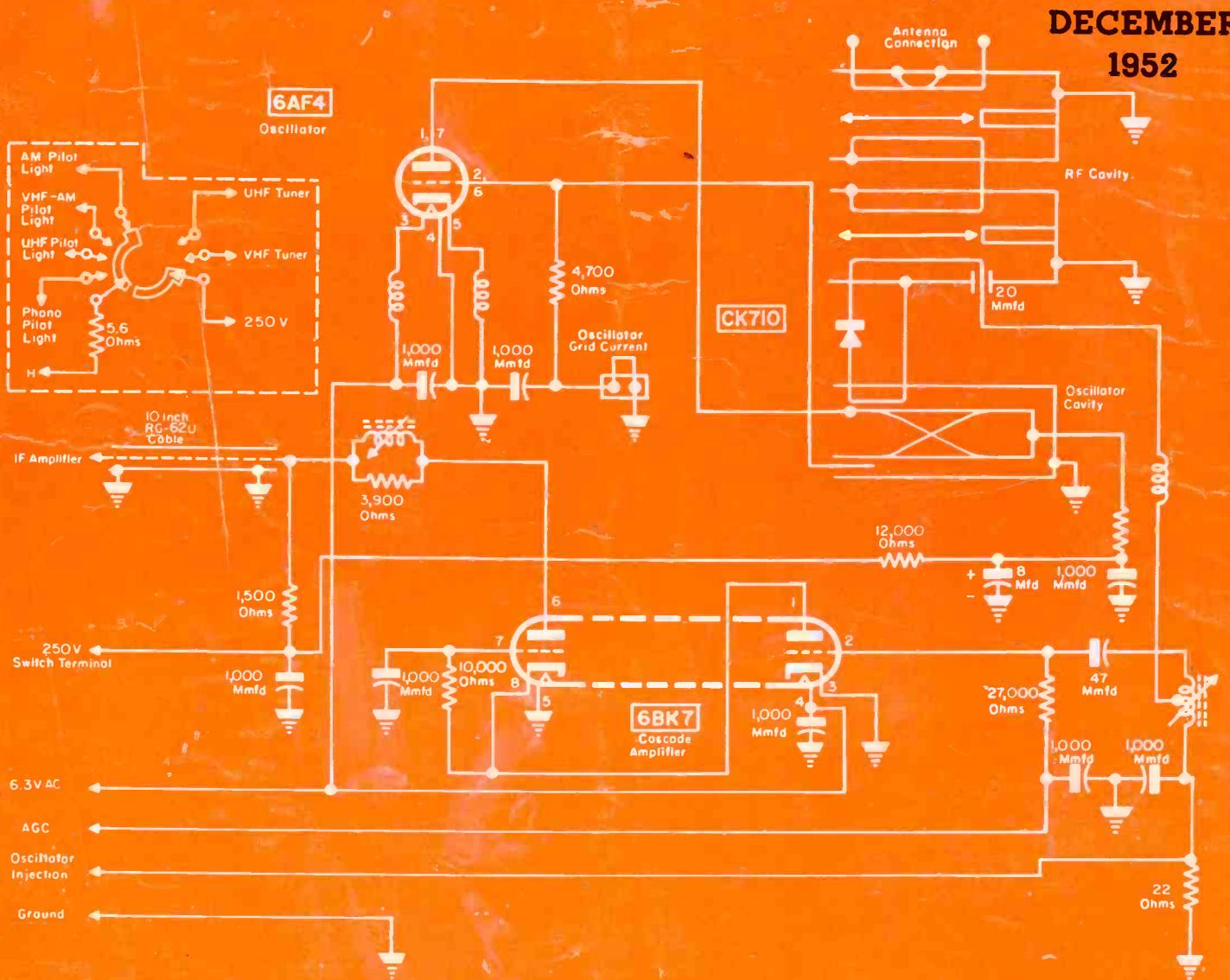


SERVICE

DECEMBER
1952



Single-conversion, continuous-tuning uhf tuner.

[See page 2]

It's New!

It's Better!

Here's Proof!

Now, we have finally found the answer in your V8 antenna. Servicemen tell us its the best antenna we have ever had. It really does the job because it pulls in stations we could not get before.

Here's How
the new **RADIART**

TELEVISION
V*8 ANTENNA

Solved Mr. Hartong's
Fringe Area Headaches

Burroughs

TELEPHONE 3-0273

Radio, inc.

DISTRIBUTORS OF
ELECTRONIC EQUIPMENT
WHOLESALE ONLY
711 SECOND STREET, NW CANTON 3, OHIO

October 7, 1952

Mr. William Schoneberger
Jobber Sales Manager
Radiart Corporation
3455 Vega Avenue
Cleveland, Ohio

Dear Bill,

Just a word to let you know how we feel about your new V8 antenna.

As you know, our reception problem down here is difficult because of the fringe area position. Believe me, when I tell you almost everything that has come along has been tried.

Now, we have finally found the answer in your V8 antenna. Servicemen tell us its the best antenna we have ever had. It really does the job because it pulls in stations we could not get before.

Attached is another reorder, please keep them coming.

Sincerely yours,
BURROUGHS RADIO INC.

D. R. Hartong
D. R. Hartong

drh/iw

SEE FOR YOURSELF
Try One On Your
Toughest Location



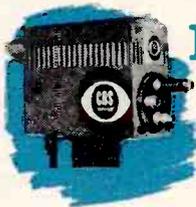
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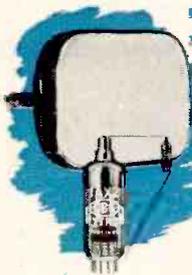
"YOU PROFIT MORE!
HERE ARE
5 BIG REASONS WHY"



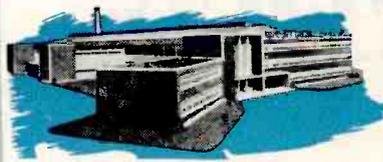
1. CBS-HYTRON IS FAMOUS . . . EASY TO SELL. The magic letters "CBS" are plugged for you on radio and TV station breaks . . . 102 BILLION times a year! CBS is known and respected by *all* your customers. CBS-Hytron is the profitable brand with endless sales assistance.



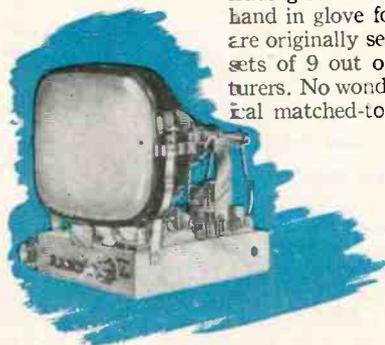
2. CBS-HYTRON SPECIALIZES IN RECEIVING TUBES. Since 1921, CBS-Hytron has concentrated on receiving types. Practice makes perfect. Put those years of know-how to work for you. Let time-proved CBS-Hytron dependability cut call-backs . . . make more money for you.



3. CBS-HYTRON LEADS IN TV TUBES. You know them. CBS-Hytron TV originals: 1AX2, 1X2A, 6BQ6GT, 12A4, 12B4, 12BH7, 12BY7, 12BZ7, 25BQ6GT, and the original rectangular 16RP4. Even CBS-Hytron standard TV tubes are designed-for-TV . . . tested-for-TV . . . to give you peak performance and profit.



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5. CBS-HYTRON IS MATCHED-TO-THE-SET. Combined engineering skills of leading set makers and CBS-Hytron work hand in glove for you. CBS-Hytron tubes are originally set-engineered right into the sets of 9 out of 10 leading set manufacturers. No wonder CBS-Hytron is your logical matched-to-the-set replacement tube.

IT PAYS TO BE FUSSY! Just any standard brand won't do. If you want: Trouble-free, advanced performance. Maximum customer satisfaction. Minimum call-backs. More profit. Five big reasons point the way: Insist on CBS-Hytron!



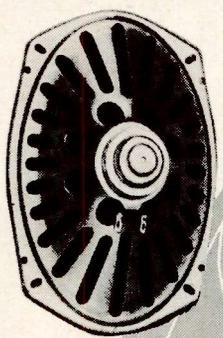
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Germanium Diodes

Complete data yours for the asking. Write
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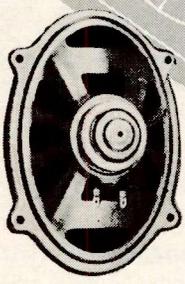




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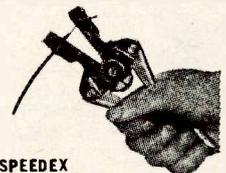
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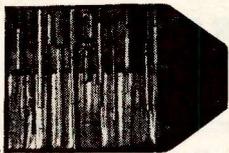
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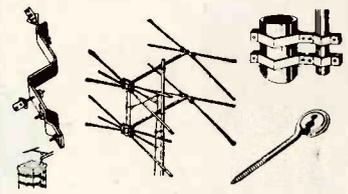
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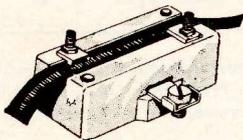
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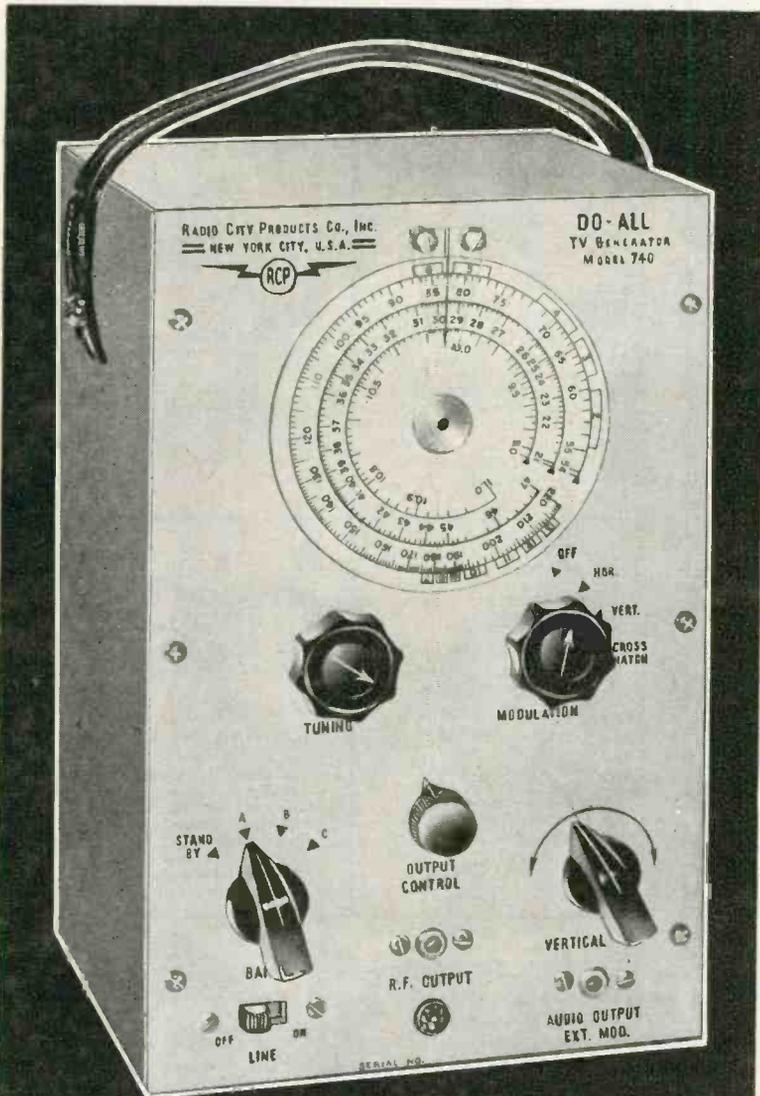
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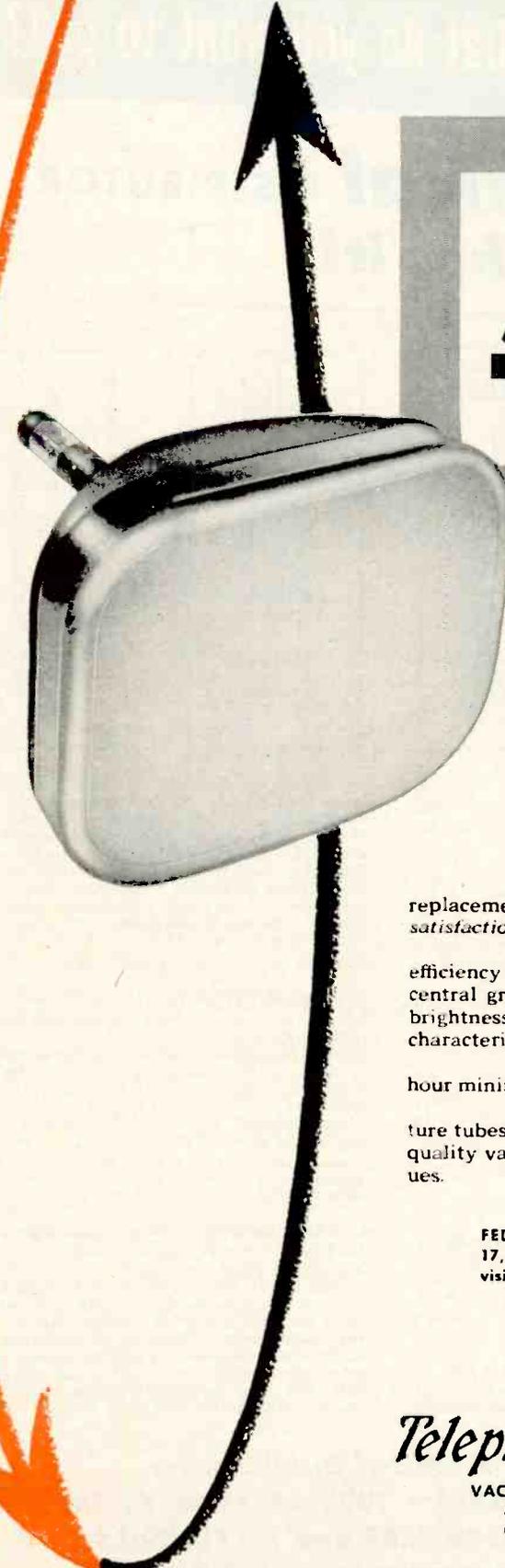
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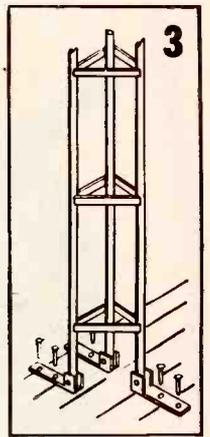
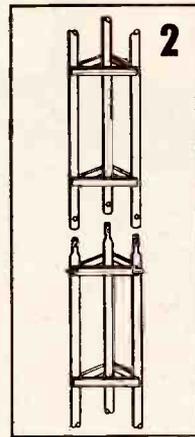
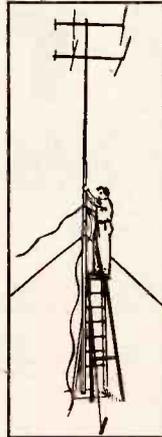
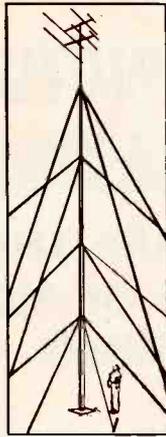
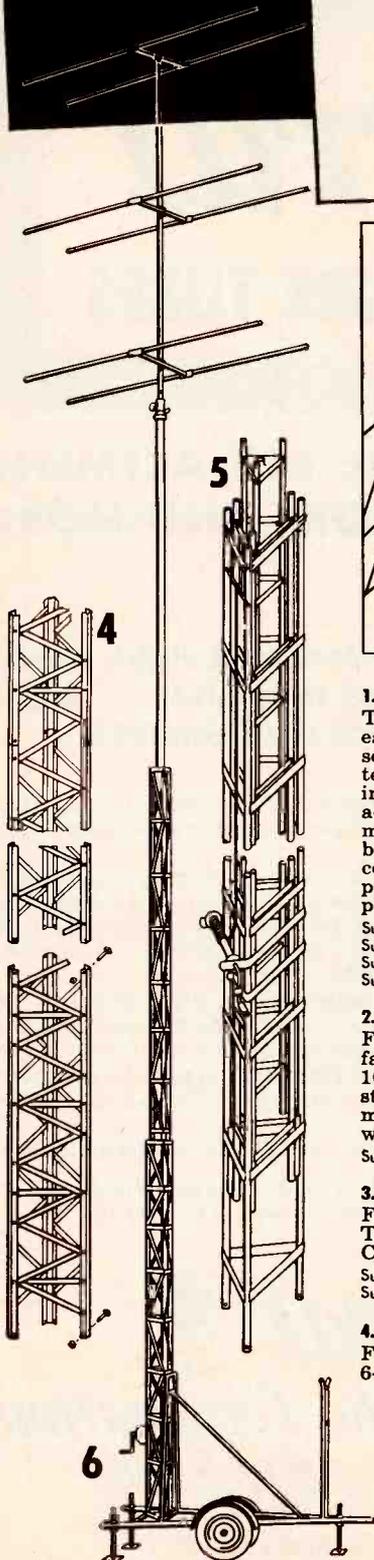
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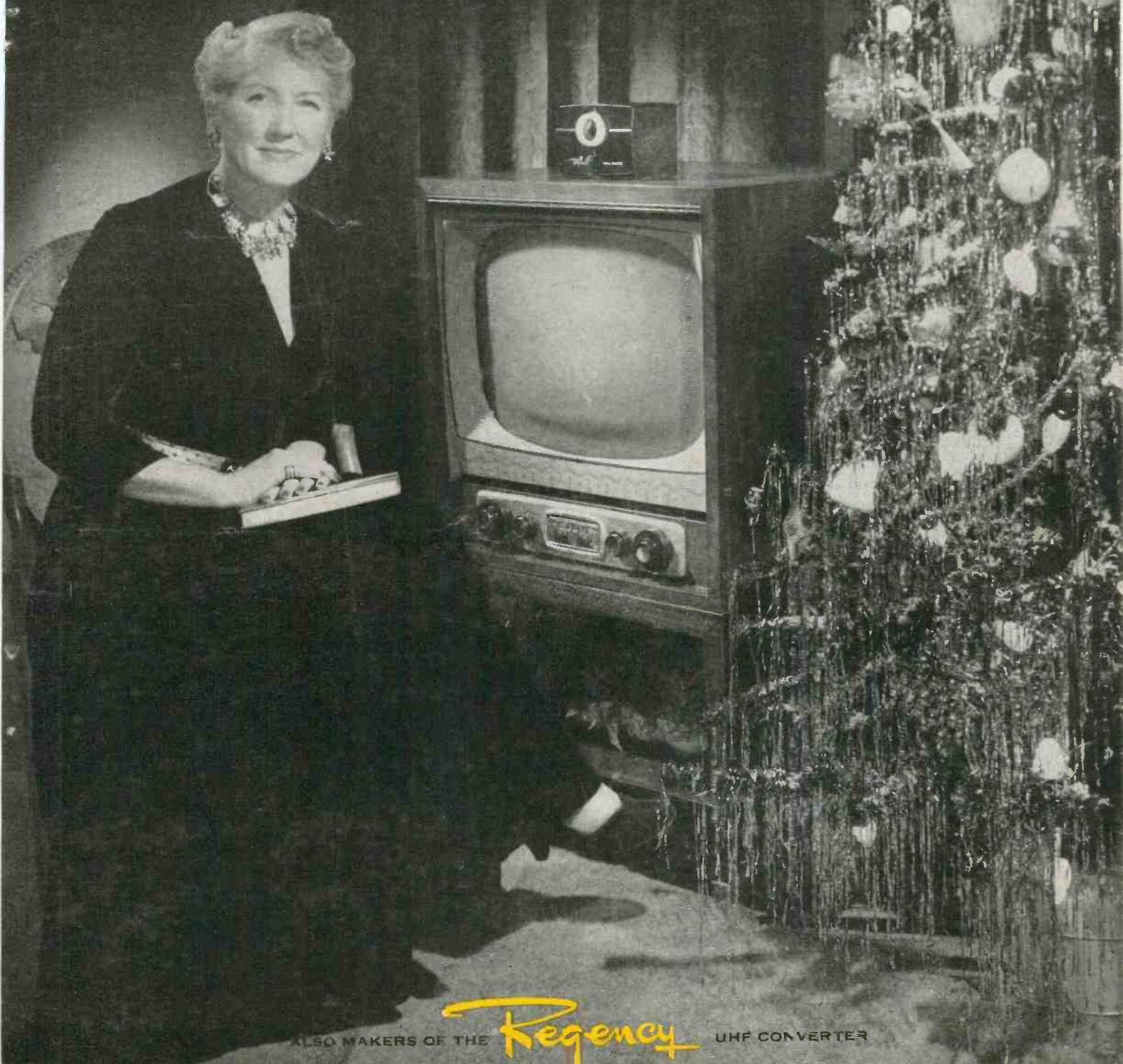
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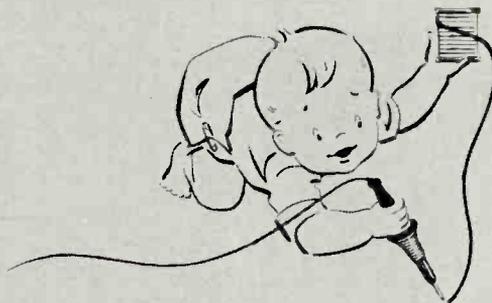
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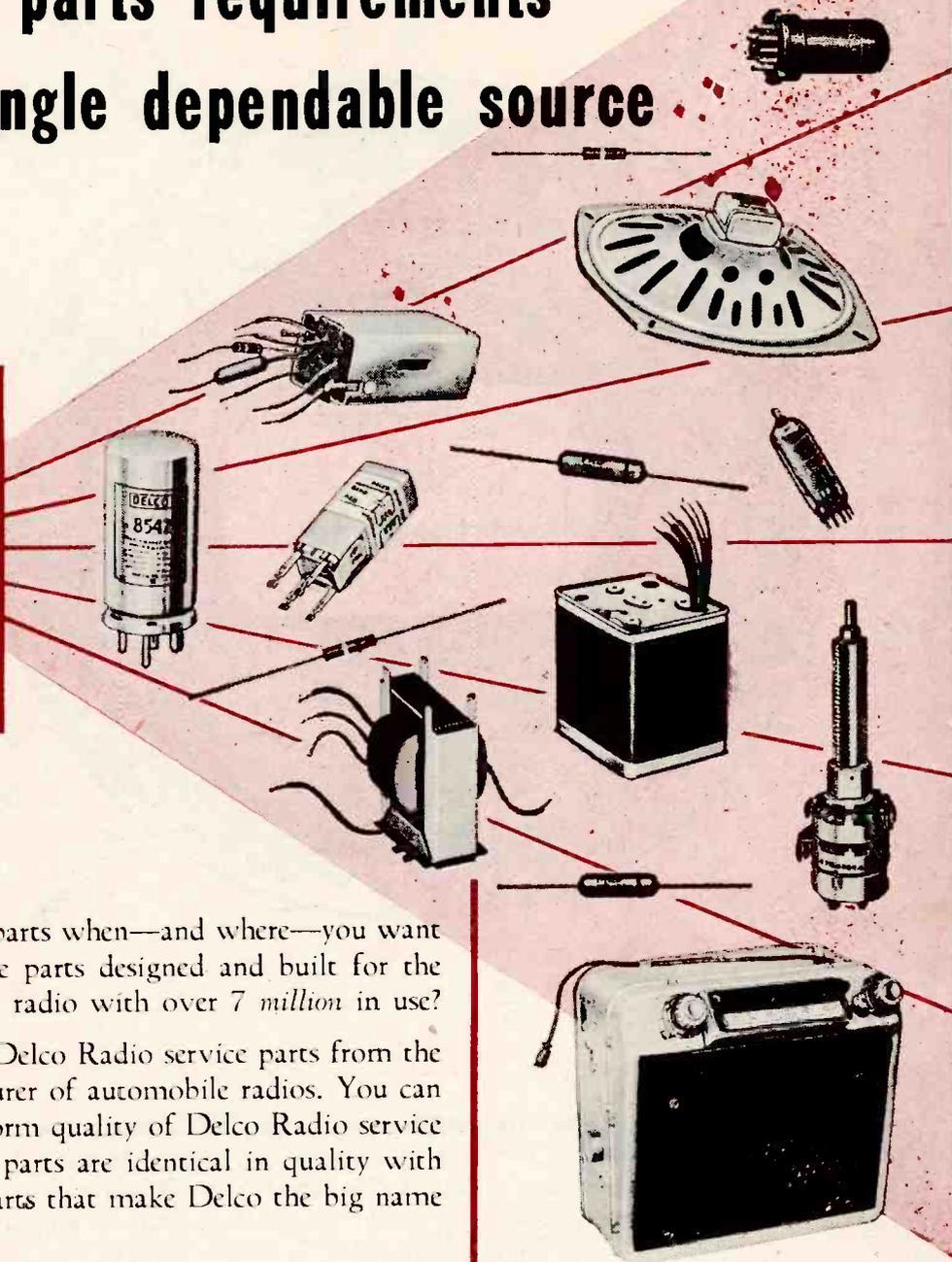
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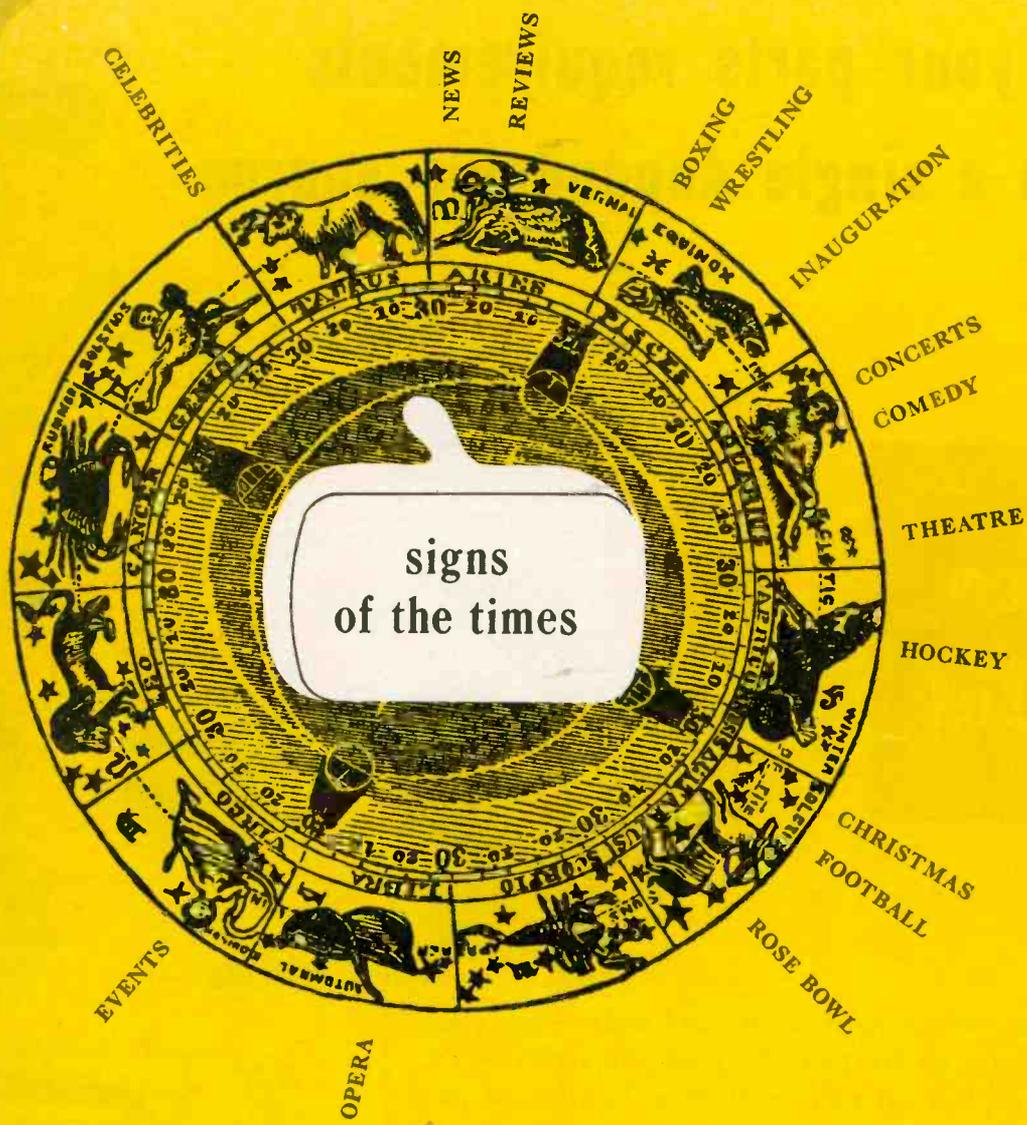
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Here's the greatest advance in TV antennas since TRIO'S introduction of the dual channel yagi! The sensational new TRIO ZIG-ZAG antenna is basically a multiple element yagi type antenna on each channel, yet one 2-bay antenna — and in some models a single bay antenna — covers all VHF channels!

