Hum and noise is 80 db below rated output.

HORIZON *20*
20-WATT AMPLIFIER $84.95 (SIZE: 14½" x 4")

Incorporating the revolutionary new unity-coupled circuit in a 10-watt amplifier design, the HORIZON 10 offers performance never before achieved at such a moderate price!
The built-in preamp-control unit offers a choice of 3 inputs, 3 record equalization curves, a loudness control and separate bass and treble controls.
Harmonic distortion is less than .5%; intermodulation distortion, less than 2% at rated output. Frequency response is ± 1 db, 20 cps to 20 kcs; power response, ± 2 db, 20 cps to 20 kcs. Hum and noise are better than 70 db below rated output on high-level input, better than 50 db on low level input.

HORIZON *10*
10-WATT AMPLIFIER / PREAMP $79.95 (SIZE: 14½" x 4")

in high fidelity

The HORIZON 5 achieves a new high in frequency response (± 1 db, 20 cps to 100 kcs) and voltage output (up to 10 volts) — a new low in distortion (less than .2% harmonic, .3% intermodulation)!
Four inputs, 7 record equalization curves, a loudness-volume control and bass and treble controls are provided.
Entire unit slips quickly, easily into either the tuner or 20-watt amplifier.

HORIZON *5*
PREAMPLIFIER-CONTROL UNIT $49.95 (SIZE: 2½" x 10½")

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

FRINGE AREA FM ANTENNA

By

JESSE L. MEREDITH, JR.

A judicious compromise between maximum gain and directivity for good DX.

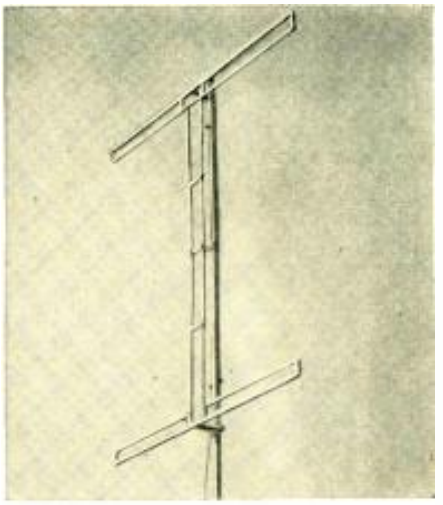


Fig. 1. View of the stacked-dipole FM antenna for home construction.

THE antenna to be described here and shown in Fig. 1 was designed out of frustration and necessity. It represents a compromise between maximum gain and directivity.

Not being complete TV addicts, we like our FM, but living in the outer reaches presents a complex FM problem. Our location is equidistant on a straight line between two large cities, both of which have good FM stations. To further complicate matters, we are located in a bottom-land area having hills rising 700 feet across the reception paths in both directions.

The usual folded dipole and reflector for FM works fairly well but is, of course, directional. The gain from the back of the dipole using a reflector is not sufficient to create quieting action in the set for those stations behind the reflector. A TV antenna will bring in the FM stations quite well, but is more directional than the dipole and reflector. A look at the bank balance killed any thought of using a directional antenna with a rotator. What to do? A bi-directional antenna is of course the answer, but the simple folded dipole just does not give enough gain.

A thorough perusal of the various suppliers' catalogues did not turn up anything that seemed quite suitable for stacking—that is, an antenna that would stack, have an impedance of 300 ohms to match the transmission line when stacked, and not be frequency sensitive due to necessity of matching with a tuned stub. True, FM reception is not as critical as TV; but nevertheless, our available signal in this area is still relatively low and any little help cannot be ignored.

Two folded dipoles of 600-ohm impedance stacked without reflectors results in 300-ohm impedance to match the twin-lead. This arrangement gives, according to the reference books, a gain equal to that of a dipole and reflector and is bi-directional. Not being an engineer, I spent much time searching reference books for the proper formulas to give me the answers I

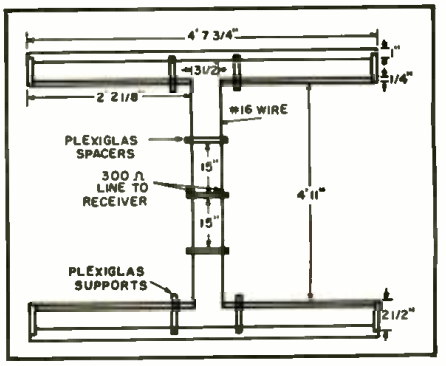
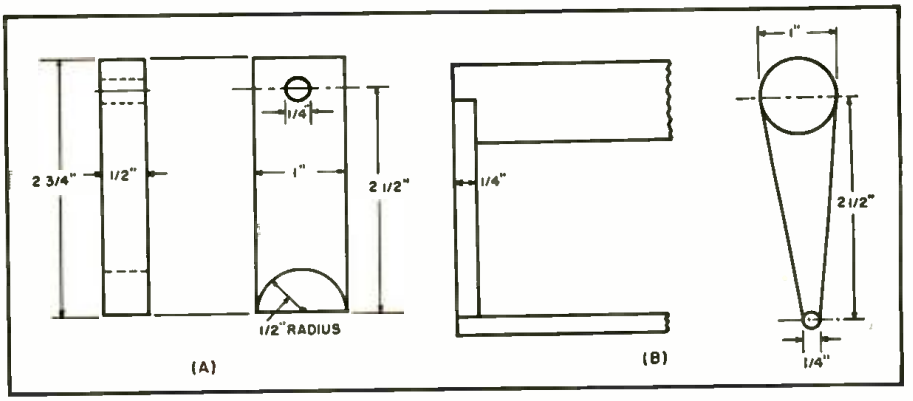


Fig. 2. Over-all dimensions of the folded-dipole stacked FM antenna.

Fig. 3. Dimensions for the folded-dipole supports and end pieces. (A) the supports cut from flat ½" Plexiglas and (B) tapered end pieces made from ¼" brass stock.



avoid "RHUBARBS"

The key to successful servicing is a satisfied customer. In television servicing, customer satisfaction is assured only when your highly technical knowledge is employed with components that meet or exceed performance expectations. Taking chances with components of questionable quality leads eventually to "rhubarbs" with dissatisfied customers. Nothing can be more harmful to the future of your television servicing business.

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needed. The results have certainly justified my expended energy and are quite satisfying from a reception standpoint.

The frequency range of stations available is from 92 to 108 megacycles, there being none in this area between 88 and 92 megacycles. Because of this, I arbitrarily selected 100 mc. as my center frequency—this also made all the calculations a lot easier. The resulting dimensions for the antenna are shown in Figs. 2 and 3.

For the 1-inch diameter tubing, standard ¾" electrical thin-wall conduit was used, the outside diameter of this being .922". Brass brazing rod, obtainable from welders' supply stores, was used for the folded section of each dipole, and ¼" brass stock was used for the connecting end pieces. The supporting insulators were made from ½" Plexiglas. The conduit and brass rod are soldered to the end pieces to make a secure, noncorrosive electrical path. The main assemblies are fastened to the antenna mast by "U" clamps and 4" stand-off metal spacers.

The matching section was constructed of No. 16 wire and strengthened by ¼" square Plexiglas spacers every 15" to dampen vibrations. No. 16 wire was chosen as representing the best compromise for the half-wave section. A matching section of 600-ohm impedance using ¼" bars gave a prohibitive spacing. No. 16 wire has the necessary strength and keeps the spacing down to practicable proportions.

This antenna represents a not-too-technical person's approach to the problem of satisfactory FM reception in a fringe area, but I must say it satisfies my reception needs much better than any other yet tried.

—30—

PROJECTION TV HINT

By GEORGE ANGLADO

RECENTLY we received a call to pick up a Philco projection-type TV receiver with the complaint of distorted images. When the picture came on, we noticed that the images in the foreground appeared in correct proportion, but that the images in the background appeared short and squatty.

At the face of the projection picture tube inside the optical barrel were two permanent magnets set in a clamp and tilted toward the screen. We moved one magnet around until the picture was completely distorted, then back to the original position until the picture was clear. However, only the front of the picture was clear with the background still distorted. We moved the other magnet around and, to our surprise, found that there was no difference in the picture quality.

Assuming that this was the culprit, and not having a magnet of this type on hand, we substituted a small 4-ounce speaker magnet and mounted it on the neck. Upon adjustment of this new magnet, the distortion in the background was completely cleared up with a perfect picture as a reward. —30—

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.

SYLVANIA "POLYMETER"

The Radio and Television Division of *Sylvania Electric Products Inc.*, 1221 W. Third St., Williamsport, Pa. is now offering its new "Polymeter" for AM, FM, and TV service applications.

Response of the instrument is flat from 20 cps to 30 mc. It uses the

company's new 7" meter movement and reads peak-to-peak a.c., d.c., r.f. voltages, and d.c. amperes. A resistance, decibel, and zero center scale are provided for service work.

The unit comes complete with test leads and an r.f. probe. It is designed for 105-125 volt, 50-60 cycle operation. It measures 11½" x 8½" x 7".

A data sheet on this new Type 302 unit is available from the company on request.

NEW "POWERSTATS"

The Superior Electric Company, Bristol, Conn. has announced the availability of a new line of "Powerstat" variable transformer types 136 and 236. The new units replace the company's types 1126 and 1226.

An 8-page bulletin describing this new line is now available from the company on request.

NEW TRIPLETT TESTER

Triplett Electrical Instrument Company, Bluffton, Ohio is now offering a combination v.o.m. and v.t.v.m. in a single unit, the Model 631.

The new instrument includes 34 ranges: ten a.c.-d.c. voltage, six d.c. resistance from .1 ohm to 150 megohms, db and output readings on the v.o.m. and four v.t.v.m. ranges includ-

ing a 1.2 volt range for grid voltage and accurate discriminator alignment.

One switch on the unit selects all ranges and minimizes chance of incorrect settings and burnouts. The

meter is a 5½" unit. Leads are 48" long, with test prods and removable alligator clips at one end. For the v.t.v.m. there is a 48" lead with a one megohm built-in resistor. The leads are banana type for low contact resistance and have pencil-thin prods.

DECADE BOX

Electro-Measurements, Inc., 4312 S.E. Stark St., Portland 15, Oregon has recently introduced a new a.c. decade box providing more than a million one-ohm resistance steps from zero to 1,199,999 ohms.

Called a "Dekabox," the assembly is mounted on a compact, adjustable mounting base. This may be set to the most convenient angle for reading the

six decade dials which display the value of resistance in a single horizontal line.

A catalogue sheet giving complete specifications on the unit is available on request.

TRANSISTOR SOCKETS

The Electronics Division, *Hydro-Aire, Inc.*, 3000 Winona Ave., Burbank, Calif. has designed a standard strip of transistor sockets for use in transistor circuits. The new socket makes possible the grouping of transistors, especially in computer circuitry.

The first model measures 6" x 1" x ¼". It has 10 sockets. Other models are being developed to accommodate 30 or more sockets in a single strip.

The strip material is phenolic, the transistor contacts are of phosphor bronze, and the solder contacts are copper. Internal connections are handled by a printed circuit. The strip is designed to handle the standard RETMA 3E15 transistor base.

PRINTED CIRCUIT COUNTER

The Radiac Company, Inc., 489 Fifth Avenue, New York 17, N. Y. is now offering a new Geiger counter employing a printed circuit.

The "Prospector" Model GC-238 utilizes miniaturized components, an

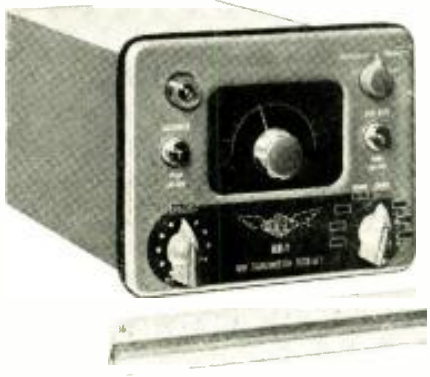
electronic high-voltage supply operating on standard low-voltage batteries, and a standard size Geiger tube built into the case for physical protection. The case is made of drawn aluminum and has a contoured non-slip handle.

The instrument weighs 2¾ pounds. It features three methods of indication, audio, flashing neon light, and a meter with three ranges of sensitivity.

V.H.F. AIRCRAFT RADIO

Gonset Company, 801 S. Main Street, Burbank, California is now merchandising a compact, economical v.h.f. transmitter-receiver designed for use by private aircraft for plane-to-ground communication.

The AR-1 includes a receiver which is continuously tunable from 108 to 128 mc. to provide coverage of conventional range and tower frequencies in addition to those used for "Omni-



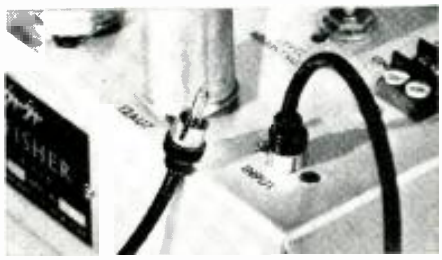
range." The transmitter is crystal controlled and has provision for eight channels, crystals for 122.1 and 122.5 mc. being supplied with each unit. Transmitter power input is 5.5 watts.

The unit will fit into the glove compartment of small planes. The transmitter-receiver weighs 4 pounds, 7 ounces while the dynamotor power supply weighs 3 pounds, 4 ounces.

CONNECTING CORDS

V & H Sales Company, Long Hill Branch, Bridgeport, Conn. is now offering its new "Audio-Aid Unit-Connectors" for the quick and neat interconnection of audio components.

Shielded, insulated wire with "molded-on" insulation to protect the



soldered joints at the two phono plugs and convenient standard lengths of 3, 5, and 7 feet are features which have been incorporated for the audiophile.

The capacitance of 28 $\mu\mu$fd. per foot, shielding against a.c. fields, and the firmness of the joint between wire and plugs are added features. Special lengths are available on a custom basis.

PORTABLE V.T.V.M.

Gertsch Products, Inc., 11846 Mississippi Ave., Los Angeles 25, California is now offering a portable, true peak-reading vacuum tube voltmeter, the Model VM-1.

Designed to operate over the bandwidth from 50 cps to over 100 mc., the new unit may be used to measure positive peak, negative peak, or the peak-

to-peak voltage of a waveform. Voltage range of the VM-1 is 100 volts full scale, with multipliers available to 30 kc. The actual measuring elements are housed in a probe to allow direct connection to the voltage source with a minimum of shunt capacity and series inductance.

CRYSTAL DIODE CLIP

Atlas E-E Corporation, Bedford Airport, Bedford, Mass. is now offering a new diode clip which is capable of holding all the major makes of crystal

diodes including those with wire leads .018" diameter and up, and/or terminals from .065" to .085" diameter.

The clip has an average contact resistance of 750 microhms and a capacitance less than 1 $\mu\mu$fd. at 100 kc. at $\frac{9}{16}$" spacing, making it ideal for u.h.f. applications. It is silver-plated phosphor bronze and is available in three styles: for eyelet or hollow rivet mounting and through-panel connections, for surface panel mounting and connections, and for rear-of-panel connections.

ELECTRONIC SWITCH

Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, N. Y. has added an electronic switch to its line of test equipment in kit and factory-wired form.

The new *Eico* Model 488 permits the simultaneous observation of two

separate traces on the screen of a scope. It also serves as a square-wave generator over the range of switching frequencies. It features continuously variable switching rates in three ranges from less than 10 cps to over 2000 cps.

H.V. CONVERTER

Precise Measurements Company, 942 Kings Highway, Brooklyn 23, N. Y. is in production on a miniature high-voltage converter which weighs less than 3 ounces.

Small enough to fit in the palm of your hand, the new unit delivers any voltage from 0 to 7000 volts by simply connecting the input to one or two dry cells. The unit will also operate on a.c. current.

Circuit diagrams, supplied with each unit, show suggested hookups including stabilizer circuits that provide regulation of 2% or better and use only a few simple components.

Applications include Geiger counters, phototubes, photoflash outfits, dust collectors, megohmmeters, etc.

INPUT TRANSFORMER

United Transformer Company, 150 Varick Street, New York 13, New York has added a highly shielded input transformer to its "Ouncer" series.

The Type O-16, designed to operate from a low-impedance microphone or line-to-grid, provides a 200:1 step-up impedance ratio. Frequency response is within 1 db from 30 to 20,000 cps. The primary is center-tapped, balanced

to 1%, and is suitable for sources of 150, 200, 250, 500, or 600 ohms. With 250 ohm sources, the secondary impedance is 50,000 ohms.

Very high shielding for minimum hum pickup is effected through the use of two heavy gauge *Hipermalloy* shields. The over-all dimensions are 1 5/16" x 1½" x 1½" including the orientable mounting bracket.

(*Continued on page* 148)

ARC REDUCTION

By SOL DAVIS

WHENEVER a circuit is opened by means of a switch, through relay contacts, or by a telegraph key, sparking usually occurs. Sometimes it is rather difficult to reduce the sparking with the result that contacts become pitted or corroded. Besides the transient involved can cause interference in a receiver and if in the vicinity of a TV set or antenna, a slight case of TVI occurs.

A simple and easy method of curing this difficulty is diagrammed in Fig. 1.

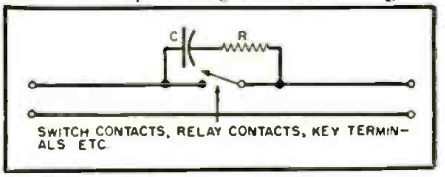


Fig. 1. Method for reducing contact arcing. See text on determining component values.

A condenser and series resistor are put across the terminals of the key, bug, or relay. The value of the condenser should be as large as possible, preferably .1 to .25 μfd., depending on the voltage rating. The resistor value is determined by $R = E/2I$ where E is the value of voltage across the terminals and I is the current (in amperes) that is being broken.

This circuit has been used where several amperes at low and high voltages had to be opened as well as in circuits where milliamperes at hundreds of volts were interrupted and it has never failed to work. —30—

STRAP FOR TV TUBES

MANY older television receivers have the picture tube arranged almost on the chassis. When removing for test it is necessary to place the picture tube about in its original position.

A light strap may be used to advantage to hold the picture tube in place, placing the strap over the tube and attaching to the chassis.

Care should be used with metal strap buckles so that they do not rest on or strike the TV tube. . . . . H. L.

How strap is used to hold TV tube in place.

Spot Radio News

(*Continued from page 22*)

are sharply tuned for high selectivity. In addition, where required, a cavity resonator can be inserted between the antennas and the receiver to give even higher selectivity.

There are a dozen push-buttons in the remote-control console. Ten of the push-buttons are for data station selection; the remaining two are used to select the desired receiver and transmitter at the repeater station.

The demodulated signal from the receiver is amplified first and then fed to a gated counter which counts the input cycles for a period of one second, displays the result for about a second, and then repeats the cycle. A digital printer records the output frequency as it appears on the frequency counter.

RADIO HAS ALSO come to the aid of instruments that can be used to measure the thickness of electro-deposited coatings.

In a device, called the "Dermitron," also developed at the Bureau of Standards, reflected flux is sensed in a single coil which is excited with high-frequency current when it is in close proximity to a specimen. The probe coil is very small and designed to be held in physical contact with the sample. Its miniature size makes it possible to measure plating thickness of small specimens and sharply-curved surfaces.

Power to the device is supplied by a commercial oscillator with a 6-watt output; the amount of current through the circuit is controlled by means of a voltage divider placed across the oscillator. Between the voltage divider and a d.c. microammeter is a parallel circuit containing in one branch a variable resistance and in the other the probe coil with its condenser. Each branch contains a germanium diode in opposite phase with the other. Thus, during one half of the cycle the current passes through the test probe and the meter, and during the other half of the cycle, the current passes through the variable resistance and the meter, but in the opposite direction. The d.c. meter registers the difference between these two currents.

Initially, it was said, the meter is made to read zero when the probe is placed on a reference surface of the bare basis metal. This is done by balancing the variable resistance against the test probe and its condenser. The test probe is then placed on the metallic surface to be tested, and the resulting change of impedance is indicated by the meter reading; this depends upon the conductivity of the metallic surface layer.

In practice, the Bureau's experts reported, a technique known as the peak method has been found to give most accurate measurements, because it diminishes errors due to dust or dirt on the sample, the geometry of the object and the inclination of the

probe. In this procedure, the probe is first brought near the surface of a bare piece of basis metal and then slowly raised. The needle of the meter will move in one direction until a peak value is reached; it will then reverse its direction. The instrument is adjusted so that the peak for the basis metal occurs at the zero reading. The probe is then placed on the sample to be tested and slowly raised until the peak reading for the sample is obtained. This method has been adopted for all measurements except those made on coatings of nonconductors on metals, or of poorly conducting metals on highly conducting metals. These coatings require direct contact between the probe and the surface of the specimen at the time of the reading.

The range of thickness which can be measured by this unique device depends upon the frequency used. A given frequency may be used only for thicknesses through which a significant amount of current penetrates. High frequencies are most suitable for the accurate measurement of thin coatings because the penetration of the current is shallower. At a frequency of 2 megacycles most coatings up to 1.5 mils in thickness can be measured accurately. A frequency of 100 kilocycles has been found to permit measurement of coatings up to 6 mils, but measurements of thin deposits have not been found to be so accurate at this frequency as at 2 megacycles.

Coils used for the test probe must be small; a coil used at 2.5 mc. is .030" in length and .10" in diameter. Coils are wound on a bobbin and cast in a resin to assure sturdiness and stability.

FOR THE FIRST TIME in the history of Australian radio, all of the broadcasting facilities in the nation were combined to cover the recent visit of the Queen of England. Over 350 remotes were used and tied in to a line that was, at times, several thousand miles in length.

Reporting on this ambitious broadcast in the *EBU Bulletin*, A. N. Finlay, assistant general manager of the Australian Broadcasting Commission, said that every precaution against failure was taken. The mike amplifiers and line equipment were supplied in duplicate. Attractive dual microphone holders were designed, so that standard type mikes could be unobtrusively mounted on a single stand. Special windshields were also designed and installed on the microphones in exposed locations to reduce wind noise. The noise was further reduced by means of high-pass filters designed to restrict the very low-frequency response of the mike circuits.

Nine portable magnetic tape recorders were used, and over 70 miles of tape recordings were made during the Royal Tour. Frequency-modulated link equipment, operating in the 75-mc. band, was used to cover the event. In one instance, the equipment was placed aboard a plane flying over the

OUR 34th YEAR AS RADIO PARTS DISTRIBUTORS

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VERY BEST BRANDS AVAILABLE FOR IMMEDIATE DELIVERY. INDIVIDUALLY BOXED.

0A4	1.19	6AC5GT	.89	6F5GT	**59c**	6X8	1.29	12BH7	.89	35Y4	**95c**
0Z4	**59c**	6AC7	1.49	6F6GT		6Y6G	**69c**	12BY7	.89	35Z3	
0Z4O		6AF4	1.76	6F7	1.59	6Z4/84		12BZ7	1.19	35Z4	.69
1A5GT	.79	6AG5	.99	6F8G	1.59	7A4	.95	12F5GT	.69	35Z5	.59
1A7GT	.79	6AG7	1.49	6G6G	.95	7A5	1.19	12H6	.89	35/51	.79
1B3GT	.95	6AH6	1.89	6H6GT	.89	7A6	.89	12J5GT	**69c**	36	**95c**
1B5	**29c**	6AJ5	2.95	6J5GT	.59	7A7	**79c**	12K7GT		37	
1H4		6AK5	.89	6J6	.79	7A8		12K8	.89	38	**88c**
1H5GT	.59	6AK6	1.19	6J7G	.69	7B4	.89	12Q7GT	.89	39/44	
1J6GT	**59c**	6AL5	.69	6J8G	1.19	7B5	.89	12S8	.89	41	
1L4		6AQ5	**69c**	6K5GT	.69	7B6	.89	12SA7GT	.69	42	**69c**
1L6	1.29	6AQ6	.79	6K6GT	.59	7B7	**89c**	12SC7	.95	43	
1LA4	1.19	6AQ7	1.19	6K7GT	.69	7B8		12SF5GT	.69	45	
1LA6	1.19	6AR5	.79	6K8GT	1.19	7C4	1.29	12SF7	.95	45Z5	.69
1LC5	.69	6AT6	.59	6L5G	.95	7C5	.89	12SG7	.89	46	
1LC6	**1.19**	6AS5	.89	6L6G	**1.39**	7C6	**79c**	12SH7GT		47	**89c**
1LD5		6AU5GT	1.29	6L6GA		7C7		12SJ7GT	**69**	50A5	.95
1LE3	1.19	6AU6	.59	6L7	1.19	7E5	**79c**	12SK7GT		50B5	**69c**
1LH4	1.19	6AV5GT	.89	6N6G	1.29	7E6		12SL7GT	.89	50C5	
1LN5	1.19	6AV6	.59	6N7GT	1.19	7E7		12SN7GT	.95	50C6G	1.29
1N5GT		6AX4	.69	6P5GT	.69	7F7	.89	12SQ7		50L6	.79
1P5GT	**79c**	6AX5	.79	6Q7GT	.59	7F8	1.49	12SQ7GT	**69c**	50X6	.69
1Q5GT		6AX6	.69	6R7GT	.69	7G7	1.19	12SR7GT		50Y6	.95
1R5		6AY5GT	.89	6S4	.59	7H7	.95	12Z3	.95	57	**79c**
1S4	.95	6B4G	1.29	6S7GT	**1.19**	7K7	**1.19**	14A7	**95c**	58	
1S5		6B8GT	1.19	6S8GT		7L7		14AF7		70L7	**1.49**
1T4	**69c**	6BA6	.59	6SA7GT	**69c**	7N7	.79	14B6	**89c**	70L7GT	
1U4		6BA7	.89	6SC7		7Q7	.69	14B8		71A	**79c**
1U5	.59	6BC5	.69	6SD7GT	.99	7R7	.79	14C5	1.19	75	
1V		6BD5GT	.89	6SF5	.59	7S7	1.19	14C7	**95c**	77	.69
1X2A	**89c**	6BE6	.59	6SF5GT	.59	7V7	.79	14F8		78/6D6	.95
2A6		6BF5	**69c**	6SG7	**69c**	7W7	1.19	14H7	**1.29**	80	.69
2A7		6BF6		6SH7		7X6	.95	14Q7		83	1.49
2B3	.89	6BG6G	**1.89**	6SH7GT	.69	7X7	**79c**	14W7	1.19	84/6Z4	.69
2B7	.89	6BG6G		6SJ7	.79	7Y4		14X7	1.19	85	.79
2X2/879	.79	6BH6	**69c**	6SJ7GT	**59c**	7Z4	.89	19BG6	**1.89**	VR90	**$1.19**
3LF4	1.29	6BK7	1.19	6SK7GT		12A7	1.49	19BG6G		VR105	
3Q4	.69	6BL7	.79	6SL7GT	.69	12A8	.69	19T8	.89	VR150	
3Q5GT	.89	6BN6	1.19	6SN7GT	.79	12AH7	1.49	24A	.69	VT51	**29c**
3S4	.69	6BQ6G	1.13	6SQ7	**59c**	12AL5	**59c**	25AC5GT	1.19	VT52	
3V4	.95	6BQ6GT	1.13	6SQ7GT		12AT6		25BQ6	**1.19**	117L7	1.49
5T4	1.29	6BQ7	**1.29**	6SR7GT		12AT7	.89	25BQ6GT		117N7	1.89
5U4G	.69	6BZ7		6SS7	.99	12AU6	.69	25L6GT	.59	117P7	1.89
5V4G	.89	6C4	.59	6T8	.89	12AU7	.79	25W4GT	.69	117Z3	.59
5W4	**59c**	6C5GT		6U5		12AV6	.59	25Z5	.69	117Z6	1.19
5W4GT		6C6	**69c**	6U6GT	**69c**	12AV7	.89	25Z6GT	.69	715B	5.00
5Y3GT	.49	6CB6		6U7G		12AW6	1.19	32L7GT	.95	807	1.49
5Y4G	.59	6C8	1.29	6U8	.89	12AX4	.69	26	**59c**	866A	1.49
5X4G	**97c**	6CD6	**1.89**	6V3	1.29	12AX7	.69	27		1299	**49c**
5Z3		6CD6G		6V6GT	.69	12AY7	1.89	35A5	.95	1619	
6A7	.89	6CF6	**1.19**	6W4GT	.59	12BA6	.59	35B5		2051	.95
6A8GT	1.29	6D6/78		6W6	.69	12BA7	1.19	35C5	**69c**		
6AB4	.69	6D8G	1.13	6X4	**59c**	12BE6	**69c**	35L6			
6AB7	1.19	6E5	.69	6X5GT		12BF6		35W4	.59		

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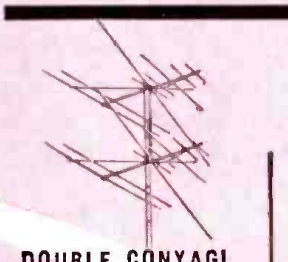

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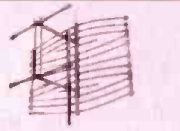
The equivalent of 40 dipoles
Newest development for long distance TV reception. MONEY BACK GUARANTEE. This is a BIG ANTENNA. Reflectors 9 feet long. Conical elements over 10 feet long. Solid rugged wind proof construction. List Price $49.95
DEALER NET $15.95
Complete with twin lead, mast, mount and everything you need for professional installation $22.94



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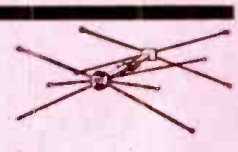
For UHF and VHF RECEIVES ALL CHANNELS

212 miles reception recorded. 125 miles common. This unbeatable antenna has been reinforced to withstand 150 mile winds.

Satisfaction guaranteed or your money back. Less Mast, List Price $49.95. Your Cost **$19.95**



CONICAL TV ANTENNA

10 Element conical . . . rugged throughout. Only **$3.95**

Double bay array, with stacking bars **$7.25**

4 Bay array, with harness and stacking bars **$14.95**

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Factory assembled, single-bay Each **$2.39**

Two-bay array with matching device **$4.59**

Two-bay array with matching device, 3 mast sections, and UHF-VHF coupler **$7.59**

300 OHM TWIN LEAD

UHF TUBULAR 300 OHM LINE
1,000 ft. **$29.50**
100 ft. **$3.95**
All Channel Foam Line. 100 ft. for $6.95. 50 ft. for $3.95

55 Mil.
100 ft. $1.59
1000 ft. **985**
20 Ga., 80 Mil,
100 ft. 1.89
1,000 ft. 16.95

FOUR CONDUCTOR
Rotor Cable Clear or Brown. Very Special.
1,000 ft. $14.95
100 ft. ... **$1.95**

TV MASTS AND HARDWARE

Bargain Chimney Mount	Net $1.49
Vent Mount	$1.89
Stainless Steel Chimney Mount. Net	**$2.50**
Twin lead ins	each 3c
Mortar nail insulator	each 8c
Mast ins	each 15c

Ten foot mast. Seamless, expanded end, sturdy enough for the largest arrays.
Only ..... each **$2.39**

5 ft. DURABLE MAST, heavy gauge 1¼ diam. with interlocking end. Slip two sections together for a ten-footer. 5 sections = 25 ft. Each section. $1.25

FILTER CONDENSERS

FP Type or Tubular with Leads—Fresh Stocks Always

.5 mfd.	450V.	.35	80-40	450V.	1.29
.5-.5	450V.	.45	10 mfd.	50V.	**.19**
10-	450V.	.39	20-	50V.	
10-10	450V.		25-	50V.	.19
20-	450V.	**.45**	50-	50V.	.25
20-20	450V.	.49	100-	50V.	.29
30-	450V.	.45	20 mfd.	150V.	.35
30-30	450V.	.59	20-20	150V.	
40	450V.	.49	30	150V.	**.45**
40-40	450V.		30-30	150V.	.49
60	450V.	**.69**	40	150V.	.49
60-40	450V.	.89	40-20	150V.	**.49**
80	450V.	.69	40-40	150V.	
			50-30	150V.	

MOLDED TUBULAR BY-PASS CONDENSERS

600 VOLT
.001 ..... **9c**
.002 .....
.005 .....
.01 ..... 12c
.02 .....
.05 ..... **12c**
1 ..... 19c

400 VOLT
.25 mfd. ... ea. 19c
.5 mfd. ... ea. 29c

MISCELLANEOUS BUYS

6-foot LINE CORD UL. 10 for **$1.00**
TV INTERLOCK CORDS ea. 49c
I. F. TRANSFORMER—456 Kc 19c
PILOT LIGHTS. Type No. 47 10 for 39c; 100 for $2.95
VOLUME CONTROLS WITH SWITCH. 2" shaft, 1 meg, ½ meg, ¼ meg. 34c
SINGLE ION TRAPS 19c
DOUBLE ION TRAPS ... ea. 29c
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TUBE KITS

BEST BRANDS AT BEST PRICES

3V4, 1T4, 1R5, 1S5	**$2.19**
3Q4, 1T4, 1R5, 1S5. List Value $8.00. Tube Kit only	**$1.98**
3S4, 1T4, 1S5, 1R5. List Value $7.80. 4-Tube Kit	**$1.98**
1U4, 3S4, 1S5, 1R5. List Value $7.80. All Four Tubes for	**$1.98**
117Z3, 1U5, 3S4, 1R5, 1T4, AC-DC Portable Kit. All for	**$2.49**
12AT6 12BA6, 12BE6, 35W4, 50B5. 5 Tubes for	**$2.59**
50L6GT, 35Z5GT, 12SQ7GT, 12SA7GT, 12SK7GT. 5 Tubes for	**$3.49**

SELENIUM RECTIFIERS

65 mil	$ .69
75 mil	.79
100 mil	.89
150 mil	1.29
250 mil	1.65
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Extra long narrow tips to reach tight spots. Practically indestructible.

Featherweight but 135 watts!

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12" COAXIAL PM SPEAKERS. High Fidelity with Crossover filter attached. 20 watts; 40-19,000 cps. response; 8 ohm Voice coil ..... ea. **$12.95**

10" coaxial speaker. Take advantage of your TV set's FM sound. This speaker matches and replaces 80% of all TV speakers **$10.95**

$19.95 15" COAXIAL SPEAKER. 20-17,500 cps. 25 watts ..... ea.

8" coaxial speaker. QUALITY when space is at a premium. **$9.95**

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Rated BEST BUY in Saturday Review and Consumers Reports. The nation's most popular deluxe HI-FI speaker.

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Complete with heavy magnet 6 x 9 PM speaker, grille, screen, switch kit, switch plate and bracket, all wiring harness and complete instructions.