This sensational antenna has sharper directivity and higher front-to-back ratio. It provides snow-free pictures, and fade-free sound even in the most remote fringe areas.

Tremendous forward gain is accomplished without long, bulky, arrays that operate on only one channel. With the new fringe area model ZIG-ZAG antenna, one bay provides tremendous gain on all low channels, 2 thru 6, and the other bay provides similar high gain on channels 7 thru 13.

HOW THIS AMAZING ANTENNA WORKS

Trio ZIG-ZAG antennas utilize a new principle whereby an array is composed of a series of elements, one or more of which is resonant on any one channel while the remaining elements, which are non-resonant on that channel, provide parasitic voltages having the proper phase relative to the direct voltage. These act as very efficient directors and reflectors. All elements are directly connected to the feed-line.

The various models, listed below, are designed to provide a simple installation for all areas, from metropolitan to extreme fringe. Two bay models, like the single bay models, are operated with a single 300 ohm lead-in to the set, with less than a 3:1 standing wave ratio.



STURDY, VIBRATION-PROOF CONSTRUCTION
Rugged strength is designed into all models. Antenna is shipped with all hardware mounted on the boom with the exception of the mast clamp. Complete assembly consists only of matching color-coded elements to the color-coded boom and tightening nuts which furnish clamping action. Complete assembly is accomplished in minutes.

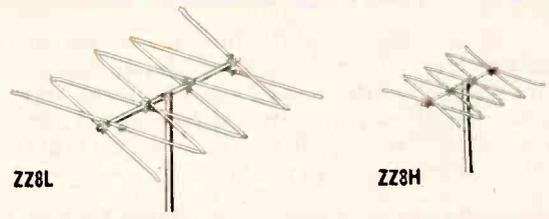
8 MODELS FROM WHICH TO CHOOSE:



ZZ12L

ZZ16H

FOR EXTREME FRINGE RECEPTION — ZZ16H provides over 14 DB voltage gain as compared with a resonant reference dipole on Channels 7 thru 13, and ZZ12L provides gain of 12 to 14 DB on Channels 2 thru 6. Gain of the ZZ12L is 12 DB on Channels 2 and 3 and is 14 on Channels 4, 5 and 6. These models have narrowest forward lobe and highest front-to-back ratio and should be used in areas where co-channel interference is a problem.



ZZ8L

ZZ8H

FOR NORMAL FRINGE RECEPTION — Where maximum gain is not necessary, these models are ideal. The ZZ8H for Channels 7 thru 13 and the ZZ8L for Channels 2 thru 6. Voltage gain is 9 DB on Channels 2 and 3 and 11 DB on Channels 4 thru 13. These models have patterns comparable to a well designed multi-element single channel yagi.



WRITE FOR CATALOG

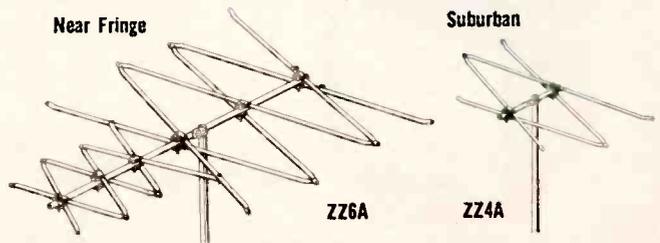
ZZ6L

ZZ6H

FOR NEAR FRINGE RECEPTION — These models provide a voltage gain of 8 to 9 DB on Channels 2 thru 13. These models have pattern and gain comparable to a cut-to-channel yagi. ZZ6L covers Channels 2 thru 6. ZZ6H covers Channels 7 thru 13.

Near Fringe

Suburban



ZZ6A

ZZ4A

SINGLE BAY ALL-CHANNEL RECEPTION — Model ZZ4A is a single bay antenna providing adequate gain and directivity on all channels, 2 thru 13, in suburban areas. Model ZZ6A is also an all-channel single bay antenna providing greater gain for near fringe use.



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ADVANTAGES ADD UP TO:**

Satisfied customers — Raytheon Picture Tubes will give your customers the finest picture, the finest performance possible. They'll build your reputation as a competent and thoroughly dependable Service Dealer — put you in line for repeat business and the business of your customers' friends.

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SERVICE

The Big Job Ahead

WHEN during the early part of the year, Washington announced that at long last the freeze lift was off, powers would be boosted, and up to 2,000 stations would eventually be allocated, there was abounding joy everywhere. Enthusiastic forecasts and plans poured in. Unfortunately, because of defense requirements, station-processing problems, and even transmitter manufacturing difficulties, many months passed by before any of the predicted activity began to show signs of life. And even then, only a few allocations began to dribble out of the Commission's offices.

Suddenly, Washington became a beehive of motion. Allocations began to appear by the dozens. And to add more brightness to the scene, new transmitters were placed on the air. Denver and Portland, hailed the first group of new stations; two *vhf* and one *uhf*. TV interest boomed. The effect on industry was electrifying.

Soon scores of communities will witness similar enthusiastic scenes, with the introduction of low and high-band telecasting.

Service Men will face a rugged schedule in these new centers of activity, particularly where *uhf* will be used. In some instances, such as Portland, TV will be a completely new facility, the station will be within reasonable distance of the larger cities and towns, rough terrain will not be too prevalent, and installation may therefore not be particularly difficult. Of course, it will always be necessary to consider certain problems, such as distance and direction from the transmitter, and especially heavy foliage and roof-top conditions. Foliage and roof tops may appear to be unimportant during initial installation, but subsequent seasonal changes can introduce many peculiar and disturbing effects on reception. Because of the beam-of-light character of ultrahigh signals, barren and heavily-leaved trees can control transmission paths. Wet or dry trees and roof tops, too, particularly the metal type, can play havoc with reception.

Reporting on these conditions, noted during early *uhf* tests in Washington, D. C., researchers said that good reception during summer months, when foliage was heavy, suffered not only a signal strength loss, but from heavy

reflection, in the winter months, when the trees were bare. Mounting the antennas on comparatively high poles above most trees was found to be a sound solution in many instances. Rain was also found to be an annoyance, causing reflections.

In ultrahigh areas where pickup from *vhf* stations is now possible, even on a fringe basis, Service Men will face another serious problem. For in this instance, viewers will be interested in continuing to receive *vhf* programs, plus transmission from the new station, which may be in an entirely different direction.

This problem already obtains in Reading, Pa., where antennas are now directed toward Philadelphia for the three veryhigh stations in that city, and toward Lancaster to receive signals from that point. Since the ultrahigh station (WHUM-TV; channel 61) is located about 22 miles north of Reading on Blue Mountain, it will be necessary to either install a separate *uhf* antenna, or mount it atop the present *vhf* pole and use a rotator to change the direction of the antennas. Service Men, of course, will have to determine the type of antenna to be used, and whether a strip tuner or converter can be installed to provide best results. It will also be necessary to consider the number of new stations that may go on the air in an area. Reading viewers will eventually have two *uhf* stations, 61 and 33, the latter belonging to WEEU-TV, which will probably begin its operations in the early spring.

Another problem that will face Service Men in some areas will be channel shifts. There are 30 stations which will eventually have to change their channels. In a few cities, the switch has already been made, but, in the main, the shifts are still to come. The problem will not be too acute for those within primary range, but will be quite disturbing in the fringe zones where high-gain antennas cut to specific channels are now being used. As indicated earlier in this journal,* some manufacturers have developed high-gain antenna systems, covering several channels, permitting installation at the present time for reception of the current and new channels, whenever it is placed on the air. The absence of such an arrangement will interrupt service, since viewers will be obliged

to wait for an installation of a new antenna cut to the new frequency. In crowded fringe zones served by a few shops, the resulting delays can become very annoying. Anticipating this problem, many Service Men have begun to advise customers that their favorite station will soon change its frequency, and it would be wise to install a new antenna now to provide continued service.

Specifically, the following stations are on the frequency-shift calendar: WBKB (Chicago), 4 to 2; WDTV (Pittsburgh), 3 to 2; WXEL, WNDK (Cleveland), 9 to 8, 4 to 3, respectively; WTMJ-TV (Milwaukee), 3 to 4; WLWT, WKRC-TV, WCPO-TV (Cincinnati), 4 to 5, 11 to 12, 7 to 9, respectively; WJAR-TV (Providence), 11 to 10; WLTW (Atlanta), 8 to 11; WTAR-TV (Norfolk-Portsmouth Newport News, Va.), 4 to 3; WAVE-TV, WHAS-TV (Louisville), 5 to 3, 9 to 11, respectively; WBRC-TV (Birmingham), 4 to 6; WRGB (Albany-Troy Schenectady), 4 to 6; WLWC (Columbus), 3 to 4; WHAM-TV (Rochester), 6 to 5; WMCT (Memphis), 4 to 5; WLWD, WHIO-TV (Dayton), 5 to 2, 13 to 7, respectively; WSYR-TV (Syracuse), 5 to 3; WOOD-TV (Grand Rapids), 7 to 8; WDEL-TV (Wilmington), 7 to 12; WMHC-TV (New Haven), 6 to 8; WJAC-TV (Johnstown, Pa.), 13 to 6; WOC-TV (Davenport-Moline-Rock Island), 5 to 6; WGAL-TV (Lancaster), 4 to 8; WSAZ-TV (Huntington, W. Va.-Ashland, Ky.), 5 to 3; WTTV (Bloomington, Ind.), 10 to 4; and WOIT-TV (Ames), 4 to 5.

There's a big job ahead for Service Men in '53, but it is certain that those who are well-trained, alert and resourceful will be able to meet the challenge and ring up a proud record of success.

Packaged Hi-Fi

TV WILL NOT be the only boom item in '53. Audio, particularly *packaged hi-fi*, will be a worthy contender.

When, as one specialist noted recently, it is recalled that during the year over \$60,000,000 has been spent on classical records alone, it is not too difficult to deduce that there is quite a sizeable market for music systems which are certainly much better than the standard phono in the radio or TV set which reproduces lp recordings through a speaker, amplifier, record changer and cartridge assembly normally designed to meet mass market price requirements.

Yes, it's quite a market and Service Men can supply the required amplifier (plus preamp, if necessary), record changer, speaker and enclosures, *all assembled*, to provide the better music record owners want, and at an attractive price. Some shop owners are now spotlighting such *packaged hi-fi* service. Even manufacturers have become interested and begun to market complete units, either in single cabinets or dual amplifier-changer/speaker setups. Kit assemblies are expected to be announced, soon, too.

In '53 *packaged hi-fi* will be quite a factor. A complete report on this new trend, detailing the design, construction and circuitry employed in typical *hi-fi* packages will appear soon in SERVICE. Watch for it.—L. W.

*TV Antenna Digest, SERVICE, Sept. 1952.

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SERVICE... *The National Scene*

NEW STATION APPROVALS EXPECTED TO APPROACH 140 BEFORE YEAR END--A prediction made a few weeks ago by FCC's headman, Paul Walker, that at least 125 TV building grants would be issued before the year is out, now appears to have been quite a modest forecast. For at this writing, 127 have received permission to break ground and go on the air as soon as possible, and at least a dozen or more will join the new-station ranks before '52 ends. The latest to win approvals include: WALA*, Mobile, Ala. (channel 10); KTXL, San Angelo, Tex. (channel 8); WOSH, Oshkosh, Wis. (48); WEOK, Poughkeepsie, N. Y. (21); WKLO, Louisville, Ky., operators of WHAS-TV and WAVE-TV (21); WONE, Dayton, Ohio (22), who also operate WHIO-TV; WGFG, Kalamazoo, Mich. (36); WIBM, Jackson, Mich. (48); WBCK, Battle Creek, Mich. (58); WTAC, Flint City, Mich. (16); WLOK, Lima, Ohio (73); KDRO, Colorado Springs, Colo. (13); KDZA, Pueblo, Colo. (3); WBAY, Green Bay, Wisc. (2); KOPO, Tucson, Ariz. (13); WRAK, Williamsport, Pa. (36); KITO, San Bernardino, Calif. (18); WWOD, Lynchburg, Va. (16). . . . The operators of WIP, Philadelphia, have received a grant for channel 29. . . . Other cities which will soon have TV include Yakima, Wash., with two channels, 23 and 29, and Monroe, La., which will have a low-band station on channel 8.

LICENSING PROPOSALS DENOUNCED IN CHICAGO, LOS ANGELES AND PHILADELPHIA--New measures to legislate TV and radio Service Men's activities in Philadelphia, Los Angeles and Chicago, have run into a storm of violent protests. . . . In Philadelphia, industry groups declared, at a special conclave, that neither laws or policing were necessary to control servicing. The prexy of one industry group indicated that a consumer-level educational program would solve many of the current problems. . . . In Chicago, the plan for municipal licensing was described as opening the door to political spoils, which could destroy even the best licensing intent. In contrast, the heads of several servicing associations felt that there is an urgent need for licensing, and it won't be long before such control arrives, either on the city or state level. . . . Commenting on a bill recently introduced in Philadelphia, the chairman of one servicing association noted that the measure had been offered because the councilman's office had been flooded with complaints about TV service. It was stressed that the proposed measure would up-grade the industry, minimize ill-will and curb the loss of dignity resulting from the operations of unethical groups. . . . A statement from one source bluntly declared that the state legislature in Pennsylvania would definitely consider licensing, and such controls might become an official statute on the books during '53. . . . At an all-industry meeting on the Pacific coast, an ordinance being studied by the Los Angeles city council was received with mixed reaction, industry reps criticizing the measure, and some service delegates describing it as a measure which could work and prove helpful.

THREE-DIMENSIONAL TV CALLED PROJECT FOR THE FUTURE--Notwithstanding the excited forecasts of some motion-picture executives, three-dimensional projection and viewing is many, many years away. Thus viewed a score of TV specialists recently, who indicated that there are mountains of problems to solve before such a scheme can become practical. It will be necessary to allocate specific channels, employ synchronized cameras and projectors, and in addition, viewers will have to wear polarized-type glasses.

NEW YORK SERVICE GROUPS TO COMBAT MALPRACTICES--In a unified effort to halt dishonest and inefficient servicing, service associations in New York City, and several neighboring communities, are participating in an active campaign which will promote a BBB booklet to educate the public on problems of TV service, and support and contribute to a control program which will serve as a check on the servicing industry. The latter group will serve to screen problems encountered by consumers or the BBB.

*Temporary call letters. Official calls will in most instances carry a TV suffix.

SERVICE... The National Scene

CREDIT CLEARING HOUSE FOR SERVICE MEN PROPOSED--A novel credit reporting and collection agency, which would serve radio and TV Service Men only, has been devised by a service operator in Texas. The set up would, it was noted, expedite collection, and prevent an accumulation of bad accounts or unpaid bills.

PILOT-MODEL LAWRENCE COLOR TUBES SCHEDULED FOR EARLY NEW YORK EXHIBITION--The controversial tri-color tube, invented by physicist Dr. Ernest W. Lawrence of the University of California, demonstrated earlier in the year, has been improved, it was recently announced, and is now ready for production. The tube, in its present state, is about 18" long, and will be available in single and three-gun models for installation in systems using dot or field-sequential techniques. Demonstrations of the tube may take place within the next few months in New York City.

TRANSISTOR CIRCUITRY COURSES OFFERED--A historic series of lectures, stressing the actual circuit designs which have been engineered for transistors, were recently conducted under the joint auspices of the New York section of the AIEE and IRE. The unusual seminar was under the supervision of five Bell Telephone Lab engineers, who described the novel manner in which semi-conductors can be used in not only commercial, but home equipment of the future. A comprehensive review on transistorized devices appears in this issue on page 40.

INCREASED APPLIANCE USE FOUND TO INTRODUCE TV LINE-VOLTAGE PROBLEMS--The widespread electrification program now underway throughout the country, involving the installation of dishwashers, ranges, washing machines and dryers, mangle, clocks, oil burners, and dozens of other home appliances, has introduced serious line-load headaches for TV set owners, particularly those in fringe areas. The resulting voltage surges and dips have been found to reduce picture height and width, introduce line modulation, interfere with focusing, and even affect brightness on some occasions. Constant-voltage transformers have been found to be very effective, for they can correct line-voltage variations to better than 3%, with a 95 to 125 input voltage change. A complete report on this technique will appear soon in SERVICE.

MANUFACTURERS AND ASSOCIATIONS INTRODUCE COMPREHENSIVE TRAINING PROGRAMS--In one of the most ambitious schooling projects ever conceived, set makers have begun to send huge trailers completely equipped with test equipment, receivers, antennas, and manned by seasoned engineers, to those areas where TV will soon be a factor. For the first time Service Men are being given an opportunity to become acquainted with vhf, and particularly uhf gear, before telebroadcasting is even inaugurated. Offered in one travelling clinic are practical instructions on the operation and servicing of continuous tuners, strip tuners, converters, antennas, lead-ins, and all-channel type receivers. . . . In New York City, another unusual training program will soon be placed in operation under the sponsorship of RTMA. Inspired by the service committee of the association, and approved by the entire membership, the program will provide training for about 100 in a trade school at a very small charge for tuition and books. Test equipment and parts will be supplied by association members; about \$30,000 worth of gear and \$10,000 worth of parts will be made available. Currently, the program calls for night study three times a week for a 9-month period. Applicants for the course will be screened, and entry will be based on extent of knowledge; one with substantial experience may only require several months of study, while a newcomer may have to attend all of the classes. It is expected that graduates of the course will receive official seals noting their technical proficiency. The pilot course in New York City will serve as a proving ground for similar schools to be established on a national scale, sponsored in this instance by local distributors and manufacturing reps. Both efforts will certainly produce rewarding results, benefiting the manufacturer, distributor, Service Man, and, of course, the consumer. . . . Congratulations, gentlemen.--L. W.



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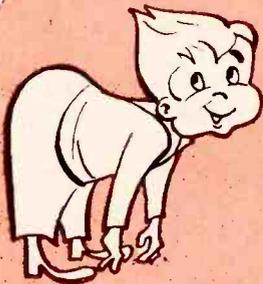
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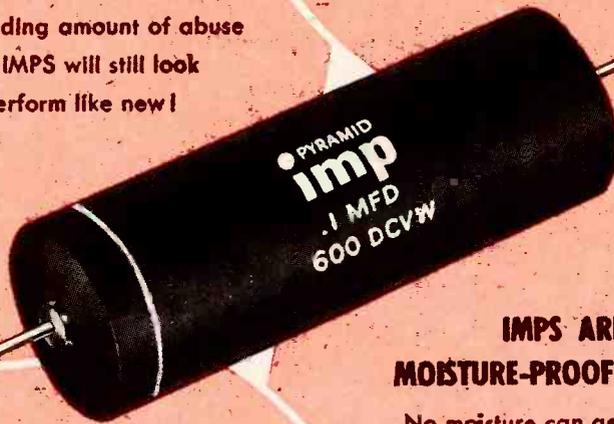
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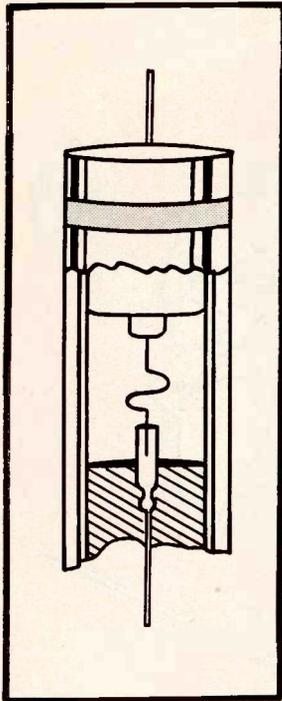
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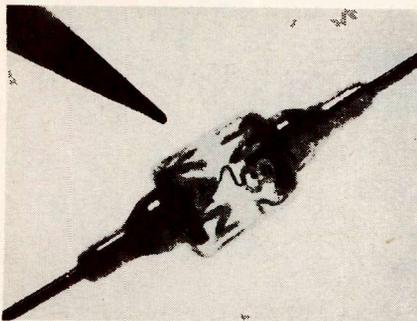
UHF CRYSTAL Mixers and

Mixer Circuitry . . . Harmonic-Frequency Multipliers in VHF-UHF Chassis . . . Troubleshooting UHF Tuners . . . How to Replace Crystals in Ultrahigh Equipment



(Above)

Fig. 1. Typical *uhf* crystal diode. (Raytheon CK710.)

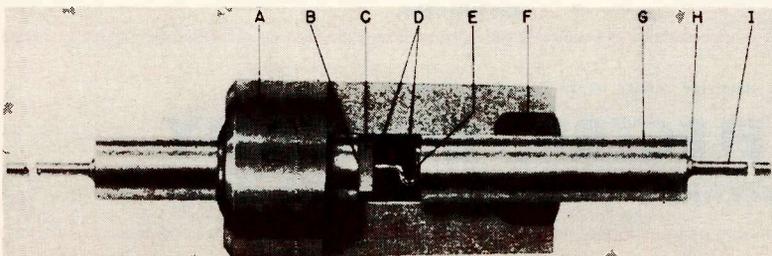


(Above)

Fig. 1a. Another type of *uhf* crystal. (Sylvania 1N82)

(Below)

Fig. 1b. View of 1N72 germanium crystal: *A* = mineral-filled molded plastic case; *B* = solder; *C* = germanium pellet; *D* = welds; *E* = platinum-ruthenium whisker; *F* = thermosetting cement; *G* = nickel pin; *H* = weld, and *I* = leaded copper clad wire. (Courtesy G. E.)



DURING WORLD WAR II, along with the development of microwave radar, the crystal detector received considerable attention and was quickly developed from the old galena and adjustable catwhisker of our youth into a highly developed state.

Present-day crystals use highly refined silicon or germanium as the rectifying element. The old adjustable catwhisker has been replaced by a fixed point contact, and in some crystals the contact is welded to a germanium pellet, as illustrated in Fig. 1, *a* and *b*. All current-type *uhf* TV crystals use germanium.¹

Operation of Crystal Diode

When the crystal is used as a mixer, two voltages are applied to the crystals, a large amplitude voltage (see Fig. 2) from the local oscillator and a small amplitude signal voltage (*S* in Fig. 2). The output of the crystal is bypassed for both the oscillator frequency and signal frequency. The output current of the crystal consists of a *dc* rectified component (*D*) and *if* component (*F*). Of course, the crystal mixer should be as efficient as possible, and thus it is important to obtain maximum conversion efficiency; conversion efficiency is defined as the ratio of the *if* output power to the *rf* input power. Looking at Fig. 2, it will be noted that the maximum *if* output is obtained in the region where the crystal voltage current characteristic curve is steepest or at point *C*. If we operated at point *A* or *B* less *if* output would be obtained at these points, than at point *A*, for a given signal input because the slope of the curve is less at these points. A measured curve showing the relative con-

¹Crystals now being used in *uhf* TV tuners and converters are the G.E. 1N72, Sylvania 1N82, and Raytheon CK710.

version for a range of crystal currents is shown in Fig. 3, indicating that the crystal should be operated with a direct current between .5 and 1 *ma* for best results. This range of crystal current also results in the optimum noise figure.

To obtain a good noise figure for operation in fringe areas, crystal mixers must be so designed that the signal input circuits tune and match the crystal to the antenna, the local oscillator is strong and loosely coupled to the crystal, the *if* circuit is matched to the crystal and also adequately bypasses both signal and oscillator frequencies. The foregoing design criteria serves to provide as much of the signal into the crystal, obtain maximum conversion efficiency and the maximum *if* output from the crystal, as well as minimize oscillator radiation.

Mixer Circuitry

There are two general types of crystal mixer circuits, the shunt and series types, as shown in Fig. 4. These circuits are illustrative of typical mixers; many variations are possible in the method of coupling, such as inductive instead of capacitive coupling to the local oscillator or different coupling to the *rf* or to the *if* tuned circuit. In each case it is important to isolate the *rf*, oscillator, and *if* currents to their own respective circuits, except where they must all flow through the crystal mixer.

The crystal diode is also frequently used as a harmonic frequency multiplier. Because of the difficulty of making oscillators operate at *uhf*, some tuners use a conventional *vhf* oscillator and multiply its frequency up to that required for *uhf* operation by means of a crystal multiplier circuit. The crystal diode most frequently used for this service is the 1N34A or the 1N34. This crystal multiplier should not be confused with piezoelectric quartz crystal harmonic oscillators. In harmonic crystal multipliers, the crystal is closely coupled to a *vhf* local oscillator. This close coupling would produce a high crystal current and tend to burn out the crystal, if it were

Multipliers

by HENRY R. HESSE

Senior Engineer, TV Receiver Division
Allen B. DuMont Labs

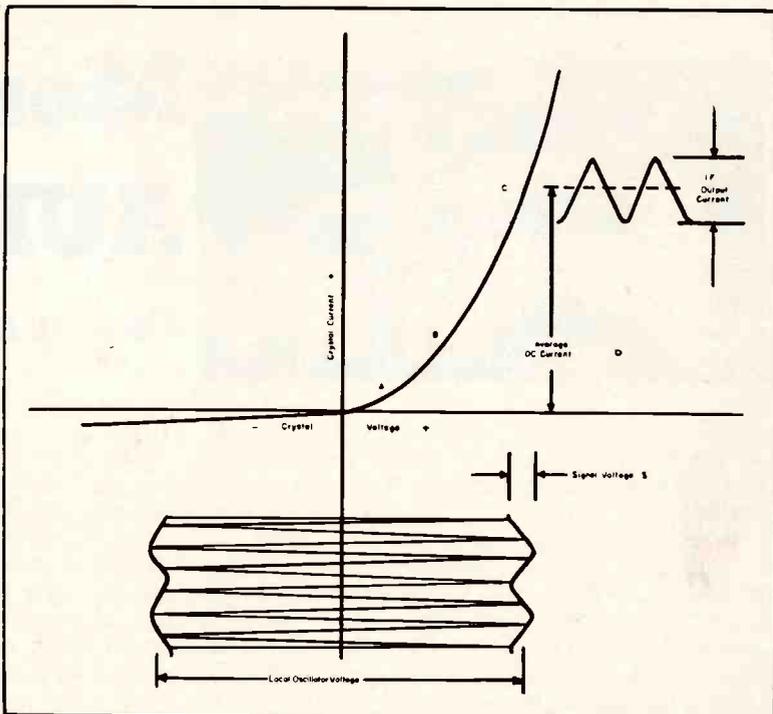
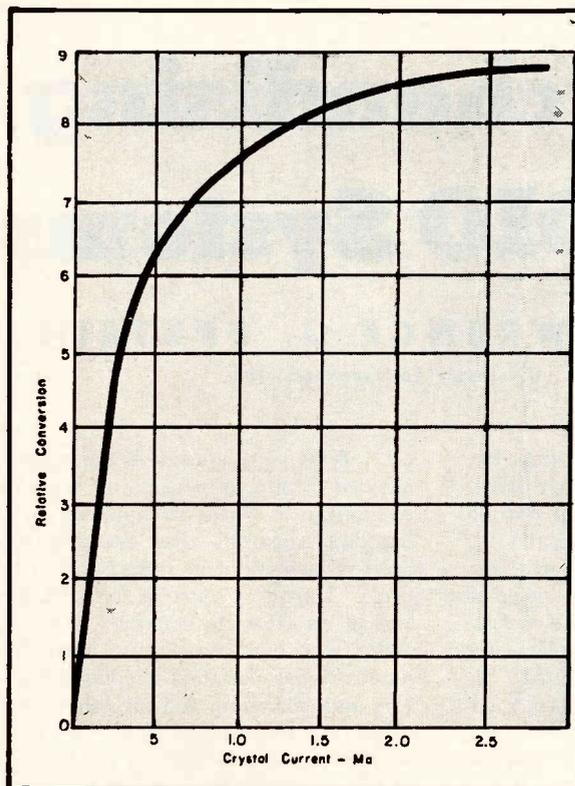


Fig. 2 (above). Plot illustrating operation of a crystal mixer. The *dc* voltage-current characteristic of a typical crystal is shown.

Fig. 3 (left). Curve showing relative conversion versus crystal current.

not for a high resistance in the crystal circuit.

This resistance is bypassed for *rf* by a capacitor which charges up and biases the crystal. The crystal current now only flows when the oscillator voltage exceeds the bias voltage. These pulses of current flow are rich in harmonics and when the current is made to flow through a circuit tuned to a particular harmonic frequency, it develops a voltage across the tuned circuit at that frequency. The mixer crystal is coupled to this harmonic-tuned circuit to obtain its *uhf* local oscillator injection. The use of a harmonic crystal multiplier usually results in undesired harmonic frequencies and therefore there are many spurious responses to cause multiple images. Harmonic crystal multipliers are necessary in all *uhf* tuners having replaceable turret strips for *uhf* operation. Harmonic crystal multipliers in any other *uhf* tuners are undesirable because of the possibility of spurious responses.

Uhf Tuner Troubleshooting

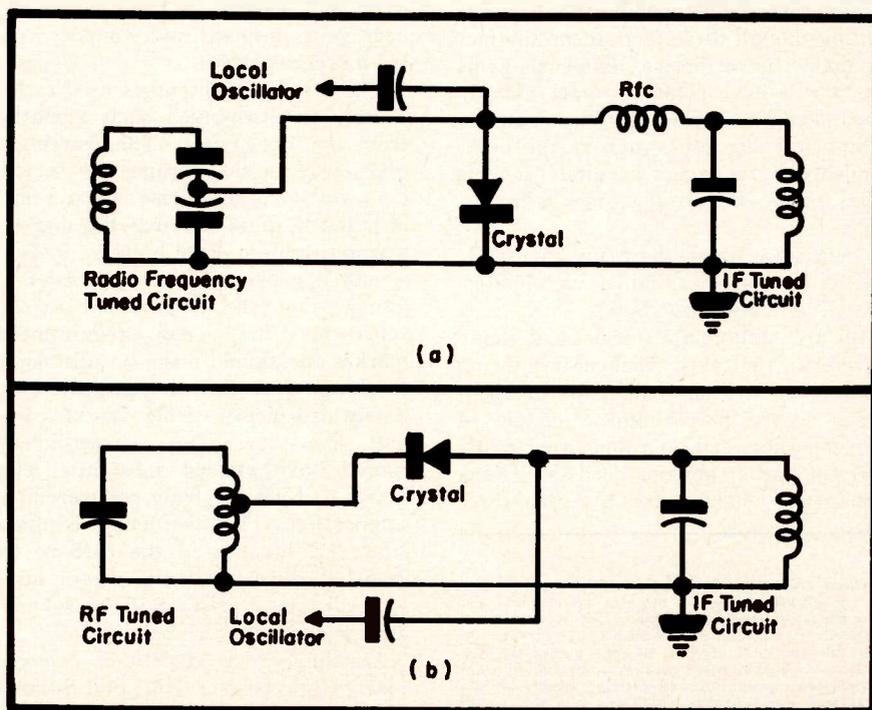
Troubleshooting in *uhf* tuners involves checking the crystal diodes and local oscillator tubes. The most important single measurement in the tuner is the *dc* crystal current. This single current reading, if between .5

and 1 *ma* *dc*, will verify the correct operation of both the crystal and local oscillator. The *dc* crystal current should be observed while tuning over the entire band, as the local oscillator strength and coupling of the oscillator

to the crystal both vary and thus change the crystal current. The operation over a part of the band may be satisfactory, but not over another part of the band.

[To Be Continued]

Fig. 4. Two types of crystal mixer circuits. In *a* is a shunt type, while in *b* appears a series type.



A Frank Discussion of the Excellent Potentials That Obtain Today in the Commercial and Home Markets, and Particularly the Hi-Fi Fields



Merchandising AUDIO Systems

by **LAWRENCE J. EPSTEIN**

University Loudspeakers, Inc.

AUDIO OR SOUND normally has three basic *markets* and about ten basic *applications*.

From a dollar volume point of view, the *industrial market* is probably the most lucrative for a single installation. Aside from the obviously vast potential of that market, it is one in which the need for *audio services* is most apparent, has become practically an accepted necessity, and is a field in which Service Men will encounter prospects who by the very nature of their background and work will appreciate and respond to facts and figures. It is, however, in this field that one does find the most difficult competition, the greatest number of *specialists* with seasoned personnel, generally adequate lab and fabricating facilities, and an impressive degree of experience and finances to earn extra consideration by a prospect with respect to responsibility. Disheartening though these facts seem, the fact remains, nevertheless, that such firms as a rule have plenty of work already committed and tend to concentrate on the really big jobs, such as the giant industries, the larger hospitals, schools and public institutions, the railroads, etc.

But what about the many thousands of small factories, mills, warehouses, small sanatoriums, hotels, etc., who still are without the services of sound even in the most elementary form? An amplifier, one mike, an inexpensive record player and a couple of loudspeakers can go a long way in satisfying rather obvious needs and weak budgets. Chances are, too, that there

(Above)

Audio truck: An installation which was the hub of a unique promotion used to attract attention to the products of an enterprising food products distributor and a cooperating supermarket. On rental type audio trucks, profuse use of the Service Man's firm name serves as an effective and consistent promotion, advertising effectively the services and facilities which are available to the public through him.

exists an acquaintance with some key individual connected with such firms: a friendship developed through the repair of the plant superintendent's TV set, or the hotel manager's combination, or a midget set for the office at the warehouse. It must also be remembered that there's plenty of electronic equipment being used in industry today. As in any field, popularity depends greatly upon reputation and word-of-mouth advertising. One job leads to another. If audio is the media of entrance into industrial patronage, it will not be long before other kinds of work related to your profession will appear in your shop. The reverse is equally true. Your strength, therefore, lies in the fact that your prospect *knows* or may have heard of *you*, and having confidence in the quality of your work and the integrity of your word will perhaps be more inclined to hear your proposal and consider your bid more favorably.

The term *commercial* is used rather loosely to distinguish such a market from the industrial. The warehouse gives way to the garage, the factory is now a small enterprise in a top floor loft, the hospital becomes the doctor's waiting room and the hotel is, instead, a motel. Though the impression is gained that the commercial market represents the small requirements market one should make no mistake in thinking that this is entirely true. There are plenty of big supermarkets and five-story office establishments which have yielded substantial contracts and yet are truly commercial in application. The distinction is made, however, because in the case of the two latter examples, the bigger audio specialist enterprises will be found a strong and eager competitor.

Of the garden variety of *commercial* prospects one will find literally hundreds to thousands in a commun-

ity. When one considers the recommended technique of thinking of audio equipment in terms of application, it becomes apparent that *every* enterprise regardless of its nature is a prospect. During a visit to one jobber, and in an effort to convince him that audio was universal in its need and application, a classified telephone directory was picked up and the jobber was asked to open the book to any page and with eyes closed point to any part of page, it being my chore to provide a use for sound for the category thus indiscriminately selected. The number that might use audio systems amazed the jobber, and your truly, too! It was really a convincing test. It seems that too few have ever taken the trouble to do some honest thinking on the subject. Often one needs the stimulus of a challenge to prod us into using the ingenuity of which we are capable.

The beauty of the commercial sound job is that it generally stems from the personal contact between seller and buyer. As a radio and TV Service Man, your relationship with the other local merchants, the church, the social clubs and the many business and professional folks you service or sell is of inestimable value and cries for exploitation. The equipment is usually simple and the expenditure reasonable. Competition is not often as keen as with industrial jobs where competitive bidding is a standard procedure. The average commercial job can be *negotiated*.

Is it worth the effort? Let us analyze that query. If you've been studying the trends in your business lately, checking costs of operation, and noting where the major part of your income is derived from, perhaps it may occur to you that often you are vulnerable to

(Continued on page 59; see basic application table on page 32)

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- Double-tuned transformers for peaking both video and sound.
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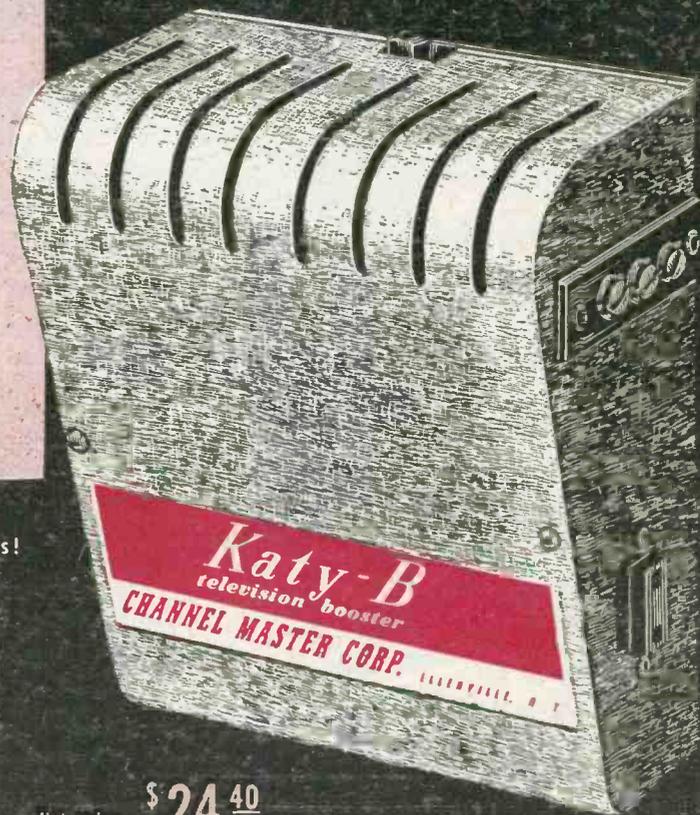
	KATY-B	Booster A	Booster B	Booster C
Gain (high no. preferred)	8.5 Times	4.2 Times	5.9 Times	6.2 Times
Noise (low no. preferred)	6.5	14.3	8	9.1
VSWR (low ratio preferred)	1.5:1	9:1	2.6:1	3.8:1
Balance-to-Unbalance Ratio (high ratio preferred)	10:1	1.4:1	5.8:1	7.1:1

Typical Comparison on Channel 12

TV "snow" is noise generated by the set and booster. The amount of noise present depends primarily upon the first tube in the receiving system.

This means that where a booster is used, the amount of "snow" in the picture depends almost entirely upon the performance of the booster, and the tube(s) it uses. Most single channel boosters on the market today have poorer Noise Figures than modern TV front ends. Therefore, while these boosters may contribute gain, they actually deteriorate picture quality by adding noise.