All for only **6.57**

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All Tubes Have Daylight Type Dark "A" or "B" Faces

SIZE	PRICE	SIZE	PRICE	SIZE	PRICE
7JP4	17.95	16KP4 16"	21.95	20CP4 20"	27.95
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10BP4B 10"	14.95	16RP4 16"	**21.95**	20HP4 20"	29.45
12JP4 12"	**17.95**	16TP4 16"		21AP4 21"	**30.10**
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12UP4A 12"	19.40	16YP4A 16"		21FP4 21"	**31.95**
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14CP4 14"		17CP4 17"	25.40	21WP4 21"	31.95
14GP4 14"	21.90	17GP4 17"	**26.90**	21YP4 21"	**36.95**
14HP4 14"		17HP4 17"		21ZP4 21"	31.95
15AP4A 15"	22.50	17LP4 17"	26.90	24AP4 24" 6 mo.	53.95
16AEP4 16"	22.50	17TP4 17"	26.90	24CP4 24"	**62.50**
16AP4A 16"	**22.60**	19AP4B..		24DP4 24"	
16QP4A 16"	22.20	19QP4B..	**28.80**	27EP4 27"	78.50
16EP4A 16"		19FP4B..		27GP4	**79.95**
16GP4B 16"	**24.20**			27LP4	
16JP4A 16"				27NP4	
				27RP4..	

THESE ARE BRAND NEW PICTURE TUBES

15 MONTH GUARANTEE ON ALL TYPES
SEND 25% DEPOSIT AND WE WILL SHIP FROM STOCK IMMEDIATELY

RESISTOR KITS

Insulated ½, 1 and 2-watt assortment of most used values, I. R. C. Ohmite, Stackpole, Speer.

100 for. **$2.95**

TV Filament Resistor Kit

Replace GLO BAR resistors in ALL G.E. Television. Also used in Motorola, Hoffman, Sears, Pathe, Telestone. 1 kit will replace any temp. sensitive resistor. Net .. **$1.44**

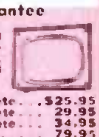
21" TV CONVERSION KIT COMPLETE WITH CABINET AND NEW TUBE

15 Month Guarantee

Now you can make that conversion. This table model cabinet eliminates your bottle neck. Supplied complete with 21" picture tube, 70 degree yoke, gold mask and safety plate, fly back transformer and width coil, very easy to install and all for **$50.00**

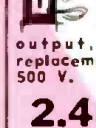
TV CONVERSION KITS

ALL NEW TUBES
15 Month Guarantee



Easily installed consisting of rectangular tube, 70 degree yoke, beautiful mask, flyback transformer and width coil.

17" Kit, as above, complete	$25.95
20" Kit, as above, complete	29.95
21" Kit, as above, complete	34.95
24" Kit Rectangular	79.95
24 Kit, Round	69.95
27" Kit, as above, complete	99.95
24" & 27" Rectangular Kits Contain 90° yoke.	

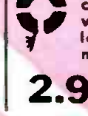


Flyback Transformer TV Horizontal output, universal replacement, 14,500 V.

2.49 ea.

BIG SCREEN TV

90° matched unit deflection kit for 24 and 27 inch rectangular picture tubes. A newly designed combination of horizontal output flyback transformer and wide angle deflection yoke for 90° applications. Flyback transformer develops 18.5 k.v. with 280 volts of B supply. Only a single 6CD6 driver and a 6AX4 damper need be used to fully deflect the 90° sweep. AGC-AFC winding is incorporated. Yoke is housed in a non-rigid shell so that expansion and contraction will not injure the windings. Complete with matching network and wire leads. Complete kit, including 6CD6G, 6AX4GT, schematics and instructions for conversion procedure, $38.45 value, only **$17.95** net.



70 degree cosine yoke with 4 leads and network.

2.95 ea.

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For Your Tape Recorder

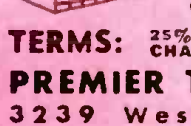
1200 ft. plastic base type 1251—list $5.50. Dealer net **$3.67**
600 ft. plastic base type 651—list $3.50. Dealer net **$2.33**

P M SPEAKERS

Very best quality—NATIONAL BRANDS. Individually Packed.

3"	ea.	$1.39
4"	ea.	1.59
5"	ea.	1.59
6" Special Price	ea.	1.79
8"	ea.	3.23
10"	ea.	5.10
12"	ea.	5.95

5 x 7, 6 volt field auto radio speaker $1.89



REGENCY RC-53

All channel UHF Converter. Much more gain than strips, and fits any set. Only ... **$14.96**

TERMS: 25% DEPOSIT with order, balance C.O.D. ALL shipments F.O.B. Chicago. ORDERS LESS THAN $5.00—$1.00 SERVICE CHARGE. CABLE ADDRESS: CONTULAB. These prices supersede all previously advertised prices, subject to change

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harbor to carry a report of the arrival of the Queen. Coverage on FM continued from the vessel carrying the Queen, a harbor ferry, and a car in the royal entourage.

Splitting amplifiers were used, it was said, to feed the Royal speeches and descriptions, where required, for public-address systems and for film or newsreel sound track purposes. In some instances, the sound tracks were dubbed in days later from magnetic tape recordings made at the station's studios. One of the unusual characteristics of the broadcasting system in Australia, the station's spokesman said, was the ability of the system to transmit simultaneously over a network of 64 medium-wave and nine short-wave transmitters in the nation and Papua-New Guinea. This facility was used for the broadcasts describing the arrival and departure of Her Majesty and the Duke, as well as the progress of the royal party through the capital cities in each state. These broadcasts were said to involve 11,500 miles of program lines; mostly of the open-wire type. When it is realized that this line length is nearly equivalent to the distance from the North to the South Pole, one can appreciate the complexity of the problem that was involved, and successfully solved.

NOTWITHSTANDING the number of grant withdrawals entered since the first of the year, there are a healthy number of stations now operating; nearly 400. And it has been forecast that before the year is out, we may see as many as 500 on the air. As this column was being prepared, stations noted on this page had received the green light to build.

THE LIMITATIONS of the present standard of time, the mean solar day, instigated a search a while ago for new methods to determine time and frequency. The probe resulted in the development of an atomic clock utilizing the absorption characteristics of

(*Continued on page* 114)

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 (mc.)	POWER* (Video)
Alabama	Dothan	WTVY	9	186-192	55.6
Florida	Daytona Beach	WFMJ-TV	2	54-60	1.26
Nevada	Henderson	KLRJ-TV	2	54-60	10.96
Oklahoma	Tulsa	KVOO-TV	2	54-60	100
Oregon	Portland		12	204-210	316
Texas	Big Spring	KBST-TV	4	66-72	1.33

NEW CALL LETTER ASSIGNMENTS

Arizona	Mesa	KVAR	12	204-210
Florida	West Palm Beach	WEAT-TV	12	204-210
North Carolina	Gastonia	WTVX	48	674-680
Ohio	Columbus	WTVN-TV	6	82-88
"	Mansfield	WTVG	36	602-608
Wisconsin	Wausau	WSAU-TV	7	174-180
Texas	Corpus Christi	KVDO-TV	22	518-524

*ERP=(effective radiated power, kw.) . . =Call letters to be announced

NEW TV STATIONS ON THE AIR

(As of September 25, 1954)

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.)
Iowa					
Sioux City	KTIV	4	66-72	14.61	51.2
Kentucky					
Louisville	WQXL-TV	41	632-638	1.55	200
Maine					
Poland	WMTW-TV	8	180-186	5.43	105
Missouri					
Cape Girardeau	KFVS-TV	12	204-210	4.79	316
Joplin	KSWM-TV	12	204-210	4.79	58.9
North Carolina					
Durham	WTVD	11	198-204	4.93	60
Oklahoma					
Muskogee	KTVX	8	180-186	5.43	316
Vermont					
Montpelier	WMVT	3	60-66	16.1	18.3
Canada					
London, Ont.	CFPL-TV	10	192-198	5.08	117
Port Arthur, Ont.	CFPA-TV	2	54-60	17.8	5.1
Quebec City, Que.	CFCM-TV	4	66-72	14.61	1.3
Regina, Sask.	CKCK-TV	2	54-60	17.8	19.5

WACH-TV, channel 33, Newport News, Virginia, is now back on the air. WKAB-TV, channel 48, Mobile, Alabama; WCOC-TV, channel 30, Meridian, Mississippi; KSTM-TV, channel 36, St. Louis, Missouri; and WCHA-TV, channel 46, Chambersburg, Pennsylvania, have gone off the air.

The frequency of the video carrier = 1.25 + channel lower freq. limit. Total number of TV stations now on the air in U.S.: 395 (124 of which are u. h. f.)

NEW

WALSCO *Imperial*

INTRODUCING the greatest advance in Conical antennas ... it's the *all-new* WALSCO *Imperial*. Featuring a new "barrier disc" insulator with 2 inches of air space between the terminals to prevent *shorts*. Soot deposits, dirt, moisture, solt, etc., *connot* affect this insulotor. The WALSCO *Imperial* will therefore mointoin *lasting* high gain performance *onywhere*, regardless of weather conditions. Contact surfaces and terminals will *never* rust or oxidize. Front end hardware is *stainless steel* to prevent corrosion losses *permanently*.

MOST REVOLUTIONARY CONICAL ANTENNA IN 4 YEARS

Front end elements are pre-assembled to holding plates which are fastened to the insulator with one wing nut. Less than 2 minutes to assemble.

3 year unconditional guarantee!

Guaranteed lasting high gain on all VHF channels

WALSCO ELECTRONICS CORPORATION

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ammonia to provide a control element in a servo loop containing a precision oscillator. The success of this initial experiment has led to the further development of electronic atomic clocks utilizing cesium atoms. Now a cesium beam clock under development is expected to attain the staggering accuracy of 1 part in 10 billion! . L.W.

APPLICATION NOTES

By RUFUS P. TURNER, K6AI

WHILE the condenser substitution box (decade condenser) is a simple device, its efficient use depends upon observance of several rules taken for granted by the manufacturer of the unit. These rules are listed here for the benefit of the technician who either has given no thought to them or, through neglect, has forgotten them.

1. Check the residual capacitance of the box. This is done by turning all of the switches to zero and measuring the capacitance between the input terminals with an accurate bridge. Residual capacitance is between 10 and 25 $\mu\mu$fd. in good boxes. Add the measured value to all box settings whenever the setting is less than 1000 times the residual capacitance.

2. Use the shortest possible leads between the box and the external circuit, and keep these leads well separated. This reduces the added shunting capacitance. In some applications requiring close maintenance of lead separation, it may be advisable to use a length of low-capacitance coaxial cable for connection to the box. The inner and outer conductors of the cable provide two leads with constant and permanent separation. The total capacitance of the cable alone must be measured and this value added to all box settings.

3. If an accurate bridge is available, check the capacitance of the box at all settings and prepare a suitable correction chart.

4. If the box is to be used at radio frequencies, it should be inspected for internal resonances at the chosen frequencies. A grid dip meter or "Q"-meter can be used for the purpose.

5. Remember, charged condensers can deliver surprisingly vigorous electric shocks. When the box has been used in high-voltage d.c. circuits, the condensers should be discharged immediately after use. This can be done conveniently by short-circuiting the input terminals with a short piece of heavy wire, and turning each switch successively to each of its positions several times, pausing each time for at least 5 seconds. During storage, a heavy wire jumper should be connected permanently between the input terminals.

6. Do not expose the condenser box to a.c. or d.c. voltages or currents in excess of its ratings.

7. If the box contains electrolytics, observe the correct input polarity, and do not use on a.c. unless the unit is recommended for a.c. operation by its manufacturer.

8. Know the characteristics of the circuit in which the box is to be used. This means a knowledge of the exact value of d.c. voltage plus any superimposed alternating or fluctuating component. The combined voltage must not exceed the rating of the condensers in the box.

These few hints should be heeded for most efficient box operation. —30—

Antenna Antics

(Continued from page 90)

home in the Olney section of Philadelphia one windy morning. The set was a 12" *Philco* and the channel 10 test pattern was bouncing up and down like a nervous "yo-yo." The bouncing was also apparent on channels 6 and 3, but was not nearly as disturbing.

After making our indoor antenna check to prove it was the antenna, we put up our aluminum ladder. The antenna was a couple of years old and there were quite a few places where the wire was loose. These we snugged in and the condition was partially alleviated. It wasn't quite satisfactory, however. So, we hooked up the telephones. I stayed on the roof and my cohort went down to watch the set.

At the next heavy gust of wind two things happened. My colleague yelled, "The picture's bouncing now," and I heard a loud metallic crash. I spotted the trouble on the antenna and so disregarded the crash. It sounded like a kid kicking over an ash can or something anyway. More important, the lead-in wire coming from the antenna connection to the mast stand-off insulator at the bottom of the mast had flapped against the metal mast. I flapped it a couple more times and the telephone on my ear confirmed that we had the trouble. The fluttering of the wire against the mast was causing the picture to jump excitedly. I installed two more mast stand-offs to take up the slack, so there would be no recurrence of the trouble. My partner signalled, "OK, three good pictures."

I went to the edge of the roof to climb down our ladder. Something was different, there was no ladder sticking up over the roof. I looked over the edge and there was no ladder. Where in the world—and then I saw it, a shiny, twisted mess stretched out across the pavements—our hundred and twenty-buck ladder.

I had to stand there, shivering on a windswept roof for an hour and a half until another crew was able to arrive and free me from my lonesome perch. Never again did I go on a roof without lashing the top and bottom of an aluminum ladder.

We were doing an orientation one day in lower North Philadelphia, in one of those fifty-year-old, three-story row houses. We didn't need the ladder since there was a trap door into the attic and then another trap door from the attic onto the roof. My partner went up on the roof and we hooked up the phones. The set was a 12" *Emerson*. Channels 3 and 10 were good but there was a bad ghost on channel 6.

My partner soon had the antenna loose from the mount and began to rotate it. The picture assumed all sorts of weird shapes and shades and

then cleared up. I called, "Hold it there!" Channel 6 was coming in good, but when I checked 3 and 10, they were worse than 6 had been. I reported to the roof and after a bit more experimentation we knew that one aerial was not going to clear up the trouble. Channels 3 and 10 were coming best from one direction to the detriment of 6. The solution was either a rotating antenna or two separate antennas. The customer decided on two separate aerials; one for 3 and 10 and the other for 6. These we installed and then mounted a knife switch on the rear of the set.

We were finished and I had come down out of the attic. My partner was climbing through the roof trap door, when he dropped his screwdriver into the attic. I shouted up for him to stay on the rafters while he was retrieving his screw driver. I had just completed the instructions when, like the heavens opening up, the plaster over my head began to crack in jagged lightning-like streaks. Then my erstwhile partner was spewed forth from the ceiling and fell amidst shrieks onto a bed next to me. Thank goodness for comprehensive insurance.

The majority of TV antenna troubles happen because of the effect weather conditions have on the system. Broken wire, loose wire, loose connections, and wire flapping against the antenna mast or house walls constitute most of the troubles. Sometimes the aerial might swing out of orientation or, it may not have been installed correctly in the first place; it may not be in the best spot or beamed correctly.

Above all, whenever on an antenna call, be careful on the roof, make all of your moves slowly, take time and be safe. —30—

MAGNETIZATION OF TV BACK CUP

By JAMES A. McROBERTS

THE gun of a picture tube is particularly sensitive to magnetic fields in its neighborhood, and such a field can originate in the cup affixed to the back of the set. If this cup becomes magnetized, you will get distortions of the picture when the back is on; the picture will be normal with the back off. The test is to use a cheater cord to furnish the set with power and move the cup over the neck of the cathode-ray tube while observing the picture (usually with a mirror). If the cup causes distortion, then it must be demagnetized or a new cup used.

A magnetized cup may result from putting the ion trap and assorted parts into it when changing a picture tube or performing some other service operation. It is such a handy place for holding such items. Put the ion trap some place else! Also, do not touch the cup with magnetized screwdrivers—maybe the one you are using has become magnetized from testing ion traps and speaker fields. Do not use the cup as a carrier for the yoke, and make certain that it does not come in contact with the loudspeaker, even temporarily.

—30—

MEET HARRY W. DICKOW

BY C. HOWARD BOWERS

FOR the most part, the men we have had the pleasure of interviewing for career sketches, have been quite versatile, i.e., commercial radio has been a good starting point. It gets one around, gives him the opportunity to see what's going on, and provides leads for bigger and better things! This article covers the wireless career of Henry W. Dickow of Garden Grove, California (near Los Angeles), who is one of the really old time wireless men of this country. Fact is, Mr. Dickow has been identified as an amateur operator, commercial operator, installer, inspector, manufacturer, radio and service shop owner, engineer, instructor, and publisher of magazines and radio data, and that about covers the field!

Henry Dickow admits falling victim to the wireless malady back in 1907 when it started gaining momentum; when promoters were pushing hot securities to a gullible public—even then there was glib talk about the possibility of the human voice eventually being transmitted through space. In those days amateur radio operators were not known as "hams" but rather as just plain "Nuts" who constituted quite a menace to their neighbors with their flimsy poles and sagging wires as well as the blinding glare and awful racket of the old open spark gaps. All these things brought real thrills and joy to their owners, however, and the excitement so stimulated young Dickow that he discarded a legal career that his father had foreseen for him and, quoting none other than Mr. Dickow himself, "I much preferred the dots and dashes of the continental code to the fame of those who mutter in legal jargon!"

By 1913 our friend, still in short pants, was really on the move when he braved the Government wireless examination—and passed! Again quoting the ex-publisher, "License in hand, I made straight for the Marine Superintendent's office of the Marconi Company, San Francisco and was promptly offered a job—with one proviso, namely that I must get a pair of long pants before being assigned a ship!" His first ship was a wooden schooner, the "SS Fifield" with a wireless shack the size of a sardine can and about as smelly. Two trips aboard this craft and "school was out" for Dickow. No more of that in spite of the munificient salary of $10.00 per month and chow. However he changed his mind (they always do) when Marconi suggested a larger steel ship, the "SS Grace Dollar" bound for the Orient. Three years on this and various other craft won him a position ashore in the construction department of RCA, the duties of which consisted of a daily tour of the San Francisco waterfront inspecting and checking the wireless gear of the ships in port.

Now ashore young Dickow founded the San Francisco Radio Club, Inc., and in due course published their first year book listing its roster and other activities as well as achievements. Thus began his interest in the publishing field which culminated in the founding of the monthly magazine, "Pacific Radio News." The magazine enjoyed a very brief existence as World War I interrupted and our publisher joined the Navy with a special request that he be assigned wireless duty in the Atlantic. True to form he was ordered to Honolulu, T. H. in the Pacific and put in charge of Navy radio station KHK. At the war's end he returned to San Francisco and served as Radio Inspector for the U. S. Emergency Fleet Corporation before acquiring a partner and resuming the publication of the "Pacific Radio News." A few months later our hero traded a full 5-watt de Forest radiophone transmitter to his partner for full interest in the magazine and became its boss! Success followed success in the publishing business with perhaps a slight dip during the 1929 depression until World War II when his publishing business was sold and Henry joined the Army Signal Corps as a Senior Radio Engineer. His discharge came after almost four years with the armed forces where he served with distinction.

Henry W. Dickow is an "old timer" in the wireless field but certainly not in years, and we wish him much luck and continued success!

—30—

OUTDOOR SOLDERING

By **ELBERT ROBBERSON**

Use this simple trick when soldering in remote places where power lines are not available. A car battery can be employed.

ONE of the problems a marine-radio technician faces when loading his tool kit for a job on a boat is what to do about soldering. Although in many boat-radio repairs soldering is not required, on the jobs where it is, the supply voltage may be 6, 12, or 32 volts so the conventional electric soldering iron is useless. Consequently an iron is seldom carried.

But what about that one-in-a-hundred job of replacing a resistor wired to a miniature socket, or some other operation that can be performed only by soldering? Working on a boat, you are marooned when it comes to getting more tools from the shop.

In a jam, a little ingenuity can be used in place of several pounds of assorted soldering irons. From his pockets, or the bottom of the tool bag, a technician can usually dig up all that is needed to solder anything from the pigtail on a ⅓-watt resistor up to a battery cable half-an-inch thick, by the system of resistance soldering.

Fig. 1 shows the basic circuit used in resistance soldering. Although it may appear similar to that of arc-welding, this is different in that no attempt is made to draw an arc—a light contact is maintained with the point of the carbon and heat is generated as a result of the resistance of this junction. In a matter of seconds, the work rises to the proper heat and solder may be flowed into the joint.

The heat generated depends upon the current, which, of course, is a function of both the battery voltage and circuit resistance, in accordance with the relation I^2R. Sufficient heat for heavy soldering, such as required

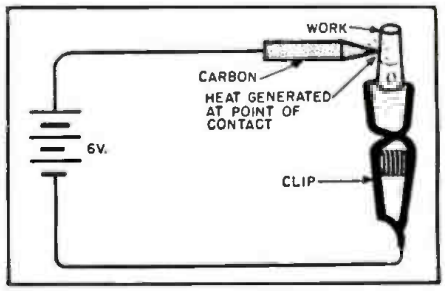


Fig. 1. Basic circuit used in resistance soldering. While similar to arc welding, no attempt is made to draw such an arc.

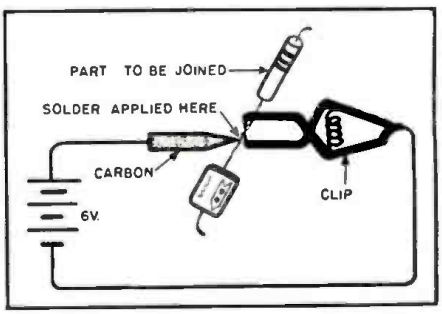
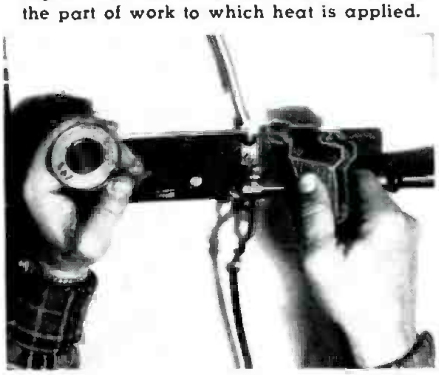


Fig. 2. Using the resistance welding technique in soldering two component parts.

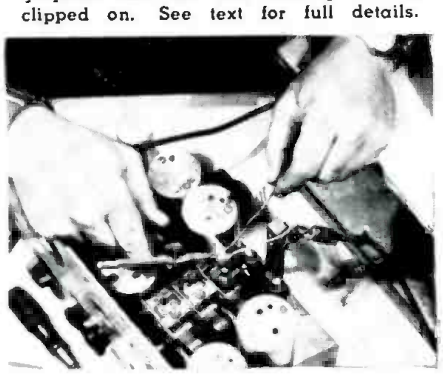
on heavy battery cables or copper tubing, may be generated by a 6-volt battery, while lighter soldering calls for lower voltage, obtained by tapping across only part of the battery. Heavy leads, #8 stranded copper or larger, should always be used so that most of the heat is generated at the point of the carbon, not in the supply cable.

Electrodes are of the very simplest sort—carbons pulled from flashlight dry-cells and filed to a point on one

Resistance soldering is facilitated by a simple holder for the carbon electrode, which is made up from brass pipe fittings, using a drill and hacksaw. Note that the lug, which is heavier than the wire, is the part of work to which heat is applied.



By using a common lead pencil, a broken loop connection in this direction finder is being soldered. About an inch from the point, the pencil is notched, exposing the graphite, and the "hot" battery wire is clipped on. See text for full details.



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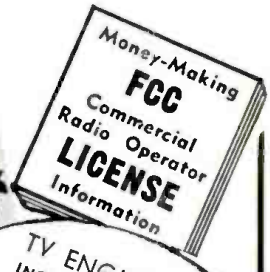

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Letter from nationally-known Airlines. "We would also appreciate if you would place the following additional advertisement in your bulletin—Wanted —Superintendent of Communications....." Salary $666.66 per month.

Letter from nationally-known Airlines. "We are contemplating placing..... .....an Airline Ground Radio Engineer." Starting salary $385 per month.

These are just a few examples of the job offers that come to our office periodically. Some licensed radioman filled each of these jobs . . . It might have been you!

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR Coaching AT HOME in Spare Time

Name and Address	License	Lessons
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Clifford E. Vogt, Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foerch, 38 Beucler Pl., Bergenfield, N. J.	1st Phone	38

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Desk RN-69, 4900 Euclid Bldg., Cleveland 3, Ohio
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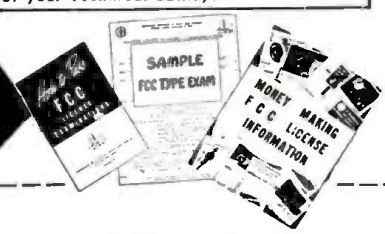

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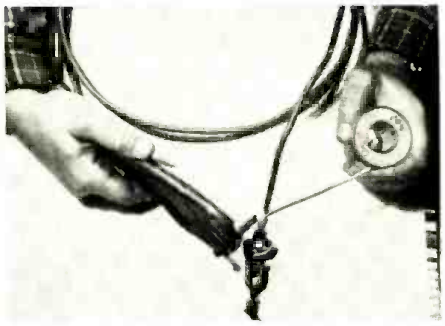
For prompt results, send air mail.

Special tuition rates to members of the U. S. Armed Forces.



Soldering with no "tools." The carbon rod is pulled from center of flashlight cell, the current feed wire wrapped around one end, and the whole gripped with pliers.

end or even common wooden pencils.

There are several methods by which this kind of soldering may be performed, either as a regular matter of course or as a strictly emergency measure. The worker who intends to do heavy resistance soldering regularly may want a tool such as the pistol-grip carbon holder shown in the photograph. This tool consists basically of a piece of threaded brass pipe into which the carbon will slip, with a pipe cap having a hole just large enough to pass the carbon. The pipe is slit on the threaded end with a hacksaw, so that screwing the cap on has a compressing action to grip the electrode firmly.

A handle which may be whittled or sawed from boxwood and a strapping arrangement to secure the carbon holder to it, complete the tool. A piece of #6 flexible cable is used for connection to the battery.

Another possibility is that the tool bag usually boasts a pair of "vise-grip" pliers and these can be used as an electrode holder for even the heaviest work.

For fine work, there is nothing better than a common lead pencil. The wood insulates the electrode except at the very tip, and the heat can easily be kept to an entirely safe level for the most delicate components.

In the usual boat-radio installation, current for resistance soldering can be taken from the power mains to the equipment being worked on. In this case, it is safest to disconnect the supply lines from the equipment to make accidental flow of current inside the set impossible; although if care is used it is often possible to leave the cables connected and to ground the work to the chassis with a clip-lead, and obtain soldering current by connecting the carbon to the "hot" power-input terminal.

Since voltages higher than six are too hot, when working on gear having higher voltage input, the feedline can still be used as a current source if the battery end of the cable is temporarily connected to only one battery of the bank.

There may be instances where it would be difficult to use the equipment feedline for the supply of soldering current. In this case, a single battery may be "borrowed" from the vessel's

bank or an engine and brought to the radio. This is safer than taking the work to the battery, because of the ever-present danger of gasoline fumes or hydrogen below decks, which might be ignited by the incandescent carbon.

In addition to using care in handling the hot carbon to avoid the danger of fire or painful burns, it is also necessary to be careful not to look too long at the hot spot while soldering. If the carbon is held so the holder is between the contact point and the eyes, there will still be sufficient visibility to do the work, without the danger of glare-blindness.

Not only does resistance soldering insure that radio repairs can easily be performed out in the middle of the bay—the feature of plenty of heat, *fast*, makes it a very useful adjunct to conventional soldering tools on the bench in the shop. One of the batteries of a d.c. power-supply bank can be used, or transformers can be bought that are made for the job, and come with accessories to take care of many different kinds of work.

Don't be all at sea, when it comes to seagoing soldering. Use your pencil and discover just how easy those soldering jobs can be. —30—

MINIATURE EQUALIZER

By JOHN J. HOWELL, JR.

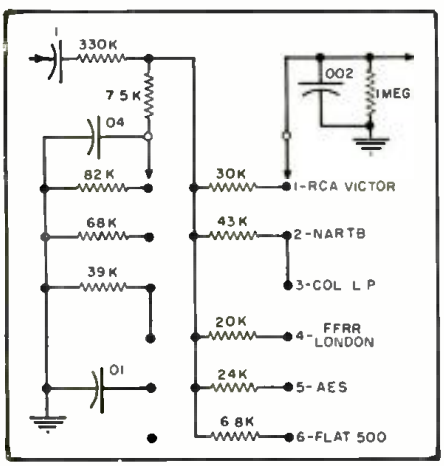
USING Mr. Boegli's article in the April issue ("New Developments in Phono Equalizers") as a base, I have been able to build an equalizer small enough to fit into a two-inch chassis, three inches deep, by using a Mallory 3126J rotary switch.

Wiring has been limited to the pigtails except for the three leads necessary to connect to the grid, plate, and ground.

The omission of the 78 rpm and 250 cycle steps is justified for most fans because of the widespread use of LP and 45 rpm records.

Several of my friends have installed this unit in their preamplifiers and are so pleased that I thought that I would pass it along for the benefit of others. The circuit diagram of Fig. 1 gives an idea of the equalizer's compactness. —30—

Fig. 1. A miniaturized equalizer based on Boegli's circuit of April 1953 and using a Mallory 3126J rotary selector switch.



POWER SUPPLY FOR REFORMING ELECTROLYTICS

By JOSEPH AMOROSE

BECAUSE the technician cannot run to the jobber for a fresh electrolytic condenser every time he needs one for replacement, he is compelled to keep a certain number of these units in stock. The bad feature of this is that such condensers tend to dry out. They will then require "reforming." If they are placed in service without reforming, the rectifier tube will overload and often burn out.

The prudent technician will, therefore, employ some external means of reforming the condensers before installing them in a set. An inexpensive and easily made unit for doing this job quickly is shown in Fig. 1. It is a d.c. power supply which provides approximately 150 volts d.c. To reform the electrolytic, merely hook it up to the output terminals of the power supply as shown. Caution: Be sure to connect the condenser properly—correct polarity must be observed.

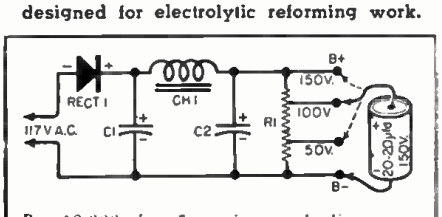
The condenser should first be connected to the low voltage (50 volt) terminals and left there for about 10 minutes. Next, the condenser is moved to the next higher terminals (100 volt) and left for another 10 minutes. Finally it is connected to the top voltage terminals (150 volt) for a final 10 minute period. After this the condenser is ready for use.

If the condenser has been shelf-stored for a long period (and draws excessive current) the unit should be left connected to the voltage divider for longer periods—about 15 minutes on each step of the scale.

The length of time required to reform a condenser depends on the amount of leakage present. The average condenser, however, can usually be processed in about 15 minutes, using only 5 minute periods on each step of the divider. To be absolutely sure, it is advisable to reform all condensers before installation, even newly purchased ones since the technician cannot know how long the units were on the jobber's shelf before being purchased.

The power supply diagrammed in Fig. 1 makes the work of reforming quick, easy, and inexpensive. It assures the customer a good, long-lasting, satisfactory job. If desired, for condensers of higher voltage rating, a little higher voltage can be obtained from the power supply by substituting a filter choke of a lesser value than that shown in the parts list. —30—

Fig. 1. Schematic of a d.c. power supply designed for electrolytic reforming work.



R_1—10,000 ohm, 5 w. wirewound adj. res.
C_1—40 μfd., 150 v. elec. cond.
C_2—20 μfd., 150 v. elec. cond.
CH_1—15 hy., 500 ohm filter choke
Rect.$_1$—100 ma. selenium rectifier

Mecsures 6¼" x 9½" x 4½"

Superior's new Model 670-A

SUPER METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers)
REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to +18 +14 to +38 +34 to +58

ADDED FEATURE:

Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40 NET

Superior's new Model TV-11

TUBE TESTER

SPECIFICATIONS:

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron, Miniatures, Sub-Miniatures, Novals, Sub-minars, Proximity fuse types, etc.
★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because *all elements are numbered according to pin-number in the RMA base numbering system*, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus *it is impossible to damage a tube by inserting it in the wrong socket.*
★ Free-moving built-in roll chart provides complete data for all tubes.
★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.
★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute

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

$47.50 NET

SUPERIOR'S NEW MODEL TV-40

C.R.T. TUBE TESTER

★ **A complete picture tube tester for little more than the price of a "make-shift" adapter!!**

The Model TV-40 is absolutely complete! Self-contained, including built-in power supply, it tests picture tubes in the only practical way to efficiently test such tubes; that is by the use of a separate instrument which is designed exclusively to test the ever increasing number of picture tubes!

EASY TO USE:

Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base *(ion trap need not be on tube)*. Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

★ **Tests *all* magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!**

SPECIFICATIONS:

- Tests *all* magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Tests for open elements.

Model TV-40 C.R.T. Tube Tester comes absolutely complete—nothing else to buy. Housed in round cornered, molded bakelite case. Only .....

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Try any of the above instruments for 10 days before you buy. If completely satisfied *then* send down payment and pay balance as indicated on coupon. **No Interest or Carrying Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-67 3849 Tenth Ave., New York 34, N. Y.

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

Name.....
Address.....
City..... Zone.... State.....

☐ Model 670-A.....Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months.

☐ Model TV-11.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model TV-40.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.

Square-Wave Generator

(*Continued from page 51*)

presentation on the scope screen. For all practical purposes, we can assume that the composition of a square wave includes its fundamental and its eleventh harmonic. Thus, if you apply a 100 kc. square wave to the vertical amplifier of your scope and it looks good, you can assume a 1 mc. bandpass for the scope amplifiers. The same visual check can be made with a 30 cps square-wave input to check the low frequency response. See Fig. 4 for distortion patterns and their causes.