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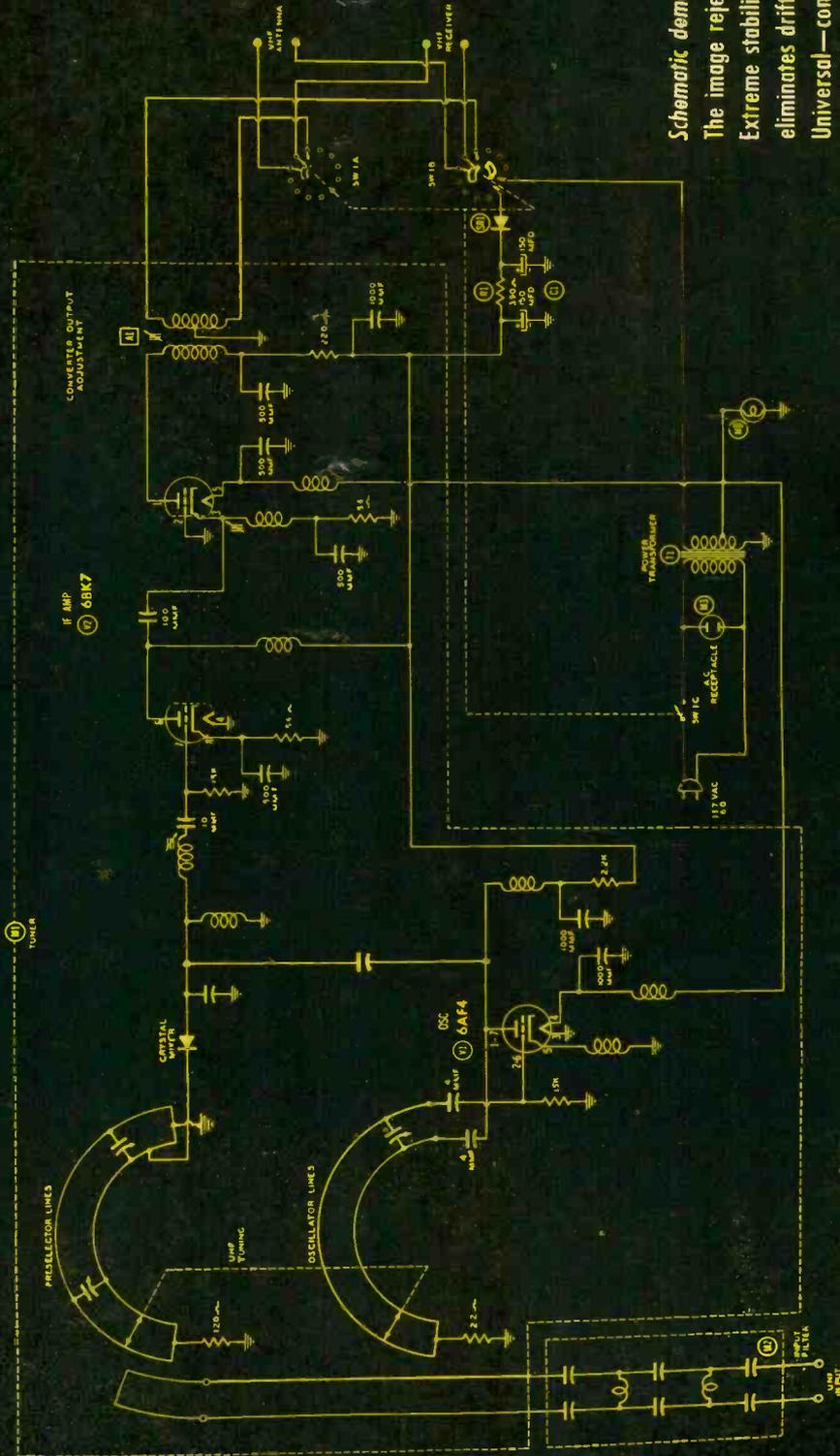
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Isolating Resistor Characteristics . . . Reasons for Horizontal Sync Pulse Distortion on 'Scope Screen . . . Use of 'Scope as Voltmeter and How to Read Peak-to-Peak Voltages on the 'Scope

In The Field ‡

DURING BENCH WORK, the isolating resistor has been found essential in visual-alignment; when connected in series with the *hot* lead to the 'scope, it provides a neat sharply-pointed marker. However, the waveforms in sync and sweep circuits appear badly distorted unless the isolating resistor is removed. Why is this?

An isolating resistor actually provides more than *isolation*; in practice, it also provides a filtering action, observed with respect to the marker display. Troubleshooting in sync and sweep circuits requires wide-frequency response instead of narrow frequency response, as does visual alignment. The effect of the undesired filtering action of an isolating resistor on a vertical sync pulse is shown in Fig. 1. In this type of work, a *compensated high-impedance probe* is required instead of a simple *isolating resistor*.

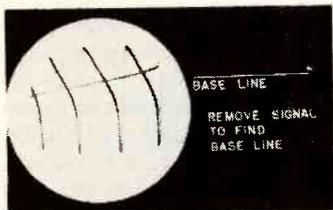
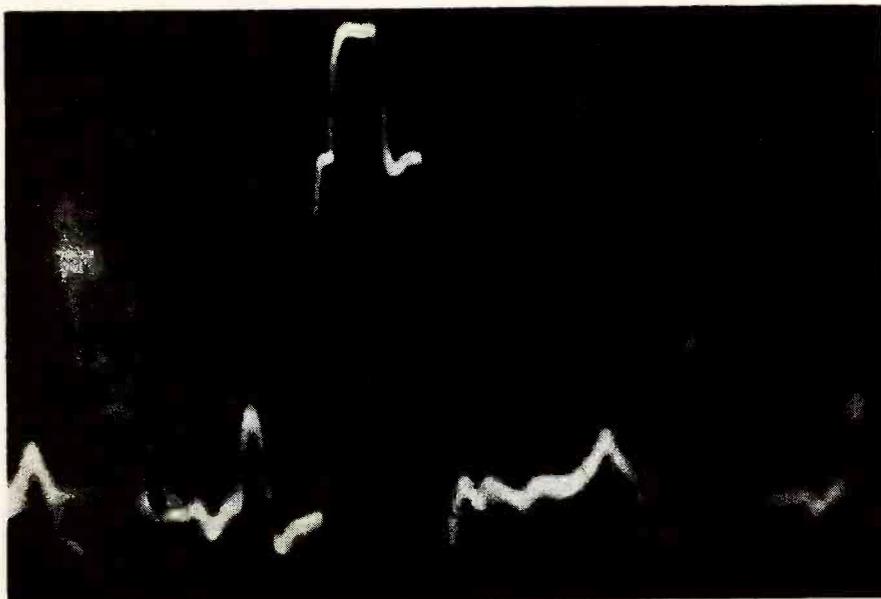


Fig. 4. A horizontal sync pulse which exhibits rounding of the corners, tilt, and slow rise time. The fault can originate at any of several points.



THE 'SCOPE HAS often been described as a voltmeter, too. If this is so, is the voltage read from the bottom of the wave to the top, or from the retrace line in both directions?

The peak-to-peak voltage is read from the bottom of the wave to the top. However, *the retrace line has nothing to do with voltage readings*. Positive-peak and negative-peak voltages are read from the *zero-volts base line*, as shown in Figs. 2 and 3. This line is found by momentarily removing the signal from the input of the vertical amplifier. Of course, the 'scope must first be calibrated before voltages can be measured. It must be remembered that the peak-to-peak voltage of a sine wave (usually used for calibrating) is 2.83 times its *rms* value. Service voltmeters usually indicate *rms* values of sine waves.

Fig. 2. Trace illustrating that the base or zero-volts line in the display is *not* the same as the retrace line. The retrace line can appear at *any* level, depending upon the setting of the sync-hold control. The base line is found by temporarily removing the signal input to the vertical amplifier.

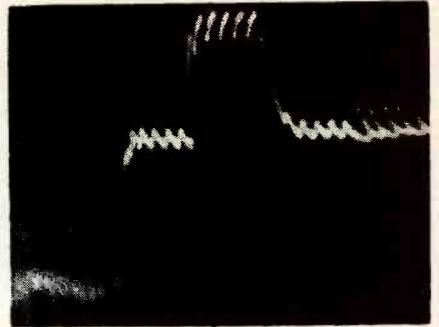
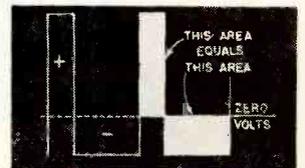


Fig. 1. 'Scope pattern illustrating distortion of the vertical sync pulse and associated signal by use of an isolating resistor. The resistor *kills* the high-frequency response of the 'scope; slots in the vertical sync pulse are reduced to sawteeth riding on top of the pulse, while horizontal and equalizing pulses are likewise attenuated and distorted to small sawtooth waves. Horizontal sync pulses are twice as wide as the equalizing pulses, and the horizontal sawteeth rise up twice as high as the equalizing sawteeth for this reason. Horizontal sawteeth (sync pulses) appear spaced a *half picture line* apart, because the even and odd fields sandwich on a 60-cycle scope sweep.

WHY DOES THE horizontal sync pulse on a 'scope screen show considerable distortion?

There are a number of possible factors responsible, and the cause must be determined by trial and analysis. It is important to determine if the receiver is properly aligned, and if the contrast control is properly set. The proper adjustment of the video amplifier must also be checked. Then it is necessary to see if the 'scope itself will pass a 30-kc square wave without visible distortion. Next, one must note if the 'scope is being applied in such manner that the circuit under test is not unduly loaded. Finally, it is wise to find out if the TV station is transmitting standard sync at the time of test. Fig. 4 illustrates a typical horizontal sync pulse with defects that can originate at any of several points.

Fig. 3. Waveform indicating how positive-peak, negative-peak, or peak-to-peak voltages can be read on a calibrated 'scope, after locating the zero-volts base line. The excursion above the *O-V* line shows positive peak voltage; the excursion below the *O-V* line shows negative peak voltage, and the total excursion shows peak-to-peak voltage. It is a fundamental law of electricity that the *ac* waveform will always have a positive-peak area equal to the negative-peak area. But this does not mean that the positive-peak voltage is equal to the negative peak voltage.



‡Based on questions posed during meetings conducted by R. G. Middleton, senior engineer at Precision Apparatus Co., Inc., and author of *TV Troubleshooting and Repair Guide Book*, published by John F. Rider.



Fig. 1. Audio amplifier, with remote control unit. (Courtesy Brook Electronics, Inc.)

How to Evaluate Such Factors as Power Output and Gain, Harmonic and Intermodulation Distortion, Frequency Response, Source Impedance, Hum and Noise Level, Tone Controls, and General Design and Construction in Amplifiers

Picking Out the Right AUDIO AMPLIFIER

by MARK VINO

THE MAJORITY OF CUSTOM-built radio-phonos have been found to use commercial amplifiers rather than privately-built units. The primary interest of most assemblers, therefore, is not in amplifier construction practice, but in the quality standards by which the products of various manufacturers may be judged and selected for purchase.

The design of audio amplifiers is an advanced art and there exist many different and equally successful ways of achieving fidelity reproduction. It is necessary to be concerned with tangible results, in terms of performance, rather than with the design methods chosen to achieve these results. The circuit designer's decisions about whether to use triodes or pentodes, fixed or cathode bias, direct or resistor-capacitor interstage coupling,

concern only various means towards the same end.

Specifications for Audio Amplifiers

Manufacturer's performance data on amplifiers normally include seven factors: (1) Power output and gain; (2) per cent harmonic distortion, either given as a total, or listed separately for each order of harmonic; (3) per cent intermodulation distortion; (4) frequency response; (5) source impedance (the same information may be indicated by the damping factor); (6) hum and noise level; and (7) degree of control over treble and bass boost or cut.

Amplifier Power

The power capability of an audio amplifier should be suited to its func-

tion. Occasionally the use of super-powered amplifiers with outputs of 30 or 40 watts have been used for home installations, but the current trend is towards lower power, with no less than ten and no more than twenty watts output. One reason for this trend is undoubtedly the very low value of distortion generated by modern amplifier circuits.

Power Sensitivity

The signal input voltage required to drive the amplifier to rated output determines a characteristic called *power sensitivity*. Insufficient sensitivity for the signals available will simply mean inadequate volume; a large excess of gain is also disadvantageous. An amplifier should therefore be chosen with

(Continued on page 28)

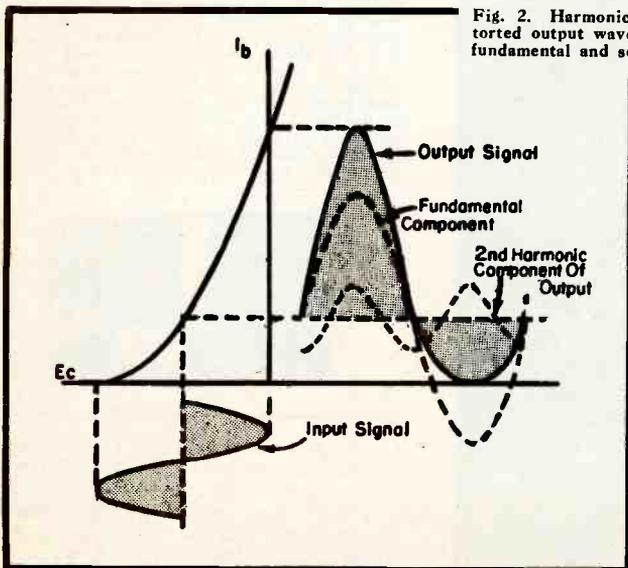
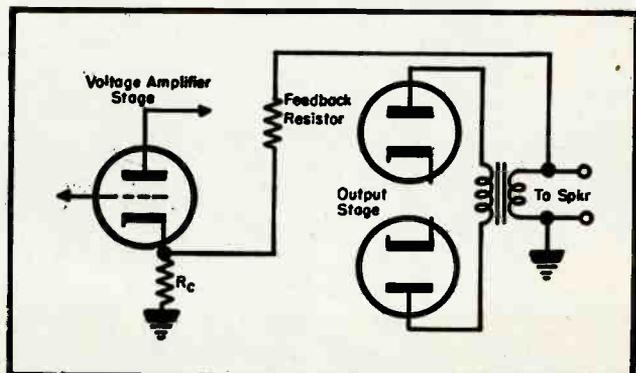


Fig. 2. Harmonic distortion caused by non-linear transfer characteristic of vacuum-tube. The distorted output waveform may be analyzed into the components shown in dotted lines, consisting of the fundamental and second harmonic. (By permission from *Principles of Electron Tubes*, by H. J. Reich. Copyright, 1941; McGraw-Hill Book Company, Inc.)

Fig. 3. Typical modern feedback circuit. Voltage is fed back out of phase from the voice-coil winding of the output transformer to an earlier stage, reducing distortion and noise, increasing the damping factor, and improving frequency response. The smaller the value of the feedback resistor in relation to R_c , the greater is the amount of feedback.



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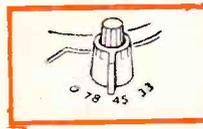
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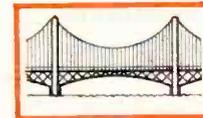
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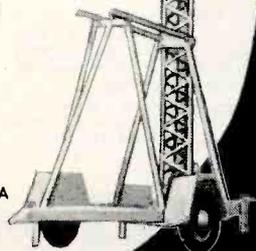
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Audio Amplifiers

(Continued from page 26)

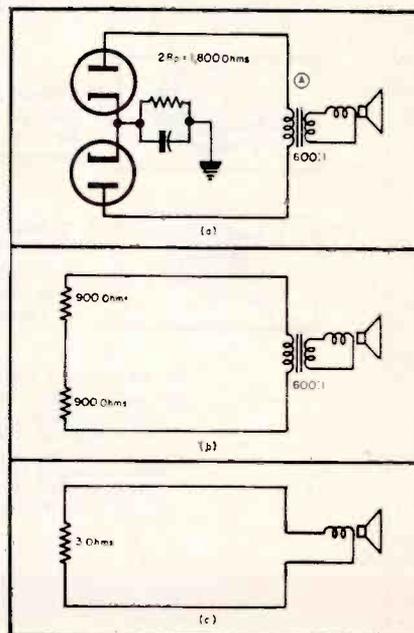
a power sensitivity appropriate to the input voltages that will be fed to it.

Harmonic and Intermodulation Distortion

Waveform distortion of the type illustrated in Fig. 2 is called *non-linear, amplitude, or harmonic* distortion. This distortion injects spurious harmonics into the amplifier output; that is, new signals are produced at frequencies which are multiples of the original signal. The plot shows how a non-linear vacuum tube transfer characteristic changes the shape of the input. The distorted waveform in solid line is the resultant of the two waveforms in dotted lines, the latter consisting of the original signal and its second harmonic.

These spurious harmonics create a harsh, unpleasant quality in the reproduced sound. This is mainly due to the formation of intermodulatory products. When both low and high frequencies are passed simultaneously through a distorting device, intermodulation takes place, and the sum and difference frequency sidebands associated with amplitude modulation are created. These sideband frequencies, like the spurious harmonics, are new tones, injected into the system, but unlike the harmonics they are musically discordant with the original tones

Fig. 4. Braking action of the amplifier output stage on the loudspeaker is illustrated in (a). The source impedance of the amplifier is equal to the plate resistance of the output stage (shown as $2K\Omega$) stepped down by the output transformer; in this case 3 ohms. The damping factor is $8/3$ or $2\frac{2}{3}$. In (b) and (c) are equivalent circuits to illustrate the load seen by the loudspeaker.



from which they were produced. Their effect is therefore much worse; it is intermodulation which can make loud orchestral music sound like the screeches coming from a zoo's bird house.

The smallest percentage of harmonic distortion that can be perceived depends upon the order of harmonic and the frequency range of the equipment, but is of the order of one to two per cent. (Higher order harmonics must be kept especially low.) Distortion invariably increases as the amplifier is taxed for more power, and so the distortion rating must be related to the power level with which it is associated. There are commercial amplifiers which have succeeded in keeping harmonic distortion at rated power to a small fraction of one per cent. The harmonic distortion of a typical radio with a single-ended pentode output and no feedback is likely to be at least 10% at full output. Whatever the percentage of distortion, the rated intermodulation percentage will probably be about four times as great.

Frequency Response

The frequency response of the amplifier is rarely a limiting factor in the frequency response of the entire system. The range of frequencies covered should be at least 40 to 14,000 cycles, ± 1 or 2 db, but the range within a feedback loop of the amplifier circuit must be very much greater, to avoid phase shift and regeneration within the loop. Frequency response ratings from a few cycles to 100 kc are dramatic, but have little significance except as they apply to a part of the circuit within the feedback loop or loops. However, it is important that frequency peaks and a tendency towards self-oscillation do not exist at either subsonic or supersonic frequencies. These give rise to motorboating and supersonic oscillation, both of which may indirectly cause serious distortion in the audible range. There are very high-quality amplifiers on the market which purposely introduce progressive attenuation beyond the extremes of the audible frequency spectrum to suppress unwanted interference (turntable rumble, supersonic oscillations, etc.) originating in these inaudible bands.

The frequency-response rating of an amplifier should be given at rated power, since the handling of frequencies at very low power levels may not properly represent performance at higher output.

Source Impedance

The output stage of an amplifier drives the loudspeaker in the same



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way that a generator drives a motor. Just as the internal resistance of the generator acts as an electrical brake against the motor's inertia, the plate resistance of the amplifier's output stage *brakes* the loudspeaker.

If the generator is turned off the motor which is connected to it cannot continue to spin freely; each revolution of the motor armature induces a back *emf* that is harnessed to the generator's armature, and free revolutions of the motor have to drive the generator as a motor. The analogy

to the case of the amplifier and speaker is exact. If the cone tries to continue oscillating on its own after the signal has stopped, the internal impedance of the output stage acts as a braking load. All motion of the voice coil in the speaker's magnetic field must induce a back *emf*, which is applied through the output transformer to the output tubes. When the plate resistance of these tubes is low, the voice coil must send an appreciable amount of energy back into the amplifier in
(Continued on page 30)

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Audio Amplifiers

(Continued from page 29)

order to move, and the voice coil comes to a grinding halt instead.

The loudspeaker sees an amplifier impedance, or source impedance, equal to the combined plate resistance of push-pull output tubes stepped down by the impedance ratio of the output transformer, as illustrated in Fig. 4; p. 28. This source impedance should be appreciably lower than the rated impedance of the voice coil. When it becomes less than about $\frac{1}{4}$ of the value of the voice-coil impedance, however, there is little advantage in further

reduction, as the *dc* resistance of the voice coil remains as a limiting factor.

The source impedance (always referred to a particular impedance of voice coil winding) may also be expressed as a ratio to the impedance of that winding, in which case it is called the *damping factor*. This is equal to the rated impedance of the voice coil winding, divided by the source impedance seen by the voice coil terminals; or the output impedance divided by the source impedance.¹

A low-source impedance (or a high damping factor), in addition to acting against speaker hangover, also counteracts the resonant peak in out-

put introduced by the mechanical system of the speaker. This benefit is derived from the fact that a low-source impedance tends to keep the voltage across the loudspeaker terminals constant, despite the varying motional impedance of the speaker.

Triode output tubes have a high load impedance-plate resistance ratio, and therefore have inherently good damping factors. Beam pentodes have inherently poor damping factors, but the use of large amounts of negative feedback may increase the damping factor to exceed that of triodes without feedback.

Hum and Noise Level

The two main types of noise produced by amplifiers are hum and thermal noise. The amplifier circuit is especially susceptible to both of these in low level, high-gain circuits, so that amplifiers which include preamplifier stages for microphones or magnetic pickups may be expected to have a higher noise level than basic amplifiers with low power sensitivity. Two features of circuit design which are beneficial in keeping noise low are the use of *dc* on tube filaments in low level stages, and the use of feedback over such stages.

The amplifier hum and noise level should be at least as low as the FCC standard for FM broadcast stations, which allows a maximum level of 60 db below maximum output.² Since there may be other sources of hum in the system, and since the hum level in the amplifier itself may increase due to the aging of parts, it is a good idea to seek a hum and noise rating which is perhaps 70 db below output to secure a margin of safety.

Tone Control

It is not too many years ago that the term *tone control* meant a single treble-cut switch, and indicated advanced design. The modern amplifier should afford, as a minimum for tone control, independent boost or cut of both bass and treble. Further flexibility is sometimes provided in control over record turnover frequencies.

Many tone control circuits are designed so that boost or cut begin³ in the neighborhood of the psychological mid-point of the audio spectrum (about 800 cycles). Surveys have indicated that those designs which leave

¹The damping factor is also equal to the load impedance presented by the output transformer to the output tubes, divided by the plate resistance of the output stage.

²The hum rating is occasionally given in terms of absolute power. If the hum is 60 db below rated output, the number of microwatts of hum will be equal to the number of watts of signal power.

the frequency region between about 500 and 3,000 cycles relatively unaffected, and only apply correction beyond these points, are more liable to provide correct compensation for the usual equipment and program deficiencies. It has also been found that about 12 db of maximum boost at 60 and 12,000 cycles is adequate.

Amplifier Design

Any audio amplifier, of whatever type, is a good one if it meets the performance specifications cited earlier. There are a few technical design principles, however, which are universally observed in good amplifiers, and which are worth checking prior to purchase.

(1) The output stages of all quality amplifiers are push-pull circuits.

(2) The components used in the amplifier should be conservatively rated as to voltage breakdown, current or power handling capacity, and other such characteristics. It is pretty safe to assume that a good transformer, especially the output transformer, will be a relatively large one.

(3) Modern high-quality amplifiers are designed with negative feedback taken over the output stage; Fig. 3, p. 26. This is desirable in the case of triode output tubes, and absolutely essential with pentodes, which require at least 15 db of feedback. Occasionally the feedback is used in conjunction with a frequency selective circuit for tone control, so that boost of a particular band of frequencies is achieved by reducing the feedback over that band. This practice is only acceptable if the residual feedback over the output stage, after maximum reduction is still 15 db or more.

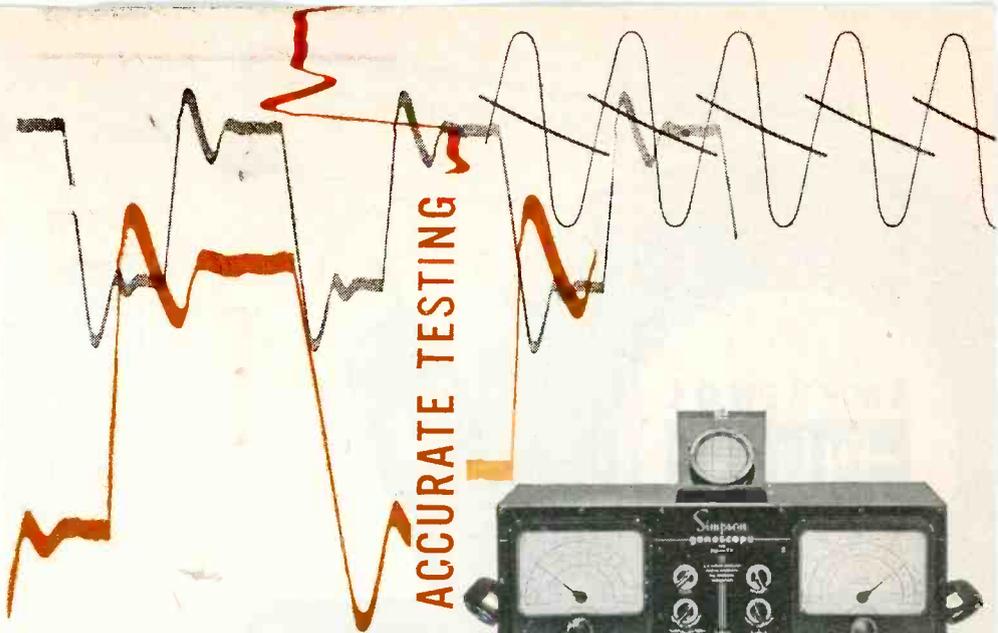
Amplifier Construction

There are many pitfalls in amplifier construction, but excellent results may be achieved if a standard conservative design, (such as the Williamson) is used, and if the components are of good grade and properly rated. The purchase of kits is recommended for those who have not had experience in amplifier design, because the importance of proper physical layout and wiring, and the significance of certain component characteristics, may not be appreciated. For example, some of the lesser known but desirable part characteristics are:

(1) Low *dc* resistance in heavy current-carrying filter chokes.

(2) Low capacity to ground or coupling capacitors, especially when

*The frequency at which boost or cut is considered to begin is at that point of the frequency spectrum where response is up or down about 3 db.



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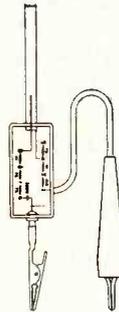
zenith

motorola

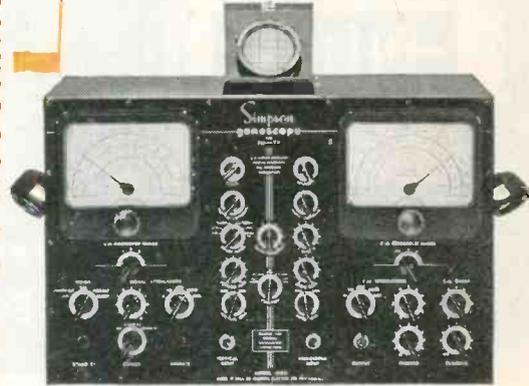
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the grid resistor is high in value (ruling out bathtub capacitors).

(3) Good voltage regulation of the power transformer.

(4) Low-leakage reactance and low distributed capacity in the output transformer.

But, whether the amplifier is bought, assembled from a kit, or built from odd parts, it should be the strongest link in the assembly of reproducing components.

NEXT MONTH

THE CONCLUDING installment of the Cyrus Glickstein article on the reading of difficult schematics will appear in January SERVICE.

TRIAD OPENS CALIFORNIA PLANT

Over 500 guests attended the opening of the Triad Transformer Manufacturing Company's new plant, at 4055 Redwood Ave., Venice, Calif.



At Triad plant opening: Ernest Clover, director of Triad plant sales (center), and O. D. Perry and L. W. Howard, operating partners of Triad.



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Merchandising Audio

(Continued from page 22)

PROSPECT	1	2	3	4	5	6	7	8	9	10
AIRPORTS	X	X	X	X	X	X				
APARTMENTS	X	X	X	X	X	X	X	X	X	X
ARCADES	X	X	X	X	X	X	X	X	X	X
ARCHITECTS	KEEP IN TOUCH WITH THEM-THEY OFTEN INCLUDE SPECIFICATIONS IN ORIGINAL BUILDING PLANS									
ARENAS	X	X	X	X	X	X	X	X	X	X
ARMY ORGANIZATIONS	X	X	X	X	X	X	X	X	X	X
AUDITORIUMS	X	X	X	X	X	X	X	X	X	X
BAKERIES		X	X	X	X	X				
BALLROOM		X	X	X	X	X				
BANDS	EQUIP BANDS WITH THEIR OWN SOUND SYSTEM									
BANKS	X	X	X	X	X	X	X	X	X	X
BARRACKS	X	X	X	X	X	X	X	X	X	X
BARS	X	X	X	X	X	X	X	X	X	X
BASEBALL PARKS	X	X	X	X	X	X	X	X	X	X
BEACHES	X	X	X	X	X	X	X	X	X	X
BOARD OF EDUCATION	X	X	X	X	X	X	X	X	X	X
BOWLING ALLEYS	X	X	X	X	X	X	X	X	X	X
BREWERY	X	X	X	X	X	X	X	X	X	X
BROADCAST STATIONS	X	X	X	X	X	X	X	X	X	X
CAFES	X	X	X	X	X	X	X	X	X	X
CAMPS	X	X	X	X	X	X	X	X	X	X
CAPITOL BLDG.	X	X	X	X	X	X	X	X	X	X
CARNIVALS	X	X	X	X	X	X	X	X	X	X
CATHEDRAL	X	X	X	X	X	X	X	X	X	X
CHURCH	X	X	X	X	X	X	X	X	X	X
CLINICS	X	X	X	X	X	X	X	X	X	X
CLUBS	X	X	X	X	X	X	X	X	X	X
COLLEGE	X	X	X	X	X	X	X	X	X	X
COMMUNICATIONS CENTERS	X	X	X	X	X	X	X	X	X	X
CONDUCTORS	A FINE SOURCE OF INFORMATION-SOUND SYSTEMS, INSTRUCTION AND RECORDINGS									
CONTRACTORS	BUILDING PLANS AND INSTALLATION PROBLEMS-KEEP IN TOUCH									
CONVENTS	X	X	X	X	X	X	X	X	X	X
COURTS OF LAW	X	X	X	X	X	X	X	X	X	X
DANCE HALLS	X	X	X	X	X	X	X	X	X	X
DENTISTS	X	X	X	X	X	X	X	X	X	X
DISTILLERIES	X	X	X	X	X	X	X	X	X	X
DOCTORS	X	X	X	X	X	X	X	X	X	X
EDITORIAL HOUSES	X	X	X	X	X	X	X	X	X	X
ELECTRICAL ENGINEERS	NEW BUILDINGS, FACTORIES AND MODERNIZATIONS									
ELECTRICIANS	THESE FELLOWS DO THE INSTALLING - KEEP IN TOUCH									
ELEVATORS	X	X	X	X	X	X	X	X	X	X
ESTATES	X	X	X	X	X	X	X	X	X	X
FACTORIES (GENERAL)	X	X	X	X	X	X	X	X	X	X
FAIRS	X	X	X	X	X	X	X	X	X	X
FARMS	X	X	X	X	X	X	X	X	X	X
FIELDS (SPORTS)	X	X	X	X	X	X	X	X	X	X
FIESTA	X	X	X	X	X	X	X	X	X	X
FILM STUDIOS	X	X	X	X	X	X	X	X	X	X
FIRE COMPANIES	X	X	X	X	X	X	X	X	X	X
FOOTBALL PARKS	X	X	X	X	X	X	X	X	X	X
FORGES	X	X	X	X	X	X	X	X	X	X
FOUNDRIES	X	X	X	X	X	X	X	X	X	X
GARAGES	X	X	X	X	X	X	X	X	X	X
GASOLINE STATIONS	X	X	X	X	X	X	X	X	X	X
GENERATING PLANTS	X	X	X	X	X	X	X	X	X	X
GOLF CLUBS	X	X	X	X	X	X	X	X	X	X
GOVERNMENTS	X	X	X	X	X	X	X	X	X	X
GRILLS	X	X	X	X	X	X	X	X	X	X
HARBORS	X	X	X	X	X	X	X	X	X	X
HOMES	X	X	X	X	X	X	X	X	X	X
HOSPITALS	X	X	X	X	X	X	X	X	X	X
HOTELS	X	X	X	X	X	X	X	X	X	X
JAY HAWK COURTS	X	X	X	X	X	X	X	X	X	X
JAILS	X	X	X	X	X	X	X	X	X	X
JOCKEY CLUBS	X	X	X	X	X	X	X	X	X	X
KINDERGARTEN	X	X	X	X	X	X	X	X	X	X
LABORATORIES	X	X	X	X	X	X	X	X	X	X
LAW SCHOOLS	X	X	X	X	X	X	X	X	X	X
LAWYERS	X	X	X	X	X	X	X	X	X	X
LEGISLATURE	X	X	X	X	X	X	X	X	X	X
MACHINE SHOPS	X	X	X	X	X	X	X	X	X	X
MANUFACTURING PLANTS	X	X	X	X	X	X	X	X	X	X
MECHANICAL ENGINEERS	FOR FACTORIES, MILLS & PERSONAL USES - SEE THEM ALL									
MINES	X	X	X	X	X	X	X	X	X	X
MONASTERIES	X	X	X	X	X	X	X	X	X	X
MOTION PICTURE STUDIOS	X	X	X	X	X	X	X	X	X	X
MUNICIPALITIES	X	X	X	X	X	X	X	X	X	X
NAVY ORGANIZATIONS	X	X	X	X	X	X	X	X	X	X
OFFICES (BUSINESS)	X	X	X	X	X	X	X	X	X	X
OIL FIELD	X	X	X	X	X	X	X	X	X	X
ORCHESTRAS	EVERY ORCHESTRA - POPULAR OR SYMPHONY NEEDS A SOUND SYSTEM									
PARKS	X	X	X	X	X	X	X	X	X	X
PIERS	X	X	X	X	X	X	X	X	X	X
PLANTATION	X	X	X	X	X	X	X	X	X	X
PLAYGROUNDS	X	X	X	X	X	X	X	X	X	X
POLICE	X	X	X	X	X	X	X	X	X	X
POLITICIANS	X	X	X	X	X	X	X	X	X	X
POLO FIELDS	X	X	X	X	X	X	X	X	X	X
POWER HOUSES	X	X	X	X	X	X	X	X	X	X
PROVINCIAL GOVTS.	X	X	X	X	X	X	X	X	X	X
RACE TRACKS	X	X	X	X	X	X	X	X	X	X
RADIO STATIONS	(SEE BROADCAST STATIONS)									
RADIO STORES	X	X	X	X	X	X	X	X	X	X
RAILROAD YARDS	X	X	X	X	X	X	X	X	X	X
REFINERIES	X	X	X	X	X	X	X	X	X	X
REPAIR SHOPS	X	X	X	X	X	X	X	X	X	X
SARITORIES	X	X	X	X	X	X	X	X	X	X
SCHOOLS	X	X	X	X	X	X	X	X	X	X
STEEL MILLS	X	X	X	X	X	X	X	X	X	X
SUGAR MILLS	X	X	X	X	X	X	X	X	X	X
TEXTILE MILLS	X	X	X	X	X	X	X	X	X	X
TOBACCO MILLS	X	X	X	X	X	X	X	X	X	X

Fig. 1. List of basic applications for audio systems: 1 = announcing; 2 = paging and calling; 3 = entertainment; 4 = intercommunication; 5 = instruction; 6 = emergency; 7 = reinforcement; 8 = personal; 9 = recording; 10 = sales aids. This is actually a partial list which can serve as a guide in search for the likeliest and most productive prospects. Each of the suggested projects may actually consist of dozens of individual buyers. (Courtesy RCA)



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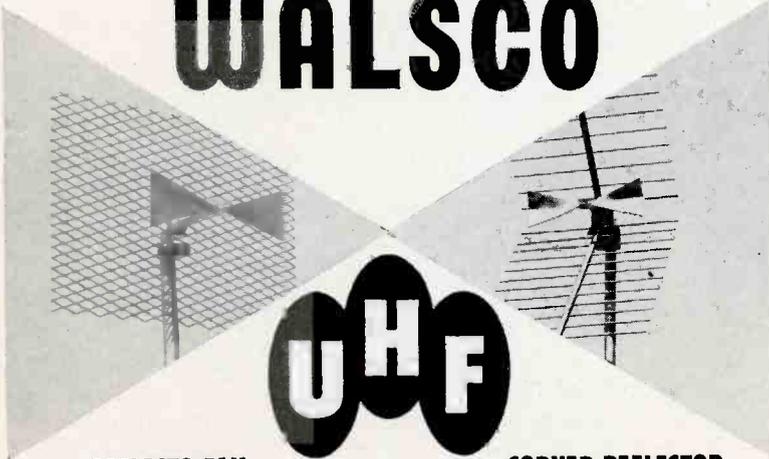
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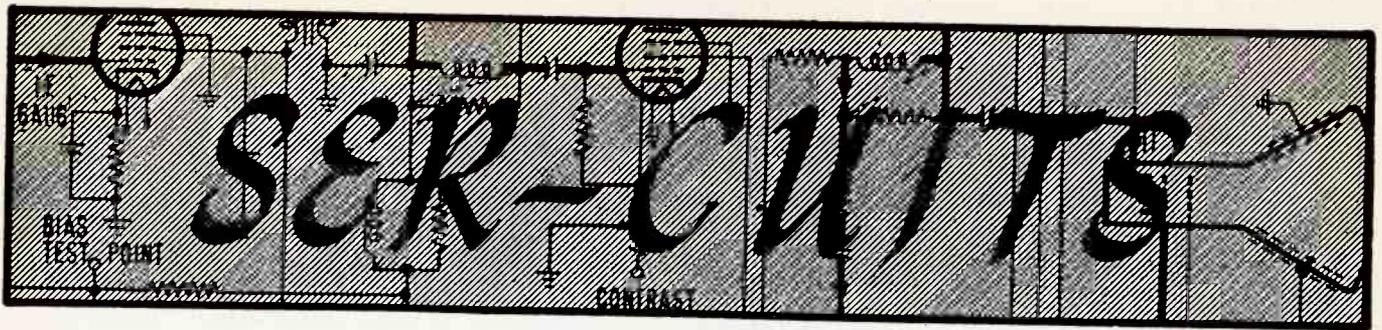
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by M. W. PERCY

Circuitry Analysis of Electrostatic-Focus Chassis With 18 Tubes, Germanium Video Detector and Selenium Rectifiers

THE USE OF ELECTROSTATIC FOCUSING, originally introduced as a means of saving critical materials and described by many as a temporary step, has become quite a standardized practice and a feature of a host of chassis lines. In these models, the picture tubes are designed for optimum focus at some fixed potential relative to its cathode, the potential value depending chiefly upon tube type, but the variation of focus with several hundred volts change in focus potential is very slight. Usually, the *focus* control is a 1.5-megohm potentiometer connected between boost voltage (about 480 v) and ground, while the arm of the potentiometer is connected to the focusing electrode in the picture tube.

The circuitry employed is well illustrated in Fig. 1, where a 17-inch tube is used. In this, an 18-tube series-filament model, Hoffman 7M109 (chassis 200), a single pentode video amplifier with a degenerative type of contrast control in its cathode circuit and a 4.5-mc beat trap in its plate circuit drives the cathode of the picture tube. A variable positive bias is also injected into the picture tube cathode circuit to serve as brightness control bias. The control grid of the picture tube is connected to a differentiating network which sharpens the negative retrace voltage spike fed to the vertical output tube. This negative spike provides retrace line blanking.

Two sync separator stages are incorporated into this receiver, the two stages utilizing a single dual triode. The composite signal, taken at a point following L_{303} , the first of two shunt peaking coils, is fed through a double time constant rc filter to the first sync separator. This stage serves the additional function of furnishing a portion of the voltage drop between the +260 and +150 v buses. The second sync separator base clips the remaining composite signal from the sync pulses and serves as a phase inverter for supplying the horizontal phase detector with nearly equal and opposite sync pulses. The voltage tap on the plate load resistor is used for provid-

ing a positive pulse which is approximately the same amplitude as the negative pulse taken from the cathode circuit. The sync signal input to the vertical integrator network is taken at the plate of the second sync separator, thus providing a larger pulse amplitude.

The vertical oscillator is a blocking oscillator type which uses $\frac{1}{2}$ of a dual triode. The output from this stage is fed directly to the vertical output stage which uses the other half of the dual triode. The output tube is matched to the vertical deflection coils through an autotransformer type of output transformer. The B -supply voltage for these two stages is taken from the boost source, the connection being made internally in the yoke.

Both picture and sound output from the tuner is fed to the first of three stages of stagger-tuned *if* amplification. The picture carrier frequency is 26.25 mc. An absorption type sound trap is employed in the output of the second *if* amplifier. An intercarrier type sound system is used, the 4.5 mc sound take-off occurring at the output of the video amplifier.

A ratio detector is used as the sound second detector. A triode voltage amplification stage follows, driving a single-ended power amplifier. A beam power output tube is coupled to the electrodynamic speaker through an audio output transformer terminated by a pair of speaker leads which are part of a four-wire speaker cable and socket. The field coil of the speaker serves as the B -power supply choke, the connection being made through the remaining two leads of the speaker cable. A germanium crystal diode is used as a video detector in this chassis. The output from the detector is coupled to the video amplifier, through a high frequency compensating network

and coupling capacitor. The *dc* component of the demodulated signal is a function of signal strength and is of correct polarity to be used as a source of *agc* voltage, separate *rf* and *if* circuits taking their negative voltage from this source.

The *ac* component of the demodulated signal is removed by an *rc* filter and the *dc* component is passed on to the first and second *if* amplifiers through their respective decoupling filters. An *rc* filter in the *rf agc* circuit also removes the *ac* component. A 2.2-megohm resistor in this circuit becomes part of an *rf agc* voltage divider when a *maximum performance selector* switch is in center and clockwise positions.

The horizontal oscillator is a cathode-coupled type of multivibrator. The stabilizing influence of a parallel tuned *lc* circuit is used as part of the plate load of one triode section. The natural frequency of the tuned circuit is made very close to the horizontal sweep frequency. The frequency of the horizontal oscillator is further stabilized by a balanced horizontal phase detector which utilizes a miniature dual diode. The oscillator drives a stage of power amplification that is coupled to the horizontal deflection coils through an autotransformer type of output transformer, which is also an active member of the high-voltage supply and which supplies a reference sawtooth voltage for the horizontal phase detector. The horizontal sweep output is varied by varying the air gap of the transformer's core. A variable control is connected in series with the portion of the transformer winding common to the input and output circuits. The setting of this control determines the magnitude of *dc* current flowing in the horizontal deflection coils.

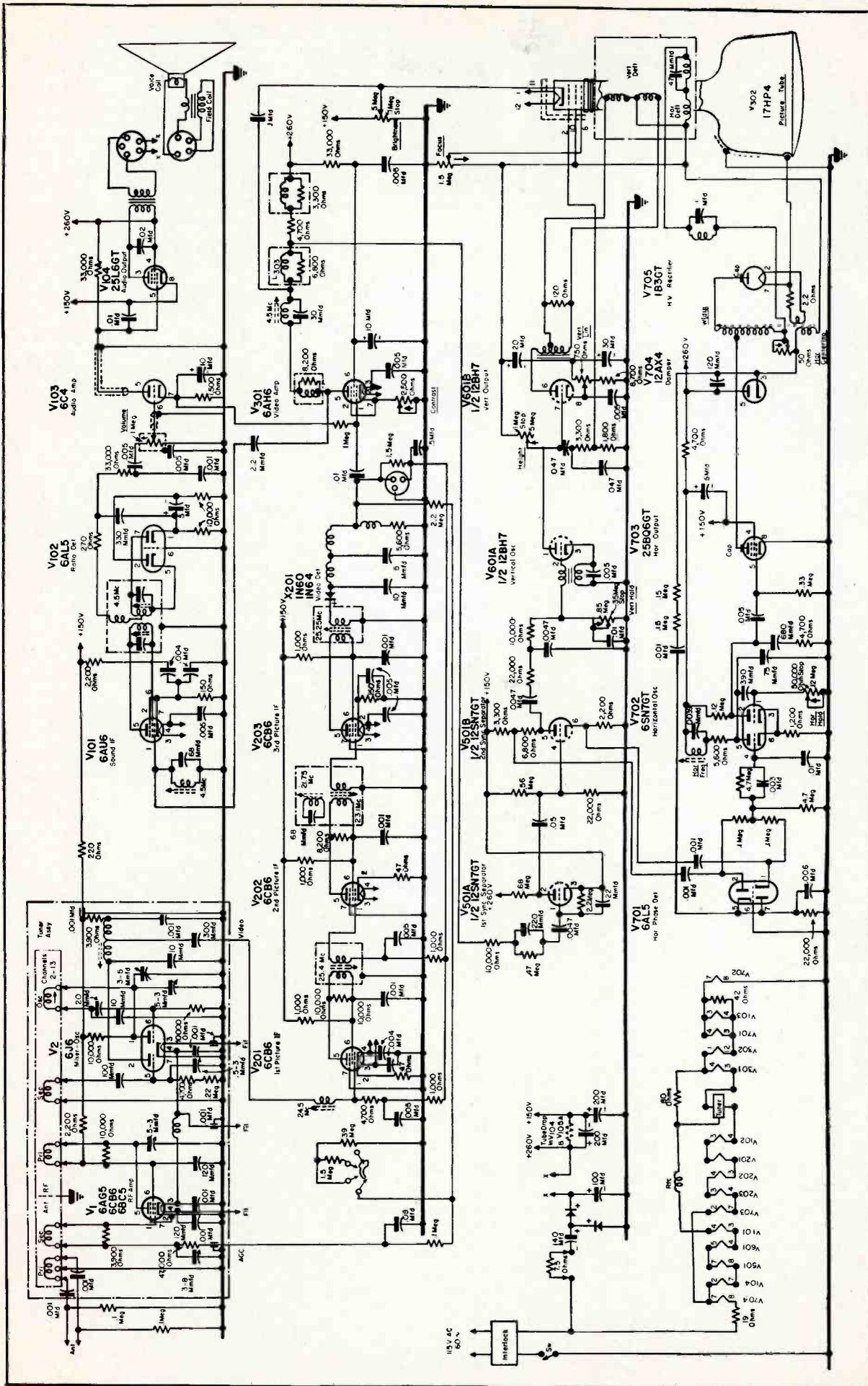


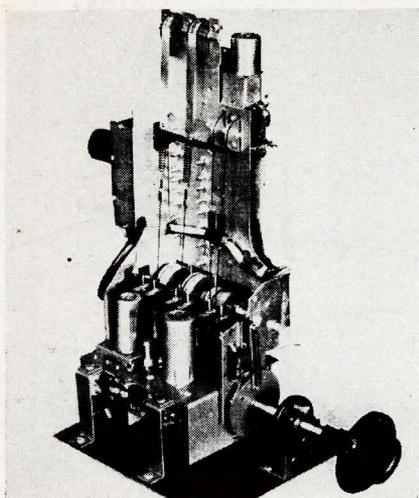
Fig. 1. Schematic of Hoffman chassis 200, model 7M109, which features an electrostatic focus type tube, 17HP4.