If you wish to check the pulse response of your scope amplifiers more accurately, you may wish to try the following procedure. Adjust the sweep length to 4 inches or a suitable length on a graduated screen. Calibrate the speed of the sweep by applying an accurate 200 kc. sine-wave signal to the vertical amplifier. Adjust the sweep frequency control on the scope until two complete sine waves appear. The speed of the sweep will then be 10 microseconds for 4 inches of deflection or 5 microseconds for 2 inches, etc. derived from $t = 1/f$ where $t =$ time in microseconds and $f =$ frequency in megacycles. Since the rise time of square waves produced by the generator is known to be .05 microsecond, if we apply the output of the generator to the vertical deflection amplifier at a frequency of about 50 kc. and observe the angle of the rise or fall time, we can then convert this angle into time by determining what part of 4 inches is included in the angle. This angle on the scope screen is the evident rise time which will become longer as the square-wave frequency increases beyond the capabilities of the scope amplifier response. By applying the formula: $t_s = (t_e^2 - t_p^2)^{1/2}$ we can calculate the pulse response of the scope amplifier, $t_p =$ rise time of the pulse applied; $t_e =$ evident rise time on the scope screen, and $t_s =$ pulse response or rise time of the scope amplifier in microseconds. Once we have found t_s we can again apply the formula $f = .4/t_s$ to find the response (in megacycles) of the scope amplifier.

At frequencies between 20 cps and 500 cps distortion to the square wave will result if the output is terminated in a resistance lower than 300,000 ohms at 20 cps. This can be avoided by direct coupling to the center arm of the output potentiometer if approximately 2 volts d.c. can be tolerated. To block this d.c. voltage, C_{16} is used. To guide you in the choice of this condenser, the following formula can be applied: $C = 6 \times 10^6/Rf$ where $C =$ the condenser value in microfarads, $R =$ resistance of the termination in ohms, and $f =$ lowest square-wave frequency being used in cps.

Build this square-wave generator and you will be more than repaid for the time and expense involved by the increased convenience it affords. —30—

International Short-Wave

(Continued from page 70)

still good level to North America 2030-2130, 2200-2300. (Young, N. Y.; De Mann, Minn., others) Second half-hour of each week-day session is *English*, Sundays is all-Danish. (Stanley, Conn.)

Dominican Republic—HI2L, 5.053, noted in Spanish with music to 2400 closedown. (Reidler, Pa.)

Ecuador—"Radio Cosmopolita," Ambato, is on the air 0630-1730, 2000-2300, according to verification letter in *English*: channel is 6.192, call is HC5PT6. (*WRH*) HC4FF, "La Voz Esmeraldas," has been heard in Norway on *new* 6.275 at 2100-2200. (Radio Sweden)

Falkland Islands—*WRH* says Port Stanley operates on 600 kc., 1500 kc., 6.125 at 1730-2100 Mon., Wed., Fri.; Sat. 1700-1900, Sun. 1645-2100.

Fiji Islands—ZJV call has been altered to VRH, 2 kw., 930 kc., and VRH4, 500 watts, 3.890, scheduled Sat. 1500-0500 Sun.; weekdays 1330-1700, 1900-2100, 2300-0530 (Sat. to 0600); programs now originate from *new* studios at Broadcasting House, Suva; the Fijian Broadcasting Commission has replaced former operators (Amalgamated Wireless Australasian, Ltd., and Fiji Broadcasting Co.) (Radio Australia: Cushen, N. Z., others) Heard with popular dance music 0100, good level in N. Z. (Hardwick)

France—Paris, 6.045, noted in *English* for British Isles 1500-1600. (Saylor, Va.) Should be parallel over 11.700. The 11.700 channel is good level in Oregon 1830-2000, news in French 1945. (Koch) The *English* at 1500-1600 has been heard some days also on 9.620A. (Scheiner, N. J.) *Paris-Inter*, 6.200, heard 1700-1800, strong signal most days; French. (Butcher, Mass.) Paris noted over 5.955 at 1620 in Spanish to close 1645, good level in New York City. (Morgan)

French Equatorial Africa—*Radio Brazzaville*, 11.070, good in *English* 1550-1602 closedown. (Deuring, Alberta.)

Noted 1430-1500 with French lesson for *English*-speaking listeners. (Collins, Iowa)

Germany—*RIAS*, 6.005, Berlin has best signal in Mass. around 1800-2000. (Butcher) *Radio Stanza (Liberation Radio Munich)*, 3.99, good level with call 0200, talks by man and woman in Russian dialects. (Pearce, England) AFN, Frankfurt, is heard well from 0900 in Ireland on its *new* channel of 3.188. (Cody) And in Britain. (Patrick, Pearce, England) By now, Cologne should have returned to 5.980 from 6.075, parallel 7.290, for North American beam 2030-2330. (Niblack, Ind.) Has *tested* on 9.735 and wants reports. (ISWC, England) *Sudwestfunk*, Baden-Baden, now radiates on 7.265 instead of former 7.320. (ISWC, England, *WRH*, Radio Sweden, others) *New* station is located near Bad Durnheim in Black Forest area. (Pearce)

Gilbert Islands—*New* is Tarawa, 6.050, radiating *Sat. only* 2100-2130 in Gilbertese; transmissions will be extended later. (Radio Australia, others) Power unknown. (*N.Z. DX Times*)

Guam—Received verification from *RCA Communications, Inc.*, Box 577, Agana, Guam, for report on KUJ39, 9.490; is a point-to-point channel using *RCA* type "P" transmitter, 1 kw., fed into a 730-foot rhombic antenna directed on San Francisco. (Morgan, Calif.)

Guatemala—TGNA, 5.952A, is again in use (replacing TGNC, 11.850) parallel with TGNB, 9.668, with *English* 2200-2345 sign-off. (Ferguson, N. C.; Niblack, Ind., others) The official government radio in Guatemala City more recently has been noted on 6.357A announcing "Radio Nacional de Guatemala," best around 2200. (Dexter, Iowa, others) TGWA, 9.760, noted opening with National Anthem sung by group and with full station announcements 0728-0730. (Ferguson, N. C.) This one also now uses call of "Radio Nacional de Guatemala" instead of former "La Voz de Guatemala." Sjoberg, Sweden, reports TGTA, *Radio Bolivar*, 6.334A, heard 2110-2235.

Haiti—*Radio Commerce*, 6.091, is very good from 1830 onwards in French. (Butcher, Mass.) *New* is the *English* session *Sun.* at 1700 over the 9.485 outlet; native music and talks about the country of Haiti are features; strong signal; at 1730 goes into French. (Euerle, Conn.; Jones, Pa., others)

Holland—Hilversum, 6.025, noted 2130-2210 with *English* for North America, S5-7, in clear. (Butcher, Mass.) On 9.590 at 1725 ending *English*, heavy QRM. (Foster, Ill.) Good in this beam 1645-1725 over 11.73. (Brooks, Kans.; Bishop, Ohio, others)

Honduras—HRN, 5.885A, noted QRK3-4 at 2000-2100. Sjoberg, Sweden)

Hong-Kong—ZBW3, 9.525, noted 0600 with BBC news relay; heard as early as 0430 some days, fair to weak signal. (Saylor, Va.; Sanderson, Australia)

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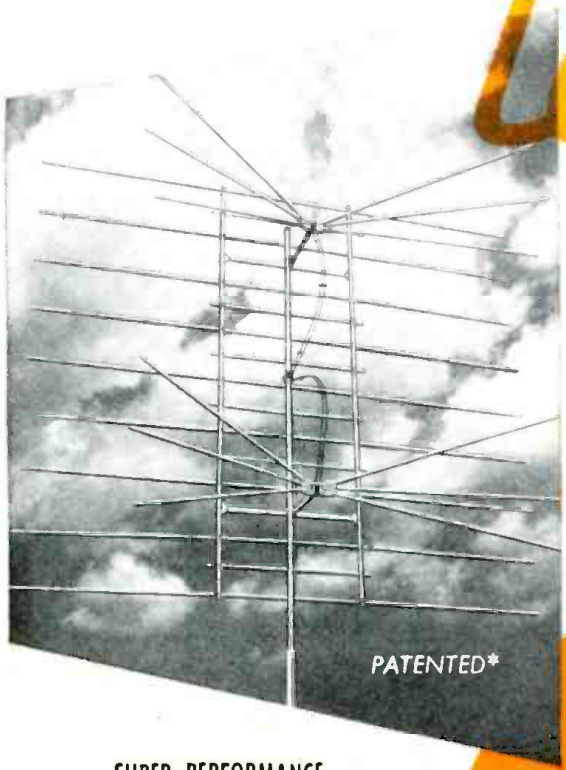
TECHNICALLY PERFECTED TV ARRAY

in the entire world!



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— designed to obsolete all existing TV arrays, provides maximum gain, maximum F/B ratio, minimum spurious lobes, no phase shift — best for B&W or Color TV

SUPER PERFORMANCE ON VHF — EXCELLENT PERFORMANCE ON UHF

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ALL ALUMINUM CONSTRUCTION LIGHTWEIGHT — DURABLE NO RIVETS TO WORK LOOSE AND BECOME NOISY!

The best S/W/R, S/N/R and H-E plane pattern TV Array ever devised. Utilizes the Patented "Conical-V-Beam" theory to perfection. "Conical-V-Beam" dipoles provide true broad-band characteristics with maximum gain and signal to noise ratio with NO PHASE SHIFT. New transmission line and spline back provide the perfect pattern on all channels. If you've tried the rest — Now! Try the best!

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Model 201 (Single Bay)	$26.50
Model 202 (2 Bays Stacked)	$57.00
Model 204 (4 Bays Stacked)	$124.00

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*"Conical-V-Beams" are produced under U. S. Patent No. 23,346, Canadian Patent No. 500,436 and British Patent No. 691,485 — other patents pending. Sold only through authorized distributors.

Hungary—Radio Budapest, 11.910, is strong 1505 with news. (Catch, England) And on 9.833 with *English* 1930-2000. (Middleton, Ohio)

India—Heard opening to West Indies 1830 on 9.755; has news 1930. (Sutton, Ohio)

Indo-China—Radio France-Asie, Saigon, now uses 11.830 for *English* 2030 but is difficult to log due to *Radio New Zealand,* same channel. (Radio Australia) Heard opening on 15.320 in *English* 0345. (Hardwick, N.Z.) Heard on 7.23 at 0533 with Vietnamese-Chinese music, fair level. (Morgan, N. Y.) "Voice of Vietnam," Saigon, noted *moved* from 7.287 to 7.26, heard after Tokyo's Home Service closes on 7.257 at 0500; weak to fair level; French news 0815. Balbi, Calif.)

Iran—Radio Teheran. EPB, 15.100, heard some days as early as 1230 with native music; French 1500; *English* news 1515, closing 1530A. (Sutton, Ohio, others)

Iraq—Radio Baghdad, 11.702A, noted 2315 with Arabic program of music and news. (Sanderson, Australia) Noted on *new* 3.295A channel 1415-1500 closedown with *English.* plays National Anthem at close. (Pearce, England) Also heard parallel over 11.702A then, good level in N. Z. (Hardwick)

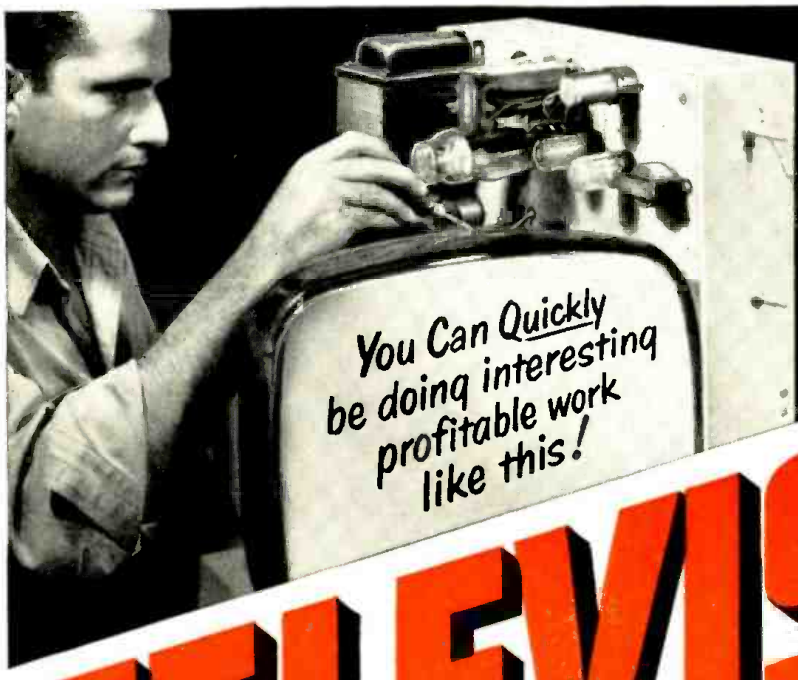
Israel—The *new* 50 kw. transmitter is *RCA*-made used with a single rhombic antenna beamed on Central Europe; the former 7.5 kw. transmitter at Tel Aviv is now used as a standby. By now should be on *winter* schedule. (Scheiner, N.J.) Improved signals noted with "Voice of Zion" session in *English* 1600-1645 closedown on 9.008A. (Klapholz, Ohio, others)

Italy—Rome, 9.780, noted 2030-2045 in Italian. (Machajewski, N. Y.) Noted with news 2130-2150 sign-off on 9.780, 9.575A, excellent level. (Kelting, N.Y.) Heard on 6.210 at 1730-1800. RAI, 6.240, Milan, noted 1730-1815 with Home service, music, all-Italian; poor level, slight CWQRM. (Butcher, Mass.) Excellent on 9.575A in *English* to North America 1920-1935, then in French. (Salovey, N. Y., others)

Japan—JOA6, 15.135, Tokyo, noted 0205-0300, strong, clear in *English* and Japanese to Hawaii. (Machajewski, N. Y.) Excellent on this channel 0000-0100. (Frederick, Washington State) Noted over 11.705 at 0700-0730 with music, news. (Frazier, Texas) The *commercial* stations JOZ, 3.925, fair, 0400-0600, JOZ2, 6.05 (moved from 6.095), in parallel, good. JKI2, 9.655, JKJ, 7.285, have 5 minutes of *English* news before signing off 0500 (*not* Sun.); this is Home Service. (Balbi, Calif.)

Kenya Colony—Nairobi, 4.885, noted 1200 with BBC news relay, 1315 with local news and weather forecast for East Africa; 1325 bulletin of South African news. (Catch, England) Heard closing 1500 with "God Save the Queen." (Pearce, England)

Kuwait—Radio Kuwait, 5.000, has been heard in Britain to closedown 1600. (ISWL, England)



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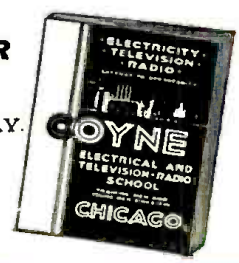

Malaya—BFEBS, 11.820, Singapore, noted 0800 with BBC news relay from London, good level in N. C. (Ferguson) Heard on 7.120 with BBC news relay 0600. (Morgan, N. Y.)

Monaco—*Radio Monte Carlo* is still on *measured* 7.349 although overseas sources reported it had moved lower; checked 1745. (Ferguson, N. C.; Pearce, England)

Mozambique—CR7BU, 4.916A, Lourenco Marques, noted 1605-1655 in *English*, then closed with "A Portuguesa"; this was on a Sat.; other days closes *one hour earlier*; barely audible 2315 with request session. (Hill, N. H.)

New Caledonia—*Radio Noumea* is reported *moved* from 3.375 to 3.355, and beamed to Europe on 6.035, on the air 1900-2100, 0200-0530. (Radio Sweden) However, Sanderson, Australia, notes this one on 3.375 at 0745 with French news, parallel 6.035.

Nigeria—Lagos, 4.800, fair strength with music 1620; news 1630-1640. (Hill, N. H.) Heard with BBC news relay 15.00. (Pearce, England) Heard on 6.110 in *English* 1400; on 7.185 in *English* 1330, fair. (Hardwick, N.Z.)

Northern Rhodesia — Lusaka, 4.826, signs off 1400 after *English* announcement, fair. (Hardwick, N.Z.)

Norway—*Radio Norway*, 9.610, Oslo, good to Eastern North America 2000-2100. (Kuhnert, Ohio, others) And to West Coast 2300-2400. (Knapp, Calif.; Brooks, Kans.)

Pakistan — *Radio Pakistan* noted parallel over 11.885 (best) and 15.255 in beam to Southeast Asia 1945-2030; news 2000. (Niblack, Ind.; Bellington, N. Y., others) Noted on 9.520A with news at dictation speed 1915-1930 at strong level; announced "Overseas Services of Radio Pakistan"; may be *listed* 9.518 channel. (Niblack, Ind.) Heard on 11.725 at 2115 with news and music, then Home Service; on 11.915 at 1915 with news and music; on 15.335 with news and music 0300; on 15.255 at 0800 with "Pakistan Calling" feature and music; on 7.010 at 0745 with Home Service. (Sanderson, Australia) Heard on 9.545 and 7.010 in beam to Turkey 1430. (Pearce, England)

Panama—HOLA, 9.505, Colon, noted 2115 at level. (Middleton, Ohio) HO50, 5.990, is scheduled 0600-0000 weekdays, 8000-2100 Sun. (Radio Sweden) Heard well 2100-2200. (Sjoberg)

Paraguay—ZPA5, 11.950, noted 1930 with music in Spanish. (Jones, Pa.)

Peru—The *English* session from *Radio Nacional*, Lima, seems to be daily now 2300 over 6.082, 9.562A. (Sutton, Ohio; Jones, Pa., others) Heard opening on 9.562 with interval signal 0645, then long anthem; at 0648 announced calls of OAX4A, OAX4T, OAX4Z; fair level, strong heterodyne on high-frequency side. (Morgan, N.Y.)

Philippines — DZH8, 11.855, Manila, noted 1030 at fair level. (Waltz, Washington State) Heard on 9.730 at 0400 with musical program and news; on 15.300 at 0245 with "Baptist Hour." (Sanderson, Australia) An airmail letter from the Manila Broadcasting Co. lists Cebu Broadcasting Co., Cebu

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Pitcairn Island—ZBP is *used on car, and phone to ships only*—in *English* 1200-1600, 1900 (weather report), 2330-0100 over one transmitter of 250-500 watts on any of these channels—375 kc., 500 kc., 600 kc., 3.800, 4.000, 5.000, 8.280, 12.000, or 12.420, according to station officials. (Scheiner, N. J.)

Poland—Radio Warsaw, 9.57, noted with *English* 1400-1430. (Pearce, England) Also 1500-1530. (Butcher, Mass.)

Portugal—Lisbon was noted recently on 11.836 at 1600-1830 closedown in all-Portuguese session; another station on 9.248A announces "Emissora Nacional, Lisboa," "Voz de Lisboa," and "Voz de Portuguesa," heard 1615-1835 closedown; last 15 minutes has news in Portuguese, and woman announcers. (Saylor, Va.) Good to North America on 9.746A at 2000-2100. (Rugel, Kans.; Sutton, O., others)

Puerto Rico—Radio Corporation of Puerto Rico, measured 15.472, noted 0747 with announcement, called and made contact 0752 with Havana, Cuba. (Ferguson, N. C.)

Roumania—Bucharest, 9.57, is good level in *English* for North America 2200-2230. (Middleton, Ohio, others) Heard parallel over 6.143A. (Levy, N. Y.) Noted also with *English* to North America 2330-2400 closedown on 9.57. (Zieske, Mich.)

Saar—Radio Saarbrucken and *Tele Saar* will establish the "biggest" station in Europe; the 20 kw. transmitter on 1421 kc. will be replaced by a 120-kw. transmitter; a commercial station of 400 kw. will operate on long-wave, and *there also will be a short-wave service from the Saar.* (Radio Sweden)

Sao Tome—CR5SC, 4.807, noted 1500 with music; closed 1559 with "A Portuguesa." (Pearce, England) Good level in N. Z. 1500. (Hardwick)

Somali—Radio Mogadishu has been heard at good strength by Chandon, Pretoria, South Africa on 7.074A in the clear 1130-1300 closedown; all announcements in Italian.

South Africa—SABC, 11.937, Johannesburg, noted 1520 with music; closed 1530 after announcements in Afrikaans. (Pearce, England) A newspaper dispatch says SABC has decided to drop the playing of the South African National Anthem at program closedown. (Gay, Calif.)

Spain—Madrid now has one or more of its *new* (reportedly 100 kw.) transmitters on the air. (Ray, Pa., others) The *announced* 9.363 channel varies greatly; more recently *measured* 9.339. (Ferguson, N. C.) Has been noted on *new* 6.212A at fine level 1100 with relay of Home Service sessions in Spanish. (Cody, Ireland, others)

Surinam—PZH5, 5.757A, Paramari-

bo noted 1740 with dance music, Dutch announcements. (Catch, England)

Sweden—Radio Sweden, 11.705, excellent in *English* 0000-0015. (Winch, Calif.) Strong on this channel with *English* to North America 0700-0715. (Machajewski, N. Y.) Excellent over 9.620 around 2100-2145. (Headen, N. C.) Heard on 15.155 with news, music 1200-1230. (Sutton, Ohio)

Switzerland — HER3, 6.165, Berne, good level 2240, slight QRM. (Kirby, Mo.) Good in beam to Britain-Ireland over 9.665, 11.865 at 1345-1600. (Parker, N. H.) Heard well from 2030 on 7.210, 6.165, 9.535. (Kelting, N. Y.)

Syria — On Mondays when HCJB, Quito, Ecuador, is silent, Damascus often can be heard to Latin America 1900-2100 on 11.915A. (Niblack, Ind.) The 9.555 outlet should be parallel.

Tahiti—Radio Tahiti, 7.025, Papeete, heard in French 0000 at good level in N.Z. (Hardwick)

Taiwan (Formosa)—"Voice of Justice" broadcasts to Chinese mainland and overseas in Chinese and Cantonese dialects 1600-1800, 0600-1130 over BEC36, 7.300, 3 kw.; the Police Radio Station uses Chinese and Amoy dialects 1730-1910. 2155-0000, 0330-0900 over BEC38, 5.960, 3 kw. The *Armed Forces Radio Station,* Kachsiung, uses Chinese 1630-1800, 2200-0000, 0330-1000 over BEC24, 9.910, 1 kw.; also from Tsoying at same time on BEC26. 10.200, 1 kw.; "Voice of the Air Force" is scheduled to Taiwan and China mainland in Chinese 1700-1800, 2200-0000, 0400-0930 over BEC32, 9.775. 2.5 kw., and 1630-1800. 2200-0000. 0330-1000 over BEC22, 7.000. 1 kw. (Scheiner, N. J.) BED6. 11.735, and BED4, 11.920, noted 0230 with news. (Sanderson, Australia, Winch. Calif.)

Tangier—Pan-American Radio operates on 1178 kc., 7.290. 0300-0630 Spanish, French; 0630-0700 *English;* 0700-0830 French; 0830-0900 Italian; 0900-1100 Spanish; 1100-1145 French; 1145-1200 Hindu; 1200-1400 Arabic; 1400-1500 *English;* 1500-1600 French; 1615-1630 Italian; 1630-1748 Spanish; 1748-2000 International Program. (*WRH*) WTAN, "The Voice of Tangier," under the direction of International Evangelism, Inc., says that 7.305 is still used but it is *experimenting* with other frequencies which may be used if found advisable. (ISWC, England)

Thailand — HSK9, 11.670, *Radio Bangkok,* noted 0500-0700; has station interval signal when breaks around 0625-0630. (Zieske, Mich.) Heard with news 0515A. (Sanderson, Australia)

Turkey—TAT, 9.515, *Radio Ankara,* is excellent in *English* to North America 1815-1900. (Salovey, N. Y., others) TAU, 15.160, good level with *English* 1600-1645 closedown; Turkish news 1545. (Foster, Ill., others) TAV, 17.825, noted with *English* for Southeast Asia 0830, news; closes 9015. (Pearce, England)

USI (Indonesia)—YDB3, 7.270, noted at weak level with music 0545, much QRM. (Morgan, N. Y.) The *Indonesian Air Force Radio* operates daily 0430-0730, 11.940, using *RCA* 7.5 kw. trans-

mitter with one-wavelength long antenna, one wave above the ground. (Scheiner, N. J.) YDI2, 3.982, Surabaja, excellent 0645-0930. (*Malmo DX-aren*, Sweden) Djakarta now has Indonesian for Central America 2000-2100 over YDF6, 9.710, 50 kw., parallel YDE, 11.770, 7.5 kw. (ORU DX program, others) Good level on 9.710 to 1230A in *English,* then in Hindu. (Koch, Ore.)

USSR—Baku, 4.958A, noted in Russian 1310 at fair level in Britain. (Catch) Moscow, 9.59A, noted in *English* 1630-1700. (Beres, N. J.) Moscow heard closing 0155 on 9.52A at very strong level. (Woolsey, Washington State) Khabarovsk, 5.950A, S8-9 in Japan around 0445-0505 sign-off. (JSWC) A Home Service station is noted some days 0630 on 9.850A. (Becker, Mich.) Komsomolsk, 7.278A, Siberia, heard 0537 with talk in Chinese by man and woman, good level; played Communist march 0547. (Morgan, N. Y.)

Vatican — HVJ's current schedule for *English* is daily 1000 and 1315 over 7.280, 9.646, 11.685, 15.120; 1100 on Tue. for Southeast Asia over 11.685, 21.740. (Butcher, Mass.)

Venezuela—A station on 9.527, giving three calls, two of which are "Radio Popular" and "Radio Hollandia," has been noted opening around 0530, best in Texas around 0630; announces frequency (in Spanish) as 9.530. (Stark, Texas)

Yugoslavia — *Radio Belgrade*, 6.100, noted 1745 with news session by woman, good level. (Morgan, N. Y.) Heard with news 1330-1345 over 6.100, 7.200. (Pearce, England)

* * *

Press Time Flashes

Armed Forces Korean Network, 6.895, relays American Forces Korean Network 24 hours daily; best around 0530; usually relays "Vagabond" or "Troubador"; CWQRM severe; QRA is Chief Engineer, AFEN Headquarters, 8214th Army Unit, Seoul, Republic of Korea. (*N.Z. DX Times*) By now, Tel Aviv, 9.008, Israel, should be back on winter schedule with "Voice of Zion" session in *English* around 1700-1745. (Scheiner, N. J., others)

WRH says a "local" broadcasting station on 3.255 as inaugurated back in 1952 in Montserrat, Leeward Islands; no further details as yet. *WRH* also says North Borneo has no broadcasting organization but that a lunchtime broadcast is radiated and that the station is used in addition for broadcasts of special events; considerable expansion is planned this year; uses *English* and Chinese and last-known schedule read 2300-2400 over VR4S, 7.237, 0.25 kw.

A French-speaker on 4.820A noted 1545 with dance music, 1600 with call in French and then closing with "La Marseillaise," appears to announce "Ici Abidjan." May be Ivory Coast. (Pearce, England) The clandestine station, "Radio Espana de Independiente," is noted in England with news in Spanish 1000 on 10.194A. (Catch)

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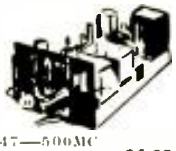

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TV Power Transformer—110 V Pri. Sec. 710 CT @ 225 MA—Fil #1—5V @ 3 Amps. #2—5V @ 2 Amps. #3—6.4V @ 10 Amps. #4—6.4V @ 1.2 Amps NEW 5.95

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MODEL FL-8

Completely eliminates 1020 cycle CW signals when used on Phone bands—or—flip a switch and only 1020 cycle CW signals come thru! Neutral switch position cuts filter out of receiver circuit. Fully self-contained in cast aluminum case 3¼" x 2¾" x 2⅜" deep. No tubes or internal wiring required. Plugs between set phone jack and speaker.
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MODEL FL-5

Similar to above, less switch. Designed either to pass or reject 1000 cycle signals. Originally made for Army SCR274N and ARC-5 equipment. BRAND NEW, in original boxes. ea. **$1.19**

PRACTICE CODE TAPES

Code Training and Practice Inked Paper Tapes on 16 MM 400 ft. Reels for telegraph and radio operation. 15 Reels to a Set, in wood case—for use with TG-34A and TG-10 Keyers.
Complete Set **$14.95**
SEPARATE TAPES for following lessons:
Tape #11—Traffic Tape #8—Code Groups
Tape #12—Traffic Tape #2—Receiving
Each on 16 MM Reel..... **$1.25 Ea.**

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PE-101C DYNAMOTOR

6 or 12 Volt

(Reprints of original CQ conversion articles—Oct. and Dec., 1952 issues, furnished.)
• This is the Dynamotor the Hams have been talking about! Easily adapted to supply 625 V. @ 150 MA. and 325 V. 125 MA. at 12 Volts—or 300 V. 90 MA. and 160 V. 110 MA. at 6 Volts. (Illustration shows modified.)
NEW **$4.75**
Eicor Dynamotor—11.6 V. input—425 V—Output at 375 MA—NEW..... **$10.95**
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		New
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"Radio Espana Independiente, Estacion Pirinaica," has been heard afternoons (*EST*) on 11.950; "La Voz de la Resistencia Basca" has been noted in Spanish and the Basque dialect 0230-0300 on 7.020A. (Radio Sweden) A program of *English* is radiated 0530 Mon.-Fri. over HLKA, 7.935, Seoul, Republic of Korea; other days has Korean then. (*N.Z. DX Times*) "Radio Industrial de Juiz de Fora, Ltda.," Juiz de Fora, Brazil, is a *new* station on 4.925, ZYV32, 1 kw., with relay of m.w. ZYT9, 1090 kc., 1 kw. daytime and 0.5 kw. night.

The Teknikens Vaarlds Radioklubb, Stockholm, has announced the Swedish SWL Championship 1954 which is open to all Swedish radio listeners; the 10 best contestants will be invited to a final "heat" in Stockholm during early January 1955. Many fine prizes are being offered. (Skoog, Sweden)

Of the many radio bulletins received here, one of the very best is that of the Japanese Short Wave Club, Box 29, Sendai, Japan, which is *all-English* and quite detailed, well-arranged (most items by frequency, some by country). Officials of the club are to be commended for the long way their club has come in such a short time. Welcomes members anywhere; membership outside Japan, including bulletin by surface mail is $1.00 or 7/-d. sterling, or 12 IRC's; by airmail (*only* to Asia, USA, Canada, Australasia), $3.00 or 22/-d. sterling, or 36 IRC's.

The *Voice of America* is now trying to catch up on backlog of reports and QSL's are being sent out as rapidly as possible. All *Armed Forces Radio Service* stations (both East, West Coast networks) are now being confirmed from AFRS, New York; reports should go *direct* there since VOA no longer will confirm AFRS reports. WRUL, *Radio Boston* is eager to receive reception reports especially from European listeners, with criticism of program material beamed to Europe; program schedule will be sent on request; latest schedule to Europe is 1459-1645 in *English* (also with Swedish, Norwegian, Dutch on alternate days) over WRUL, 11.780, 15.280, 11.780; to Latin America in Portuguese, *English*, Spanish 1745-2100 (Fri., Sat. to 2000) on 17.750, 15.350, 11.780, 9.585. (Morgan, N. Y.)

Far East Network (AFRS), Tokyo, uses *new* frequencies over a newly-installed transmitter (replacing JKI, JKL); *new* station has no call letters but is designated "FEN—Tokyo Shortwave." Current schedule is 1600-1800, 6.160; 1815-0515, 11.750; 0530-1000, 6.160; however, the daytime transmission is actually heard on 11.760 and *not listed* 11.750. (JSWC) New channels are heard well in Calif. (Balbi, others)

* * *

Acknowledgment

Thanks for FB reports, fellows! Keep them coming during the winter DX season to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA. . . . . K.R.B.

I MARRIED A TV TECHNICIAN

By LEA KESSLER

Like the traditional "shoemaker's children," families of TV technicians are often "radio-less" and "TV-less."

THIS STORY is true, only the names haven't been changed, to persecute the guilty! What do I mean, persecute the guilty? Well my husband isn't a criminal in the literal sense of the word, but I often wonder if he had another pleasurable place to live, and I wasn't a palatable cook, if I'd see him at all. His comings and goings could be compared to those of a doctor, but at least a medico's wife was prewarned before entering into the nuptial agreement. I had no such good fortune. My children think any man in a blue uniform is their father. After all how often do they see his face?

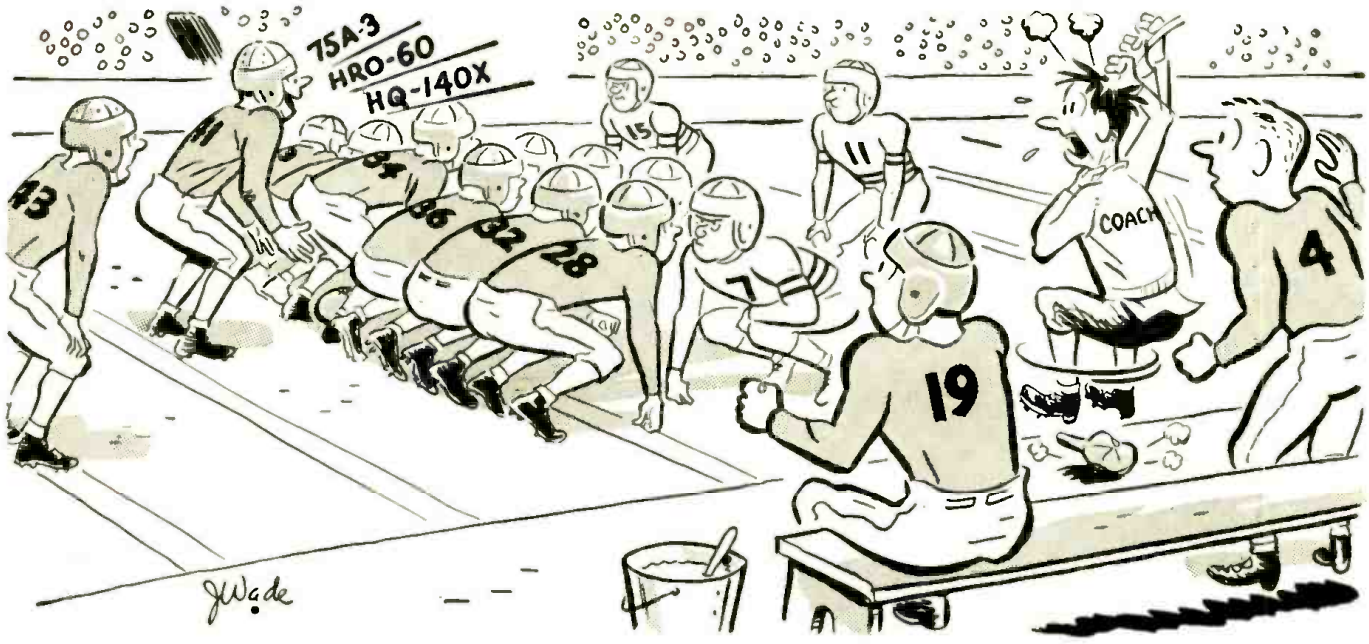
This has led to many ludicrous situations. Like the time I called for service on our oil burner. The poor man had the misfortune to be wearing a blue uniform. That did it! With the speed of track stars, my two little gremlins jumped him as he entered the door, and amid shrieks of "I got him. Mom, it's Daddy, let me go, help, oonch, oonch (my two year old doesn't speak very clearly), they floored him. Being a husky fellow, and of a determined nature, he soon righted himself, and was out of the door again, before I could catch him and explain. We were very cold that winter.