Continuous Tuning

UHF Tuner

by WYN MARTIN

[See Front Cover]



Model of combined ultrahigh tuner (top) and veryhigh tuner (bottom) which affords 82-channel coverage.

IN CONVERTING VHF receivers for combined ultrahigh/veryhigh service, several types of tuning systems can be used for one or two-channel reception or all-channel pickup.

Tuner Circuit

On the cover, this month, is illustrated the circuit of a single conversion, continuous tuning *uhf* tuner which mechanically mounts directly over the *vhf* tuner in the receiver. The tuner is coupled to the *vhf* tuner by drive gears providing tuning of both *uhf* and *vhf* by the same tuning knob. Filament and plate supply voltages for the tuner are obtained from the TV chassis.

Conversion Characteristics

The *uhf* tuner selects the *uhf* station video and sound carriers and converts them to the carrier *if* frequency of 26.75 mc for video and 22.25 mc for sound.

Circuit Description

The *uhf* tuner employs a double-tuned coax line *rf* cavity preselector. The coax-line arrangement is said to afford high selectivity, low insertion losses, uniform bandwidth and good shielding against oscillator radiation. The coax cavity is basically a one-quarter wave shorted tuned stub. The electrical length of the cavities is varied by a ribbon which is attached to

the dial cord and pulley arrangement. In this manner, tuning is similar to the varying of the length of a tuned stub which would change the resonant length for various frequencies. The dial cord is of a special material which is said to be unaffected by temperature or moisture and is locked to the pulleys to eliminate the possibility of slippage. Tracking screws are provided in the cavities to obtain uniform bandwidth and sensitivity. The tracking screws vary the capacity between the ribbon and the cavity wall and thus vary the electrical length of the ribbon.

6AF4 Oscillator

The oscillator tube used is a 6AF4, which is similar to the 6F4. Oscillator tuning is accomplished by a one-quarter wave shorted parallel-wire transmission-line arrangement. It differs from the *rf* cavities, in that a shorting bar is used to vary the electrical length of the lines, a method which is said to provide very stable operation.

Inductive-Coupling Feature

Inductive or link coupling is employed to transfer the signal between stages. The arrangement of link coupling is claimed to provide maximum selectivity and constant bandwidth over the entire *uhf* band. The signal from the output coupling link is mixed and detected by a CK-710 crystal detector and then applied to the tuned input of the cascode amplifier. A

6BK7 tube is used as a cascode pre-*if* amplifier which is tuned to a center frequency of 25 mc. The signal is amplified by the cascode amplifier and then coupled to the *if* amplifier section in the receiver through 10 inches of RG62/U cable.

Tuner Sensitivity

The *uhf* tuner maintains a fairly constant antenna input impedance of 300 ohms, has an overall bandwidth of 6 to 8 mc, and has an oscillator-injection current ratio of approximately 2 to 1. The only amplification of the signal takes place in the cascode amplifier. The signal is not amplified in the *rf* cavities; therefore, the sensitivity of the receiver on *uhf* will not quite equal that of *vhf*. A receiver equipped with a *uhf* tuner will have an overall *uhf* sensitivity of approximately 150 microvolts.

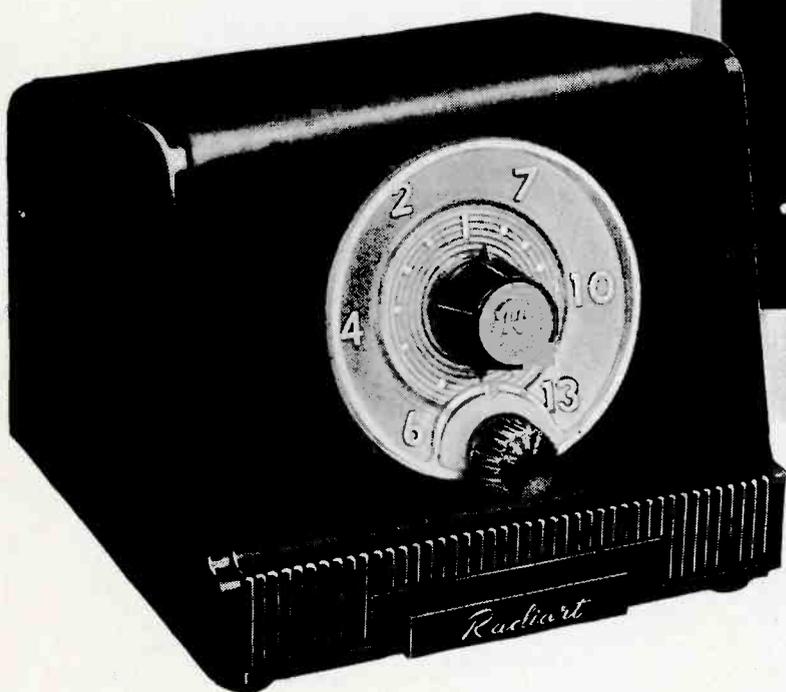
Service Notes

Service features of this tuner provide for check points to measure the oscillator grid current to determine whether the oscillator is functioning. Provisions have also been made for measuring the oscillator injection current with a multimeter** on the 100-microamp scale to check both the crystal detector and the oscillator. An opening is also provided for coupling to the center tap of the input grid coil when alignment of the cascode amplifier is necessary.

*Based on notes supplied by Raytheon Television and Radio Corp.

**Such as the Simpson model 260.

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- ★ Stand-By Position — eliminating "warm-up" time for booster
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and these too: High Signal-to-Noise Ratio ★ Wide Band Amplification ★ Complete Neutralization for Stable Operation ★ Mahogany Grained Polished Finish ★ Completely Enclosed for Dust-Free Operation ★ 15 Degree Tilt for Easier Visibility.

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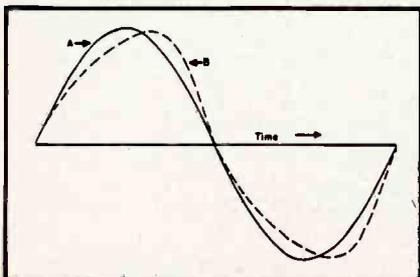
by KENNETH STEWART

Phono Needle Drag Distortion . . . Transistor Amplifiers . . . FM-AM Tuner Design

IN THE DESIGN of a phono system, one problem usually receives particular attention; the minimization of distortion. To assist in the war against this bugaboo, many intensive studies have been initiated not only in private industry, but in government labs, too. Recently, as a result of an investigation of distortion at the Bureau of Standards[‡], it was found that there exists a type of distortion that has been overlooked by many. It was learned that if a needle moves longitudinally (tangentially) with respect to the groove of an ordinary laterally recorded disk, the needle does not follow perfectly the lateral excursions of the groove, and *drag distortion* results. In the playing back of recorded music, this distortion can apparently result in spurious tones of greater amplitude than the tones originally present.

Explaining the essential mechanism of *drag distortion* the Bureau's experts declared that the usual type of disc is recorded laterally; the *af* motion of the recording needle is at right angles to the record groove. For ideal distortion-free reproduction of recorded music or information, the motion of the tip of the playback needle or stylus must duplicate exactly the original lateral motion of the recording stylus. Provided the electrical output of the reproducing pickup is

Fig. 1. Graphical representation of the phono-needle *drag distortion* recently studied at the Bureau of Standards. Solid line = lateral displacement of an ideal stylus, free to move laterally but not longitudinally, as it follows a lateral sine-wave recording. Dotted line = same recording, but stylus free to move longitudinally as well as laterally; because of this longitudinal freedom, the lateral displacement (and hence the output of the pickup) is distorted, instead of duplicating the original sine wave.



proportional to the lateral displacement of the reproducing stylus, the electrical output of the pickup will then be undistorted. But, if forces acting on the stylus cause longitudinal motion, its lateral motion will no longer exactly duplicate the motion of the recording stylus and thus distortion will be introduced.

Longitudinal Motion Causes

It was noted that there are many possible causes for such longitudinal motion. The well-known *pinch* effect, due to the uneven width of the record groove is one such cause. Another is the varying force which the sides of the record groove exert against the stylus. A third is the change in friction with changes in the pressure and velocity of the stylus in the groove.

The NBS study revolved about a mathematical analysis and lab experimentation. Mathematically, it was found that if the recording consists of a pure tone of constant amplitude,

[‡]Survey conducted by Jacob Rabinow and Ernest Codler.

FM-AM tuner which incorporates a front panel selected equalization for AES, *lp* or *EU*ropean recording characteristics. Also featured is a double shadow tuning eye, front panel control for *afc* cutout when tuning weak stations, and continuously variable bass and treble controls from 15 db boost through 15 db attenuation with flat position clearly marked. Has 15 tubes; can be mounted in the same panel formerly cut for a RC10 or C10 tuner. (C800; the Radio Craftsmen, Inc., 4401 N. Ravenswood Ave., Chicago 40, Ill.)

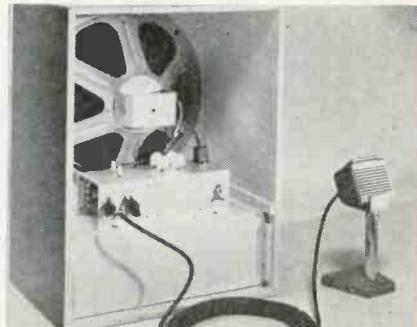
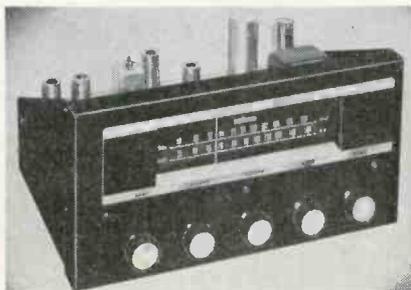
drag distortion will introduce only even harmonics, with the second harmonic predominating. A sudden transition from one amplitude to another will produce a large change in the longitudinal force on the stylus, and this may be expected to give rise to transient distortion if the needle is not properly restrained longitudinally.

In the experimental work, a conventional crystal pickup with a replaceable steel needle was used. For some of the tests a thin steel wire was spot-welded to the needle near the tip; by tying back the needle tip with this wire, longitudinal motion could be minimized. A dual-beam 'scope was used to indicate simultaneously both the output of the pick up and the longitudinal displacement of the needle tip.

Two methods of measuring the longitudinal motion of the needle were tried. The first consisted of a photoelectric arrangement in which longitudinal motion of the needle modulated a beam of light. In the second and more satisfactory method, the longi-
(Continued on page 63)

Tubeless portable PA system using six developmental and experimental transistors¹ of the junction type. Delivers 1.4 watts output from a 12" loudspeaker while operating from a self-contained 22½-volt dry battery. Transistors are atop the chassis at the rear of the speaker housing. (Courtesy RCA.)

¹See *Tube News*, this issue, p. 40.



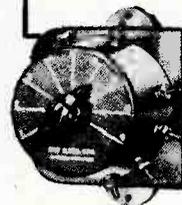
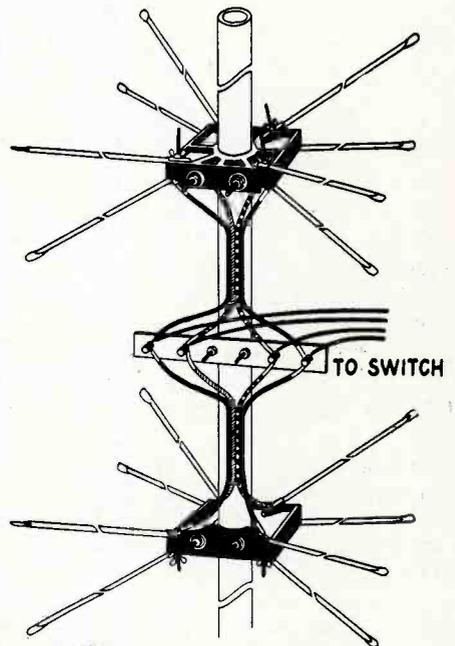
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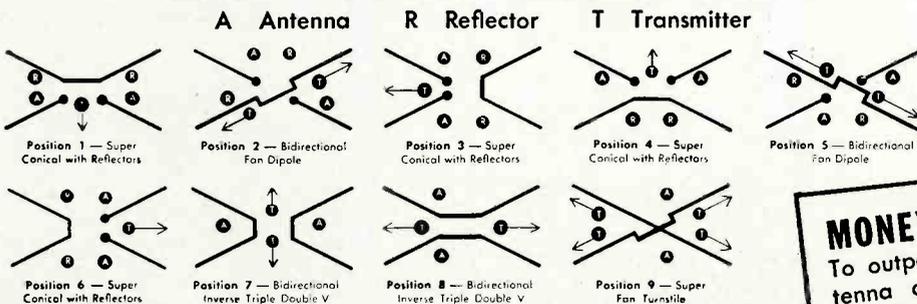


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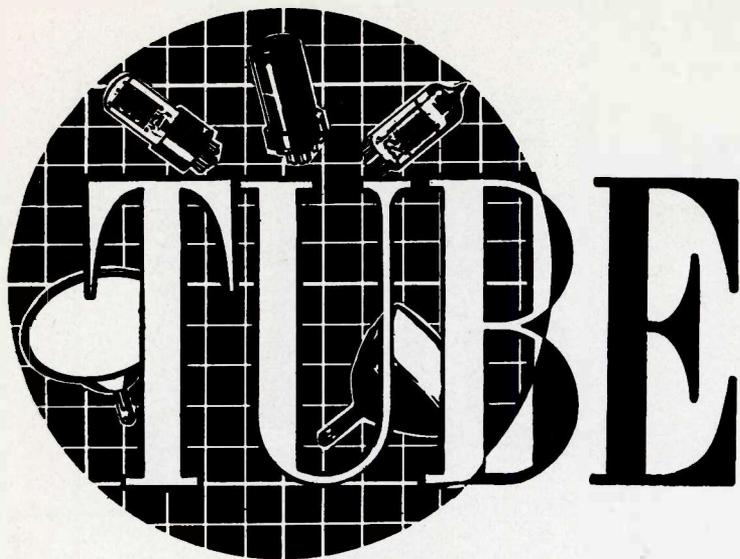
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News

by L. M. ALLEN

SINCE THE ANNOUNCEMENT of the transistor using germanium four years ago by Bell Lab scientists, intensive research programs have been set up to study the semiconductor's¹ fundamental theory of operation and develop methods of controlling its operating characteristics and construction processes.

A few weeks ago the results of experimental investigations conducted by one lab² were revealed during a series of special demonstrations. The tests disclosed that the physical ruggedness of the transistor offers obvious advantages. In addition, it was shown that the units require no *warm up* time, operating instantly when voltage is applied to its terminals. Moreover, it was said, the operating life of some transistors showed indications of being very long.

Two basic kinds of transistors were displayed; point-contact and junction.³ The point-contact transistor was developed first. While it has performed at higher frequencies, the junction transistor was said to show promises of being more important than the point-contact type in many applications. Also, it was reported that the junction types have lower noise, higher power gain, greater efficiency, and higher power-handling capabilities.

Three kinds of developmental point-contact transistors were used in the demonstrations; a general purpose switching type, a high-frequency amplifier and a very high frequency oscillator. One developmental junction

transistor was also shown; a general purpose amplifier of *p-n-p* (positive-negative-positive) construction.

It was explained that junction transistors are classed *p-n-p* or *n-p-n* depending on their design. A *n-p-n* transistor provides, as does an electron tube, negative charges in a circuit, while the *p-n-p* type has the effect of providing positive charges, thus giving circuit potentialities unobtainable with tubes.

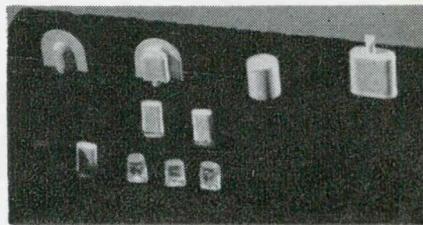
Transistors were said to be not interchangeable with present tubes, in the sense that a tube from an existing instrument can be pulled out and a transistor substituted. New circuitry must be developed, it was pointed out, to take full advantage of the special characteristics of transistors and, to fully realize space and weight saving possibilities afforded by transistors, new components will also have to be designed.

The art of crystal growing and control was described as having progressed to the point where various transistor characteristics such as current amplification, power gain, feedback resistance, and input and output resistance can be controlled to close limits.

At present, it was noted, the characteristics of high gain, low noise,

¹The original galena crystal detector of the pioneering days of radio was a semiconductor device. However, little was known then about its natural conducting properties. ²RCA Labs. ³As indicated earlier in *Tube News* (October, 1952), the development of transistors has been so rapid that their commercial application appears not too remote, although a considerable time is still expected to elapse before they become generally available in ample quantities and at low cost.

Oscillator and General-Purpose Amplifier HF-VHF Transistors.



Transistors exhibited during recent RCA demonstrations of the potential application of these tiny devices, built around specs of germanium crystal, which perform many of the functions of electron tubes. The four transistors in the front row are developmental types; a junction transistor at the left, the other three point-contact varieties. The middle and rear rows are made up of experimental junction transistor types. The larger transistors are for handling higher power in electronic circuits.

greater stability, higher efficiency and higher power capabilities indicate that the junction transistor will be widely used in audio and radio amplifiers. Another feature of the junction transistor was said to be its ability to operate with power inputs around a millionth of a watt.

The lab's specialists declared that the point-contact transistor may be applied to veryhigh frequency circuits wherever noise is not a limiting factor. Another feature of the point-contact transistor is the negative resistance properties which are especially useful in counter and similar circuits and in oscillators; negative resistance means that an increase in voltage decreases rather than increases the current.

Experimental Transistor Developments

In exploring the capabilities of transistors in audio amplifiers, a port-
(Continued on page 62)

Testing experimental single-channel battery-operated TV receiver which uses developmental and experimental transistors and no tubes except a 5-inch picture tube. Receiver weighs 27 pounds and is housed in a cabinet 12" by 13" by 7".
(Courtesy RCA)



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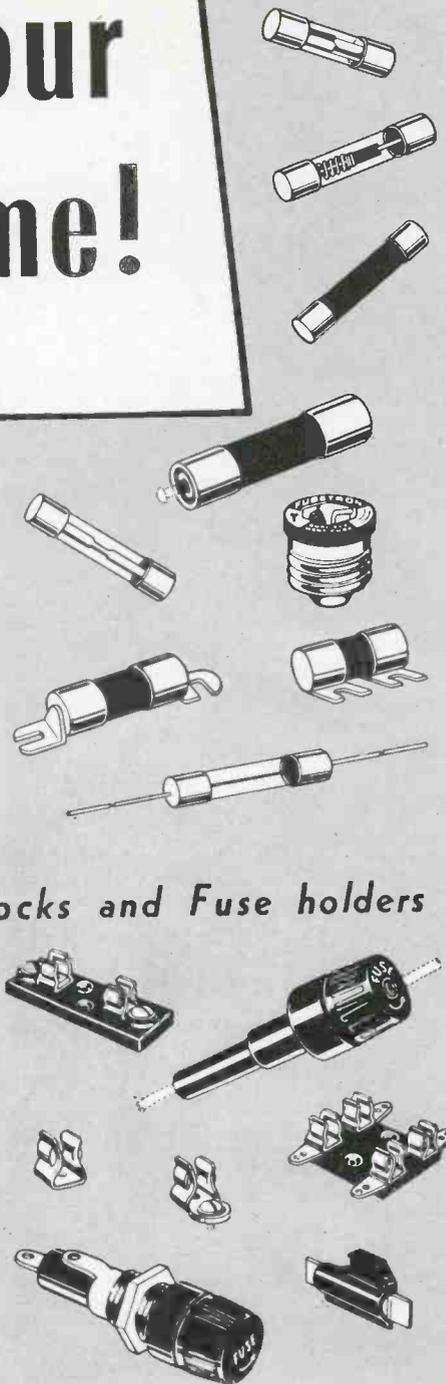
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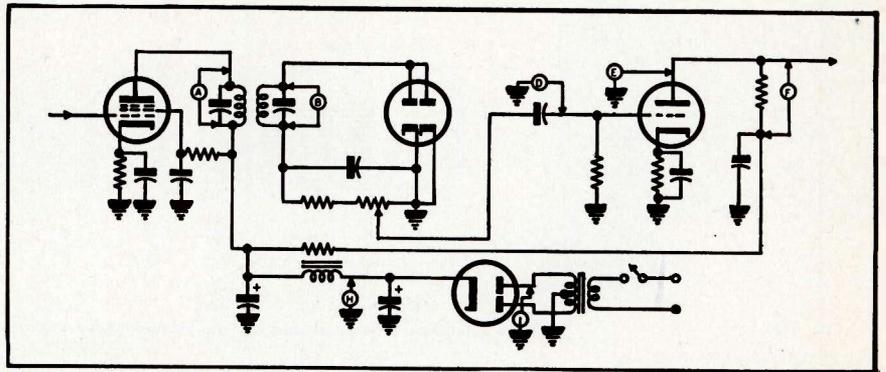
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Servicing Helps

by M. A. MARWELL

Fig. 1. Circuit illustrating where a signal-tracing dynamic type prod tester can be used to troubleshoot *af* and *rf* gain problems, *ac/dc* voltage and polarity, resistor continuity, etc.



THE USE OF SIGNAL tracking techniques to isolate sources has become widely accepted by Service Men. As a result many devices, designed to accelerate the use of this method, have been evolved. Recently, a prod-type tester¹ was developed for such work, particularly in the field. Fig. 1 illustrates how the prod can be used to probe some circuit troubles.

As an *rf* signal tracer (*A*), the test lead should be plugged into the *rf* signal tracer jack of the prod and the

phone tips plugged into the phones common jack and *af-rf* jack. An alligator clip is then connected to the chassis, or low end of *rf* or *if* transformers, and then the prod tip applied to the grid or plate of related *rf* or *if* tubes. Presence of a clear audible signal on the phone will indicate that the circuit is normal up to that point, and an increase in amplitude from grid to plate will indicate

¹Dynamic T-V Serviset (Pat. Pending); Lee Electronic Labs, Inc.

approximate gain. Phone extension cords can be used for checking distortion and weak signals under noisy service conditions.

The unit can also be used as a *af* signal tracer, (*E*). In this instance, the test lead should be plugged into the *af* tracer jack, and the phones left exactly as they were for the *rf* test. The alligator clip can then be connected to the chassis, and then the prod tip applied to the grids and plates of *af* tubes. Presence of a clear audio

Fig. 3. Partial schematic of Emerson 120163-D and 120164-B chassis, featuring new horizontal control and oscillator circuitry. In the new arrangement, a multivibrator (*V13*) is employed, and its frequency is controlled by a phase detector (*V12B*). The difference in phase between the transmitted sync pulse and the generated sawtooth is detected by the phase detector, whose output voltage is applied to the grid of the horizontal multivibrator, thus controlling its frequency. This type of control has been found to be less effected by variation in signal strength, thereby improving horizontal stability. Fly-wheel action of a horizontal phase coil (*L11*) serves to improve further circuit stability.