Speaking of service, can anyone recommend a good TV service technician? The one I have been trying to use, has taken to ignoring my requests for aid. There's nothing wrong with our set that a good picture tube wouldn't cure, but that's my version of it. Everytime I ask for a new tube, however, I get the complex argument that it's only loose electron gun elements. Quite frankly though, I'm getting tired of whacking the neck of the tube with a blunt instrument every time the screen goes black. Besides that my five year old daughter misinterprets my actions, and the other day I caught her about to smash the back of the set with a heavy hammer. When I upbraided her for this performance she argued that she was just following my example— Where do I go from here?

A long time ago I had a wide circle of friends and relatives too numerous to count. All this, however, was before the advent of television. My husband, many years ago, made a firm resolution that he would never fix a television set belonging to anyone close to us. This ruling has caused much grief, as nary a day goes by that I don't make a fresh enemy. I try my best to be diplomatic when refusing to send my husband over, but the sweeter I am, the more bitter they are afterwards. My husband, the real culprit, is never home to answer the telephone personally and therefore the blame falls on me. What friends I have left all understand how little time my husband spends at home and therefore only call for service late at night, on holidays, or Sundays. They're very considerate that way. Just a few months ago my own Mother threatened to call in another technician—it should only happen!

About a year ago one of my aunts called for service, and being a much faster talker than I am, which is no mean accomplishment, cornered me into sending my husband over. He went, at the point of a gun, and I've never heard the end of it. It seems she needed a new picture tube, and after he quoted her the absolute wholesale price, with no charge for labor, she said she'd let him know as that figure seemed exorbitant, and she certainly thought he would give her a break, being his aunt and all. Without a word, he left in disgust, and the whole family now knows what a parsimonious brute I married.

My husband is a wonderful technician, just ask him, he'll tell you. He can fix an intermittent horizontal sync condition without batting an eyelash, but getting him to fix something around the house is another story. When we bought our home, we noticed that the sample house had a fluorescent light over the sink, which was quite attractive and very useful. Right then I decided that we should have one in our kitchen. The rest of the story is very sad, but don't stop now, there's a happy ending. I bought a light without even considering the serious repercussions. After countless arguments, nagging and threats of divorce, my husband proceeded to mount the light one day. First of all, where were the screws? I scrounged around the house for fifteen minutes and finally came up with a reasonable facsimile. Then with staggering finality— How did I expect him to hang a fixture on a metal cabinet without a drill? Of course there are no tools in the house, they're all at the shop. Buying another drill would have been quite costly, and besides this menial type of labor was not meant for a genius to waste his time on. Just then, my hero arrived, Jerry, the neighbor from across the street. Certainly he didn't mind soiling his hands, and in less time than it takes to change a 5U4 he had the light in-



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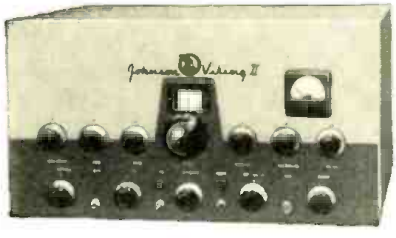

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stalled. Thank goodness for small blessings and friendly neighbors!

Aside from other important gripes, I'm afraid my children are going to be scarred for life. At least they must grow up with twitching eyes. There's not a lamp in our house that doesn't flicker.

There's not a radio here that works, but I've got a solution to that problem all mapped out. One of these days when my husband is out on the street doing calls, I'm going to sneak into the shop with all our battle-scarred radios, tag them with fictitious names and then when they are fixed, smuggle them out again. He'll never know they're ours, because he's never given them even a cursory glance.

There are some things that must be done around the house however, and these he does in his own inimitable style. They are called "temporarys." Like the time we bought a freezer. We had it put in a large walk-in closet near the kitchen for convenience sake.

There was just one thing wrong with that spot—no electrical outlet. Of course having a television technician for a husband, I didn't dare call in an electrician. Honestly though, I don't mind the extension cord draped across the floor and over the doorway. You can get used to anything, and I painted the wire to match the various parts it touches, so it isn't very noticeable. One of these days my husband promised to run the wires through the wall and attic as it's supposed to be done. It's only been this way for about a year and a half, and we do have twenty-three more years to pay on the house, so what's the hurry.

Several months ago, my husband honored me with his presence about suppertime. He was amazed that I didn't have a banquet prepared. After all what's so unusual about having your husband for supper. He immediately buried his nose in a copy of RADIO & TELEVISION NEWS and when I interrogated him as to his wants for supper, he answered something about "cooking a set." Now I don't care what kind of a delicacy this particular set may be, I think it would be quite indigestible.

One evening not so long ago I decided I had had quite enough of sitting home alone every night, so I hired a sitter and attended a local women's meeting. On my arrival home I found an enraged husband and no sitter. How did I have the audacity to go out to an old meeting just on the night when things were slow and he was able to take the evening off. Didn't I know there were no good fights that night, on television that is. Any fortuneteller would know an obvious thing like that, but unluckily I hadn't been reading tea leaves lately.

There is one compensation being married to a TV service technician, however, and that is the service sales slips found lying all over the house. They are just dandy for writing notes to the milkman. —30—

NEW TV PRODUCTS

"ANTENAPLEX" AMPLIFIER

The Engineering Products Division of *Radio Corporation of America*, Camden, N. J. has announced the availability of a "miniature" broadband amplifier which has been engineered for master antenna television systems employing 50 or less receivers.

The new MI-5185 is intended for small chain installations in motels, hotels, showrooms, office buildings, and department stores. It can also be utilized in community TV systems to extend distribution lines.

The amplifier reproduces both color and black-and-white TV signals, and comes factory-aligned for flat response on all v.h.f. channels from 2 to 13. It incorporates separate low- and high-

band amplifiers, power supply, and separate 75-ohm inputs for the low and high bands. It can be cascaded with other broadband amplifiers for additional gain, used as a preamp for channelized strips in line amplifiers, and adapted for 300-ohm input if required.

"CRANK-UP" TOWERS

Alpar Manufacturing Corp., 2910 Spring St., Redwood City, California is now offering an aluminum "crank-up" television tower which is said to be able to withstand gale winds in excess of 100 m.p.h. with top antenna loads of 100 pounds.

The tower is so designed that the guys may be installed as the tower is raised thus making it possible for one man to install the unit unassisted. According to the company, the tower is rustproof and corrosion resistant, automatically locks into position, and may be quickly lowered if required.

Data sheets giving full information on the line are available from the company on request.

CRYSTALS FOR COLOR TV

Standard Piezo Company of Carlisle, Pa. has announced the quantity production of low-drift, 3579.545 kc. crystals for use in the subcarrier oscillator circuits of color television receivers.

Known as the Type TV-1, the new

crystal is currently being made to a frequency tolerance of .003% over the temperature range from 20 to 65 degrees C. The crystals are pressure mounted in nickel-plated brass holders measuring ¾" wide by $^{49}/_{64}$" long, exclusive of leads on pins. The container is filled with dry nitrogen and hermetically sealed. Either .050" pins for plug-in mounting or tinned wire leads are available.

Engineering data is available on letterhead request to the manufacturer.

INDUSTRIAL TV CAMERA

Diamond Power Specialty Corporation, Lancaster, Ohio is in production on the "UtiliVue" closed circuit television system, the Series 400.

The new camera can be used either with a video monitor or with a standard TV receiver. It can be tuned to

any channel from 2 to 6. All controls and power supply are built into the camera. Voltage regulation is built-in and the camera has automatic illumination compensation. It is available with either a "Utilicon" or "Vidicon" pickup tube. Multiple receiving points can be fed.

Distribution of this new equipment is being handled through *Graybar Electric Co.*

MARKER INJECTOR

Scala Radio Company, 2814 19th Street, San Francisco, California is now marketing a marker injector which provides a second marker on the response curve for easier TV alignment, for use in adjusting broadband amplifiers, and for marking the critical frequencies employed in color TV and radar equipment.

The Dual Marker Injector is equipped with a 4.5 mc. crystal which provides a second mark on the scope screen on the other side of the response curve when the marker generator is set at the picture carrier frequency. This built-in crystal oscillator provides calibration every 4.5 mc. ± .02%.

STACKING KIT

A special kit, designed to simplify stacking of two of the company's "Super-Vision" antennas in weak-signal areas, is now being offered by *Davis Electronics*, 4002 West Burbank Blvd., Burbank, California.

The kit may be used for either horizontal or vertical stacking and assures proper spacing for greatest possible in-

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0A3/VR75	.97	1U4	.46	6AT6	.36	6N7	.95	7A5	.55	12A7	.98	12SG7	.70	36	.35
0A4G	.60			6AU6	.40							12SH7	.70		
0B2	.74	1U5	.40	6AV5GT	.79	6Q7	.49	7A6	.65	12AH7GT	.85	12SJ7	.55	37	.35
0B3/VR90	.90	1X2	.55	6AV6	.36	6R7	.49	7A7	.65	12AL5	.40	12SK7GT	.49	39-44	.35
		2A3	.90			6S4	.39	7AD7	.90	12AT6	.35			42	.40
0C3/VR105	.95	2A5	.49	6AX4GT	.57	6S7G	.55	7AG7	.55	12AT7	.62	12SL7GT	.49	43	.53
0D3/VR150	.85	2A6	.49	6B7	.93	6SA7	.40	7AH7	.55	12AU6	.36	12SN7GT	.50	45Z3	.40
0Z4	.53	2A7	.60	6B8G	.29							12SQ7GT	.53		
1A4P	.35			6BA6	.38	6SC7	.75	7B4	.44	12AU7	.59	12SR7	.49	46	.45
1A5GT	.40	2B7	.62	6BA7	.55	6SD7GT	.38	7B5	.55	12AV6	.44	12Z3	.39	47	.85
		2X2	.39			6SF5GT	.45	7B6	.55	12AV7	.64			49	.38
1A7GT	.45	2X2A	1.14	6BC5	.49	6SF7	.58	7C4	.55	12AX4GT	.55	14A4	.65	50L6GT	.61
1AB5	.38	3A4	.44	6BE6	.37	6SG7	.40	7C7	.65	12AX7	.55	14A5	.57	50X6	.62
1B3GT	.67	3A5	.90	6BF5	.69							14A7	.53		
1C5GT	.40			6BG6G	1.15	6SH7	.60	7E5	.59	12AY7	.72	14AF7	.59	50Y6GT	.57
		3A8GT	.59	6BH6	.45	6SH7GT	.50	7E6	.40	12BA6	.47	14B6	.45	56	.47
1C7G	.37	3B7	.39			6SJ7	.54	7F7	.64	12BA7	.59			57	.53
1D7GT	.75	3D6	.38	6BJ6	.41	6SK7	.39	7F8	.90	12BD6	.46	14B8	.63	58	.56
1E7GT	.35	3LF4	.71	6BK7	.89	6SL7GT	.49	7G7	.80	12BE6	.45	14C5	.80	70L7GT	1.00
1F4	.40	3Q4	.48	6BL7GT	.65							14C7	.65		
1F5G	.44			6BN6	.89	6SN7GT	.48	7H7	.56	12BH7	.65	14E6	.65	71A	.52
		3Q5GT	.48	6BQ6GT	.75	6SQ7	.37	7J7	.75	12C8	.34	14E7	.80	76	.42
1H4G	.40	3S4	.46			6SR7	.45	7K7	.80	12F5GT	.35			77	.53
1H5GT	.38	3V4	.50	6BQ7	.88	6ST7	.48	7L7	.77	12H6	.45	14F7	.65	78	.43
1J6G	.59	5T4	1.25	6C4	.35	6T8	.57	7N7	.57	12J5GT	.39	14F8	.90	81	1.10
1L4	.45	5U4G	.49	6C5	.39							14H7	.57		
1L6	.61			6C6	.54	6U7G	.45	7Q7	.57	12J7GT	.57	14N7	.67	82	.67
		5V4G	.76	6C8G	.85	6U8	.59	7R7	.59	12K7	.53	14Y4	.67	83	.77
1LA4	.59	5Y3G	.38			6V6	.38	7S7	.83	12K8	.55			84	.52
1LA6	.75	5Z3	.33	6CB6	.42	6W4GT	.41	7V7	.87	12Q7G	.57	19	.45	85	.57
1LB4	.77	6A6	.45	6CD6G	1.05	6W6GT	.41	7W7	.85	12S8GT	.60	19BG6G	1.15	89Y	.29
1LC5	.59	6A7	.80	6D6	.67							19T8	.75		
1LC6	.75			6D8G	.95	6X4	.35	7X6	.57	12SA7GT	.62	22	.40	117L7GT	1.17
		6A8	.65	6E5	.76	6X5	.35	7Y4	.40	12SC7	.68	25AV4GT	.80	117Z3	.38
1LD5	.49	6AB4	.42			6X8	.70	7Z4	.45	12SF5	.48			117Z4GT	.73
1LE3	.75	6AB7	.71	6F6	.45							25BQ6GT	.75	117Z6GT	.70
1LG5	.75	6AC5GT	.95	6F7	.90							25L6GT	.40	2051	.93
1LH4	.75	6AC7	.68	6F8G	.69							25W4GT	.45		
1LN5	.55			6G6G	.63							25Z5	.60	90D1	1.47
		6AF4	.89	6H6	.49							25Z6GT	.40	9002	.98
1N5GT	.61	6AF6G	.75											9003	1.30
1P5GT	.56	6AG5	.47	6J5	.38							26	.42	9006	.67
1Q5GT	.55	6AG7	.90	6J6	.50							27	.37	803	2.95
1R4	.81	6AH6	.88	6J7	.49							32L7GT	.95		
1R5	.47			6J8G	.90							35C5	.37	807	1.25
		6AK5	.59	6K6GT	.39							35L6GT	.45	814	3.50
1S4	.55	6AL5	.35											836	7.95
1S5	.40	6AQ5	.39	6K7G	.38							35W4	.43	866A	1.45
1SA6	.48	6AQ6	.36	6K8G	.64							35Y4	.44		
		6AQ7GT	.68	6L6G	.39							35Z3	.40		

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crease in gain. A specially constructed 450-ohm matching harness, with terminal block and all necessary braces and insulators, is included in the kit.

COLOR MONITOR

Conrac, Inc., of Glendora, California has delivered its first color monitor for TV station application.

The new unit uses a tri-gun 15GP22 kinescope, mounts on a standard 19" relay rack, occupies only 26¼" of rack space, and has easily accessible controls. The Model CD15 operates from composite video or video and separate sync. It employs 31 tubes in addition to the 15GP22.

Further information on this unit is available from the company on request.

REPLACEMENT TRANSFORMERS

Merit Coil and Transformer Corp., 4427 North Clark St., Chicago 40, Ill. has announced the availability of three new horizontal output transformers which are exact replacements for similar *Admiral* units.

The new units, Models HVO-22, HVO-23, and HVO-24, all have mounting brackets, mounting centers, terminal boards, and terminal locations comparable to the *Admiral* units they are designed to replace.

Complete information on these transformers is available from the company.

TV COMPONENT TESTER

Transvision, New Rochelle, N. Y. has recently introduced a 6-in-1 TV component tester, the Model 100.

The new unit tests flyback transformers and yokes; it tests picture

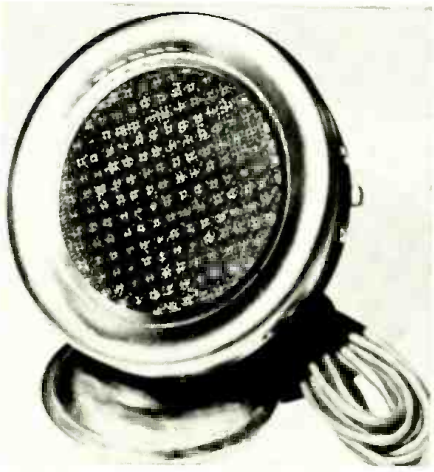
tubes; it is a selenium rectifier checker; it serves as a picture tube reactivator; it checks condensers for capacity, shorts, or opens; and it will check continuity.

REMOTE CONTROL SPEAKER

Tele-Matic Industries, Inc., 1 Joralemon St., Brooklyn, N. Y., has just introduced an external speaker unit, the "Tele-Pal."

Designed to be placed at the television viewer's chair, the unit permits remote-controlled personalized listening. The viewer can control the level of the sound portion of the TV

program by regulating the volume control in the unit. It incorporates a switch which permits the viewer to



shift from "Tele-Pal" listening to the set's regular TV sound system and *vice versa*.

The unit can be installed by a technician in less than five minutes. It is merely hooked to the speaker in the TV receiver.

U.H.F. CONVERTER

Rex Engineering and Manufacturing Co., Box 13, Bluffton, Ind. is now offering the "Elgin" Model 1210 u.h.f. converter.

The compact new unit features a no-loss input circuit, converts to channel 6, has low oscillator radiation, and covers all 82 channels.

A data sheet on the Model 1210 is available from the company on request.

G-E "DELAY STICK"

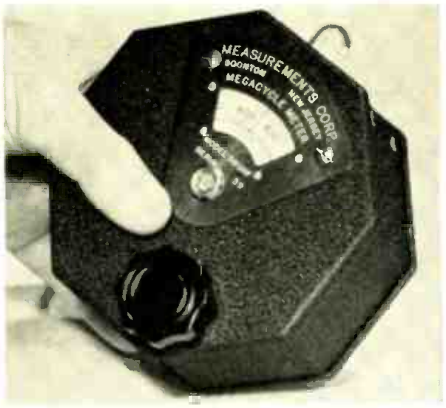
General Electric Company has developed a new component for mass-production color TV application—the

"Delay Stick" which is designed to replace conventional delay assemblies in color sets.

The new part offers neater and simpler assembly in addition to being more compact and less costly.

GRID-DIP OSCILLATOR

A grid-dip oscillator for applications in the u.h.f. range has been announced by *Measurements Corporation* of Boonton, N. J.



Designated as the Model 59 "UHF Megacycle Meter," the new unit is designed for u.h.f. TV, Citizens radio band, and important mobile communications bands. It measures many parameters and phenomena dealing with transmission and reception of signals in the range of 430-940 mc.

The Model 59 is rated at 30 watts and operates from a standard 117 v., 60-cycle source. The company will supply full details on request. —30—

QSL CARDS WAITING

THE Far East Amateur Radio League (FEARL) has in its QSL Bureau thousands of unclaimed QSL cards. Most of them are for "J" and "JA" callsigns issued to former occupation personnel who have since returned to the States. There are also quite a few "KA" calls.

If any former "J", "JA", or "KA" licensees wish to claim these cards, self-addressed, stamped (U. S. postage) envelopes should be sent to: FEARL QSL Bureau, P.O. Box 111, APO 500, % Postmaster, San Francisco.

Former FEARL members are entitled to have their cards returned postpaid upon receipt of their current addresses.

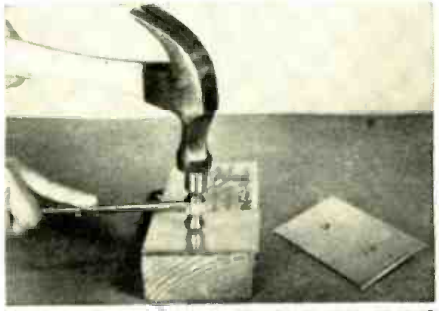
Cards not claimed in six months will be destroyed, so act promptly if you want your cards. —30—

DIMPLING SHEET METAL

IT'S pretty difficult to countersink screws in sheet metal, but you can still mount screws flush if you "dimple" the metal first. A good technique to use is shown in the photograph.

Place the metal to be dimpled on a block of wood. Place the rounded head of a ball peen (machinist's) hammer against the metal at the point where you want the dimple. Strike the flat head of the ball peen hammer a sharp blow with another hammer. If the sheet metal is thick, two or three hammer blows may be needed to give a good dimple. —30—

Technique for dimpling piece of sheet metal.



Lafayette's GREAT BARGAIN SALE!

3 TUBE CIRCUIT

alliance

CASCAMATIC the NEW automatic **TV BOOSTER**

SMASH PRICE! ~~29.95~~

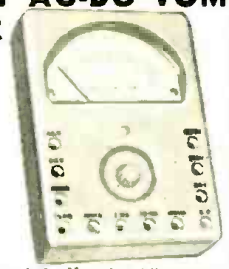
6.45 ea. IN LOTS OF 3 singly, ea. 6.95

The Alliance Cascamatic TV booster is the latest accessory which combines all the advantages of television boosters in a single unit! Fully automatic — requires no further tuning — no manual control. Automatically turns on and off with set. Completely hidden from view — mounted in back of the set. Instantly installed — requires no further attention. Improves quality of both picture and sound signals. Eliminates noise — improves signal-to-noise ratio. Features famous "California" circuit with three tubes. Works on all VHF channels. Uses two 6J6 tubes and one 6BK7. Attractive metal cabinet 4" x 5¼" x 4½". 110-125 volts, 60 cycles AC. Complete with tubes and instructions. Shpg. wt. 2¼ lbs.

CASCAMATIC TV BOOSTER.
List $29.95 — In Lots of 3, ea. 6.45; Singly, ea. 6.95

NEW POCKET AC-DC VOM MULTITESTER

9.95



This instrument is one of the best buys that Lafayette has ever offered in a Wide Range **AC-DC MULTITESTER.** An ideal portable unit that meets the need for a compact, yet rugged test instrument. Has ease of operation usually **FOUND ONLY IN MORE EXPENSIVE INSTRUMENTS.** Has 1000 ohms/volt sensitivity on both AC or DC. Uses full 3" rectangular meter with large, easy to read scale. Uses 1% precision resistors. Jeweled D'Arsonval microamp meter movement. Ranges: AC-DC and output volts 0-5, 0-25, 0-250, 0-1000V; DC current 0-1, 0-10, 0-100. Resistance 0-10K and 0-100K ohms. In handsome sturdy bakelite case. Size: 4¾" x 3¼" x 1⅞". Supplied Complete with test leads and batteries. A Must for every serviceman, shop, Laboratory or experimenter—and at Lafayette's Price you can afford to own one. Shpg. Wt. 2½ lbs.

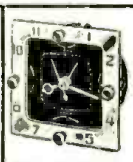
MODEL RW-27C—Complete.....In Lots of 3 **9.45**; Singly, ea. **9.95**

Lafayette Greatest Tape Buy Ever!

1200 FT. REEL
Genuine Plastic Base
RECORDING TAPE

$1.89 per roll plus postage (C.O.D.'s accepted)

LAFAYETTE made a terrific deal with one of the leading manufacturers of recording tape to supply us with their regular tape which sells for almost twice our price. **WE GUARANTEE ABSOLUTE SATISFACTION OR YOUR MONEY BACK.** The finest, professional-quality recording tape obtainable. Highest performance for thousands of playings. Red Oxide Base in a smooth, uniform coating; greater signal strength; with maximum fidelity; uniform frequency response from 40-15,000 cps.

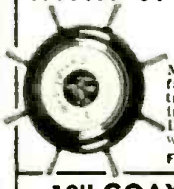


STOP-GO SESSIONS TIMER

No. MS-67
4.75

The timer that's almost human. Just set this marvelous Sessions electric timer mechanism to switch on or off your radio, television, or electrical appliance automatically. Will turn on your radio at any desired time. Has miracle "Sleep Switch" so that you can play your radio when you go to bed and it turns off automatically at a pre-set time, allowing up to 90 minutes to elapse. With mounting bracket. For 117 volts 50/60 cycles AC.

YACHT STYLE BAROMETER



- Made in Germany.
- Hardwood Polished Case.
- Solid Brass Spokes.

May be used on wall or desk. Open face porcelainized scale reveals intricate mechanism. Reads 26 to 32 inches. Polished brass bezel, 5¼" in Diameter by 1½" deep. Forecasts weather 12 to 24 hours in advance.

F-51.....Net **5.75**

Top Quality CRYSTAL MIKE

$5.75

- —52 db output level
- Range 30 - 10,000 cps
- 10 ft. cable and connector
- Handle and interlocking base

A really fine microphone by a manufacturer known the world over. Use for amateur broadcasting, public address and home recording. Can be used with floor stand. Shpg. Wt. 2½ lbs.

PA-21 ..... **5.75**

3 LENS TURRET MICROSCOPE

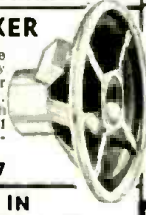
100X-200X-300X

7.45

Precision built for accuracy and long lasting service. Triple position turret holds 3 achromatic color-corrected objectives for magnification of 100X, 200X and 300X power! Heavy base and stand—inclines through 90°. Dual knob focusing by rack and pinion. Adjustable plane sub-stage mirror. High-grade microoptics used throughout! Complete with fitted wooden carrying case and slides. Shpg. Wt. 4½ lbs.

F-10 ..... NET **7.45**

12" COAXIAL SPEAKER

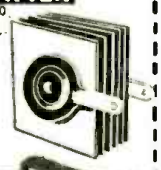


12-inch Alnico V PM with 1 inch voice coil and heavy one piece cone. Specially designed 3-inch Alnico V PM tweeter completes this combination speaker, range 40 to 17,000 cps. Built-in high pass filter. Installs same as regular PM speaker only two wires to connect. Impedance 8 ohm. Wt. 8 lbs.

STOCK NO. SK-22..... **11.97**

SELENIUM RECTIFIER

Stock No.	Mfl	Each	Lots of 10 Each
RE-12	65 MA	.57	.55
RE-14	75 MA	.67	.64
RE-10	100 MA	.80	.75
RE-15	150 MA	.92	.85
RE-16	200 MA	1.19	1.08
RE-11	250 MA	1.29	1.19
RE-17	300 MA	1.39	1.29
RE-18	350 MA	1.57	1.50
RE-13	400 MA	1.75	1.68
RE-19	450 MA	1.77	1.70



A REAL BARGAIN IN CRESCENT, 3 SPEED AUTOMATIC "INTERMIX" RECORD CHANGER

ONLY 19.95

WITH TURNOVER CRYSTAL CARTRIDGE

Famous-make latest design, fully automatic changer at record low price! This peerless performer plays all 7", 10" and 12" records in any sequence. "Free-Floating" featherweight tone arm has Webster turn-over cartridge and dual needles for 33⅓, 45 and 78 rpm, balanced for excellent tonal reproduction. Automatic shut-off after last record. Direct rim drive turntable action and constant speed motor for "wow"-free operation. Easily installed. Will not jam. Dim: 13" x 11¼" with 5 1/16" clearance required above and 2 7/16" below mtg. board. Complete with Phono and AC Cords. Fresh stock. Quantity limited at this low price. Wt. 10 lbs. No. A501 ..... 19.95

WESTERN ELECTRIC HEARING AID

Reg. price ~~$185.00~~ — *Our price* **$14.95**

Brand new, in original Western Electric's jeweler's case. Supplied with receiver, receiver cord, battery cord and plug (less batteries). Money back guarantee. Act now while they last! Uses Burgess XX30E and 8R batteries at $1.55 per set.

MAP MEASURER & COMPASS

- Not a gadget—a real instrument!
- Measures curved or irregular shapes!
- Use on any size map.

Ideal for motorist—camper—hunter—boating enthusiast! Just trace along route and read distance from dial! Built-in Magnetic compass fully calibrated.

F-47..... Net **1.69**

SONOTONE 9980-S

TURNOVER CERAMIC PHONO CARTRIDGE WITH DUAL SAPPHIRE NEEDLES

REPLACEMENT FOR COLUMBIA 360—VM—WEBSTER AND CRESCENT RECORD CHANGERS

SPECIFY STOCK NO. PK-40

In lots of 5, each.... 3.50 — Singly, each.... 3.98

4 x 40 FIELD GLASS

- Imported from Germany.
- Built-in Magnetic Compass.
- Smooth Center Focusing.

Magnifies objects 4 times! Not a "drugstore toy". Contain fine optically ground and polished lenses. 40 mm objective lenses for maximum light gathering power. Complete with neck strap.

F-39—Tax Included.....Net **3.99**

SPEEDWAY ¼" DRILL

Powerful, lightweight drill, for home or shop. Capacity: ¼" in steel, ½" in hard wood. Speed at full load: 1,500 r.p.m. Heavy duty trigger switch with "lock" and instant release. With Jacobs geared key chuck. For 115 volts AC-DC. Shpg. Wt. 4 lbs.

HD-108 Speedway ¼" Drill.....Net **14.29**

PRECISION DRAFTING SET

11 Pieces—Fitted Felt-Lined Case

$2.75

Made in Germany, of heavy brass, nickel plated and polished. Instruments include 5½" Compass with pencil and pen points and lengthening bar, 5⅛" Divider, three 3¾" sidewheel bow dividers with needle point, pen point and pencil point, 5" Ruling pen, extra handle for pen or pencil, capsule with extra leads. Interchangeability of these many parts makes this an exceptionally versatile set. Your money back—if this set is not worth twice our price!

F-13..... Net **2.75**

Phono Cartridges

3.5 volt output

Guaranteed high quality exact duplicates for direct replacement of all standard cartridges such as L70, L82, L92, W60B, N10, and many others. Pin plug connectors for all 78 r.p.m.

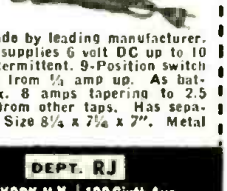
LIST PRICE $5.50

STOCK NO. PK-11—Single, each....1.99

BATTERY ELIMINATOR AND CHARGER

WAS ~~36.75~~

SPECIAL **17.45**



Typical Lafayette Value. Made by leading manufacturer. Operates from 110 VAC and supplies 6 volt DC up to 10 amps continuous, 15 amps intermittent. 9-Position switch adjusts output for any drain from ½ amp up. As battery charger delivers approx. 8 amps tapering to 2.5 amps; lower rates obtained from other taps. Has separate voltmeter and ammeter. Size 8¼ x 7⅛ x 7". Metal Cabinet. Shpg. Wt. 16 lbs.

SPECIAL

3-SPEED PHONO MOTOR WITH TURNTABLE

Plays 33⅓, 45 and 78 RPM records. Quiet dependable operation assured by rubber shock-mounted friction type motor. Speed change control permits instantaneous meshing of proper idler for desired speed. Shpg. Wt. 3½ lbs. List Price $10.95.

Stock No. ML-13.....Net **4.95**

FREE BARGAIN CATALOG FOR LEISURE HOBBYISTS

Microscopes, Binoculars, Barometers, Compasses, Timers, Hearing Aids, Tools, Car Radios, Record Players, Tape Recorders, TV Boosters, Antennas, Intercoms, Hi Fidelity Equipment, P.A. Systems, All Radio, TV & HAM SUPPLIES. Chock full of buys at great savings. Write today for your free copy.

Lafayette Radio

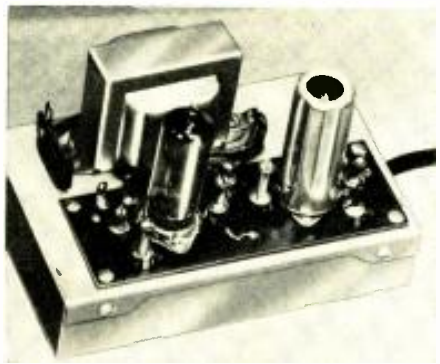
DEPT. RJ	
NEW YORK, N.Y.	100 Sixth Ave.
BRONX, N.Y.	542 E. Fordham Rd
NEWARK, N.J.	24 Central Ave.
PLAINFIELD, N.J.	139 West 2nd St.
BOSTON, MASS.	110 Federal St.

What's New in Radio

(*Continued from page* 108)

TWO-METER CONVERTER

A new, low-priced converter built to receive the two-meter band on a conventional short-wave receiver is



being offered by *Marshall Mfg. Co.*, 1406 Venice Blvd., Los Angeles 6.

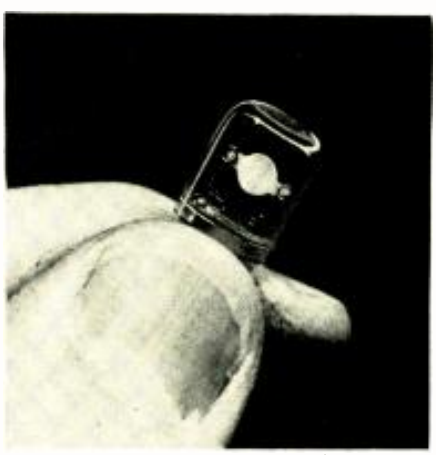
It is being supplied in four models, *i.e.*, with or without a.c. power supply and in wired or kit form. All of the critical wiring is already done for the prospective kit builder.

The unit measures 5" long, 3¼" wide, and 3½" deep. The output frequency is 21 to 25 mc.

MINIATURIZED CRYSTAL

James Knights Company of Sandwich, Ill. has recently introduced a new crystal, the JK-G3.

The miniaturized, high-stability unit features extreme compactness as well as high "*Q*" for maximum performance. It is available in a frequency range of from 10 to 100 megacycles.



The crystal is vacuum sealed in glass to provide shock and contamination protection.

ADJUSTABLE POWER SUPPLY

The *Shasta Division* of *Beckman Instruments, Inc.*, P.O. Box 296, Richmond, California is now marketing an adjustable power supply, the Model 701.

The new unit is an unregulated supply providing d.c. voltages from 0 to 250 at a maximum load of 90 ma. (360 volts, open circuit) and an a.c. fila-

ment power, 6.3 volts at 3 amps, center tapped.

Ripple has been kept to the low value of 20 mv. r.m.s. by use of a two-section choke input filter. An auto-transformer in the primary permits d.c. output adjustment. A monitoring meter is also provided on the front panel of the instrument.

VIBRATOR PULLER

The James Vibrapower Company, 4036 N. Rockwell St., Chicago 18, Ill. is now offering a new vibrator puller to the service industry.

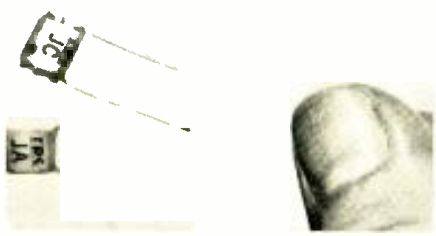
The new unit is designed to automatically release the vibrator ground clamp, grip the can firmly, and permit easy removal from the most confined auto radio chassis.

The Model C-905 is available from the company's distributors or further information can be obtained from the company.

SUBMINIATURE WIREWOUNDS

Resistance Products Company, 714 Race Street, Harrisburg, Pa. has developed a new line of subminiature precision wirewound resistors.

The Type JA is ¼" in diameter and ¼" long. Maximum resistance is 125,000 ohms at .1 watt. The type JC is ¼"



in diameter by ⅜" long. Maximum resistance is 250,000 ohms with a power rating of .15 watt. Tolerance of ± 1% is standard with tolerances of ± .05% available. These resistors have a mounting hole for a #2 machine screw.

SUBMINIATURE SWITCHES

Micro Switch of Freeport, Illinois has recently introduced a new series of tiny, three-position, panel-mounting subminiature toggle switch assemblies.

Each assembly has two single-pole, double-throw basic switching units,

providing control of as many as four circuits. One basic switching unit is in each extreme toggle position. Neither unit is actuated in the center toggle position. However, due to the fact that there are two single-pole, double-throw switching elements, it is possible to have three different combinations of two circuits open and two circuits closed at any time.

SENSITIVE RELAY

Hedin Tele-Technical Corp., 640 W. Mt. Pleasant Ave., Livingston, N. J. is in production on a new sensitive relay which has been designed primarily for electronic chassis having sufficient height but little adjacent space.

The relay provides a hermetically sealed, d.p.d.t. combination and has a capacity of up to 3 amperes inductive load. It is equipped with a standard octal socket. Wattage consumption is .1 and less, depending on the contact arrangement, or less than 1 ma., depending on the voltage used. —30—

SELENIUM SHORTAGE

BECAUSE of the recent curtailment in the mining of copper, from which selenium is obtained as a by-product, and because of selenium stockpiling for military requirements in the event of a national emergency, the amount of raw material available for selenium rectifiers has been reduced materially.

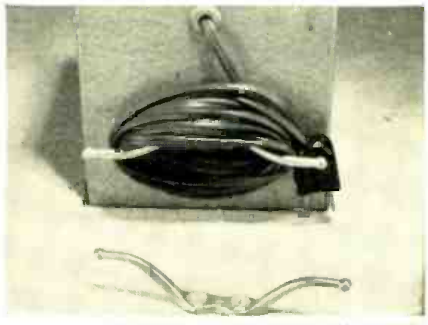
One way to insure a continuous supply of replacement rectifiers and to forestall reduction in production of these units is the reclamation of used selenium rectifiers. One rectifier manufacturer is requesting, therefore, that all service technicians and others using selenium rectifiers return replaced rectifiers to their distributors. The manufacturer, Sarkes Tarzian, Inc., is issuing credit to their distributors for all rectifiers returned, depending upon size. These credits, of course, will be passed on to service technicians and other distributor customers. —30—

CLEATS FOR LINE CORDS

CLOTHESLINE and awning line cleats, available at local hardware and dime stores, make excellent holders for line cords on portable electronic equipment. Use flat-head machine screws to mount them on the back of the cabinets of your electronic gear.

If you have a portable p.a. system, you'll find that the larger line cleats also make good holders for loudspeaker line and spare microphone cable. —30—

Keep line cords kink-free with cleats.



CRYSTALS

Guaranteed to oscillate!
Your choice of frequencies!
Largest selection in the world!

NOTE! EVERY CRYSTAL TESTED FOR ACTIVITY BEFORE SHIPMENT! All numbers listed are FUNDAMENTAL FREQUENCIES in Kilocycles.

FT-243

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

1045	2305	2535	2770	2940	3130	3525	6200	6573	7325	7710	7990	8133.3
1110	2320	2545	2775	2945	3135	3640	6206	6575	7340	7720	8000	8140
1129	2350	2550	2780	2950	3140	3655	6225	6600	7350	7730	8006	8141.7
1150	2355	2557	2785	2955	3145	3680	6235	6606	7375	7740	8008.3	8150
1195	2360	2560	2790	2960	3150	3700	6240	6625	7400	7750	8010	8158.3
1525	2365	2565	2795	2965	3155	3760	6250	6640	7406	7760	8016.7	8160
1900	2370	2570	2815	2970	3160	3800	6273	6650	7425	7770	8020	8163.4
1915	2375	2575	2825	2975	3165	3885	6275	7000	7440	7780	8025	8166.7
1930	2390	2580	2830	2980	3170	3940	6300	7006	7500	7783.3	8030	8170
1940	2415	2585	2835	2985	3175	3955	6306	7025	7510	7790	8033.3	8173.3
1950	2430	2590	2840	2990	3200	3980	6315	7040	7520	7800	8040	8180
1965	2435	2595	2845	2995	3202	3990	6325	7050	7530	7810	8041.7	8183.3
1977	2440	2650	2850	3005	3205	3995	6335	7073	7540	7820	8050	8190
2015	2442	2655	2855	3010	3210	6000	6340	7075	7550	7830	8058.3	8191.7
2017	2450	2660	2860	3015	3220	6006	6350	7100	7560	7840	8060	8200
2020	2455	2665	2865	3020	3225	6025	6362	7106	7570	7850	8066.7	8206.6
2025	2460	2670	2870	3025	3230	6040	6373	7125	7580	7860	8070	8208.3
2035	2465	2675	2875	3030	3235	6042	6375	7140	7590	7870	8073.3	8210
2040	2470	2680	2880	3035	3240	6050	6405	7150	7600	7880	8075	8216.7
2055	2475	2685	2885	3040	3290	6073	6406	7160	7610	7890	8080	8220
2060	2480	2690	2890	3045	3300	6075	6425	7173	7620	7891.7	8083.3	8225
2065	2485	2695	2895	3050	3310	6100	6440	7175	7630	7900	8090	
2090	2490	2705	2900	3055	3320	6106	6450	7200	7640	7910	8091.7	
2105	2495	2710	2905	3060	3340	6125	6473	7206	7650	7920	8100	
2125	2505	2715	2910	3065	3410	6140	6475	7225	7660	7930	8106.6	
2130	2510	2720	2915	3070	3420	6142	6500	7240	7666.7	7940	8108.3	
2135	2515	2750	2920	3075	3455	6150	6506	7273	7670	7950	8110	
2140	2520	2755	2925	3095	3465	6173	6525	7275	7680	7960	8116.7	
2195	2525	2760	2930	3100	3500	6175	6540	7300	7690	7970	8125	
2300	2530	2765	2935	3110	3510	6185	6550	7306	7700	7980	8130	

FT-243

Lots of 10 or more. Each..... **34c**
Lots of 5 or more. Each..... **39c**
Individually. Each..... **49c**

4035	4300	4635	4930	5295	5645	5782.5	5906.7	6275	6706.6	6906.6	7625	7975	8475
4045	4330	4680	4950	5300	5660	5800	5907.5	6300	6725	6925	7673.3	8240	8500
4080	4340	4695	4980	5305	5675	5806.7	5925	6306	6740	6940	7675	8250	8525
4095	4395	4710	4995	5327.5	5687.5	5820	5940	6325	6750	6950	7706.6	8273	8550
4110	4397.5	4735	5030	5335	5700	5825	5950	6340	6773.3	6973.3	7725	8275	8575
4135	4445	4780	5035	5385	5706.7	5840	5955	6350	6775	6975	7773.3	8300	8600
4165	4450	4785	5090	5397.5	5725	5850	5973.3	6373.3	6800	7450	7775	8306	8625
4175	4490	4815	5127.5	5435	5730	5852.5	5975	6375	6806.6	7473.3	7806.6	8325	8650
4190	4495	4820	5165	5437.5	5740	5860	5995	6400	6825	7475	7825	8340	8675
4215	4535	4840	5180	5485	5750	5873.5	6206.6	6406.6	6840	7506.6	7873.3	8350	8690
4220	4540	4845	5205	5500	5760	5875	6225	6425	6850	7525	7875	8375	
4255	4580	4852.5	5235	5545	5773.3	5880	6240	6673.3	6873.3	7573.3	7906.6	8400	
4280	4610	4880	5245	5582.5	5775	5892.5	6250	6675	6875	7575	7925	8425	
4295	4620	4900	5285	5587.5	5780	5900	6273.5	6700	6900	7606.6	7973.3	8450	

FT-241-A

Lots of 10 or more. Each..... **79c**
Lots of 5 or more. Each..... **89c**
Individually. Each..... **99c**

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

CR-1A

Lots of 10 or more..... **69c**
Lots of 5 or more..... **74c**
Individually. Each..... **79c**

			5980	6670	7120	7460	7930	8032	8116	8171.2	8272.5	8340	8423
			6181	6700	7130	7470	7960	8050	8126	8176	8284	8351	8428
			6350	6740	7160	7550	7980	8060	8128	8193.2	8290	8357	8430
			6380	6750	7180	7570	8007	8080	8132.3	8194.2	8297.1	8373	8438.7
			6450	6890	7230	7590	8010	8090	8137	8200	8308	8374	8475
5020	5300	5590	6510	7010	7350	7670	8013	8092	8140	8205	8317	8380	8502.8
5041.6	5520	5677.7	6530	7020	7360	7730	8018	8103.7	8142.8	8216.2	8320	8392	8528.5
5180	5550	5700	6550	7040	7400	7790	8020	8110	8146.1	8220	8328	8400	8554.2
5208.3	5583.3	5722.2	6650	7080	7440	7810	8025	8115	8152	8260	8335	8404	8580
													8590

FT-171

Lots of 10 or more. Each..... **79c**
Lots of 5 or more. Each..... **89c**
Individually. Each..... **99c**

			2123	2280	2415	2630	3010.5	3500	3667.5	3825	3995	4255	5492.5
			2125	2282.5	2435	2665	3175	3510	3682.5	3870	4017.5	4280	6000
			2131	2290	2442.5	2725	3202.5	3520	3695	3880	4037.5	4310	6210
			2145	2300	2467	2780	3205.5	3550	3700	3945	4050	4345	7165
			2150	2305	2470	2835	3215	3562	3712.5	3950	4080	4350	7950
			2155	2320	2532.5	2911	3237.5	3569	3760	3955	4097.5	4360	8000
1151.8	1940	2045	2191	2340	2545	2940	3250	3570	3790	3966.5	4110	4400	9200
1562.5	2010	2065	2220	2360	2550	2967	3322.5	3580	3807.5	3970	4112	4735	9590
1738	2030	2082	2258	2390	2557	2990	3400	3637.5	3810	3975	4177.5	5200	
1746	2040	2105	2260	2405	2582	3010	3422.5	3660	3812.5	3980	4245	5225	

NOTE! 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. CALIFORNIA BUYERS add sales tax. INCLUDE APPROXIMATELY 5c PER CRYSTAL FOR POSTAGE. ALL CRYSTAL ORDERS—Indicate second choice frequencies wherever substitution may be made.

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200 KC. FT-241	1.99	2670 KC. FT-243	2.99
200 KC. Type DC-15 in octal tube base type holder	1.99	2647 KC. FT-443	2.99
327.8 KC. No. D-168342. (Used in TS-102 AP)	9.95	2670 KC. DC-34	2.99
500 KC. FT-241	1.99	2718 KC. Type 1-C	2.99
1000 KC. FT-241	2.49	2738 KC. FT-243	2.99
1000 KC. Type DC-9, in octal tube base type holder	3.45	2738 KC. MC-7	2.99
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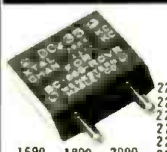
2142 KC. DC-34	2.99	3088 KC. FT-243	2.99
2174 KC. DC-34	2.99	3093 KC. FT-243	2.99
2182 KC. FT-243	2.99	3088 KC. FT-243	2.99
2500 KC. FT-243	1.99	3103 KC. FT-243	2.99
2632 KC. FT-243	2.99	3188 KC. FT-243	2.99
2637 KC. FT-243	2.99	3193 KC. FT-243	2.99
2638 KC. DC-34	2.99	3198 KC. FT-243	2.99
		3203 KC. FT-243	2.99
		5000 KC. FT-243	1.99
		10.000 KC. Type SR-5 Bliley, in CR-1 holder	1.99



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			2240	2415	2605	2851	3095	3395	3665	3870	4020	4175	4370
			2255	2422	2625	2853	3117	3412.5	3680	3885	4030	4177.5	4380
			2258	2435	2643	2894	3149	3422.5	3695	3890	4035	4192.5	4397.5
			2275	2446	2665	2895	3155	3462	3700	3895	4050	4210	4415
			2280	2466	2685	2899	3161	3480	3750	3905	4055	4215	4435
1690	1890	2090	2295	2467	2710	2925	3190	3485	3760	3920	4065	4235	4440
1705	1910	2105	2300	2478	2711	2926	3201	3500	3765	3925	4080	4240	
1720	1930	2106	2315	2491	2725	2960	3270	3520	3770	3935	4085	4255	
1738	1950	2131	2326	2500	2732	2971	3279	3540	3775	3940	4090	4275	
1746	1970	2155	2335	2510	2745	2980	3280	3550	3790	3950	4095	4280	
1770	1990	2175	2340	2415	2764	3000	3297	3575	3792.5	3960	4097.5	4305	
1790	2010	2195	2355	2527	2775	3010	3311	3580	3807.5	3965	4115	4310	
1810	2030	2202	2360	2540	2776	3023	3317	3610	3825	3985	4130	4325	
1830	2050	2215	2375	2559	2807	3027.5	3365	3630	3830	3995	4135	4335	
1850	2075	2220	2390	2586	2816	3055	3385	3650	3850	4012.5	4150	4345	
1870	2082	2235	2395	2587	2831	3077.5	3390	3655	3855	4015	4155	4350	

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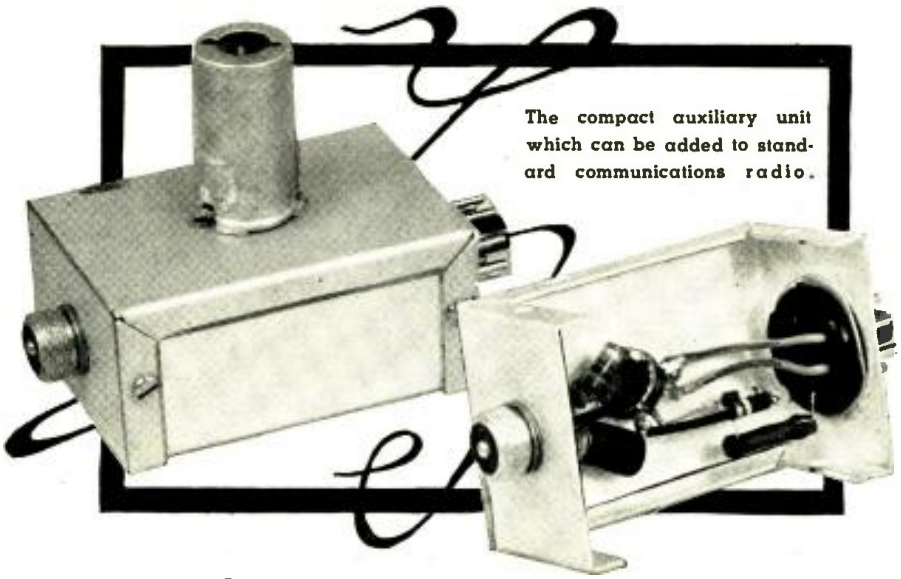


The compact auxiliary unit which can be added to standard communications radio.

By
EVERETT G. TAYLOR, W8NAF

Add a simple adapter to your broadcast or short-wave receiver to provide a temporary public address system.

MOST amateurs or short-wave listeners have, at one time or another, been called upon to supply a p.a. system for outings, church socials, fraternal groups, and the like.

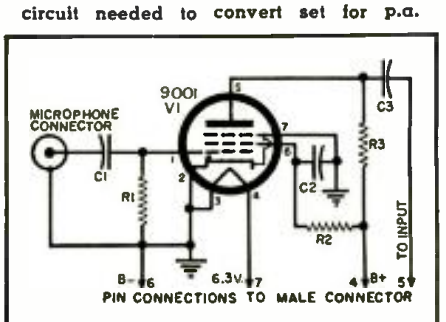
Nearly all commercial receivers on the market at the present time will give sufficient output to meet most of the requirements but they lack sufficient preamplification for a crystal or dynamic microphone. Some of the more recently produced receivers, such as *National, Hallicrafters, RME,* etc., have an accessory socket on the rear of the chassis. Heater, high voltages, and grid input to the first audio stage will normally be found at this socket.

Recently, the author was called upon to supply a source of music and a public address system for a little "fun and frolic." Why not the regular receiver, which in our case is a NC-57-B, to supply the music? On the regular broadcast band we can get the domestic music with the short-wave bands giving out with the tango from Latin America or music with a Continental flavor. What about the ad libbing? No mike input. Why not use the accessory socket and build a little amplifier to get the necessary —50 db from the crystal microphone built up to a usable figure so it will drive the first audio stage in the receiver.

Construction was started and proved to be simplicity itself. Only about ten components were required plus the consumption of about an hour or so of time in building the gadget.

A type 29335 *ICA* "Flexi-mount" aluminum case is used to house the parts. An *Amphenol* type 75-CL-PC1M microphone receptacle is required and is mounted on one end of the case, while on the other end is a type 86-CP8 plug which serves as the power connector and coupling to the grid of the first audio tube in the receiver.

Complete schematic diagram of auxiliary circuit needed to convert set for p.a.



R_1—10 megohm, ½ w. res.
R_2—1 megohm, ½ w. res.
R_3—220,000 ohm, ½ w. res.
C_1, C_3—.002 μfd. ceramic cond.
C_2—.02 μfd., 400 v. cond.
V_1—9001 tube

We chose to use a 9001 tube as it gives sufficient drive to the remainder of the audio section and it is quite inexpensive as a surplus part. Any other similar type of tube may be used by observing the proper pin connections.

A .002 microfarad coupling condenser is used in the input circuit to isolate the microphone since when a dynamic microphone is employed the effective bias which is developed by the 10 megohm resistor in the grid circuit will be destroyed by the loading effect of the secondary of the input transformer needed with the dynamic mike. In using the "grid leak" type of bias, fewer parts are required and the cathode is at ground potential which will reduce hum effects being picked up by the cathodes from the heater with the resulting 120-cycle hum in the speaker.

The usual volume control was omitted as the normal a.f. gain control in our receiver may be used for this purpose. There is no need for a bypass condenser at the junction of the plate and screen resistors to ground as sufficient capacity is employed within the receiver itself for this application.

For the *National* NC-57-B the following connections are used to supply power to the preamplifier: pin 7 to the heater, pin 6 to the grounded side of the heater and negative high voltage, pin 4 to positive high voltage, and pin 5 to the .002 μfd. coupling condenser from the plate of the 9001. Other receiver pin connections will be found by consulting the instruction book supplied with the receiver.

—30—

TRIPOD ADAPTER

By JAMES CLIFTON

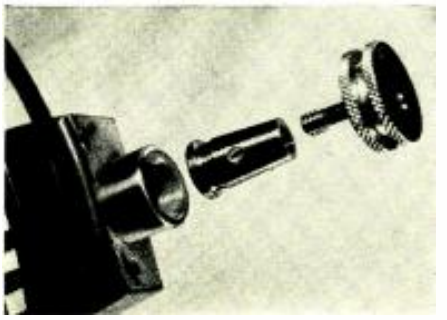
NO machine work is needed to fit your microphone to a camera tripod. Only two inexpensive items comprise the adapter.

First obtain a standard male mike connector, cable type, from your radio parts supplier and then get a standard Eastman Kodak tripod screw from your photo dealer.

Loosen the small screw on the mike connector and remove the spring. Insert the tripod screw into the empty hole and tighten the screw, locking the pieces together.

That is all there is to it! To use, just screw the adapter into the mike socket, then attach the unit to any tripod exactly as you would any camera. —30—

"Exploded" view of tripod adapter.



The "Mark 12"

(*Continued from page 73*)

sistance of the speaker voice coil; thus the effective damping is limited by this factor rather than by the amplifier.

For full power output, 8 millivolts are required at the phono jack for magnetic pickups. The radio-TV-tape inputs require a .3 volt input. The output at the tape recording jack is 1 volt.

The bass and treble controls are of the continuously-adjustable type, affording any desired choice of tone correction over the bass range ± 15 db at 50 cycles and the treble range from + 12 db to −15 db at 10,000 cycles.

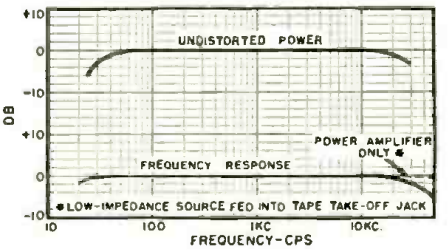


Fig. 7. Frequency response and power curve for the "Mark 12" preamp-power amplifier. The power curve was plotted on the basis of 1 per-cent distortion with 0 db representing maximum power output of 12 watts.

Low-noise, deposited-carbon resistors are used to achieve the lowest possible noise level. The tube heaters are given a positive bias of 22 volts for minimum hum and a signal-to-noise control, P_1, provides further hum reduction plus the ability to cancel out a good part of any residual hum that may be fed to the amplifier *via* the phonograph pickup connections.

To what lengths the etched circuit technique can be employed to further miniaturize high-fidelity equipment no one can foretell but the "Mark 12" is one step along the way and actual proof that quality and compactness are compatible. —30—

KEYING MONITOR TVI

ONE of the FCC's field offices recently received twelve complaints against an amateur station which was causing interference to television reception.

After thorough investigation, including three visits to the licensee's amateur station, the TVI committee reported that, although the transmitter was "clean", interference-causing harmonics were radiated whenever the keying monitor was coupled to the transmitter. The keying monitor employed a crystal rectifier and a neon-lamp audio oscillator. The offending harmonics apparently were caused by non-linear rectification and harmonic frequency resonance in the circuits and leads associated with the keying monitor.

Further use of the monitor was discontinued until it could be modified to operate without interference to television reception.

The FCC commends the work of the various TVI committees in resolving interference problems such as the case just cited. —30—

FIND THE OPEN FILAMENT

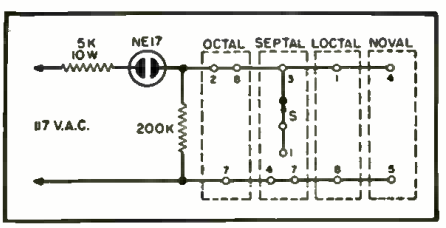
By PHIL WEISS

THE TUBES in most radios and many TV sets have their filaments wired in series. When a string of such tubes won't light up, it's a pretty safe bet that one of them has an open filament. But which one?

A tube checker will do the job and so will an ohmmeter, but it's easier with the device diagrammed and pictured. No need to remember the filament connections of the different tubes, or fumble with the switches, or meter leads. Simply plug in each tube and watch the neon lamp. If the lamp glows, the tube has a continuous filament; if not, you've found the bad tube.

The chassis has four sockets: octal, loctal, 7-pin miniature, and 9-pin miniature. There is space for additional sockets, if desired, but these four will accommodate 99% of all the tubes likely to be found in a series string.

A switch is provided to avoid error, in the case of certain tubes which have an internal connection. For example, the 50B5 has an internal connection between pins 1 and 7. Such a tube might appear good, even though the filament (3 and 4) was actually open. The switch removes pin 1 from the circuit.

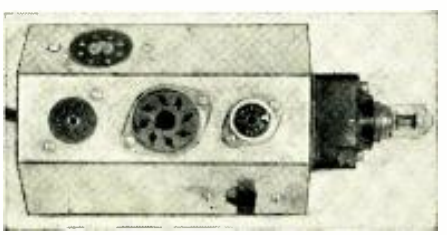


Schematic of a simple device for checking open filaments by means of a neon bulb.

The neon lamp is connected so that it glows dimly even when no tube is plugged in, to indicate that the circuit is turned on. The feeble glow becomes bright when a good tube is plugged into any one of the sockets.

Besides saving time in a busy shop, the instrument also solves the problem of the customer who brings in his radio with the innocent request, "None of these tubes light up. Will you find the bad one for me, please?" He doesn't want to pay for service. He just wants to buy a tube. With this easy method he can check his own tubes. If he finds a bad one and gets his radio working, he will leave with a happy smile and a grateful heart. On the other hand, if the set still doesn't work properly after replacing a dead tube, he will be more willing to pay a legitimate service charge to get it repaired. —30—

Photograph of unit. Four sockets are provided but space is available to add more.



Certified Record Revue

(*Continued from page 60*)

advantage in this rather obvious music. Of course the big difference between this and the old *Mercury* is the sound. The *EMI* engineers did nobly by our Soviet friend and there is simply no comparison. The violin sound is clean and edgeless, the orchestral accompaniment full of rich sonority with splendid brass and percussion. A very "big hall" sound and a transparency to the recording that is unique and seems to be much favored by the *EMI* recordists. It would be interesting to hear other Soviet artists and orchestras recorded with the same modern techniques. I fear this is just wishful thinking. All in all a top-notch disc and highly recommended. The RIAA curve did not need adjustment.

DUKAS
THE SORCERER'S APPRENTICE
FAURE
PELLEAS ET MELISANDE
ROUSSEL
THE SPIDER'S FEAST
Detroit Symphony Orchestra conducted by Paul Paray. Mercury "Olympian" MG50035. RIAA curve. Price $5.95.

The redoubtable Paul Paray has made some lasting marks in recording despite his relatively small output. He follows the success of his "Bolero" and Franck "D Minor Symphony" with this version of the "Sorcerer's Apprentice." Rarely has a performance been so completely and obviously superior to all other competition. Even the formidable Toscanini is outgunned here! The principal reason lies in the absence of pretense and bombast which mars several of the other editions. This is frothy, lighthearted, and capricious and recalls nothing so much as the famous Disney portrayal of the work in his "Fantasia." Couple this gaiety and warmth with precise tempi and strong-willed accents and you have an unbeatable performance. The "Spider's Feast" is a delightful ballet given a vigorous but lighthanded performance by Mr. Paray, and is much superior to the older version on *Esoteric*. The Fauré work is in marked contrast to the other pieces. A quiet, retrospective sort of thing, beautifully played with good taste and restraint. Throughout, the disc is typical *Mercury* sound. Tremendous dynamics in the "Sorcerer" along with plenty of spine-tingling transients. The "Spider's Feast" is full of dazzling hi-fi effects. Good acoustic perspective adds to a highly desirable disc. A slight cut in the treble control made the RIAA curve sound better to me.

HINDEMITH
DAS MARIENLEBEN
Jennie Tourel, mezzo soprano with Erich Itor Kahn, pianist. Columbia SL 196. NARTB curve. Price $11.90.

One of the most profoundly beautiful song cycles ever written, this is one of the great recordings of the year. To those of you to whom Hindemith conjures up thoughts of his "Symphony in E" and "Kleine Kammermusik," with their complex scoring and dissonance, this will come as something of a surprise, which is not to say that "Das Marienleben" is not without dissonance. Dissonance is surely present, but when it is tempered with the lyric beauty in this work, it is hardly noticeable. Based on poems of the great Austrian poet Rainer Maria Rilke, Hindemith has created a work of great power and reverence. An important work from the standpoint of modern vocal composition, Hindemith has frequently revised it and the version herein recorded was finished in 1948. As a vehicle for the talents of Jennie Tourel, it is well nigh perfect. A difficult work to sing, this recording is a living tribute to Jennie Tourel's fabulous artistry. Breathing, intonation, inflection, articulation, all these problems and more are dealt with in a sure and certain manner, in a voice of exquisite beauty. Soundwise, this is far superior to the old recording on *Lyrichord*. What talents Frances James had were obscured by the miserable sound. Miss Tourel is miked rather "close-to" in this recording and the "presence" of her voice is uncanny. Wide frequency re-

sponse is evident as are the splendid dynamics. Mr. Kahn at the piano is, as always, an astute and perceptive accompanist. An English translation of the poems is included with the album, but we would have been better served with a good German-English libretto. Great singing of great music. A *must* with voice students and a prize recording for the serious audiophile. The NARTB curve was adequate without further adjustment.

BENEVOLI

FESTMESSE FUR 53 STIMMEN

Vienna Symphony Orchestra conducted by Joseph Messner with the Salzburger Domchoir, Franz Sauer, organist. Epic LC 3035. NARTB curve. Price $5.95.

Lo, the wonders of the age of LP! The last performance of this work was in 1628 at the consecration of the Salzburg cathedral! Written as a "feast mass" for the occasion, it is a gigantic work scored for 53 parts: 16 vocal and 37 instrumental. You might think that such a work would be thick textured, but such is not the case, so clever is the scoring. Plenty of tremendous sound here though, in the baroque tradition, with bright trumpets and solid tympani and an occasional low pedal on the organ continuo. A great many prominent soloists comprise the separate choirs, among them Ilona Steingruber and George Maran. The vocal and orchestral elements are fairly well balanced except for some "fusion" now and then. Spacious acoustics and good dynamics lend a feeling of "presence." One of the best of recent baroque recordings and highly recommended. Some treble cut and bass boost necessary with the NARTB curve. Quiet surfaces in my copy.

NATHAN MILSTEIN RECITAL

Nathan Milstein, violinist with Carlo Bussotti, pianist. Capitol FDS P8259. RIAA curve. Price $5.95.

Nathan Milstein has fared very well at the hands of the *Capitol* engineers. This disc, as a minor compendium of his talent, is beautifully recorded. String tone is very clean and his attacks come through with bite and authority. The music serves best to show off the wide range of the Milstein repertoire. Especially interesting is the Pergolesi "Sonata #12" and Milstein's own arrangement of Paganini's famous "Theme in A Minor." Milstein has lost none of his fluency or technique through the years, and with the superior recording he is now afforded, sounds better than ever. Carlo Bussotti does a competent and sympathetic job of accompaniment on the piano. RIAA curve was "just right." Quiet surfaces.

ORFF, CARL

CATULLI CARMINA

Soloists, four pianos and percussion instruments Wiener Kammerchor conducted by Heinrich Hollreiser. Vox PL 8640. NARTB curve. Price $5.95.

This is one of the most unusual and sensational recordings of the year! Carl Orff is a modern German composer, who has turned his back on most present day musical thought and has come up with a "primitive" music, peculiarly his own. Of very simple harmonic structure, his music is noted more for its rhythmic drive used in repetitive sequences. His use of the human voice (or voices) as a rhythm "instrument" is the most remarkable feature of all. Part of a trilogy which begins with "Carmina Burana" (recently released on a *Decca*) and ends with the as-yet-unrecorded "Triumph of Aphrodite," this work, along with the others, is derived from love poems of the Roman poet Catullus (about 50 B.C.). This boy Catullus wrote some pretty "hot stuff"! A Latin-English libretto is furnished with the album, which is not quite complete. If you know enough Latin to decipher the untranslated sections, you'll find out what I mean by "hot stuff." Zowie!! The opening and closing choruses of the work are for voice and an orchestra comprised entirely of percussion instruments and four pianos. Some tremendously exciting effects are produced, especially in dynamics. The middle sections are for unaccompanied voices and here is the best illustration of Orff's rhythmic use of the voice. A little weird and uncanny at times, but really quite fascinating. Plenty of tympani and xylophone and many other percussion effects for you hi-fi

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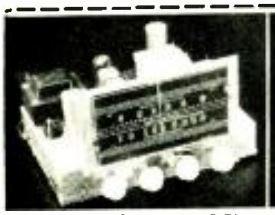
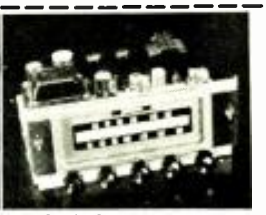


(A) HALLICRAFTERS S-78A

(B) JACKSON FA8C



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Model AM9A, Hi-Fi amplifier and tuner. Ship. wt. 39 lbs. Sale price, $39.95
Model AM9A with our CU-14Y 12" coaxial PM speaker, both for $49.95.
Model AM9A with our P15-CR 15" coaxial PM speaker, both for $59.95.

11-TUBE FM-AM HALLICRAFTERS

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McGEE's SALE PRICE $69.95 LESS SPEAKER

★ HIGH FIDELITY ★ AUTOMATIC FREQUENCY CONTROL

(A) Hallicrafters Model S-78A, 11 tube FM-AM superhet custom chassis. Size 73/8" x 12½" x 11" deep. Complete with tubes, knobs, escutcheon, diagram and instructions. Receives broadcast 540 to 1700 kc, plus FM 88 to 108 mc. AFC holds FM stations in perfect tune. Output transformer matches 3.2 ohm or 500 ohm. High fidelity response, 50 to 14,000 cps. Bass boost tone control. A full 11 tube transformer powered chassis with push-pull 6K6 audio. This chassis found in $400 to $600 radio combinations. Has input for crystal phono pickup. Self-powered preamplifier necessary for G.E. variable reluctance cartridge, $3.95 extra.

S-78A Hallicrafter 11 tube FM-AM chassis. Ship. wt. 22 lbs. $69.95
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S-78A Hallicrafter with our P15-CR 15" coaxial PM speaker $89.95
3/352 Collaro 3 speed record changer, less cartridge. $38.95 extra.
3/352 Collaro changer with G.E. RPX-052 Golden Treasure cartridge, $58.95 extra.
45 RPM spindle for Collaro changer, $2.50 extra.

8-TUBE JACKSON FM-AM $39.95 LESS SPEAKER

REGULAR $59.95 VALUE– ONLY 1000 TO SELL

(B) Model FA8C, Jackson 8 tube FM-AM custom chassis. Receives broadcast 540 to 1600 kc. and FM 88 to 108 mc. 9" etched glass slide rule dial. Chassis size 7" x 13" x 7" high. Full superhet circuit with AVC. Complete with tubes: 12AT7, 6BE6, 2-6BA6, 6AL5, 6AT6, 6AQ5 and 6X4. Output transformer matches 3.2 or 8 ohm speaker. Input for crystal pickup with radio-phono switch on front of chassis. Full size "High-Q" ferrit loop stick antenna mounted on chassis. Separate antenna for FM. Has bass boost tone control. Knobs, escutcheon, diagram and instructions included.
Model FA8C, 8 tube FM-AM radio chassis. Ship. wt. 12 lbs. Sale price $39.95.
Model FA8C with our CU-14Y 12" coaxial PM speaker, both for $49.95.
Model FA8C with our P15-CR 15" coaxial PM speaker, both for $59.95.

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$12.95 — 12-Inch Model CU-14Y

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Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.8 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price $12.95 each, two for $25.00.

Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 20 cps. and up to 17,500 cps. Full 21½ oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular $62.50 list speaker. Model P15-CR, McGee's Sale Price, $23.95.