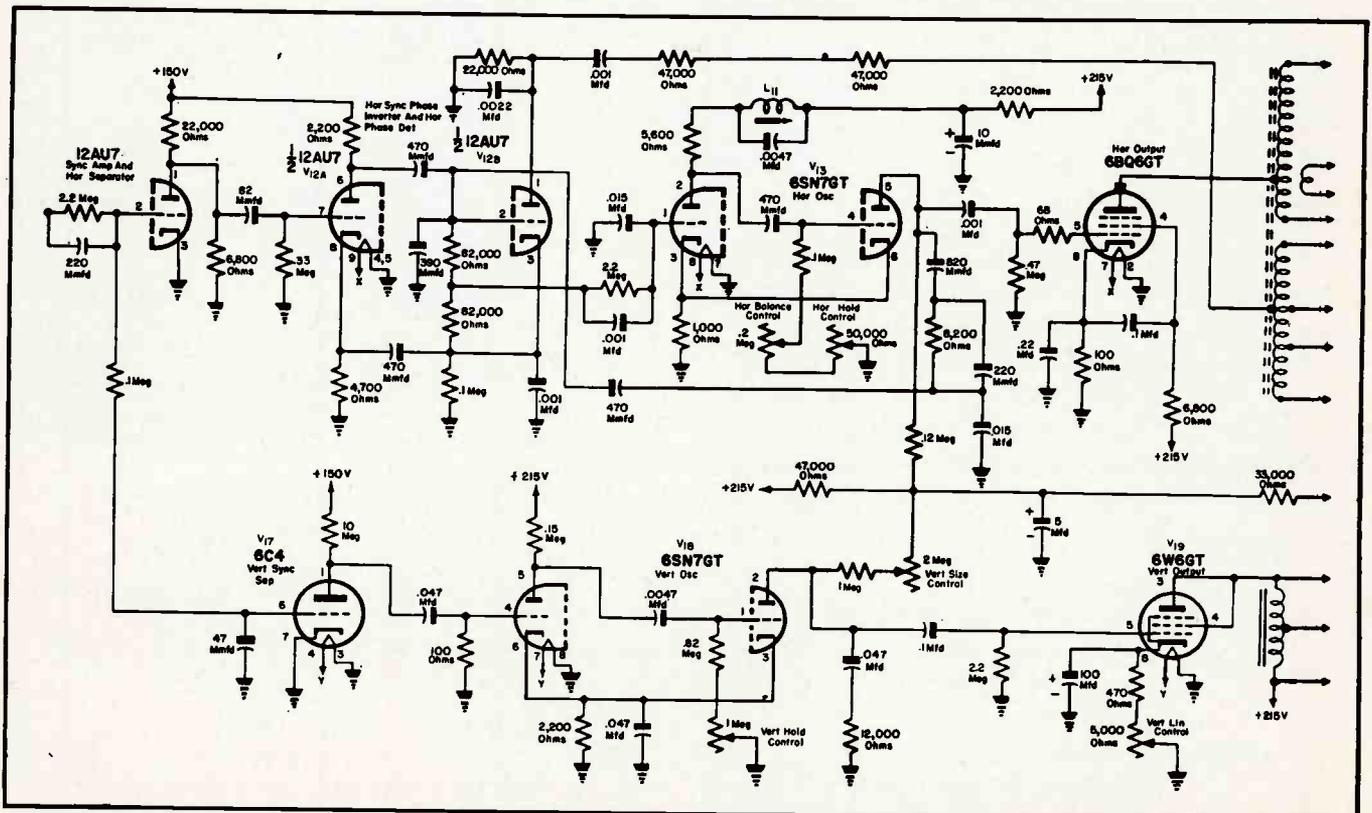
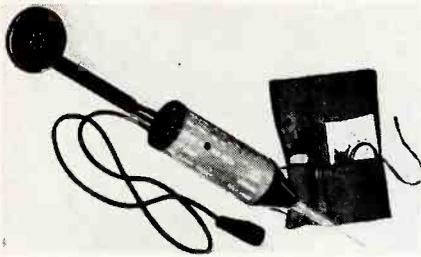


Fig. 2. View of dynamic prod tester.



signal on the phone will indicate that the circuit is normal up to that point, while an increase in amplitude from grid to plate will indicate approximate gain.

It is also possible to use the prod as an indicator. On *ac*, both electrodes in a neon indicator will glow (Fig. 1, *I*). On *dc*, only one electrode will glow (*H*); glow in the lower electrode denotes positive polarity at the prod tip. The relative intensity of the glow indicates the approximate voltage for *ac* or *dc*.

Through the use of a 100,000-ohm to 1-megohm range, the instrument can be used as a substitute for high value resistors in the grid, plate load, etc. With the test lead plugged into the appropriate high-resistance jack, (Fig. 1, *F*), this test will check for open resistors and restore circuit operation by substitution.

Static Tests

The prod, in static tests with the power off, will also indicate high ohms continuity and leakage, range 0-500,000 ohms approximate, and low ohms continuity and shorts, 0-5 ohms.

In the high-ohm continuity test (*D*), it is possible to check coils, capacitors, resistors, tube filaments and elements, and transformers for shorts, leakage of open circuits. A click in phone indicates continuity, Relative amplitude of the click indicates approximate resistance or leakage. No click indicates an open circuit.

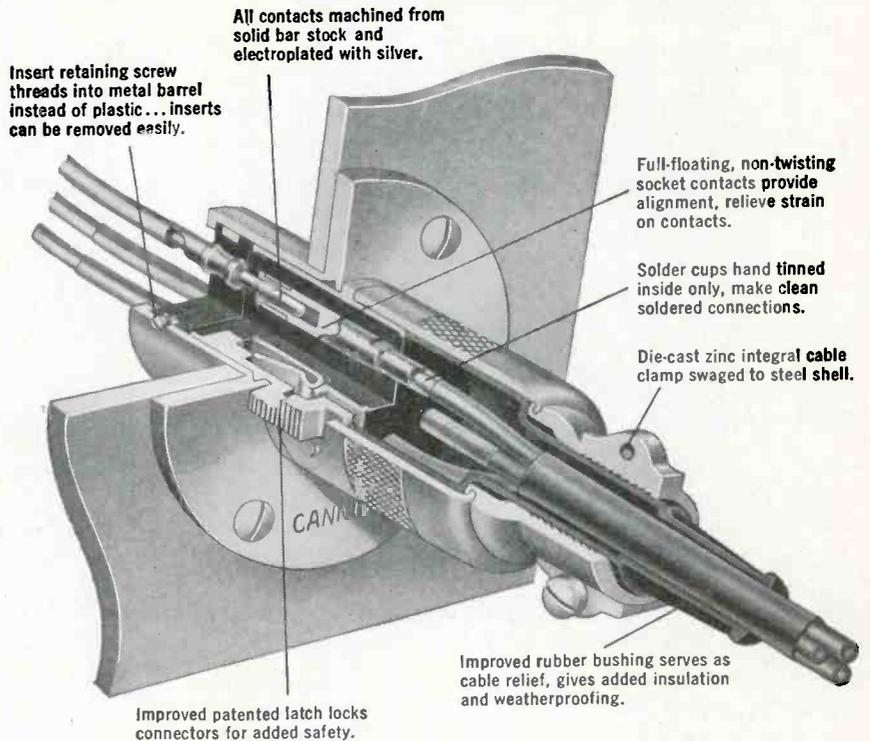
When testing for low-ohms continuity and shorts (*B*), a bright light indicates a direct short or continuity of circuit.

24-Inch Set Vertical Jitter Cure

When the *hot* horizontal deflection coil lead in Hoffman chassis 187, 187B and 187C lies close to the vertical deflection tube, the 6BL7GT, horizontal voltage pulses are coupled into the vertical system causing the triggering of the vertical blocking oscillator to become abnormal. This condition results in a rapid vertical jitter of the picture. The remedy for this problem is to dress the red deflection yoke lead away from the 6BL7GT.

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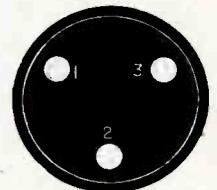


If you talk to sound technicians anywhere you'll find Cannon Type P connectors are the accepted standard of quality... taking a beating day in day out where frequent changes in circuits are required on all kinds of jobs up to 30 amp. capacity.

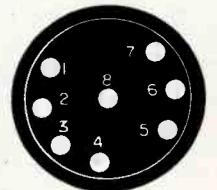
The close attention to important details called out in the above illustration is typical of the care used in the design and construction of all Cannon Plugs—the world's most complete line.

The above type series is distributed through selected franchise distributors. The line is fully described in the Type P Bulletin. Engineering bulletins describing each of the many basic types of Cannon Plugs will be sent on request.

Type P insert arrangements include 2-3-4-5-6 and 8 contacts. All contacts are 30 amp. capacity except those in P-8 layout which are 15 amp. Full scale layouts, front view pin insert, engaging side, shown at right.



P-3



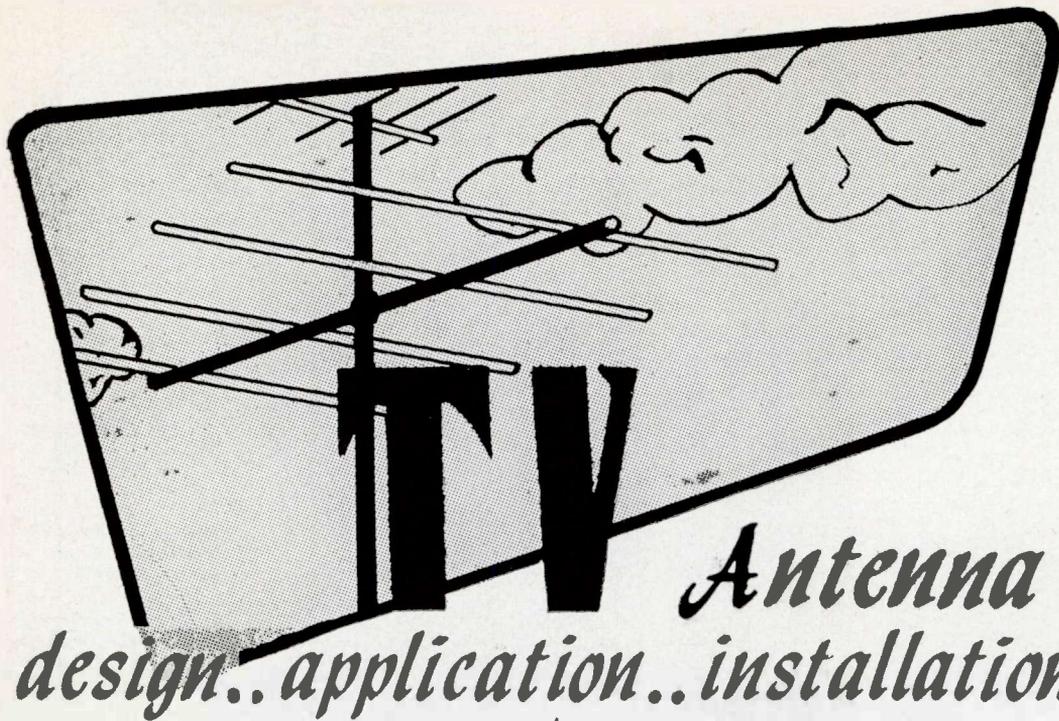
P-8

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Antenna Digest

design.. application.. installation.. service

by RALPH G. PETERS

Ultrahigh Antenna-Accessory Progress Report

THE MARKED SUCCESS of the ultrahighs in the northwest and the certainty that the new channels will prove just as attractive and effective in the many new areas in the east and elsewhere when the broadcasters pull their *uhf* switches, has sparked the development and production of quite an assortment of extremely interesting antennas and accessories.

From one lab¹ has come an electronic filter network designed for a triangular dipole and conical² which employs a high and low-pass circuit, and which is said to isolate the *vhf* antenna from the transmission line, for the *uhf*

antenna. The system operates in reverse for the *vhf* antenna.

Antennas in this setup are placed so that a single output feeds the single transmission line, even though a double input is received from both antennas. The system is aptly illustrated in Fig. 1.

The *uhf* bow-tie antenna is claimed to improve the conical's directional characteristics. When the *uhf* portion of the antenna is in use, the conical's dipoles are noted as acting as reflectors, improving gain on the *uhf* band.

Also produced by this manufacturer is a straight bow-tie antenna for *uhf*

with a screen reflector³.

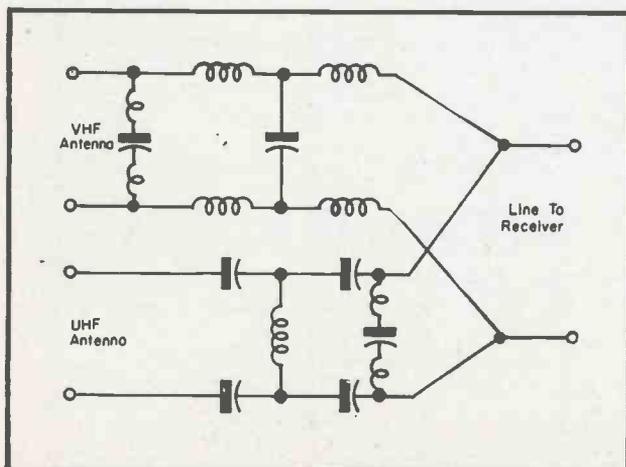
The bow-tie, all-aluminum, is riveted through to an insulating block which in turn is riveted to a steel strip. This strip, about four inches in length, is bent into a rectangular channel which connects to both reflector and profiled U-bolt clamp. This clamp is behind the reflector.

From another source⁴ has come word that another type of *all-vu* antenna⁵ has been evolved.

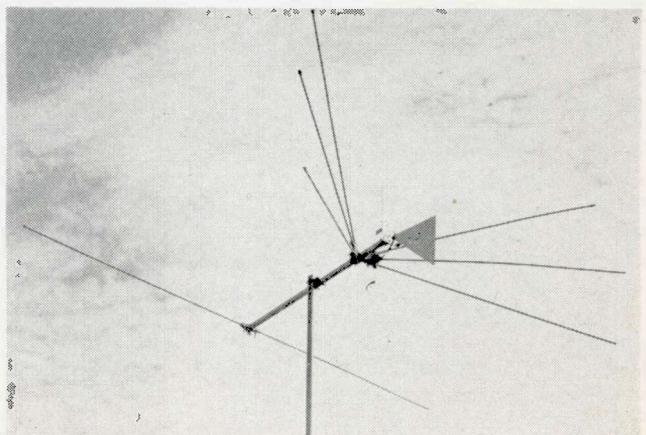
The *uhf* section in this model features *free-space* terminals, which are

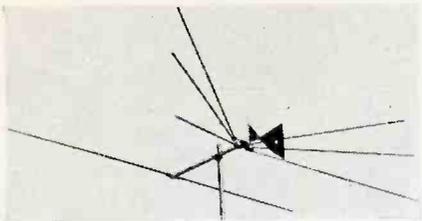
¹JFD. ²JET 283. ³JFD UHF 600.
⁴Channel Master. ⁵Ultra Fan 413.

Fig. 1. Filter network used in *uhf/vhf* antenna system, which permits use of single leadin line to both antennas. (Courtesy JFD)



Combination ultrahigh/veryhigh antenna using a bow-tie for *uhf* and a conical for *vhf*. (JFD 283)





Another combination uhf/vhf antenna with a triangular dipole for the high channels and conical V for the standard bands. A 2-stage filter for coupling to a common feed line is also employed in this system (Channel Master 413)

described as preventing the accumulation of moisture, soot, ice, and dirt at the antenna feed points.

Vibration, another factor which can seriously affect uhf reception, is said to have been minimized by the provision of two stamped holes in the triangular dipole. These holes serve to lessen wind resistance.

A single transmission line can be used with this antenna too; the vhf and uhf bands are electronically iso-

Stacked four-element uhf antenna. (Taco 3008)



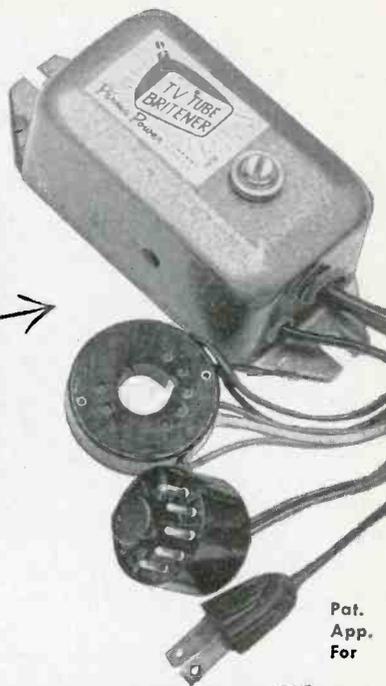
lated by a 2-stage filter which automatically eliminates interaction. No switching is necessary in tuning from one band to the other.

On low band vhf (channels 2 to 6) the all-vhf functions as a conical antenna. (Continued on page 59)

Jerry Berger, Brach plant manager; Ira Kamen, vice president in charge of sales at Brach, and Jay Saphier, ad and sales-promotion manager at Brach, viewing uhf distribution equipment designed for 2- and 4-set use.



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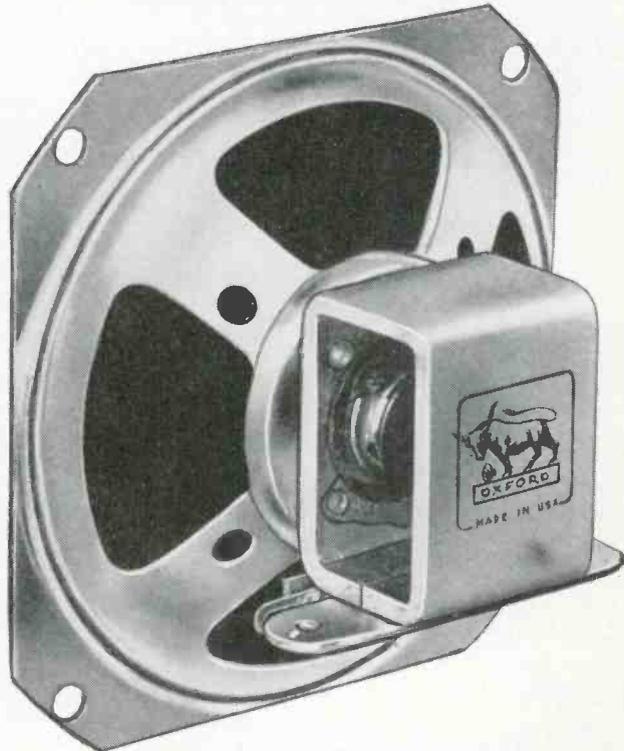
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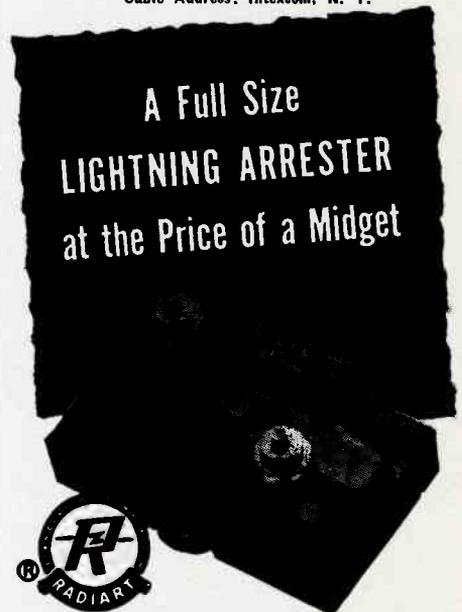
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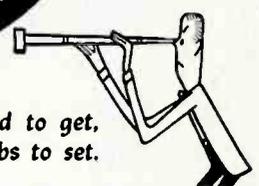
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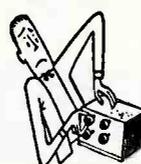
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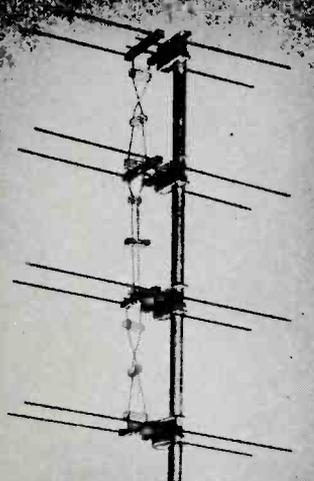
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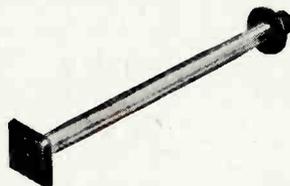
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27-Inch All-Glass Picture Tubes.....	Oct.
Twin-Diodes Medium-Mu Triode for Auto Radios.....	Oct.
Twin Power Triodes for Projection TV.....	Feb.
Twin Triodes for Vertical Deflection.....	Apr.
UHF Continuously-Tuned Oscillator Circuitry (4AF4); <i>Wyn Martin</i>	May
Ultrahigh Tube Design and Application.....	Mar.

NEW! MOSLEY WALL-THRU

For TV, FM and Amateur Transmission Line

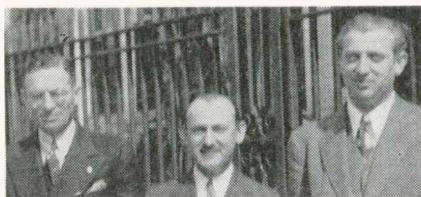


- Fits Any Wall Up to 1 3/4" Thick!
- Completely Weather-Proof!
- For Standard Flat 300 Ohm Line or RG-59/U Co-ax Cable!
- MOSLEY Lead-In Socket Can Be Mounted Direct to Inside Plate!
- Precision Molded Polystyrene End Plates!
- Easily, Quickly Installed!

Cat. No. 625
 List Price..... \$1.95
 Cat. No. 625-PK
 WALL-THRU, complete with MOSLEY Universal TV Lead-in Socket and Plug. List Price \$3.00

MOSLEY ELECTRONICS
 2125 Lackland Road • Overland 14, Missouri

Rep Talk



Charley Golenpaul, Dan Bittan and Herman Smith at opening of first Aerovox plant in New Bedford.