REG. $48.75 COLLARO CHANGER

3-SPEED HI-FI, IMPORTED FROM ENGLAND

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Regular $65.00 list Collaro Model 3/352, 3 speed automatic record changer on sale at McGee for only $38.95. Famous imported English changer popular among audio enthusiasts all over America. Plays all 3 speed and all 3 sizes. Intermixes 10" and 12" records of the same speed. Shuts off automatically after the last record. Heavy duty motor and turntable gives even speed operation. Rubber pallet on turntable. Compensating spring shifts weight of tone arm for LP and standard records. Plug-in head can be fitted with your favorite high fidelity cartridge. Each changer shipped with a complete service sheet. Large 45 RPM spindle $2.50 extra. Changer size, 14¾" long, 12¼" wide. 4¾" above motor board and 2⅞" below. Ship. Wt. 20 lbs. Model 3/352 Collaro changer, less cartridge $38.95. With G.E. RPX-052 Golden Treasure variable reluctance cartridge $58.95.

ENGLISH GARRARD CHANGERS

RC-80 WITH GE RPX-052 $68.51

Garrard "Triumph" Model RC-80, 3 speed automatic record changer. Plays all 3 sizes automatically and shuts off after last record. Heavy duty AC phono motor and weighted turntable gives constant speed. Muting switch silences pickup during change cycle. Complete with two separate plug-in shells for either crystal or G.E. variable reluctance cartridge. Overall size, 13¼" wide, 15½" deep and 8" high. 2½" below motor board and 5½" above. 105-125 volt, 60 cycle AC. Ship. wt. 20 lbs. Large 45 RPM spindle $3.43 extra. Model RC-80 Garrard changer, less cartridge $48.51. With flip-over crystal cartridge $52.46. With RPX-052 G.E. Golden Treasure cartridge $68.51.

RC-90 WITH GE RPX-052 $88.11

Garrard "Crown" Model RC-90, new 3 speed automatic record changer. All of the features of the RC-80, plus many new developments. Has new adjustable speed control to regulate speed faster or slower on all 3 speed settings. Manual position for playing single records. New 4 pole heavy duty AC motor and heavy turntable eliminates wow. Complete with two separate plug-in shells for desired cartridge. Finished in cream and brown. 15½" long, 13½" wide. 5¾" above motor board and 3⅞" below. Ship. wt. 19 lbs. Large 45 RPM spindle $3.43 extra. Model RC-90 Garrard changer, less cartridge $68.11. With flip-over crystal cartridge $72.06. With G.E. Golden Treasure variable reluctance cartridge $88.11.

SALE!

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(Pictured to the Left)

WALNUT RADIO-PHONO-CABINET

Made for $900.00 Class Capehart Cost Over $200.00 to Build

$79.95

No. K-275 (left illustration). Walnut radio-phono cabinet 42" h. 42" w. 22" deep. Made for Capehart selling for $900. Radio chassis area 14" h. 11½" w. Changer compartment 14"x 26" w. 12" baffle completely enclosed. Cabinet weighs approx. 175 lbs. Ship. wt. 275 lbs. Sale price $79.95.

WALNUT RADIO-PHONO CABINET

Made for $700.00 Class Capeharts

$59.95

R-1758 (right illustration). Walnut radio-phono cabinet 37" h. 40" w. 21" deep. Radio area 14½" wide. Changer compartment 25½" wide. Hinged top lifts in two sections. Baffle for 2 12" speakers. Made for $700 Capehart combination. Ship. wt. 160 lbs. Sale price $59.95.

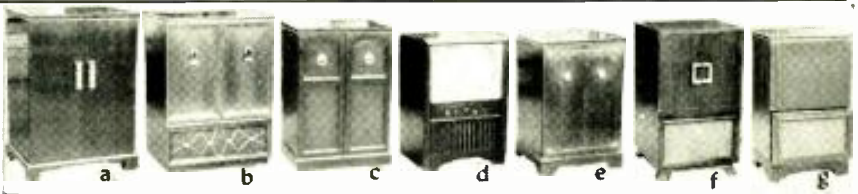
$100.00 LIST BUICK AUTO RADIO

$44.95

6 AND 12 VOLT MODELS

No. 981320. 7 tube 6 volt Buick radio. Custom made for '50, '51, '52 Buick. Also '53 Buick special only. Cost over $100 retail. Push-button tuning, tone control, built-in 8" speaker. PP 6V6 audio. Ship. wt. 20 lbs. For a limited time, sale Price only $44.95.

No. 981323. 8 tube 12 volt Buick radio. Custom made for all '53 Buicks except the Special. Cost over $100 retail. Magic Selectronic single push-button tunes set electronically. Built-in 8" speaker, tone control, PP 12V6 audio. Ship. wt. 20 lbs. Sale price $44.95.



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27" MAHOGANY FULL DOOR CAB.. $69.95

(a) No. 27-MA. Mahogany with full doors for 21", 24" and 27" TV. 43" h. 30¼" w. 23" deep. Chassis area 27¾" w. 25" h. 18¼" deep. Baffle for 10" speaker. A beautiful cabinet that cost the factory over $100. Made for a $600 TV set. Ship. wt. 90 lbs. Sale Price $69.95. Blank panel $5.00 extra.

27" ¾ DOOR MAHOGANY CAB..... $69.95

(b) No. 27-34MA. Mahogany with ¾ doors for 21", 24" and 27" sets. 43" h. 31¼" w. 223/4" deep. Chassis area 27½" w. 26¾" h. 21" deep. Baffle cut for 2 10" speakers. Made for one of America's largest TV builders. Cost over $100. Ship. wt. 90 lbs. Sale Price $69.95. Blank panel $5.00 extra.

21" MAHOGANY FULL DOOR CAB.... $44.95

(c) No. 21-FDT. 21" full door mahogany. 39" h. 27" w. 22" deep. Chassis area 24" w. 21½" h. 18¾" deep. Baffle for 12" speaker. Panel cut for 21" tube. Made for a $395 set by a famous TV factory. Ship. wt. 75 lbs. Sale price $44.95.

21" MAHOGANY CAB. $29.95

(d) No. 21-OFM. 21" Mahogany open front. 37" h. 25½" w. 20½" deep. Chassis area 24" w. 21½" h. 18¾" deep. Baffle for 10" speaker. Small overall, but plenty big enough for 21" set. Made for a $295 TV set. Ship. wt. 65 lbs. Sale price $29.95.

17" MAHOGANY FULL DOOR CAB... $29.95

(e) No. AH-430. Mahogany with full doors 36" h. 24" w. 21¾" deep. Chassis area 22" w. 17¾" h. 18¾" deep. Blank panel. Holds 17" TV easily. Baffle for 10" speaker. Ship. wt. 80 lbs. On sale at less than it cost a famous TV factory. Sale price, $34.95.

17" WALNUT ½ DOOR CABINET ... $29.95

(f) No. AH-85A. Walnut with half doors. 36" h. 20¾" w. 21½" deep. Chassis area 19" w. 18¼" h. 18¾" deep. Blank panel. Will hold most 17" sets. Baffle cut for 10" speaker. Ship. wt. 65 lbs. An attractive well proportioned cabinet on sale at only $29.95.

17" TV CAB. WITH PHONO DRAWER .$19.95

(g) No. SE-21. TV-phono comb. 40" h. 24" w. 18½" deep. Blank panel. TV chassis area 19" h. 20¾" w. Changer drawer 19¾" w. 13" deep. Baffle for 10" speaker. Mahogany finish. Ship. wt. 75 lbs. Sale price $19.95.

MIKE-PHONO-BROADCAST OSCILLATOR $7.95

Sensational new 1955 model microphone-phono oscillator for the broadcast band. Have own miniature radio station that broadcasts only in your own home. Plugs in to 110 volt house current. Input jacks for crystal mike or record player. Priced with tubes 12K8 and 70L7. Stock No. LE-3. ship. wt. 3 lbs. Sale price $7.95. Crystal mike and desk stand $4.95 extra.

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BIZET
CARMEN
(ORCHESTRAL SCENARIO)
Andre Kostelanetz and his orchestra. Columbia ML4826. NARTB curve. Price $5.95.

We've had the plain old *opera* "Carmen," the "Carmen" *suite*, and now (thanks to Mr. Kostelanetz) we have "Carmen" as an *orchestral scenario*. Which certainly proves the popularity of this work. One might expect this sort of thing to be a "cornball." Such is happily not true. Actually this music merely does the familiar suite one better; it represents the entire score in orchestral terms. Kostelanetz, who is usually railed against for his saccharine sweetness and over-lush orchestration, plays it close to the vest here, and except for an occasional lapse into his "idiom" does a straightforward and commendable job. The sound is very good indeed. In fact as far as sound is concerned, this is head and shoulders above any other "Carmen" disc in the catalogue. String tone, brass, woodwinds, and percussion—all are reproduced with startling clarity. Another disc which should be popular with a great many people and especially, the beginning hi-fi addict. No adjustment to the NARTB curve was needed.

CHARPENTIER
MAGNIFICAT IN D AND OTHER WORKS
The Chamber Orchestra of the Concerts Pasdeloup, The Chorale of the Jeunesses Musicales de France with soloists, conducted by Louis Martini. Haydn Society HSL102. NARTB curve. Price $5.95.

This is a follow-up to the sensational Charpentier "Te Deum," with which the *Haydn Society* began the Charpentier renaissance last year. This recording is continuing proof of the *Society's* wisdom in this undertaking. While this "Magnificat" is not as exciting as the "Te Deum," it has its own appeal in its fabulous scoring. Five soloists and two choirs and two orchestras are used with organ continuo. A very dramatic work, this should find favor with those of you who incline towards the baroque. There are five other works on this disc such as an "Offertory" and a magnificent "Salve Regina." All the forces in the recording exhibit a very high degree of musicianship. The dedication in their work is splendidly evident. Sound is generally good. Strings are somewhat edgy at times, some choral/orchestral "fusion" occurs. Excellent woodwind reproduction and for good measure the pedal in the organ continuo is properly sonorous. Slight treble cut helped the NARTB curve. Good surfaces.

RACHMANINOFF
PIANO CONCERTO NO. 2
PRELUDE IN G MINOR
PRELUDE IN G MAJOR
Geza Anda, pianist, with the Philharmonia Orchestra conducted by Alceo Galliera. Angel 35093. RIAA curve. Price $5.95.

I strongly urge you to listen to this recording. Just once in a long while is an oft-recorded warhorse given new life. I really feel this is the best version on records today. I hesitate to say definitive . . . there are a few shortcomings here and there. In the main the recording is characterized by two things. One is the completely surprising artistry of this young pianist Geza Anda. His reading is so well-paced, so beautifully modeled, he makes some of his competition sound like plodding amateurs. Listen to his sensitiveness and restraint in the 2nd movement and you'll see what I mean. The other thing that is outstanding on this record is the sound. Paradoxically, this is also one of its shortcomings! The piano is simply fabulous. A more realistic and beautifully liquid tone would be hard to imagine. The attacks are properly percussive, but without any harshness or ringing. The orchestral accompaniment is superbly balanced, the whole wide range, but not in the "tromped up" spectacular sense. The only thing that mars this sonic picture is the acoustic perspective. Reverb time has been cut to the

bone and there is barely enough left to sustain the "presence." Fortunately, it is not altogether dead and this saves the piano tone from excessive "dryness." A second or two more of reverb and this would have been an even better recording than it is. If you don't own this work as yet, or you're looking for a replacement, you won't go wrong on this.

GOUNOD
ROMEO ET JULIET
Janine Micheaus as Juliet; Raoul Jobin as Romeo with chorus and orchestra of Theatre National De L'Opera conducted by Albert Erede. London LLA-18. RIAA curve. Price $17.85.

The first recording on LP of this romantic opera and one that is going to be very hard to beat in subsequent versions. In fact after a good listening session with this album, I would think it most imprudent of anyone to try and improve upon it. Yes, it *is* that good! The winning combination of the talented Janine Micheau and Raoul Jobin and the native fluency of the chorus of the Theatre National, is but one of the reasons for this superiority. In matters of sound, this is probably the finest opera recording yet produced. The soloists and chorus are blessed with the proper acoustic perspective that allows for clear, concise, diction. The orchestra sounds particularly good, with plenty of dynamic shading and wide frequency response. Above all, a nearly perfect balance is maintained; the vocal elements never fight with the orchestra but blend into a smoothly splendid sonic picture. Highly recommended.

TAYLOR, DEEMS
THROUGH THE LOOKING GLASS
Eastman Rochester Symphony Orchestra conducted by Howard Hanson. Mercury MG40008. RIAA curve. Price $5.95.

Mercury continues its "American Music Festival Series" with this first LP recording of this delightful Deems Taylor score. There was an old 78 rpm set of this work years ago, that was highly prized by collectors. A more up-to-date recording has been needed for a long time and this one fills the bill to perfection. A series of five "pictures" from Lewis Carroll's fantasy which depicts the further adventures of "Alice in Wonderland," is set to some highly original and some highly derivative (and amusing) music by Mr. Taylor. With tongue in cheek he essays the use of Wagner's "Parsifal" and "Die Meistersinger" in the Jabberwocky scene and cavorts musically in other spots as well. A highly listenable work, it should be a favorite with you hi-fi fans as there is an absolute wealth of wonderful material here. This is the usual *Mercury* recording with the clean strings and the bright brass and the incredible percussion. Very weighty and sonorous in parts and with some fantastic dynamics. A real killer-diller! RIAA curve did not need adjustment. Quiet surfaces.

STRAUSS, JOHANN AND JOSEF
NEW YEAR CONCERT 1954
Vienna Philharmonic Orchestra conducted by Clemens Krauss. London LL970. RIAA curve. Price $5.95.

This has been an annual event for some years now, and it is sad to realize that Clemens Krauss will not be with us next year. Ever more keenly is his death being felt. As in the past, this is an outstanding recording from every aspect. Krauss' conducting is a labor of love and is magnificent, the repertoire is well chosen, the orchestra plays like angels and the sound is typical of the very best *London*. It is perhaps most fitting that this, one of Viennese Krauss' last recordings, should contain the great "Blue Danube," which is afforded a heart-warming, a great performance. There are plenty of light frothy tunes here, and the feeling of "Gemutlichkeit" is everywhere. Some wonderful reproduction here, especially in the number called "Plappermaulchen" (chatter-box). Great soaring strings, and solid and accurate percussion are noteworthy. If your wife says she doesn't like hi-fi, try this one on her!

That's all for this month—we'll be back next month with a whole new batch of records and tapes for review.

—30—

MANUFACTURERS' LITERATURE

The various listings presented in this section are for your convenience. The bulletins, unless otherwise indicated, are available to all our readers. For prompt attention write directly to the manufacturer for this literature.

POWER SUPPLY DATA SHEETS

Descriptions of several new product lines are contained in the series of new catalogue pages and folders recently issued by *Dressen-Barnes Corporation* of 250 N. Vinedo Ave., Pasadena 8, California, manufacturer of d.c. power supplies.

One catalogue page covers the Model 3-150-L low-cost power supply, another describes the Model D3-300E multiple super-precision power supply, while the third catalogue page covers the Models T-100-B and T-100-D transistor power supply models.

A four-page folder covers regulated power supplies for development and research. It includes performance data and curves.

DEFLECTION YOKE DATA

Syntronic Instruments, Inc., 100 Industrial Road, Addison, Ill. has just released a catalogue page picturing and describing its new rotating coil deflection yokes with deflection angles up to 52 or 70 degrees.

This complete data includes four advanced design features, three dimensional drawings, and tables of electrical and mechanical characteristics with full explanations to assist design engineers. A table listing a wide variety of coil inductance combinations is also shown.

COLOR TV MANUAL

The second edition of "Practical Color Television," prepared for use by the television service industry and technical schools, is now ready for distribution.

The 80-page manual which contains text, drawings, and photographic explanations of the electronic operations of color TV has been revised and expanded since publication of the original edition.

The new manual is available from the Commercial Service Section of *RCA Service Company, Inc.*, Camden 2, N. J. for $2.00 a copy. In quantities of 12 or more the cost is $1.60 ea.

PRINTED CIRCUIT LAMINATES

A new four-page bulletin just published by *The Richardson Company*, 2661 Lake St., Melrose Park, Ill. gives information on Grades T-725 and T-812 copper-clad "Insurok" laminates for use in printed circuits.

The bulletin devotes one page to important design considerations in the production of printed circuits and gives complete specifications on the two laminates, including characteristic properties, punching information, sheet size, and sheet thicknesses.

R.F. FILTERS

Balco Research Laboratories, 49-53 Edison Place, Newark 2, N. J. describes its complete line of r.f. filters in a new four-page bulletin just released.

Included are low-pass, high-pass, bandpass, band-rejection, and complementary units. Actual size photographs of units and typical response curves illustrate what can be done in compact units to give maximum attenuation over the desired stop-band with minimum insertion loss and v.s.w.r. over the passband.

Write the company direct for a copy of this bulletin.

ROTATIONAL POT

The Markite Corporation, 155 Waverly Place, New York, N. Y. now has copies of its technical bulletin, No. B53, available covering engineering specifications on its Type 2094 rotational potentiometer.

The data sheet includes mechanical specifications, performance graphs, electrical specifications, and other pertinent data.

PRINTED CIRCUIT DATA

The Formica Company, 2614 Spring Grove Ave., Cincinnati 25, Ohio has issued a colorful and informative booklet on its "Copper Clad for Better Printed Circuits."

The publication is lavishly illustrated and contains details on the various applications of printed circuitry and the different methods of applying this technique.

"MAGNETICON" COMPONENTS

The *Magneticon Division* of *Magnetic Recording Industries*, 11 E. 16th Street, New York 3, N. Y. has issued a 4-page data sheet covering its line of components developed for broadcast stations, recording amateurs, and hobbyists.

These components enable the user to produce and reproduce magnetic recordings on a flat magnetic disc while utilizing his existing equipment. The booklet describes the line with more detailed specifications available on request.

CONDENSER CATALOGUE

A new 20-page catalogue, No. X-100, which illustrates and fully describes a complete line of miniature, hermetically-sealed, high-temperature tubular

paper condensers is now available from *Gudeman Company*, 340 W. Huron St., Chicago 10, Illinois.

The publication includes dimensional drawings, electrical characteristics, engineering data, and tables of voltages, capacitance values, and tolerances.

STANCOR CATALOGUE

The *Standard Division* of *Chicago Standard Transformer Corporation*, Addison and Elston, Chicago 18, Ill. has released copies of its 1954 industrial catalogue of stock transformers for radio, television, amateur, communications, and other electronic applications.

The new publication lists replacement and new equipment transformers with complete electrical and physical specifications on over 500 transformers. Sixty-five new replacement units are listed for the first time.

E-V CONDENSED CATALOGUE

A new condensed catalogue covering its full line has been issued by *Electro-Voice, Inc.* of Buchanan, Michigan.

Catalogue No. 119 gives basic facts about the company's products for the audio and video fields. It illustrates and describes microphones for TV, broadcasting, p.a., paging, recording, and communications. It also covers high-fidelity speakers, components, enclosures, and complete two-, three-, and four-way reproducing systems; phono cartridges; p.a. loudspeaker systems; v.h.f., u.h.f., and FM boosters; and RME electronic products.

JENSEN CATALOGUE

Jensen Manufacturing Company, 6601 S. Laramie Ave., Chicago 38, Ill. has issued a new catalogue, No. 1040, and two new data sheets, Nos. 164 and 165.

The catalogue covers the *Jensen* line of general-purpose and commercial sound loudspeakers in addition to accessory cabinets, volume controls, and transformers. The data sheets cover the drive-in theater speaker line (No. 164) and the company's high-fidelity equipment line (No. 165).

IRC RESISTOR GUIDE

International Resistance Company, 401 N. Broad Street, Philadelphia 8, Pa. has issued a "Resistor Engineering Guide" which lists over 130 types of resistors and special products manufactured by the company.

Data given for each type includes JAN or MIL equivalent, rated wattage, standard tolerances, temperature rise at rated load, temperature coefficient, maximum operating temperature, ohmic values available, dimensions, and approximate prices.

Please specify Form S-074A when writing for a copy of this guide.

TUNG-SOL TUBE MANUAL

Tung-Sol has announced the release of the 20th edition of its "Tube Characteristics Manual" containing 200 pages including a brand new section

on cathode-ray tube substitutions.

This most recent edition is 34 pages larger than the preceding issue and contains data on 600 receiving tubes, 110 premium types, 170 CR tubes, 85 diodes plus tube base diagrams, color codes, dial lamps, and numbering codes.

The manual is available only through the company's tube wholesalers. —30—

NEW ENGLAND HI-FI SHOW

THE First Annual New England High Fidelity Music Show will be held in Boston, October 22, 23, and 24, at the Hotel Touraine, according to Gardiner G. Greene, president of Browning Laboratories and president of the newly-organized corporation sponsoring the event.

The entire industry, comprising audio equipment manufacturers, distributors, and dealers, has indicated its intention of supporting this show.

The three-day affair will be open to the public at no charge. Equipment on demonstration will include record changers, amplifiers, tuners, loudspeakers and enclosures, tape recorders, audio cabinets, and a host of other components comprising a hi-fi system.

Among those who have agreed to act in an advisory capacity are: Arthur Fiedler of the Boston Pops Orchestra; Edward Weeks, editor of the "Atlantic Monthly"; Rudolph Elie of "The Boston Herald"; Joseph Zimbler of the Boston Sinfonetta; Harold Rogers of "The Christian Science Monitor"; and other New Englanders of equal prominence in their fields.

Show officers, elected to serve with Mr. Greene, include: Lynn Eaton of the National Company, vice-president; Ted Jones, general manager of station WCRB, treasurer; Michael Scott, manufacturers' representative, secretary; and Harry N. Reizes of New York, consultant.

Lewis Kornfeld of Radio Shack Corp. is the advertising manager for the show and Cyrus Durgin of the "Boston Globe" was named manager of special events.

Arthur Johnson is the manager of the show and offices have been set up in Room 9 of the Hotel Touraine. —30—

TEXAS "AMATEUR DAY"

SUNDAY, October 10th, has been set as the second annual "Amateur Day" at the State Fair of Texas. Registration starts at 8 a.m. with a program at 3 p.m. followed by a prize drawing.

The Picnic Pavilion and Play Area has been reserved for the all-day program with activities centering around the Pavilion.

A booth in the General Exhibits Building will house two complete transmitters during the run of the fair, October 9-24. The transmitters will be TVI-free and two TV sets—one a clean set of good design which can operate next to a TVI-proof transmitter and the other set one which can be cleaned up by means of a high-pass filter—will be in operation to demonstrate to the public that all "TVI" doesn't originate with amateur transmitters.

A message center will be in operation for the benefit of the public.

E. F. Aymond, Jr., W5UHV, is chairman of the Amateur Day Committee. He cordially invites all hams to Dallas for this event. —30—

"HI-FI IS FOR EVERYBODY" . . .

says Robert Newcomb

. . . Regardless of budget, way of life, or space limitations. Ownership of a true high fidelity system no longer requires an extensive technical background. In fact, today it doesn't even require more than a moderate expenditure to enjoy the wonderful realism of high fidelity.

Look over these new Hi-Fi Products and you'll see that Robert Newcomb not only believes that Hi-Fi is for everybody . . . but has a complete line of products to prove it.

Whatever your Hi-Fi plan, whatever your Hi-Fi budget, Newcomb is right there with the right amplifier.

FOR SUPERIOR RADIO RECEPTION . . .

New CLASSIC 200
2 KNOB FM-AM TUNER

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Designed for use with any amplifier having its own complete set of controls. It's today's most advanced tuner. Designed and built by Newcomb . . . Completely new, distinctly different, and noticeably better! Fully enclosed and beautifully finished to use "as is." To place in a cabinet, Newcomb's exclusive "Adjusta-Panel" feature makes a simpler, neater job. U/L approved. Output is 10 volts at less than ¼%. 1 volt at less than 4/100%. Effective to 200 ft. from amplifier.

Many new circuit advances have been made in both FM and AM sections. Results: *30 db* of quieting with only 1½ micro-volts input on FM. 1 Microvolt AM sensitivity for 1 volt output. Only 6⅜" high by 11½" by 11½".

FOR TRUE STEREOPHONIC REPRODUCTION . . .

New MODEL 3D-12, 25 WATT
2 CHANNEL AMPLIFIER

$179.50
AUDIOPHILE NET

Really two complete matched 12½ watt amplifiers and preamplifiers in one. Common set of control knobs for both amplifiers offers easier operation, perfect results. All normal controls are provided plus new "focus" control. Channel selector switch gives operator choice of stereophonic reproduction, stereophonic reversed, Channel A, Channel B, or enhanced 2 channel monaural for simulated stereophonic reproduction of ordinary records. Dual tape "inputs" and dual "outputs" to tape make the 3D-12 ideal for use with the new "Binaural" tape recorders. Crossover selector provides various recording curves for both channels. Special switch provides correction for Cook Binaural recordings. Distortion below 1% at 25 watts. Response ±1 db 20—20,000 cycles.

NEWCOMB *Classic Series* AMPLIFIERS . . .

WITH REMOTE CONTROL . . . . . OR . . . . . .

These remote controlled Newcomb Classic Series Amplifiers offer matchless performance and complete sound control . . . music exactly as you want to hear it. Words can't describe these superb products. Both give you: True remote control up to 50 or 100 ft.; Separate crossover and rolloff controls for up to 36 different recording curves; New "Level" control; Advanced design Loudness control; New rumble filter; Seven inputs; Mike input; Tape "Input"; "Output" to tape; No-Glare petite pilot light; and they're U/L approved. Only your ears can convince you Hi-Fi can be so close to perfection. For utmost pride . . . for classic beauty . . . for luxurious operating ease and utmost listening pleasure . . . for substantial savings in cabinetry and installation expense . . . for lowest distortion *for life* . . . Own a Newcomb Classic Series Remote Controlled Amplifier. Don't fail to see and hear these premier products of Newcomb's 17 years of sound leadership.

New CLASSIC 2500-R

$297.50
AUDIOPHILE NET

25 watt Ultra Fidelity Remote Controlled Amplifier-Preamplifier • Less than 1/100% distortion up to 10 watts, less than 2/10% at 20 watts • 10 to 100,000 cycle response within 1/10 db from 10 to 30,000 cycles • Program condition compensator • Unequalled dual range tone controls, Bass range —16 db to +23 db, Treble range —25 db to + 23 db • D.C. operated preamplifier.

New CLASSIC 1500-R

$197.50
AUDIOPHILE NET

20 watt Ultra-Fidelity Remote Controlled Amplifier-Preamplifier • Less than 5/100% distortion at average listening levels • Less than ½% distortion at 15 watts • 10 to 100,000 cycle response within 1 db to 30,000 cycles • Dual range tone controls, Bass range —17 db to +20 db, Treble range —20 db to +18 db • Ultra conservative design for extended tube life.

New CLASSIC R-7

$139.50
AUDIOPHILE NET

Remote Controlled Ultra-Fidelity Pre-Amplifier
Bring your present amplifier up to date with a new "front end." The New Classic R-7 Remote Master Control Unit and Pre-Amplifier offers guaranteed results, the most modern of circuitry, tremendous range of control . . . plus operating and cabinet saving advantages of real remote control. All inputs connect directly to the power supply chassis only. Beautiful control unit is a decorator's delight.

"AUDI-BALANCE" for LIFETIME FREEDOM from DISTORTION!

Newcomb Classic Series Amplifiers with their exclusive "Audi-Balance" (Pat. Pending) distortion control device assures you of absolute minimum distortion for life! No matter how perfect your amplifier when new, its distortion is bound to increase with age. During the useful life of a set of tubes, output tube unbalance is the greatest single cause for amplifier distortion being above the minimum of which the amplifier is capable. Aging can unbalance a set of tubes and replacement pairs are seldom sufficiently identical twins to balance automatically.

With Newcomb's exclusive "Audi-Balance" feature for lifetime distortion control, you are not left to guess whether your amplifier is continuing to provide the lowest distortion possible. You *know* by just pressing a button! What's more, you can do something about it . . . instantly . . . by just turning a small control and listening to the distortion disappear!

New NEWCOMB "COMPACTS"...

For Use "As Is"...Need No Cabinetry!

With these "Compacts," Newcomb makes true Hi-Fi via selected components practical for everyone. They're simplest of all to install. Just sit down, plug in and use. They need no cabinetry but include Newcomb's exclusive "Adjusta-Panel" feature to make installation in a cabinet extremely easy if necessary. Both U/L approved. They're absolutely ideal for the apartment dweller because they're so easy to set up or move.

COMPACT 12

$99.50 AUDIOPHILE NET

12 Watt High Fidelity Amplifier-Preamplifier-Control Unit. • Less than 1% distortion at 12 watts • Response ±1 db 20-20,000 cycles • Separate crossover and rolloff controls give 36 different recording curves • Input selector and rumble filter • Seven inputs • Mike input • Tape input • Output to tape • Wide range separate bass and treble tone controls, Bass range −15 db to +18 db, Treble range −18 db to +16 db • Hum balance control • New "Level" control • Advanced design "loudness" control • Size only 4⅛" high x 12½" x 9".

COMPACT 10

$79.50 AUDIOPHILE NET

10 Watt High Fidelity Amplifier-Preamplifier-Control Unit. • 10 watts at less than 1% distortion • Response ±1 db 20-20,000 cycles • 6 position recording curve selector • Input selector • Built-in rumble filter • Separate bass and treble tone controls in new "Interlocked" tone circuitry for "foolproof" results and less frequent need for tone control adjustments • Hum balance control • 6 inputs • Tape input • Output to tape • Mike input • Loudness control • Size 3¾" x 7¾" x 9¾".

. . . FOR PERFECTION IN EVERY DETAIL

. . . . . WITHOUT REMOTE CONTROL

Identical to the Classic 2500-R and Classic 1500-R without remote control, the Classic 2500 and Classic 1500 offer full Classic Series perfection in every detail at lowest possible cost. All controls are on chassis. They also feature Newcomb's exclusive "Adjusta-Panel" that lets you instantly extend knob shafts to accommodate cabinet panels up to ¾" thick. Dial panel is removable, beautifully finished in "gold" anodizing process that never tarnishes. Panels include petite pilot light. Both U/L approved. All ratings identical to the equivalent remote control models.

New CLASSIC 2500

$219.50
AUDIOPHILE NET

New CLASSIC 1500

$119.50
AUDIOPHILE NET

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New NEWCOMB "A" SERIES

For the Budget Minded Perfectionist

MODEL A-127R 12 watt Semi-Remote Controlled High Fidelity Amplifier-Preamplifier.

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$89.50 AUDIOPHILE NET

12 watts at less than 1% distortion • Control unit on 4 ft. cable solves many installation problems • 20-20,000 cycles ± 1 db • 6 position recording curve selector • Input and rumble filter selector • Large potted output transformer • Advanced design tone controls, Bass range −15 db to +18 db; Treble range −18 db to +16 db • 6 inputs • Tape input • Output to tape • Mike input • Loudness control • Loudness compensation switch • "Adjusta-Panel" • Removable "gold" anodized dial plate • Hum balance control • "Petite" pilot light • U/L approved.

MODEL A-127
$79.50 AUDIOPHILE NET

Identical to A-127R except all controls are on chassis.

MODEL A-107

$59.50 AUDIOPHILE NET

10 Watt High Fidelity Amplifier-Preamplifier. 10 watts at less than 1% distortion • 6 position recording curve selector • Potted output transformer • New electrically isolated input circuitry requires no input switching... Just turn on and use • 6 Inputs • Tape input • Output to tape • Mike input • Separate bass and treble tone controls with new "Interlocked" circuitry for foolproof operation • Adjusta-Panel • Removable "gold" anodized dial panel • Petite pilot light • U/L approved.

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This 25¢ book can save Hi-Fi enthusiasts and music lovers hundreds of dollars. Not a catalog, "Hi-Fi Is For Everybody" is packed with money-saving facts, how-to illustrations and suggestions. Written in easy-to-understand language, this new, practical approach to Hi-Fi tells how to get more for each dollar invested in components, how to cut costs without sacrificing quality or looks, how to plan the simplest system with an eye toward building the most elaborate. Beautifully illustrated. Handy cost-estimating sheet makes it easy to keep track of purchases and budget!

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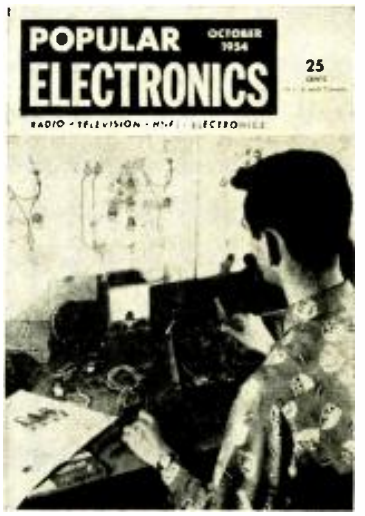

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Technical BOOKS

"HOW TO LOCATE AND ELIMINATE RADIO & TV INTERFERENCE" by Fred D. Rowe. Published by *John F. Rider Publisher, Inc.*, New York. 117 pages. Price $1.80. Paper bound.

This book is more fun than a picnic! While the text material is factual, the addition of numerous cartoons helps to point up the subject matter and drive home the points made by the author.

The discussion opens with a general survey of the interference problem and then interference sources are discussed in some detail. Techniques for locating interference and the proper steps to eliminate it are covered in the balance of the book.

For those using this book as a self-instruction text, a series of questions and answers are appended for checking purposes. Since the material is clearly and concisely written, there is no reason why anyone with a basic knowledge of radio or television should not derive considerable benefit from this volume.

* * *

"MOST-OFTEN-NEEDED 1954 RADIO DIAGRAMS AND SERVICING INFORMATION" compiled by M. N. Beitman. Published by *Supreme Publications*, Chicago. 160 pages. Price $2.50. Paper bound.

The Fourteenth Volume in this series carries schematics of radio receivers made by approximately thirty companies.

Each model described carries a table of alignment procedures, complete schematic, a tube location guide, and special hints for servicing the set.

The models covered in this volume are completely indexed by manufacturer and model number for maximum convenience. A master index covering the entire fourteen volumes in this series is currently available from the publisher.

* * *

"FUNDAMENTALS OF TRANSISTORS" by Leonard M. Krugman. Published by *John F. Rider Publisher, Inc.*, New York. 135 pages. Price $2.70. Paper bound.

This little book has been written for the technician and the amateur in the interest of providing workable information on the transistor without the burden of theory and mathematical concepts.

With this readership in mind the author has offered basic data on semiconductor physics, described and explained transistors and their operation, covered the grounded-base transistor and the grounded-emitter and grounded-collector types, and discussed transistor applications in amplifiers, oscillators, and in high-frequency circuitry.

Careful study of this book will provide the student with a basic foundation upon which to build further study and experimental work. —30—

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

A GREAT DEAL of interest is being shown by small service shop operators in learning how to determine the actual costs of doing business. The larger shops have had to know their costs of operation because payroll, operating, and general overhead expenses would rapidly destroy them if they did not have an accurate knowledge of their costs of doing business to use as the basis for determining their service charges.

The vital importance of knowing the cost of doing business is usually learned the hard way by most technicians who start their own full-time service businesses. As the curve of business failures and closures swung upward during the recent indolent summer months, the statistics included a larger-than-normal number of radio-television service businesses that could not weather the hot season's business drouth.

The failure of a service business does not always indicate that the owner did not get adequate charges for his work. Many factors are involved in the success or failure of a business. Even luck has a hand in it. But perhaps the major cause of seasonal failure is the lack of enough service work, or volume, to keep the business alive. Lacking cash reserves, the service technician is unable to pay the rent, telephone, and other fixed overhead expenses plus living expenses for himself and his family.

A negative business trait that is common among technically-trained men is the feeling they have that adequate business should come to them from a minimum of advertising. Usually this advertising is confined to a listing in the advertising section of the telephone directory. They seldom think in terms of going out and soliciting service work aggressively. Often a service technician will idly watch his business dry up when, with a little imaginative, aggressive promotion, he could keep himself busy—and solvent—on radio and phono service that is just waiting for him to ask for it.

Lately there has been a growing number of quips going the rounds of the industry about TV technicians who are too proud to service radio sets. It is beneath their dignity, they think. As one service manager put it, this type of technician "would rather starve waiting for someone to call him to repair a TV set than to look at a radio set that needs servicing."

Several years ago the Bureau employed some college students to make a house-to-house survey of a residential section of a large city to determine just how much radio, television, and phonograph service work there was available "just for the asking." More than 50% of the home owners interviewed had radio sets they would have liked to have had repaired. About thirty per-cent said they needed service on their radio-phonographs. A number of home owners were so happy to meet someone interested in repairing their radios that they wanted the interviewers to take their sets with them.

This same situation prevails in practically every city, town, and village. Service business operators become so engrossed in the TV service end of the business that they completely overlook the thousands of radio sets and radio-phonos that need everything from a simple adjustment to a major service job.

Parenthetically, a good source of service business that is bypassed by seventy-five per-cent of the technicians who service sets in the home is the automatic record player mechanism. Even major service companies avoid servicing automatic record players whenever they can. They say their regular TV technicians do not understand the changer mechanisms and waste a lot of time trying to repair them. In practically every town a radio-TV service technician who is adept at adjusting and repairing automatic record changer mechanisms could establish a stable, profitable business for himself by specializing in servicing these devices. All he would have to do to establish his business would be to contact television and radio service dealers and offer to handle their automatic changer service work.

It is obvious that there is a very definite relationship between the vol-

unie of service that is handled by a shop and its costs of doing business. The fewer the service jobs, the higher the cost of handling each service call. Where the national average cost per service call of $5.11 is based on the home service technician handling an average of 8 service calls per day, the cost would almost double if the completed call average dropped to 4 calls per day.

Business Foresight

It is probable that there will be a considerable boom in television service during the fall and winter months. During the abnormally hot summer months set owners forgot about TV programs to spend as much time as possible out-of-doors. Normal maintenance of TV sets has been widely neglected and in many cases, home owners quit watching TV when their sets developed major troubles.

The baseball world series, college football games, and a whole new package of television programs that are being introduced will recapture most of this regular television audience that was driven outdoors by the hot weather.

Set manufacturers who have jumped on the bandwagon to produce the large screen, low-cost TV sets that will sell in a price range of from one hundred and twenty-nine to one hundred and forty-nine dollars are gearing up for maximum production. There is a general feeling that many set owners will buy a new receiver in the lower price range rather than have their old small-screen sets repaired — particularly where a new picture tube or a general overhaul of the set is necessary.

However, there are a good many million sets in use that have been in service three years or more. While hundreds of thousands of new sets may be sold in this market as replacements, there still will be a service load that may be beyond the capacity of the presently established service businesses to handle—and give reasonably prompt service.

The cycle of births and deaths of new television service ventures indicates that the majority of new service businesses are started during the November-December period each year when established service businesses are handling their maximum work load. During this period, when field service technicians are pushed by supervisors to increase their daily completed-call averages from eight to ten, many technicians get the notion that television service is a lush bonanza when they turn in from seventy to one hundred dollars a day in collections for service calls completed and tubes and parts used.

The daily receipts of an efficiently managed, properly promoted major television service company during periods of peak work loads provides an illusion of tremendous profit to technicians who do not analyze all of the costs that are involved in developing that kind of service income. No thought

is given to the fact that an effective—and comparatively costly—advertising and promotion program is being conducted to attract a big volume of service customers. Neither is any thought given to the cost of maintaining the expert telephone service for taking the calls; the highly efficient routing control that reduces travel time to a minimum; the purchasing and stock control that keeps adequate supplies, tubes, and parts available; or any of the expert managerial functions that keep the service company working smoothly under a maximum work load.

This illusion of profit leads many good field service technicians to start their own TV service businesses. During the peak season for TV service business they usually keep pretty busy and *handle* lots more money each week than the "take home" pay they received as employed technicians. But the cycle of service starts running out in the spring and by summer the burden of operating at a loss becomes too heavy to carry.

It is a very healthy thing both for the country and for the electronics industry for trained technicians to aspire to own and operate their own service businesses. But it is a very foolish thing for a man to launch a service business when the odds are heavily against his making a success of it. These odds can be changed by careful pre-planning of a service business before it is started and by a thorough and honest self-appraisal of the technician's qualifications for running a service business.

Many expert service technicians have gone into business for themselves with the feeling that their superior servicing talents will bring a host of set owners beating a path to their door. But customers do not buy expert service—they do not know how to evaluate the work of an expert technician in comparison to that of a mediocre technician. The public buys showmanship, personality, and good human relationships.

Electronic service is a major business—big business. Television introduced three factors that created a tremendous potential dollar volume from service. The first of these factors was the necessity for servicing sets in the home wherever possible; the second was a higher incidence of service; and the third was the higher unit value of the parts needed in servicing.

There are now more than thirty million TV sets in service. There are estimates in some quarters that this figure will be increased to about thirty-seven million monochrome and one million color TV receivers by the end of 1955. This will mean an added potential for service business but the injection of color receivers will require a heavier investment in precision, portable test instruments to facilitate receiver adjustments in the home.

While television will create an increasing volume of service business, the bulk of the business will gradually shift into the hands of adequately

financed, capably managed service businesses that through their organizational setups are able to apply the working hours of all of their employees most efficiently.

Television, however, has blinded most service operators to the tremendous income potential that exists on other types of home electronic devices. Although, according to early TV-day forecasters, television was supposed to kill the public's interest in radio, the number of radio sets in service has increased by the millions since TV first started. High-fidelity sound reproduction is gradually seeping into the consciousness of the general public. Manufacturers of hi-fi amplifiers and speakers are carefully exploring distribution methods that will minimize distributor competition on the sale of hi-fi component units to the general public. This phase of the electronics industry is capable of tremendous expansion and it is a type of business that would fit well in the small, well-managed type of service operation.

Now that combinations of popular recordings are being made available on one hour spools of magnetic tape a broader consumer interest in tape recorders will develop. These recordings, practically free from background noise, are ideally suited to reproduction over a high-fidelity sound system.

Among the electronically-actuated mechanical devices that have been developed for general applications, the radio-controlled garage door mechanisms promise unusual opportunities for adding revenue to small and moderate-sized service shops. The prices for these devices have dropped to where the installation of a radio-controlled door system is well within the means of the average middle-class home owner.

Planning a Business

An enterprising television service technician who aspires to operate his own service business should carefully appraise the possibilities for service work in these related electronic fields before starting his business or renting a location for his shop.

One very important factor to consider most seriously is the seasonal fluctuations that play havoc with so many small service businesses. The pattern of seasonal service business variation on television seems to be far more pronounced than it was on radio. This may be due, however, to the fact that television service shops have been inclined to concentrate on TV to the exclusion of all other types of service. Old time successful radio shops, on the other hand, usually promoted battery portable and auto radio service during the late spring and summer months. The business they got on these types of radios served to cushion the hot weather drop in servicing home radio sets.

Major television service companies are turning to air-conditioner installation and maintenance to bolster their

service volume during the period that TV service is at a low ebb. With the prices of room air conditioners steadily dropping it is expected that units will be available next year at a price that will give them a mass market appeal. While the air conditioner sales season is short, it is a fast-moving business. Installation and servicing organizations must be able to expand their personnel rapidly to handle a maximum number of installations when the heat is on.

Other television service businesses promote the sale of radio-operated garage door mechanisms during the winter months and sign up customers for spring and summer installations. Still other service businesses aggressively promote appliance repairs during the TV service dull season to provide operating revenue.

Irrespective of the type of business that is selected to provide income during the summer months, it is vitally necessary that the promotional program to get that business be planned many months in advance.

A well-managed business is one that is operated on a carefully planned program that provides the basis for a reasonably stable volume of business throughout the year. Because of this planning the business will be able to take maximum advantage of the business available during its peak periods and will at least have operating revenue during the periods of normally dull business.

Service businesses that are operated without a definite long-range plan or program drift with the seasonal fluctuations of business and are left stranded when the tide of their normal business runs out.

Automation of Industry

As time goes on you will be reading more and more about the "automation" of industry. The term is a contraction of automatic production, and means a minimization of the use of labor in the processing of all types of products and in assembly operations. Since electronic circuitry will play a vital role in this new trend in manufacturing our own industry will probably pioneer the use of many of the mechanisms developed for automatic production.

While independent electronic service businesses may seldom come in direct contact with the electronic controls developed for automation of industry the end products of this development may bring about many changes in the handling of the servicing of consumer electronic instruments. An indication of the thinking of major set manufacturers about automation of set manufacturing is the recent statement by Paul V. Galvin, president of *Motorola Inc.*, that completely automatic production of television receivers will be accomplished in well under five years.

These "shadows of coming events" should be carefully considered by every technician who is ambitious to build a stable service business that can grow with the industry. —30—

Economy TV Sets

(*Continued from page 69*)

string. Its resistance is reduced gradually as the current flowing through it heats up the resistive material. When this resistor is replaced, be sure to get the exact replacement part and mount it in the same location on the chassis. If it is mounted in a cooler place it may not go down to the correct 43 ohms after warm-up. Mounted near a particularly hot component on the chassis, the resistor may go lower than the correct resistance value, allowing too much voltage for the series heater string.

Other series heater arrangements make use of specially designed tubes. Using only 25, 35, or 50 volt tubes in a receiver allows a much simpler series string arrangement. Another advantage of these new tubes is that their heaters are sturdier and less affected by small variations in current or voltage.

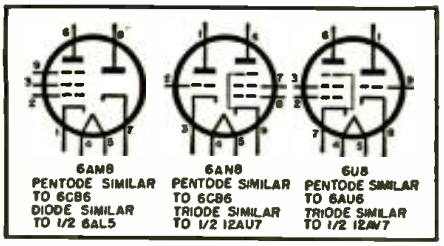
Dual Purpose Tubes

When considering the complete TV receiver circuit we did not provide a detailed description of the new dual-purpose tubes other than to discuss their application. Fig. 6 shows the base-pin connections for three new dual-purpose types. Because only 9 terminal pins are available, both the 6AN8 and the 6U8 pentode sections have an internal connection between the suppressor grid and the cathode. Only the 6AM8 has the suppressor grid brought out separately. Another point to remember is that the pin connections for the three tubes are different; only the heater connections are the same for all three.

The pentode sections of all three tubes are of the r.f., sharp cut-off type. The transconductances of the 6AM8 and 6AN8 pentodes are somewhat higher than that of the 6U8. Also, the 6AN8 triode has more current capacity and less transconductance than the 6U8 triode which is similar to one half of a 12AV7 double triode.

In some receivers, the *Raytheon* model 21T19 is an example, three 6AN8 tubes are used in place of the 6AN8, 6AM8, and 6U8 shown in Fig. 2. One of the triode sections is then connected as a diode and acts as the second detector. A further develop-

Fig. 6. Tube base diagrams of three of the new multiple tubes discussed in this article. The corresponding single tube for each section is given below the tubes.



ment towards tube reduction uses two more 6AN8 pentodes for the i.f. stages and one of the triode sections as vertical oscillator; the remaining triode operates as the horizontal a.f.c. tube. A 6SN7 or similar dual triode can then be used for the vertical output amplifier and the horizontal oscillator. This combination makes a 13-tube receiver possible without sacrificing any of the functions or reducing the performance of the older 18-tube chassis.

Vertical Chassis

The design trend started by the *Crosley* "Super V" 17-inch receivers this year has been adopted by many other manufacturers and vertical chassis are being used in 14-, 17-, and 21-inch sets. Aside from reducing the cost of manufacturing and requiring smaller and cheaper cabinets and simpler assemblies, the vertical chassis design is advantageous for servicing. Fig. 5 gives an idea of how accessible every one of the tubes is even when the set is in the cabinet. Once the cabinet is removed, alignment and troubleshooting are speeded up because everything is visible and easy to reach.

The *Raytheon* 17T18 chassis, shown in Fig. 5, has several interesting features. The picture-tube mask is part of the chassis assembly. The cabinet itself is actually only a large rectangular sleeve, fitting over the assembled chassis, picture tube, and mask. To put the set into the cabinet, the entire assembly is rested on the face of the mask and the cabinet slides over it and fastens onto the mask assembly. Another feature of this model is the use of cloth "wrap arounds" which go over the cabinet to adapt it to different interior colors.

The picture tube of the *Hallicrafters* PT-17 chassis, shown in Fig 5, is supported on the baseboard of the cabinet and its brackets must be unscrewed from the bottom before the assembly can be withdrawn.

The rear view of the *Crosley* model 426 with u.h.f. and v.h.f. tuners is also shown in Fig. 5. A dial-cord arrangement permits tuning the u.h.f. converter through a side control. Since the heater arrangement of this receiver uses the series circuit shown in Fig. 4, a separate heater transformer is added for the u.h.f. converter. In this set the baseboard is not part of the cabinet and can be removed together with the chassis.

Since no power transformer is used in any of the economy sets, the chassis is usually connected directly to one side of the power line with the resulting shock hazard for servicing. In order to avoid shocks and permit connection of test equipment, an isolation transformer must be used between the a.c. line and the TV set. Some of the isolation transformers now on the market have some means of varying the output voltage, at least from 105 to 125 volts. This is a helpful feature for checking low line-voltage operation and for spotting arcing or breakdowns due to excessive line voltage.

Another consideration when servicing the new, series heater TV sets is the necessity for turning the set off each time a tube is changed. Failure to do this may cause heaters in other tubes to burn out.

When a "dead" receiver is serviced, check continuity of the fuse-resistor combination. If it is open, try to locate the short in the "B+" or heater circuit before replacing the fuse since otherwise the second fuse may blow too. A small supply of these new resistor fuses should be maintained for replacement use. It is not good policy to jumper the fuse with a wire after the set is repaired since subsequent shorts may damage the selenium rectifiers.

From the service technician's viewpoint the new economy models present some real improvements in that tubes and parts are more accessible. Cabinet removal is simplified and both size and weight reductions make for easier handling. Less tube types used means that a smaller stock of replacement tubes need be kept for these latest models. —30—

Q.C.W.A. TO MEET

THE 1954 winter meeting of the Quarter Century Wireless Association will be held October 29th at the Hotel Belmont Plaza, 50th Street and Lexington Ave., New York. A talk on single-side band transmission will be given by Don Norgaard, W2KUJ, of Schenectady, N. Y., a research engineer for the General Electric Co. Members and guests will gather for cocktails and dinner at seven o'clock.

Organized in 1947 to foster friendship among ham operators, the Q.C.W.A. now has an active membership of more than 700 and is probably the largest radio club in the world. Full membership is open to amateurs who have held licenses for 25 years or longer. The more-or-less permanent officers are John DiBlasi, W2FX, president; George T. Droste, W2IN, vice-president; David Talley, W2PF, treasurer; and Ralph G. Barber, W2ZM, secretary. The roster includes many prominent officials of the electronic industry, government officials, high ranking officers of the military services, and professional men. —30—

ENGINEERS NEEDED

ACCORDING to word received from Griffiss Air Force Base, Rome, N. Y. the Air Force urgently needs civilian electronic engineers and physicists.

If you have experience or training in electronic research and development or in the installation and maintenance of fixed plant facilities, you are urged to apply for the available posts.

Salaries range from $3400 to $9600 per annum. Free "on-the-job" graduate degree training is offered by Syracuse University College of Engineering.

Address applications to Professional Recruiting Officer, Griffiss Air Force Base, Rome, New York. Additional information regarding the job openings may also be obtained from the same source. —30—

Phono Amplifier

(*Continued from page 43*)

former. One method of connecting the transformer will give a lower volume than the other; the proper connection is the one with the lower volume. After this correct phasing has been established, then (3) return the plate resistor, R_{13}, to the plate of the 6V6 again.

Since the power supply must furnish the negative grid biasing voltage for the 6V6, the power supply design had to proceed through a number of successive modifications before it reached its final form, as shown here in the schematic diagram. Since the entire amplifier is designed to operate at a low volume level, this reduces the plate supply current drain and permits using the smallest possible power transformer. Any one of the standard makes of 250-0-250 volt, 40 milliampere replacement type power transformers will satisfy the requirements. However, since the amplifier requires 40 milliamperes, this leaves no factor of safety in the design; in the interests of safety the amplifier should be operated in its enclosure for a number of hours to check for excessive heating.

When using an output stage having a considerable amount of feedback, as is the case here with the two-loop circuit, it is possible to keep down to a very small level of output hum with only a simple power supply filter. In this application, the filter choke was eliminated entirely, and was replaced by a 500-ohm, 2-watt resistor, R_{14}. The d.c. component of voltage across this resistor is 20 volts, just the right biasing value for the 6V6 output stage. Therefore, this resistor was removed from its usual position in the positive lead and, instead, placed in the negative lead, where the d.c. component of voltage drop will be negative with respect to ground. Then by using a simple RC filter circuit, to eliminate the a.c. components across the resistor, the 6V6 biasing voltage is obtained directly.

The 1800 $\mu\mu$fd. condenser, C_3, at the volume control, R_9, is chosen to give a drooping response at the low frequencies, since the poor acoustic loading presented by most record player enclosures would not permit the extreme low frequencies to be reproduced even if they were present. In the case of adequate speaker loading, the volume level of the amplifier is sufficiently low that even if these frequencies were to be reproduced they would be below the threshold of audibility. As an added consideration, if the response of the speaker in a particular enclosure should be of no value below some particular frequency, trying to force a bass response below that frequency by brute force will either overload the amplifier, or will force the speaker into such excessive motion that the speaker itself becomes a non-linear element, and generates a

whole group of distortion components with attendant cross-modulation.

To take advantage of the clarity furnished by this amplifier, it is advisable to use as husky a loudspeaker as possbile, to help overcome the poor acoustic properties of most speaker enclosures. A well damped speaker with a heavy magnetic structure will be more suitable than an elaborate extended-range unit, since a low value of distortion is more important in this application than is an extremely wide frequency response. With such a speaker, a child's record will be reproduced with a minimum of noise and distortion, and with a maximum of clarity and satisfaction. —30—

SERVICING U.H.F. TUNERS

By DONALD R. WALLOWER

SOMETIMES u.h.f. converters using the *Mallory* tuner shift frequency so extensively that a given station may be received twenty or thirty channels away from the correct point, if at all. If tightening the 6AF4 (or 6T4) oscillator socket contacts does not correct the trouble, the difficulty is probably caused by a coupling condenser in the oscillator circuit.

The ends of two small plates are soldered to pins 1 and 7 of the 6AF4. Soldered across their opposite ends is a small rod which is enclosed in ceramic. This, in turn, has a foil wrapped about its center to form a condenser. A tab from the tuner is soldered to the foil to provide feedback to the grid. Because movement of the oscillator tube places a mechanical strain upon the soldered connection to the foil, excessive movement can cause the foil to tear. This trouble can be corrected by resoldering the break. It is necessary that the foil make a complete and rigid circle about the ceramic to prevent mechanical movement, which would cause a frequency shift. Extreme care must be exercised while soldering, since too much heat will melt the foil. If some of the foil is missing, wrap several turns of very fine wire around it. This will give it mechanical rigidity and permit the solder to "take." The whole operation should only take fifteen to twenty minutes.

Here is a step-by-step procedure:

1. Remove the bottom plate from the compartment which encloses the oscillator tube base.

2. Unsolder the ground end of the 10,000 ohm resistor which comes from the oscillator trimmer.

3. Loosen the trimmer by unsoldering it from pins 2 and 6 of the socket, and move it toward the center of the chassis.

4. Resolder the tab and foil as outlined.

5. Replace the trimmer. Make certain it is straight and in line with the adjustment hole in the side of the compartment.

6. Resolder the ground end of the 10,000 ohm resistor.

7. Replace the cover.

8. Allow the converter to warm up. Connect it to a receiver set for channel 5, and set the converter dial to the channel number of a local u.h.f. station operating at the upper end of the band.

9. Adjust the oscillator trimmer until the station is received at this point. Use a non-metallic screwdriver.

10. Check for proper tracking. —30—

NEW EQUIPMENT FOR THE AUDIO TECHNICIAN

MAGNAVOX AUDIO SYSTEM

The Magnavox Company, Fort Wayne, Indiana is now offering a line of audio components which is available to the custom-built market.

The system includes a three-speed automatic record changer, an AM-FM

tuner, a newly-designed preamplifier and control unit, and a choice of two amplifier and speaker systems.

The lower priced of the two amplifiers, a 20-watt push-pull model, drives a four-speaker system consisting of a 12" woofer, a 12" mid-range unit, and two 5" tweeters. The more expensive amplifier, a 20-watt push-pull parallel transformer-coupled type, operates a three-speaker system utilizing two heavy-duty complementary 12" speakers and a horn-type tweeter with sound diffusers and an efficient crossover network.

System response is ± ½ db from 30 to 15,000 cps. Both systems provide a choice of corner or rectangular speaker enclosure in mahogany cabinets.

JENSEN "CONCERTO"

Jensen Manufacturing Company of Chicago is now offering a two-way system with separate woofer and tweeter housed in a compact enclosure suitable for small apartments and other areas with limited space.

The Model CT-100 "Concerto" in-

corporates the new P12-NL 12" speaker which has been especially designed for the system. In combination with the bass reflex cabinet, the system provides full bass response. A new RP-102 high frequency unit handles the frequencies above 2000 cycles. A high-frequency balance control is located on the side of the cabinet to adjust the high-frequency response to the particular room acoustics and personal preference.

The "Concerto" is available in mahogany or blonde korina veneers.

NEW CERAMIC CARTRIDGE

The *Webster Electric Company*, 1900 Clark Street, Racine, Wisconsin has added a new ceramic cartridge to its "Featheride" line.

Known as the Model GX, the new unit is a lightweight, single needle cartridge that will withstand heat and humidity. It develops .6 volt at 33⅓ rpm and .8 volt at 45 rpm with 7 grams tracking pressure and a cut-off frequency of 10,000 cps. The model GX fits any standard ½" RETMA mounting, the *RCA* 45 rpm or the *Columbia* 33⅓ rpm record players.

NEW MASCO EQUIPMENT

Among the new items recently introduced by *Mark Simpson Mfg. Co.* of

Long Island City, New York is the Model CM-8 8-watt amplifier, a compact, moderately-priced unit.

Other new units include the "Econofone," a low-cost, dual-purpose intercom system; a "multiplier" for easy transformation of the company's "Midgetalk" and "Small Talk" two-station intercom systems into multi-station intercoms; a 12 and 24 station deluxe intercom; a new 15-watt mobile amplifier, and a 27-watt phono-top amplifier.

Complete specifications on any of these units are available from the company.

REMOTE-CONTROL SPEAKER

Motorola Inc., 4545 W. Augusta Blvd., Chicago 51, Ill. has added a remote-controlled speaker to its line of audio equipment.

Designed as a companion piece to the company's Model 54HF1 table model unit, the new unit features an independent volume control and a 30 foot extension that connects to a

speaker jack built in the phonograph.

A 6" speaker is mounted toward the front of the cabinet behind a screen fabric. The speaker, itself, is matched with the 8" woofer and 6" tweeter found in the set. It gives three-speaker full sound reproduction.

AUDIO CONTROL

ElectroSonic, 7230 Clinton Road, Upper Darby, Pa. is offering a new audio control unit which has been tradenamed the "Fidelitrol."

This simplified control is provided

with three knobs and a selector switch yet offers complete flexibility of control, with automatic full compensation, adjustable to the individual's preference. Response is ± 1 db from 15 to 50,000 cycles at a distortion of less than ½ per-cent.

The unit is self-powered and easy to install. It is supplied with or without a cabinet. A four-page data sheet on the "Fidelitrol" is available on request.

NEW ASTATIC MIKE

The Astatic Corporation, Conneaut, Ohio has added a new convertible hand and desk stand type unit to its microphone line.

Tradenamed "The Gold Standard" because of its gold finish and self-supporting standard or easel which recesses into the back of the die-cast metal case, the new unit has a frequency response of 30 to 10,000 cps in the crystal version and 30 to 8000 cps in the ceramic model.

The crystal unit has been designated as the Model M302 while the ceramic mike is catalogued as the M301.

TAPE CONSOLE

The *Crestwood Recorder Division* of *Daystrom Electric Corporation*, Poughkeepsie, N. Y. has introduced a new line of console tape recorders for the home.

Both the company's push-button "300" and the "Hi-Fi 400" series recorders are offered in wood cabinets. Wood tones currently available include walnut, mahogany, and korina blonde. The console units contain extended-range dynamic speakers, fully baffled for complete range music reproduction. A 10-watt amplifier provides adequate volume for the full range of 30 to 13,000 cps ± 2 db of the "400" series.

"PORTA-VOX" SPEAKERS

Porta-Vox Co., a division of *Detroit Industrial Products Co.*, 15244 Aubrey Ave., Detroit 23, Michigan, has introduced a new series of remote control

speakers designed to be used with TV sets, tape reproducers, record players, and radio receivers.

Each unit in the series features a 4-position switch and volume control which permits four different speaker combinations each with volume controllable from your chair. Both the "Custom" and "Standard" models are housed in wood cabinets. The "Custom" measures 6" high, 12" wide, and 8" deep while the "Standard" unit is 6" high, 6" wide, and 4" deep. The "Custom" cabinet houses a 5" *Alnico* speaker in a bass reflex, acoustically treated enclosure. The "Standard" also uses a 5" dynamic speaker.

PUSH-BUTTON TAPE RECORDER

A new, low-priced push-button tape "Recordio" has been announced by the *Wilcox-Gay Corporation* of Charlotte, Michigan.

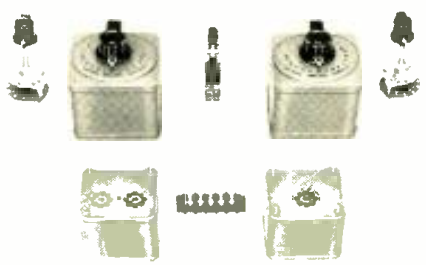
The Model 4A10 is a portable unit with dual speeds and dual tracks. It records at 3¾" and 7½" ips and uses all size reels up to 7" in diameter. Maximum recording time at 3¾" speed, using a 7" reel, is two hours.

All recording, playback, and winding functions are controlled by a keyboard. Although the unit measures only 13⅜" wide x 14¼" deep x 9" high, tape storage compartments are provided at the rear of the machine along with space for the microphone and built-in a.c. line cord.

AUDIO GEAR

Hycor Co., Inc. of 11423 Vanowen St., North Hollywood, California has announced the availability of its Model 4200 sound effects filter and Model 4201 program equalizer units in component form.

In addition to the flexibility of installation, all features and characteristics of the company's standard models are retained. The high and



low sections of either model may be obtained separately. Complete wiring instructions are included.

Bulletin TB-4 gives complete information and specifications on the kits and is available on request.

NEW PHONO UNIT

Packard-Bell Company of Los Angeles has introduced a new line of phonographs, the featured model of which is the 6P51 console.

The 6P51 incorporates three speakers, a 12" concert-type woofer and two hard-cone 5" tweeters. Frequency response is 15 to 30,000 cycles. Variable tone controls allow bass and treble to be boosted or attenuated

to handle the different recording curves. The record compensator has four switch positions, providing a playback response to match the recording characteristic.

The record changer is the English "Collaro" unit equipped with a variable reluctance cartridge holding two sapphire-tipped needles.

The console is available in mahogany and blonde oak. It is 34¼" wide, 18¼" deep, and 36½" high.

CORNER HORN CABINET

G & H Wood Products Co., 75 N. 11th St., Brooklyn 11, N. Y. is now in production on the "Cabinart" KR-5, a 20" Klipsch-designed corner horn speaker enclosure.

This new unit may be wall-mounted, corner-hung, placed on a shelf, a

bench, a table, or any other convenient location. Each unit is equipped with a handle so that it may be carried from place to place. The finished model, available in honey walnut on walnut, French mahogany on mahogany, blonde mahogany, black lacquer, and leatherette, has a 12" cut-out with an 8" plate. The dimensions are 16⅝" wide, 14" deep, and 21" high. It is also available in two unfinished utility models.

AMPRO TAPE RECORDER

A flexible, two-speed tape recorder which provides both long play and broad sound fidelity range has been introduced by *Ampro Corporation*, 2835 N. Western Ave., Chicago, Ill.

Called the "Hi-Fi Two-Speed," the new unit records and plays at either 3¾ or 7½ ips. The slower speed provides up to two full hours of playing and recording time, double that of the 7½ ips speed. The higher speed provides the extended frequency range needed for recording music.

Frequency response at 7½ ips is from 40 to 12,500 cps. At 3¾ ips response is from 40 to 6000 cps. The instrument features an all-electronic "piano key" control system.

REGENCY PREAMP

A self-contained audio preamplifier with maximum equalization flexibility has been added to the *Regency* line by *I.D.E.A., Inc.* of 7900 Pendleton Pike, Indianapolis 26, Indiana.

The new unit is housed in a mahogany or blonde cabinet measuring 16" long, 4¾" high, and 7½" wide. The

control panel of gold-like satin finish accentuates the wood finish.

Full details on this Model 350-P are available from the company.

NEW MAGNETIC TAPES

"Scotch" brand magnetic tapes No. 111 and "High Output" No. 120 are now available on high-strength polyester backing as well as on conventional acetate backing, according to *Minnesota Mining and Manufacturing Co.* of St. Paul.

Magnetic characteristics are the same as the acetate tapes but are recommended for recording applications where extreme toughness and resistance to effects of temperature and humidity change are required.

BOZAK COAXIAL SPEAKER

The R. T. Bozak Company of Stamford, Conn. is now delivering a new coaxial speaker assembly, the B-207A, comprising one B-188A woofer, one B-200X dual-tweeter, and a 4 μfd. crossover filter, ready-wired and attached to a cast-aluminum mounting ring. Dimensionally, the complete unit is the equivalent of a conventional 15" speaker and will fit behind cut-outs for either 12" or 15" loudspeakers.

Response is flat from 40 to 16,000 cps and useful beyond 20,000 cps. Impedance is 8 ohms. The power rating is 15 watts but the speaker will handle 30 watts. —30—

Within the Industry

(Continued from page 30)

MANUFACTURING CORPORATION has been formed at 6059 W. Belmont Ave. in Chicago to manufacture a new line of bobbinless precision wire types of resistors. The firm plans to make a line of resistors, condensers, etc.

* * *

DAVID S. COOK has been promoted to the post of advertising manager of the radio-television division of *Stromberg-Carlson Company.*

He has been sales promotion manager since 1946 and now assumes the position formerly held by S. H. Manson, newly-appointed director of public relations for the company.

Mr. Cook joined the company in 1943 as editor of the company's employee publication, the *"Speaker."* —30—

"Bootstrap" Interval Timer

(Continued from page 53)

of current into C_3 could damage the 2D21, resistor R_5 is employed to limit this current to a safe value.

When the power switch, S_1, is closed and time has been allowed for the tubes to come up to operating temperature, the voltage at the cathode of V_{1B} (and thus at the grid of V_2) will have reached a value positive enough to allow firing of V_2. Relay RL_1 is then energized (contacts 2 to 3 and 5 to 6) and the timer is prepared for the start of a timing sequence. One side of the output receptacle now connects directly to the power line while the other side is disconnected from the power line by the right-hand section of relay RL_1. The output receptacle thus receives power only when RL_1 is de-energized.

Assume that the timer has been turned on and the tubes are warmed up, the range switch is in position "B." and the timer dial set at 30 seconds. The "C-T-F" switch is set at "T" to allow normal timer operation. When the push-button is depressed, the following sequence of events takes place:

The grid of V_{1B} is connected through RL_1 (contacts 2 to 3), through the push-button switch S_2, through the "C-T-F" switch, S_1, to the minus 150-volt supply. This places a short circuit around C_4 and C_5, immediately discharging them. Since both the grid and the cathode of V_{1B} are now returned to the minus 150-volt supply, the tube will conduct an amount determined by the self-bias developed across cathode resistors, R_7 and R_8. This will approximate 15 volts and will place the cathode of V_{1B} at about minus 135 volts. This voltage, coupled to the grid of V_2, is negative enough to prevent firing of that tube. RL_1 is thus de-energized immediately upon depression of S_2. The right-hand section of RL_1 now connects power to the output receptacle and the timing interval has begun. Note that the left-hand section of RL_1 has broken the push-button circuit so that the length of time S_2 is depressed is not critical.

The charging condensers, C_4 and C_5, now begin to charge up toward the cathode voltage of V_{1B}, and since this rise in grid voltage causes an almost equal rise in cathode voltage (because of cathode-follower action), a linear increase in cathode potential occurs. At the end of 30 seconds (for this particular dial setting) the cathode of V_{1B} and the grid of V_2 have reached a voltage sufficient to allow V_2 to fire. This, of course, causes current to flow through the relay winding and removes power from the output receptacle. The contacts of RL_1 are now in the energized position and the timer is ready for the push-button to begin another timing sequence. It is apparent that if the range switch had been in the "A" position, the charging capacity would have been only one-fifth as great, and

the timed interval would also have been only one-fifth as long. Note that 30 seconds on the "A" scale corresponds to 6 seconds on the "B" scale, etc. This 5 to 1 ratio between the two scales is true except on the lower end of the dial where the small effects of the V_2 grid and plate time constants become appreciable.

It is also clear that a larger setting of R_3 would cause a longer RC time constant and lengthen the timed interval.

Power may be removed from the output receptacle any time after a cycle has begun by switching the "C-T-F" switch to "C" (Cancel). This places ground potential on the grid of V_{1B}, brings its cathode slightly more positive than ground and fires V_2, removing power from the output receptacle.

Notice that in the "F" (Focus) position of the "C-T-F" switch, power is continuously applied to the output receptacle.

As V_{1B} ages, the circuit will "bootstrap" less efficiently and the timed intervals would tend to exceed the dial indications. However, this tendency toward excessive intervals is effectively counteracted by using the other half of the 12AU7, V_{1A}, as the negative supply rectifier. As V_{1A} ages, the negative voltage it produces will be reduced. Since this negative voltage is the starting point from which the charging cycle begins, the effect is to shorten the time required to reach V_2's firing potential. As a result, the effects of aging in the two sides of the 12AU7 are in direct opposition and will, to a large extent, cancel. The author tried many 12AU7's of all ages in the circuit and found little deviation in dial calibration due to tube aging, whereas with a selenium rectifier in place of V_{1A}, the effect of tube aging in the "bootstrap" circuit was serious.

Figs. 4 and 5 show the parts layout. The heaters of the two tubes and the dial lights are supplied by an ordinary 6.3 volt filament transformer having a one ampere output rating. All parts, including the wrinkle finished case, are available through most radio parts suppliers. The author was able to obtain many of the parts from a local surplus dealer. The relay, RL_1, for example, was a plate-current-operated unit from an APN-1 altimeter. The only change necessary was the substitution of double-pole, double-throw contacts. Any good 117 volt relay with d.p.d.t. contacts will work. Also obtained from surplus equipment were the charging condensers, C_1 and C_5. C_5 is a 600 volt, 1 μfd. paper condenser while C_1 actually consists of two 600 volt, 2 μfd. oil-filled units connected in parallel. It should be pointed out that C_1 and C_5 must be either oil or paper condensers if the builder wants maximum stability, since electrolytic types will usually change value considerably under varying conditions. The wrinkle finish cabinet is available at small cost from most radio jobbers (the author used a *Bud* No. C-1584 to accommodate a 7" x 6" x 2" chassis). Power is

supplied to the chassis through a standard TV-type "cheater" cord receptacle.

But whether you dig through the junk box out in the garage or buy the parts brand new from a gleaming showcase, the "bootstrap" interval timer is guaranteed to produce that swell of pride that comes with building and owning a really accurate electronic device. —30—

Communication Set

(*Continued from page 46*)

If you have not already wired in the headphone jack circuit (which consists of condenser C_{21} and the jack J_1) do so now. With the headphones plugged in, the volume will sound about the same as if you were listening to the speaker. Increasing the capacity of C_{21} to .002 μfd. or larger will increase the output, but will also make the set sound more "bass," an undesirable quality in communications work.

At this point, we've checked out everything in the set except the noise limiter. This limiter makes no pretense at being the world's *best*—just the *simplest*, consisting of one of the two diodes in the 12SQ7 connected to the grid of the 50L6. This is an old trick, was used in a commercial communication set of several years ago, and is used today in a popular kit. Despite its simplicity, it will knock the tops off ignition noise bursts and similar sounds and is well worth the small amount of extra trouble to wire it in.

The leads to and from the switch, S_2, of the noise limiter are shielded as are the "hot" (ungrounded) leads between the volume control and other components. This may be an unnecessary precaution but worth doing to head off possible hum.

With the data given, troubleshooting should be at a minimum. However, voltages are given on the diagram at various key spots, so that with a voltmeter you can track down errors if the signal tracking methods don't do it. Note that the voltages were taken with a 1000 ohm-per-volt meter—with the exception of oscillator voltage on pin 5 of the 12SA7 (which should be about 4 volts) and the a.v.c. voltage (which will range between 2 volts and 8 volts—depending upon the signal). These voltages are best measured with a vacuum-tube voltmeter.

One more thing, the tuning condenser on the "converter-completer" should not move around or it will throw tuning off in the converter. One practical way to "anchor" it is to force the knob as tight as possible to the panel before securing the knob to the shaft. If a large knob is used there will be sufficient friction to discourage any movement which you do not want.

Those of you who take the time to build this unit will find the results rewarding. For low cost and a few hours' work the builder can acquire a communication set that is truly worthy of the name. —30—

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69 (bottom left)	Crosley Division
69 (right)	Hallicrafters Company
71	Berlant Associates
72, 73	Brociner Electronics Laboratory

ADDENDUM

Some of our readers have experienced difficulty in purchasing the 1B85 thyrode called for in the parts list accompanying the article "A Simple Geiger Counter" (July 1954). The tube is manufactured by Victoreen Instrument Co., 3800 Perkins Ave., Cleveland, Ohio and is listed in the current Allied Radio Corporation catalogue. It can be ordered from Allied at 100 N. Western Ave., Chicago 80, Ill.

Classified

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RADIO ENGINEERING

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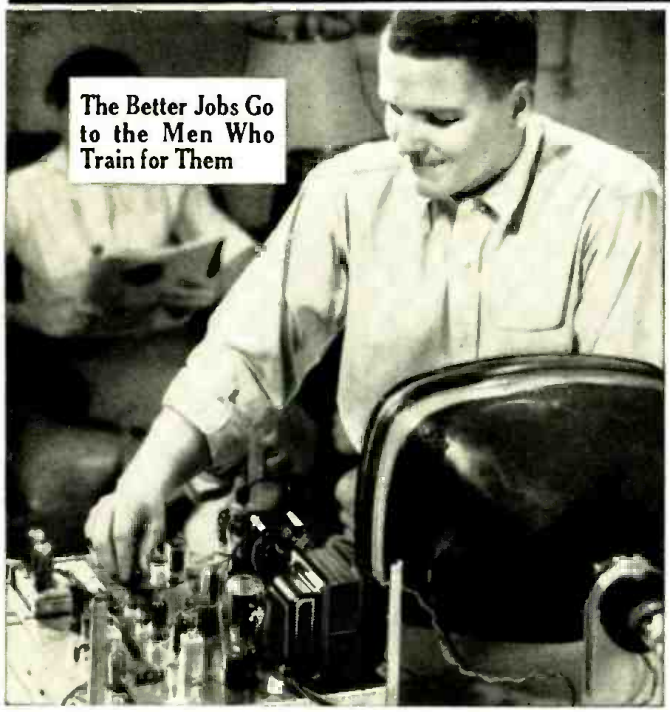

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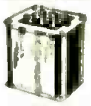

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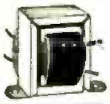
6.3 Volt 3¼ Amp



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IMPORTANT: Ship your old tube with order prepaid only. If you return your old tube, use Dud return prices. All prices F.O.B., N.Y.C. Add shipping charges.

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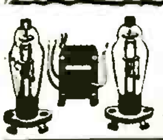

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Crkt Bkr Fuse & Mtg Clips. . 3/$1; 20/$6

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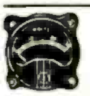
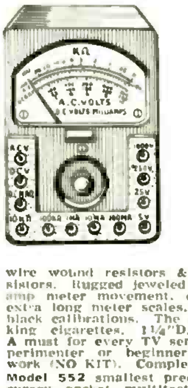


50% OFF REG RESALE PRICE
0-1MADC 3½" RND/MR35-W001DCMA/$8.33 Reg. . $3.95
0-5MADC 3½" RND/MR35-W005DCMA $8.33 Reg. . $3.95
0-100MADC/3½" RND/MR35W $3.95
0-30VDC 2½" RND/Aircraft "AN". . $2.98
0-800VDC Weston 301/3½" SQ/1000R-Per-Volt/$25.00 List $8.95
0-1500VDC 3½" RND $12.95 Reg. . $5.95
0-150VAC/Westinghouse 3" SQ. . . . $4.95
120-0-120ADC with-Shunt; "AN" . . $4.98

"TAB" THAT'S A BUY

NEW SCOOP SHEET

Just off the press. "TAB" scoop sheet. Tools, portable radios, audio equip., radio parts & equipment. All items way below usual Bargain Prices. Write for the "TAB" scoop sheet.



NEW POCKET AC-DC VOM

MODEL 727C MULTITESTER

$9.99

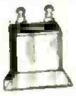
(+ 25c Ship. In U.S.A.) 1000-ohms per/volt

Reads AC & DC volts, 0 to 5, 25 250&1000 volts. DCMA: 0 to 1, 10, 100MA ohms: 0 to 10K & 100K Hi-Accuracy—1% wire wound resistors & Hy deposited resistors. Rugged jeweled D'Arsonval microamp meter movement, excellent damping, extra long meter scales, with vivid red & black calibrations. The size of 2 packs of king cigarettes. 1¼"D. 4⅝"L. 3¼"W. A must for every TV serviceman, ham, experimenter or beginner. Built ready to work (NO KIT). Complete with test leads.

Model 552 smallest precision built Hi-Accuracy pocket multitester 1% deposited carbon resistors, jeweled D'Arsonval microamp meter movement. Xtra long meter scale. AC & DC volts: 0-10-250 & 500V. DCMA: 0-1 & 250MA. Ohms: 0-100K. Miniature size 1½"D. 4"L. 3⅛"W. With test leads $6.99, plus 25c for shipping U.S.A.

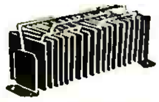
NEW "TAB" IMPORTED. Sold on money back guarantee. Schools & colleges write for qty. price & descriptive data.

OIL CONDENSERS NEW WAREHOUSE LIST



.00025MFD 25KV . . . . $4; 2/$7
.0016MFD/15K . . . . . $7; 2/$12
2X.1MFD 2000V $1.39; 2 for $2
.5MFD 600V . . . . . 25c; 6 for $1
.5MFD/1500V . . . 85c; 3 for $2
1MFD 500V . . . . . 33c; 4 for $1
1MFD 600V . . . . 39c; 3 for $1
2MFD 600V . . . . 59c; 5 for $2
4MFD/3000V . . . . $7.98; 2 for $14
4MFD/5000V . . . . $19.95; 2 for $35
5MFD 600V . . . . $1.50; 3 for $4
16MFD/600VAC/1800VDC $5.95; 2 for $10
10MFD/600V 2x2.5&5MFD $1.98; 12/$18
Write for Quantity Price

NEW SELENIUM RECTIFIERS ENGINEERED FOR INDUSTRIAL USE "TABTRON" FULL WAVE BRIDGE*



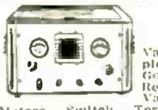
We specialize in power rectifiers to your specifications. Contact "TAB" for fast delivery on any rating. from one amp up to and above 1000 amps. convection or fan cooled. Single or 3-phase to your spec's. Magamp rectifiers also.

Max Amps	18VAC* 14VDC	36VAC* 28VDC	72VAC* 56VDC	130VAC* 100VDC	144VAC* 118VDC	266VAC* 217VDC	C.T. 30VAC 12VDC	3 PHASE BRG. AC/DC 120/150	3 PHASE BRG. AC/DC 240/30
1	$ 1.40	$ 2.40	$ 4.60	$ 8.50	$12.75	$22.25	$ 2.10	$14.90	$28.95
2	2.10	3.00	6.00	10.50	15.75	28.85	Q	15.90	30.95
2½	3.00	4.20	8.00	13.00	18.75	31.85	Q	Q	Q
4	3.75	7.50	14.50	22.25	26.75	38.85	2.95	18.90	36.95
6	4.50	9.00	17.50	33.00	34.75	54.85	3.25	20.90	39.95
10	6.60	12.75	25.00	42.50	44.75	84.85	4.75	36.90	71.95
12	8.20	16.25	30.00	46.00	54.75	99.85	5.95	41.90	81.95
20	13.25	25.50	49.00	79.50	82.75	160.85	7.95	50.90	97.95
24	16.25	32.50	58.00	86.50	94.75	190.85	9.95	89.90	159.95
30	20.00	38.00	72.00	121.50	128.75	235.85	Q	117.90	225.95
36	25.00	48.50	88.00	158.50	165.75	295.85	14.95	134.90	269.95
50	32.00	62.50	Q	189.75	195.75	405.85	23.95	179.90	359.95
100	60.00	120.00	Q	380.75	390.75	795.85	39.95	359.90	719.95

NEW RECTIFIER & TRANSFORMER

up to 14VDC at 12 amps. $19.98
up to 28VDC at 4 amps. 14.98
up to 28VDC at 12 amps. 29.98
up to 28 VDC at 24 amps. 63.98
up to 28VDC at 50 amps. 127.00

NEW HIGH CURRENT PWR SUPPLIES GTD*



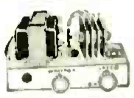
Variable 0-28VDC. Completely Built. Ready to Go. Full Wave Selenium Rectifier. Transformer, Variac. Volt & Amp Meters. Switch. Terminals & Fuse. In Hvy Dty. Steel Cabinet. Standard 115V 60 cy input. 220V to order. * One Year

Stock Number	Continuous Rating	With Meters
T28V5A	0-28VDC at 5 Amp	$47.75
T28V12A	0-28VDC at 12 Amp	89.00
T28V24A	0-28VDC at 24 Amp	129.50
T28V50A	0-28VDC at 50 Amp	239.50
T2V2A	Bat 2V Charger	3.98
T6V4A	Bat 6V Charger	5.98
T12V2A	Bat 12V Charger	9.98

NEW RECTIFIER XFMRS

Primary 115V 60 Cyc
Sec 18-15-9-0-9-15-18V
4 Amp . . . . $ 8.65; 2/$15.75
12 Amp . . . . $16.65; 2/$29.95
24 Amp $35.75; 2 $69.95
50 Amp . . . . $ 59.00; 2/$112
100 Amp . . . . $108.00; 2/$210
18 Volt only 2 Amps. $1.98
2X 12Volts/2A or 12V/4A or 24V/2Amp $3.59; 3/$10; 12/$36

NEW DC POWER SUPPLY GTD

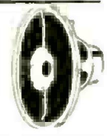


Variable DC Power Supply. Full Wave Rectification. 6000Mfd filter Condenser. fused. Rated 6.3V or 12.6V at 2 amp. operates 115V/60 cy. Model 2DCF . . . $12.98
As above except 4 amp. Model 4DCF . . . $20.98

NEW RECTIFIER CHOKES

CH07/4 Amp .07HY/.6RES/10# . . . $7.95
CH01/12 Amp/.01HY/.1RES/12# . . 14.95
CH004/24 Amp/.004HY/.025R/20# . 29.95

HI-FI SPEAKERS



All 8 ohm, V.C., Alnico V Magnets, Inbuilt Network. 2 wires needed for HF & LF Response. Famous Hi-Fi Speaker Mfrs.
15" Coaxial PM & 5" Tweeter. 25 watt/20-17500 cy. Model P25CO. $23.75
12" Coaxial PM & 3½" Tweeter. 12 watt/45-15KC Spec. . . . $12.75; 3 for $35
8" Coaxial PM & 2½" Tweeter. 8 watt/70-15000 cy. Model P8CO. . . . $7.98; 2/$15
12" HI-FI PM 10 watt 35-14kc. $9.95
8" HI-FI PM 7 watt/45-14kc. $7.25

AUDIO COMPONENTS

GE RPX050 Orig. GE Box. $6.69
GE RPX040/78 Goldtone $5.25
GE RPX041/MG Goldtone $5.25
GE RPX052/Dual (D&S) $17.75
GE RPX053/.001 & .003 diamonds. Reg $34.05; "TAB" Gtd. $25.98

"TAB" GTD Phono Needle Replacements
RPJ010 Dual .001 & .003 sapphire. . $1.69
RPJ012 Dual .001 & .003 diamonds. $20.89
RPJ001/78 or RPJ005 .001 sapphire. $1.35
RPJ003/78 or RPJ004/LP diamond. . $10.89
RPJ013 Dual diamond & sapphire. . $12.89
GTD Replacement needles all make phonos, except GE listed above, specify model.
MGor78 single osmium. . 59c; 12 for $5.98
MGor78 single sapphire styli. $1.35

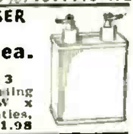
TOGGLE SWITCHES

SPDT 15A/125V Center Off—AN3022-1B 69c; 5 $2.50
SPST 5A/125V used. LN 4 $1
SPDT 15A/125V Center Off Mom. . . 79c; 3/$2.00; 20/$10
SPDT 15A/125V AN3022-3B Ea. 59c; 3 $1.25; 30/$10
DPST 20A/125V AN3027-2B Ea. 69c; 5/$2.50; 25 $10
DPST 3A/125V AH&H . . . . 3/$1.00; 20 $5
DPST 5A 125V BKLT CSD. . . 49c; 3 $1.20
3PDT 22A/125V C'Hammer. $1.49; 2 $1.98
4PDT 10A/125V. . $1.98; 3/$5.00; 20 $30

PRECISION LABORATORY POTENTIOMETER

Wire wound 20,000 ohm 2¾" Diameter/4" shaft. Special. . . . . . $1.98; 2/$3.50
HELIPOT 100-ohm/0.5%/10 Turn. . $7.98
HELIPOT 2000-ohm/0.5%/10 Turn. $7.98
MICROPOT 20,000-ohm/0.1%/10T. . $7.98
HELIPOT 30,000-ohm/0.5%/10T. . . $7.98
HELIPOT 50,000-ohm/0.5%/10T. . . $7.98

GTD. OIL CONDENSER SPECIAL



10 MFD $1.75 ea. 600 VDC lots of 3

Case dimensions, not including insulators 4⅛H x 3¾W x 1¼"D. Smaller Quantities, special $1.98

U. S. A. INFRARED SNOOPERSCOPE

Includes portable light weight M-1 vibrator power supply compact only 4 lbs. operates (2) 1½V or 3VDC battery. Delivers DC 4000V & taps at 600. 100 & 15V; includes new 1P25 Infrared tube. $100.00

BRITISH SNOOPERSCOPE

See-in-dark 2" diameter image converter tube Hi-sensitivity Willemite screen data & tube & M-1 vibrator supply. $29.95
M-1 vibrator 4000VDC power supply. $21.95
British Snooperscope tube . . . . $ 9.98
Br. Snooperscope & pwr kit $13.98

G.E. POWER RELAY

Heavy duty electric relay 3PST/NO. Contacts rated 50 amp; input 220V/1-Phase/60 cyc. Usable Transmitters. Power Circuits or Motor Starting. And motors up to 25 HP. G.E. Price $72.
"TAB" SPECIAL. . . . . $18.00; 6 for $98

SOCKET ASSEMBLIES

½" Jewel Bayonet Socket Light Dimmer (Shutter). Reg. 97c. **33¢ EA.**
Dialco 31101 Pilot Light 1" Jewel High Polish Finish. Reg. $1.03. SPECIAL. 85c; 3 for $2; 10 for $5
Neon Panel Light Dialco 95408 Red/Amber/Clear. . . . . 81c 12/$8
Lamps 40-41-44-46-47. . . . 10/79c

NEW "LENK" 180 Watt Perfect Balance SOLDERING GUN

No other soldering gun offers all these features at any price. 115VAC 180 Watt. light weight 28 ozs., swivel 180 deg. Kordless Tip. Heavy Duty Transformer. Positive Trigger-easy action. $7.45

NEW FAMOUS MAKE GUNS GTD
TAS-4 soldering gun 135W. $7.89
TAS-5 soldering gun 250W. 8.77
TAD-4 dual heat 100-150W. 9.65
TAD-5 dual heat 200-275W. 10.53

TUBES

"TAB" TESTED & GUARANTEED
PRICES SUBJECT TO CHANGE
WRITE FOR COMPLETE LISTING

Type	Price
OA2	50.88
OA3/VR75	1.04
OB2	1.37
OB3/VR90	.96
OC3/VR105	.92
OD3/VR150	.92
1B3/8016	.80
1B22	1.82
1B23	8.87
1B24	8.98
1B26	2.24
1B27	11.98
1B32/532A	2.48
1B35	9.15
1B37	14.87
1B38	29.45
1B41	49.95
1B42	17.48
1B46	1.98
1B63	45.00
1D21 SN4	3.89
1L4	.48
1L6	1.35
1LD5	.98
1LN5	.78
1R4	1.29
1R5	.59
1U4	.52
1U5	.54
1X2A	.98
2A4G	1.18
2C36	27.00
2C39A	26.98
2C40	4.98
2C43	17.48
2C44	1.15
2C51	3.88
2D21	1.18
2E31	1.49
2E43	1.49
2J31	27.00
2J32	29.48
2J33	27.00
2J34	24.98
2J37	12.70
2J38	69.98
2J39	6.98
2J42	148.98
2J48	24.45
2J49	84.00
2J50	99.98
2J51	238.98
2J55	84.98
2J56	149.00
2J62	49.45
2K22	23.48
2K23	11.48
2K25	28.49
2K25/723AB	23.88
2K28	27.48
2K29	22.88
2K33	219.48
2K39	134.99
2K41	128.00
2K48	99.48
2X2	.42
3B22	2.48
3B23/RK22	4.95
3B24	4.70
3B25	4.39
3B26	3.70
3B28	7.90
3C22	85.00
3C23	8.67
3C31/C1B	3.45
3C33	9.51
3C45	9.88
3D21A	8.15
3022	13.97
3D23	4.90
3E29	14.49
4C35	21.49
4D21	18.99
4E27	22.49
4J22	129.51
4J31	99.51
4J52	199.99
EL5BNO	15.99
5C21/C6J	9.89
5C22	38.95
5021	14.98
5J29	11.92
5R4GY	1.20
5R4GYW	1.75
5U4	.55
5V4G	.95
5Z3	.99
6AG5	.71
6AG7	1.14
6AH6	1.21
6AJ5	1.40
6AK5	.87
6AK6	.92
6AL5	.48
6AL7GT	.98
6AN5	3.27
6AQ5	.52
6AQ6	.81
6AQ7GT	1.29
6AR6	3.27
6AS7G	3.48
6AT6	.54
6AU5GT	1.10
6AU6	.56
6AV5GT	.98
6AV6	.49
6AW6	1.09
6B4G	1.18
6BA6	.54
6BA7	1.09
6BC5	.63
6BC7	1.23
6BD6	.83
6BE6	.54
6BF5	.98
6BG6G	1.58
6BH6	.63
6BJ6	.69
6BK7	1.58
6BL7GT	1.19
6BN7	2.69
6BQ6GT	1.20
6BQ7	1.65
6C21	24.50
6C4	.52
6C5	.68
6CB6	.59
6CD6G	1.69
6D4	2.70
C6J/5C21	9.89
6J4	6.66
6J5	.54
6J6	.58
6K4A	3.68
6L6	1.48
6L6G	1.08
6L6GA	1.08
6L6GAY	1.98
6SA7GT	.66
6SC7	.90
6SF5	.78
6SG7	.64
6SH7	.61
6SJ7	.58
6SK7GT	.56
6SL7GT	.64
6SN7GT	.68
6SQ7GT	.62
6SR7	.62
6SS7	.88
6SU7GTY	2.69
6T8	.96
6U4	.74
6U8	.99
6V6	1.39
6V6GT	.59
6W4GT	.52
6X5GT	.54
6Y6G	.88
7A8	.68
7C7	.76
7F7	.82
7F8	1.24
7H7	.72
7N7	.92
7V7	1.06
7Y4	.68
8D21	298.00
12A6	.48
12AH7GT	1.45
12AL5	.54
12AT6	.54
12AT7	.89
12AU6	.72
12AU7	.69
12AV6	.52
12AV7	.98
12AW6	1.18
12AX7	.98
12AY7	1.69
12BA6	.59
12BA7	.94
12BD6	.59
12BE6	.59
12BF6	.85
12BH7	1.29
12SA7GT	.68
12SC7	1.08
12SF7GT	.84
12SG7	.80
12SH7	.63
12SJ7	.54
12SK7	.66
12SL7GT	.62
12SN7GT	.68
12SQ7GT	.54
12SR7	.66
FG17	3.90
24G 3C24	1.32
25BQ6GT	.98
25L6GT	.67
25Z5	.78
25Z6GT	.58
FG27A	8.24
28D7	1.94
35B5	.52
35L6	.67
35T	4.88
35Y4	.68
35Z5	.54
41	.72
42	.68
45Z3	.88
48	1.98
50A5	.76
50B5	.54
50C5	.54
50L6GT	.62
RK61/XFG1	2.65
FG67	14.68
HY69	4.98
71A	.74
75	.64
78	.78
80	.58
81	1.38
83	1.12
83V	1.22
84/6Z4	.62
100TH	9.88
FG105	19.48
117L/M7GT	1.98
117Z6GT	.96
CV148	9.98
FG166	48.49
FG172	29.00
250TH	18.97
250TL	17.75
304TH	12.49
304TL	12.49
388A	1.48
WL417A	8.48
417A/5842	18.50
GL434A	12.69
446B	3.48
450TH	49.97
450TL	52.00
460/HF200	15.95
CK502AX	1.49
CK503AX	1.49
CK505AX	1.79
CK512AX	1.49
CK531DX	1.89
531	5.72
CK532DX	1.89
WL532A	3.68
CK533AX	1.29
CK536AX	.99
CK538DX	.98
CK539DX	2.19
CK541DX	1.99
CK543DX	.99
CK544DX	.99
CK546DX	1.99
CK571AX/5886	2.49
CK573AX/6029	3.49
WL676	34.98
703A	4.72
705A	1.88
707A	7.90
707B	14.88
715A	4.96
715B	7.94
715C	17.98
717A	.88
719A	24.48
721A	3.92
722A/287	1.94
723A/B	16.98
724A	3.95
724B	2.74
725A	9.98
726A	14.48
726B	44.88
726C	64.88
801A	.42
803	3.48
805	3.22
807	1.54
808	2.62
809	3.58
810	10.88
811	3.00
812	2.70
813	11.48
814	4.98
815	5.98
826	.95
828	9.25
829	7.94
829B	12.48
832	7.72
832A	9.92
833A	39.45
834	5.95
836	5.95
837	1.42
849	29.45
860	4.48
861	22.48
865	1.26
866A	1.50
872A	3.29
CK1005	.68
1613	.82
1614	1.95
1619	.36
1625	.32
1632	.68
1633	.98
1634	1.18
1635	1.89
1636	3.08
1642	.62
1644	.92
2050	1.48
2050W	2.48
5654	1.72
5670	3.44
CK5672	1.20
CK5678	1.28
5687	3.74
CK5702	2.90
CK5703	1.29
5713	120.00
5812	2.99
5814	2.08
5840	7.98
8012	2.58
8013A	3.92
8025A	4.68
9001	1.12
9002	.82
9003	1.12

XTAL DIODES

Type	Price
1N21A	1.55
1N21B	2.10
1N22	1.22
1N23	1.35
1N23A	1.89
1N23B	2.00
1N25	4.98
1N26	8.75
1N27	1.55
1N34	.64
1N34A	.88
1N35	1.65
1N38A	1.29
1N41	8.95
1N42	16.95
1N45	1.45
1N46	.69
1N47	4.00
1N48	.47
1N51	.45
1N54	.78
1N54A	1.00
1N58A	1.15
1N60	.60
1N63/K63	2.49
1N64	.69
1N69	.98

Other Types in Stock. Write.

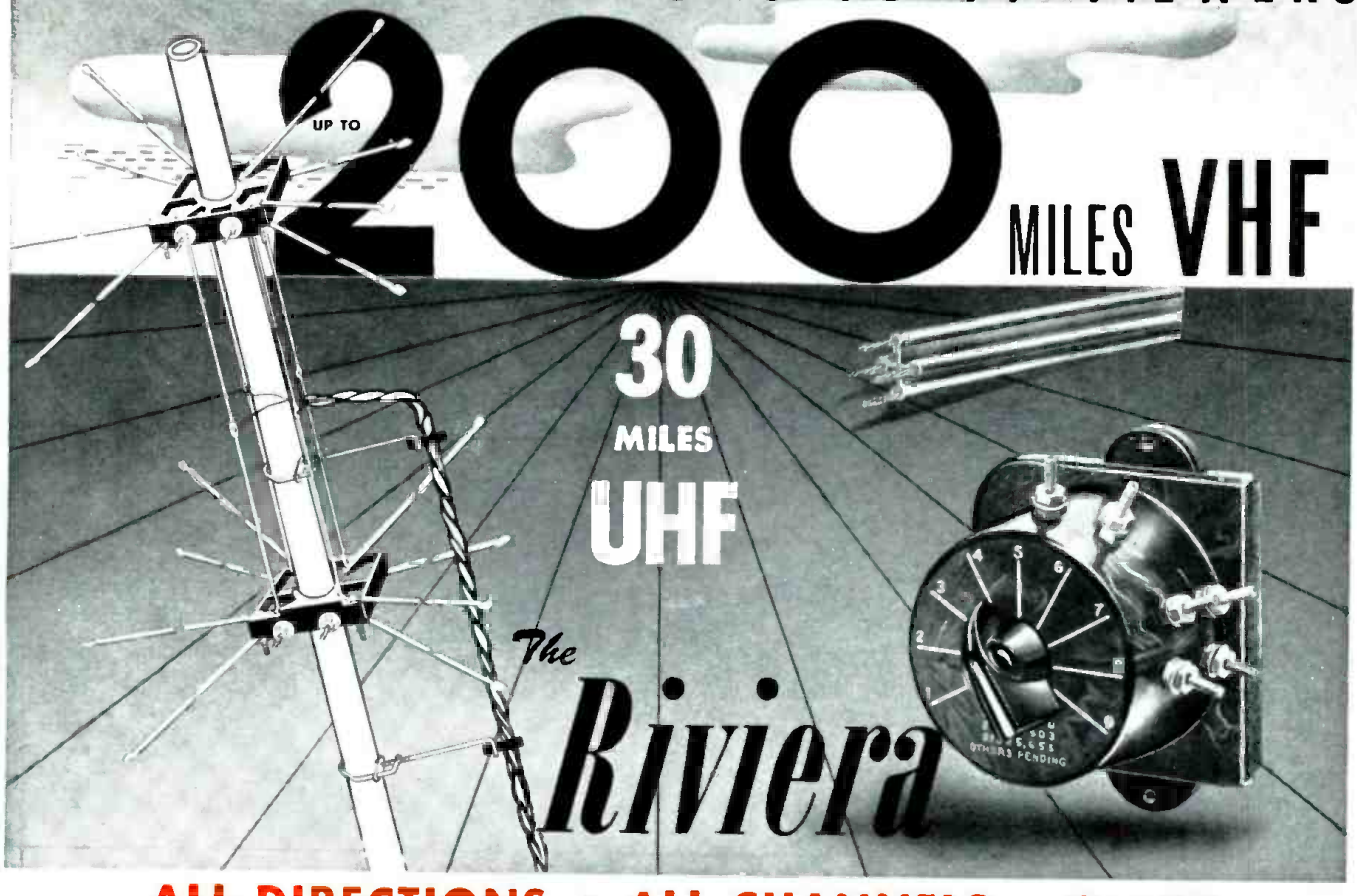
THAT'S A BUY "TAB" THAT'S A BUY

DEPT. 10RN 111 LIBERTY STREET NEW YORK 6, N. Y., U. S. A.

Money Back Guarantee (Cost of Mdse. Only) $5 Min. Order F.O.B. N.Y.C. Add Shpg. Charges or 25% Dep. Tubes Gtd. via R-Exp. only. Prices subject to Change Without Notice. Rector 2-6245

NEW PATENTED RADAR ANTENNA

OPENS NEW HORIZONS TO TV VIEWERS



ALL DIRECTIONS • ALL CHANNELS • 2—83

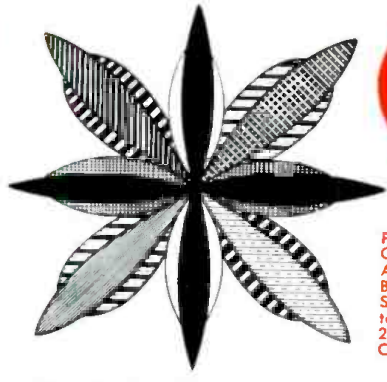
COLOR AND BLACK-WHITE *without* ANY ROTORMOTOR

These are the reasons why the "Riviera" is by far the most powerful VHF antenna on the market today!

1. Utilizes 16 elements 60" long, ½" diameter.
2. Utilizes a specially designed, extra low loss four conductor air-dielectric POLYMICALENE transmission line which has up to 50% less loss when wet than the finest conventional transmission lines.
3. The "Riviera" encompasses an electro-magnetic capture volume of well over 650 cubic feet, many times more than conventional antennas.
4. The antenna works on the revolutionary principle that the approaching wave front is elliptically rather than horizontally polarized.
5. The new specially designed 9 position electronic orientation switch, aside from changing directivity, maintains a consistently better impedance match over the entire UHF-VHF spectrum.
6. The above features combine to give the "Riviera" antenna greater usable gain at the TV set antenna terminals than the best of any competitive antennas using rotor motors.

This new wonder antenna, called the "Riviera", is already making history. Beyond any question of a doubt, and on an *unconditional money back guarantee*, it will positively outperform in the field under actual installation conditions, any and all competitive antennas on the VHF channels, with or without rotor motors.

POLAR PATTERNS



only **$49.50** LIST PRICE

Price includes: Complete Stacked Array • Stacking Bars • 9 Position Switch • Switch-to-set Coupler • 2 Stand-offs, 7½" • Complete instructions

The polar directivity response patterns show the major lobes of the "Riviera" antenna on VHF. It shows the fullness of coverage in all directions of this remarkable, patented antenna as it is turned through each of the nine switch positions. Each degree of shading constitutes a different switch position. This excellent directivity response, which can be switched at will, plus the extremely high gains, clearly indicate why the Riviera is such a superior performer.

IN UHF-VHF DISTRICTS . . . USE

The NEW Super 60

100 MILES VHF • 60 MILES UHF

ALL CHANNEL ANTENNA CORP.

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Mallory Capacitor Dependability

Shut your door—
on complaints and loss of time and money that call-backs cause you. Always use Mallory Capacitors on your service jobs.

The Mallory FP Capacitor Line is complete. There is a rating for every set. Mallory FP's are the only Fabricated Plate Capacitors on the replacement market. And they cost no more than ordinary capacitors.

Always order Mallory Plascaps® for your plastic tubular capacitor needs. Improved moisture-proofing puts an end to shorts, and leads are permanently secured.

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