BENJAMIN W. GELB, prexy of B. W. Gelb and Co., 1777 Grand Concourse, New York 1, N. Y., has successfully recovered from a brain tumor operation, and will resume his activities in the near future. Gelb is Kenwood Engineering s-m, and All-Channel and Deal Products rep. . . . *Harold Moyer*, assistant sales manager of Astatic Corp., has resigned his position to join *Ray T. Schottenberg*, Philadelphia parts rep. . . . *Edwin Cornfield* has joined the sales staff of Adolph L. Gross Associates, Inc., 45 W. 45th St., New York, N. Y. The company has also been named rep for Electro Precision Products, Inc., in metropolitan New York. . . . *R. Gordon Dougherty* has rejoined I.D.E.A., Inc., 7900 Pendleton Pike, Indianapolis, Ind., and will serve as field rep for the Regency division. . . . *JKM, Inc.*, has been appointed rep for Industrial Television, Inc., in Illinois and Wisconsin. . . . *W. E. Pfeiffer, Sr.*, 615 Stutsman St., Council Bluffs, Iowa (Iowa and Nebraska), and *J. M. Marsh Co.*, 4216 W. Jefferson St., Los Angeles 16, Calif. (California and Arizona), have been named reps for Don Good, Inc. . . . *Paul G. Scholz Co.*, Kansas City and St. Louis, Mo., has been appointed rep for Insuline Corp. of America, in Missouri, Kansas, Iowa, and Nebraska. . . . *Earl K. Moore*, 562 Cizeler Ave., New Orleans (Mississippi and Louisiana), and *Herman A. Roeder*, 10116 Kilarney Dr., Dallas, Tex. (Texas, Oklahoma and Arkansas), have been named reps for Jerrold Electronics Corp. . . . *Wilson Sales Agency*, 2750 W. North Ave., Chicago, Ill., has been appointed rep for John F. Rider, Publisher, Inc., in Indiana. . . . *Jules Levy*, after an absence of 15 years, has rejoined the D. R. Bittan Co., 53 Park Place, N. Y. 7, N. Y., and will head up the distributor division. . . . *Jack A. Berman*, in charge of sales for Shure Brothers, Inc., Chicago, for the past thirteen years, has resigned to enter the rep business in Southern California, effective February first. He will represent Shure Brothers and other manufacturers' lines.

Jack Berman

B. W. Gelb



to the
**ELECTRICAL
ENGINEER**
or
PHYSICIST

with experience in

RADAR
or
ELECTRONICS

Hughes Research and Development Laboratories, one of the nation's leading electronics organizations, are now creating a number of new openings in an important phase of their operations.

Here is what one of these positions offers you:

THE COMPANY

Hughes Research and Development Laboratories, located in Southern California, are presently engaged in the development and production of advanced radar systems, electronic computers and guided missiles.

THE NEW OPENINGS

The positions are for men who will serve as technical advisors to government agencies and companies purchasing Hughes equipment—also as technical consultants with engineers of other companies working on associated equipment. Your specific job would be essentially to help insure successful operation of Hughes equipment in the field.

THE TRAINING

On joining our organization, you will work in the Laboratories for several months to become thoroughly familiar with the equipment which you will later help users to understand and properly employ. If you have already had radar or electronics experience, you will find this knowledge helpful in your new work.

WHERE YOU WORK

After your period of training—at full pay—you may (1) remain with the Laboratories in Southern California in an instructive or administrative capacity, (2) become the Hughes representative at a company where our equipment is being installed, or (3) be the

Hughes representative at a military base in this country or overseas (single men only). Compensation is made for traveling and moving household effects, and married men keep their families with them at all times.

YOUR FUTURE

In one of these positions you will gain all-around experience that will increase your value to our organization as it further expands in the field of electronics. The next few years are certain to see large-scale commercial employment of electronic systems. Your training in and familiarity with the most advanced electronic techniques now will qualify you for even more important future positions.

How to apply:

HUGHES

RESEARCH AND
DEVELOPMENT LABORATORIES

Engineering Personnel Department
Culver City,
Los Angeles County, California

If you are under thirty-five years of age, and if you have an E.E. or Physics degree, write to the Laboratories, giving resumé of your experience.

Assurance is required that relocation of the applicant will not cause disruption of an urgent military project.

The Proof is in the Picture!

Bogen TV BOOSTERS



BOGEN MODEL BB1-A

- PRECISION-TOOLED TUNING MECHANISM
- SEPARATE TUBES FOR HIGH AND LOW BANDS
- NO HOT LEAD SWITCHING
- TURNS ON-OFF AUTOMATICALLY WITH TV SET

— to work with new and old front end designs

It's the picture received under difficult conditions that proves the value of a TV Booster. The BB1-A retains the features which put the proof in the picture for hundreds of thousands of users of the now famous BB-1 booster. Two 6J6 triodes in independent push-pull circuits provide separate amplification of the low and high bands, without hot lead switching. In addition, significant improvement has been effected in both noise and gain characteristics. Striking in appearance the BB1-A offers the convenience of one knob tuning from channels 2 thru 13 plus automatic "on-off" control.

LIST PRICE \$32.50

BOOSTER MODEL AMB-1
Antenna mounted, fully automatic broad band booster, immune to weather. Amplifies signal before line losses occur for better signal to noise ratio. **LIST PRICE \$79.50**

BOOSTER MODEL BIB-1
Automatic broad band booster readily concealed in or behind set. Requires no tuning, turns on-off automatically with TV Set. Just install and forget. **LIST \$55.50**

CALL OR WRITE FOR COMPLETE LITERATURE



DAVID BOGEN CO., INC.

29 NINTH AVE., NEW YORK 14, N. Y.

A Quarter Century of Electronic Equipment Specialization

Associations

TSDA

A NEW ASSOCIATION, the Television Servicing Dealers Association, headed by *Dave Krantz*, has been formed in Philadelphia.

Krantz, serving as temporary president, will be assisted by the following officers, also serving on a temporary basis: *Louis J. Smith*, vice president; *Edward J. Strychowski*, secretary; and *Sam Brown*, treasurer. Others named to serve on committees include *Charles Settle*, *Leroy Raber*, *Harold Lemper*, and *E. L. Bevan*.

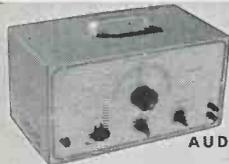
FRSAP

THE ANNUAL Federation of Radio Servicemen's Association of Pennsylvania plaque presentation will be made at the January 18, 1953 meeting. The state charter will also be presented to the association at this time.

The officers and delegates of FRSAP are anxious to have present all representatives of other servicing organizations. *Leon Helk*, 87 South Main Street, Carbondale, Pa., should be contacted to arrange for such attendance.

TEN YEARS AGO

AT AN ELECTION of officers of the Radio Servicemen's Association of Luzerne County, Pa., *E. L. Maneval* was named prexy; *Edmond Nowicki*, vice prexy; *John Kennedy*, treasurer; and *C. F. Bogdan*, secretary. . . . *John F. Rider* became a major in the army. . . . *Biley Electric*, Erie, Pa., and *Meissner*, Mt. Carmel, Ill., were awarded the Army-Navy E. . . . *James T. Buckley*, prexy of Philco, celebrated his 30th anniversary with the company. . . . *Irving Berkman* was appointed priority manager of Radio City Products. . . . It was estimated by industry that there would be six-million worthless radios throughout the country by June '43. . . . *Harry Bridge*, Philadelphia advertising radio agent, relocated to the Real Estate Building. . . . *Charley Golenpaul* began his third term as chairman of the Sales Managers Club, eastern division. . . . *George K. Throckmorton* was elected a director of RCA. . . . *D. W. May* was appointed eastern manager of G.E. receivers and tubes. . . . *Ralph Glover* joined Webster-Chicago.



AUDIO GEN. KIT
\$29.50



R. F. SIGNAL GEN. KIT
\$19.50



5" SCOPE KIT
\$43.50



T.V. ALIGN. GEN. KIT
\$39.50

BUILD YOUR OWN Heathkit TEST EQUIPMENT

Heathkits are completely engineered instruments supplied unassembled. Every kit goes together smoothly and easily. All drilling, punching, and painting has already been done for you. All parts are furnished and are of highest quality.

Detailed construction manual shows clearly where each wire and part goes and tells exactly how to build the kit. Write for free catalog.



SIGNAL TRACER KIT
\$22.50



VACUUM TUBE VOLTMETER KIT
\$24.50



BATTERY ELIMINATOR KIT
\$24.50

HEATH COMPANY

BENTON HARBOR 11, MICHIGAN

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 East 40th Street
NEW YORK CITY (14)



IMPEDANCE BRIDGE KIT
\$69.50



TUBE CHECKER KIT
\$29.50



GRID DIP METER KIT
\$19.50



CONDENSER CHECKER KIT
\$19.50

Here's the
"SKYLINE"
 all-channel performance secret

For the same reasons you spray your antenna connections, we have eliminated them!

Our continuously formed antenna elements provide maximum signal gain—and maintain it indefinitely, because they eliminate 80% of the number of element connections common to this type.

The performance is assured. That's why the pre-assembled, foldable, quick-rig, all-aluminum SKYLINE colinear antenna is fast replacing all other types in fringe areas.

Inspect it at
 your dealer's!

Amazing reception
 over 150 miles!

Patented

SKYLINE MFG. CO.

1458C5 East 17th Street
 Cleveland 14, Ohio

**VIDAIRE UNIVERSAL PICTURE-TUBE
 REJUVENATORS**

Three picture-tube rejuvenators, *Kine-Lites K-2-3-4*, that are said to be usable with any TV receiver, *ac-dc*, and on any type picture tube from 10" to 20", including electrostatic focus, have been announced by Vidair Electronics Manufacturing Co., Lynbrook, N. Y.

Model *K-2* operates with all magnetic deflection and electromagnetic and electrostatic focus tubes in parallel filament circuits; model *K-3*, similar to *K-2*, is for series-filament circuits; and model *K-4* operates on parallel filament circuits, except that it isolates filament and cathode of the picture tube.

**TV Parts . . .
 Accessories**

**WARD UNIVERSAL LIGHTNING
 ARRESTER**

A lightning arrester, *Tri-Wire*, for universal application, plus *uhf*, has been introduced by the Ward Products Corp., Division of The Gabriel Co., 1523 East 45th St., Cleveland, Ohio.

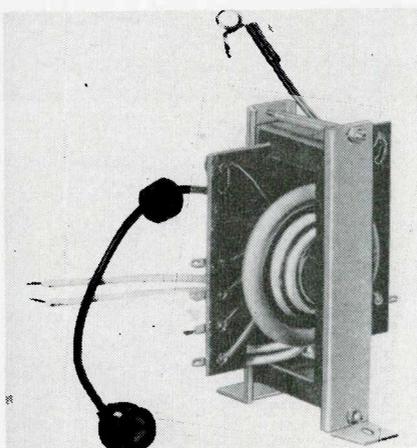
Unit can be used with flat 300-ohm line, open line, or *uhf*-recommended tubular line, and can be mounted on a flat wall or on the mast.

* * *

**RAM FLYBACK TRANSFORMER
 REPLACEMENTS FOR ADMIRAL SETS**

Two horizontal output transformers, *X071*, exact replacement for Admiral part 79C30-1 and 79C30-3, and *X072*, exact replacement for Admiral part 79C30-4, have been announced by Ram Electronics Sales Co., South Buckhout St., Irvington-on-Hudson, N. Y.

Both models are engineered for 66°-70° horizontal deflection angle, utilize a ferrite *E* core, and deliver up to 15 kv.

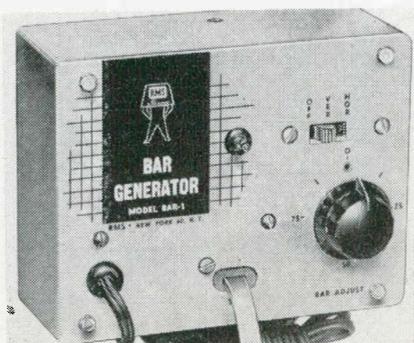


* * *

RMS PORTABLE BAR GENERATOR

A portable bar generator, *BAR-1*, that transmits a modulated carrier on channels 4, 5, or 6, and produces both vertical and horizontal bars on the screen, has been introduced by Radio Merchandise Sales, 2016 Bronxdale Ave., New York 60, N. Y.

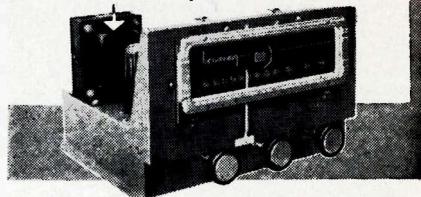
Generator features a control for adjusting the number of bars to suit the Service Man's convenience.



Browning
 announces

the new
RV-31 FM TUNER

for those who expect the exceptional



Browning FM and FM-AM tuners have long been recognized as the choice of outstanding audio engineers, when the utmost in performance is demanded. So when we improve them, we can honestly say that we are *adding virtues* rather than correcting faults.

Here's what has been added:

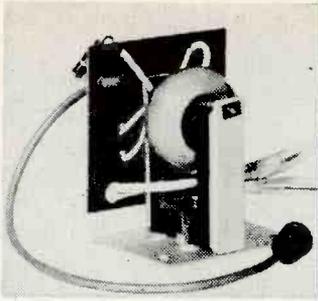
- New, all-triode RF section, for extremely low noise level.
- Higher sensitivity—3 microvolts for 20 db. quieting, instead of more than 6 microvolts as before. This is desirable in fringe areas and in noisy urban locations.
- Cathode follower output stage, to feed any high-fidelity amplifier at low impedance. For those "remote" installations, this will minimize hum difficulty and high-frequency loss through cable capacitance.
- Power outlets at the rear of the chassis, for convenience in making connections to amplifier and turntable.
- A newly designed edgelighted dial in modern style, with knobs and escutcheon in black and silver.

And here's what has been kept: true Armstrong FM circuit—selectable AFC, which can be switched out at will—drift-free operation without AFC—sensitive tuning indicator, for precision tuning with AFC switched out, and quick tuning using AFC—audio inputs for phono, TV, and recorder, for selection by a panel switch and connection to the audio amplifier—self-contained power supply—small dimensions (6½" x 11" x 9") for easy mounting in limited space.

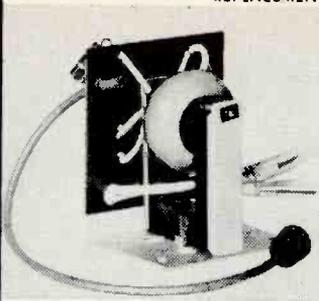
Ask your distributor of high-fidelity sound equipment for a demonstration. And read the discussion of Browning tuners in **HIGH FIDELITY SIMPLIFIED**, by Harold D. Weller—available at all sound studios.



ORIGINAL



REPLACEMENT



can you tell... which transformer is the RAM?

If you can't tell any difference between the original and replacement flybacks these days, there's good reason. They're TWINS—they're BOTH RAMS!

Yes, the great majority of famous TV set manufacturers order their original flybacks built to their own specifications by RAM. They know that a RAM-built original surpasses their every quality and performance standard.

Under the special RAM twin-transformer manufacturing technique, in most instances the originals destined for the TV set maker and the replacements destined for the RAM-brand and your jobber's shelf are both made at exactly the same time, during the identical production run!

That's why you can be certain—9 times out of 10—that a RAM-brand replacement is the best replacement, for highest efficiency and durability. And that's why RAM components are lowest-priced in the industry, for highest profits for you.

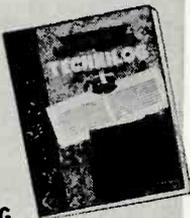
ONLY RAM manufactures 29 types of transformers, 10 types of deflection yokes and 15 types of linearity and width coils—the industry's most complete, most diversified sweep replacement line. See them at your local distributor.

FREE! RAM 1953-edition Replacement & Conversion Manual—over 5000 sweep component listings—most complete in the industry. Write Dept. S-12.



Ram ELECTRONICS SALES CO.
IRVINGTON-ON-HUDSON, N. Y.
TEST-PATTERN TESTED COMPONENTS FOR TV

opportunity
knocks
...for
you!



Write for
new free
TECHNILOG

A comprehensive UNIVERSITY handbook on sound casting technique and equipment. Shows all you need to know about selection and installation of University loudspeaker equipment.

BUSINESS OPPORTUNITIES

WANTED—Radio, Music, and Appliance dealers and service stores. Earn substantial extra income. Sell and install high fidelity and public address equipment to present customers, local merchants, church, town hall, etc. Negligible investment, use present facilities. No special equipment required, only imagination and initiative.

Giving any thought lately to new sources of revenue?

There is a way you know! Alert dealers are finding local merchant friends, as well as neighborhood civil, social, and religious services responsive to the obvious advantages of SOUND. Besides, every radio, TV, record, or service customer is a hot prospect for the sale of a high fidelity loudspeaker—at the right price! No expansion of sales force necessary, big volume sales possible through regular channels. University Loudspeakers make the job easy—a real profit opportunity for which you are already tooled up.

ADDRESS INQUIRIES TO DESK S-12



UNIVERSITY LOUDSPEAKERS • INC
80 SO. KENSICO AVE., WHITE PLAINS, NEW YORK



WESTINGHOUSE APPOINTS TUBE DISTRIBUTORS

Chief Electronics, Inc., 104 Main St., Poughkeepsie, N. Y., has been appointed distributor of Westinghouse tubes for Putnam, Dutchess, Orange, Columbia, Greene, Ulster, Delaware, Sullivan, Rockland, and part of Westchester counties in N. Y.

Masline Radio & Electronic Equipment Co., 192-126 Clinton Avenue, Rochester, N. Y., has been named Westinghouse Reliatron tube distributor in 13 counties of New York surrounding the Rochester area.

* * *

DELCO 10-MILLIONTH CAR RADIO

Recently, the Delco Radio Division of General Motors celebrated the completion of its ten-millionth car radio since it began operations in '36.

The ten-million figure is said to represent more than one-third of the total number of auto sets in the United States.



Berry W. Cooper (right), general manager of GM's Delco Radio Division, accepting from Paul Cone, the 10-millionth car radio.

* * *

MACHIN NOW SHURE V-P AND GENERAL SALES MANAGER

Victor Machin has been appointed general sales manager and vice president in charge of sales, succeeding J. A. Berman, who will become a sales representative in southern California, for Shure Brothers, Inc., Chicago.

* * *

E. A. MALLING, WINS G. E. PROMOTION

Edward A. Malling has been appointed manager of marketing for the components department of the General Electric Co., Syracuse, N. Y.

Malling has been with G. E. since '35, and has held various marketing assignments with the company at Cleveland, Bridgeport and Syracuse. For the past three years he has been a sales manager on the receiver department staff.

* * *

JACK MOORE APPOINTED DAVIS SALES MANAGER

Jack Moore has been appointed national factory sales manager for Davis Electronics, 4313 W. Magnolia Blvd., Burbank, Calif.

JFD jumbo

TV LIGHTNING ARRESTER

Only JFD Lightning Arresters have the patented* strain relief lips which prevent contact washers from ripping the twin lead apart. NO. AT102 complete with stainless steel strap and ground wire for universal mounting \$2.25 list.

Write for Form No. 84.

*U.S. Pat. No. D-4664

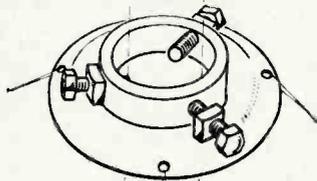


JFD MFG. CO.

BROOKLYN, 4, N. Y.
BENSONHURST 6-9200

world's largest manufacturer
of tv antennas & accessories

South River NEWS



GUY RING Model GR-1

Constructed of heavy gauge, galvanized steel, embossed for extra strength. Set screw arrangement provides positive fit for all masts ranging from 1 1/4" O.D. to 2" O.D. Complete with installation hardware.

South River Antenna Mounting Accessories are carried by every leading TV Parts Jobber from coast to coast.

Write for your copy of
our new 1953 catalog.

**SOUTH RIVER METAL
PRODUCTS CO., INC.**
SOUTH RIVER, N. J.

PIONEER AND OUTSTANDING PRODUCER
OF FINEST LINE OF ANTENNA MOUNTS

Merchandising Audio

(Continued from page 22)

seasonal forces and the idiosyncrasies of our economy. Business is no different from the human body. *A successful business is one which feeds on a balanced diet; a little of this and a little of that.* One phase goes down, the other goes up. The idea, of course, is to include functions which though related to your field, are affected by divergent and supplementary forces. Audio is such an endeavor and has indeed long been considered a *staple*.

And now for the market which unfortunately has been so forsaken by too many Service Men: *custom high fidelity.*

Really avid interest in better audio reproduction occurred with the advent of commercial FM broadcasting, just before World War II. Though there were other factors involved, the two which appeared to retard development of FM as a superior musical medium were the promotional over-emphasis of the *no static* feature which eventually relegated the band change switch to the forgotten company of the *other short wave bands*, and the almost concurrent development of practical television which so fascinated the imagination that practically no attention was paid to other projects in industry.

Recently, however, *hi-fi* has come into its own, and Service Men have become quite conscious of the fact that *hi-fi* has become practically an industry in itself.

[To be concluded in January SERVICE]

TV Antennas

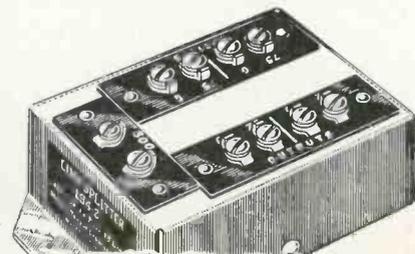
(Continued from page 45)

tenna with parasitic reflector. On high band *vhf* (channels 7 to 13) it serves as a large diameter *V* antenna. And on *uhf* it becomes a triangular dipole with sheet reflector.

In another *uhf* antenna development, a stacked four-element design* has been used, as illustrated on page 45.

*Taco 3008.

TV line splitter for dividing TV transmission line into four branch lines. Available to divide one 75-ohm line into four 75-ohm lines; one 300-ohm line into four 75-ohm lines; one 75-ohm line into four 300-ohm lines; and one 300-ohm line into four 300-ohm lines. Shipped with two resistors to provide proper termination of unused outlets. (*Blonder-Tongue*)



Tung-Sol "Quality Control" recognizes but one standard. *All* Tung-Sol Tubes meet the highest original equipment requirements of leading radio and tv set manufacturers! Use Reliable Tung-Sol Tubes.

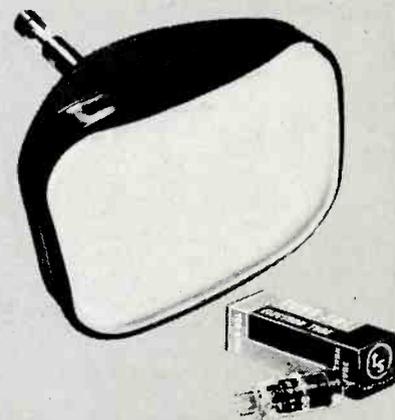
TUNG-SOL ELECTRIC INC.

Newark 4, N. J.

Sales Offices: Atlanta • Chicago • Culver City
Dallas • Denver • Detroit • Newark

TUNG-SOL MAKES:

All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes.



TUNG-SOL®
RADIO, TV TUBES, DIAL LAMPS



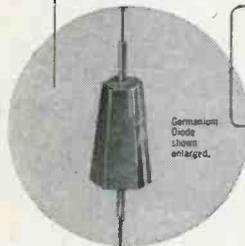
Here's a real lively "stopper" to attract attention to your place of business and emphasize the quality of your service. Colorful—bright red and two shades of blue. 15 inches high. Your jobber salesman will tell you how to get one.

Flying Saucers?

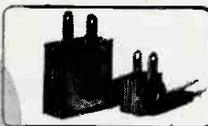
Frankly we don't know if they're fact or fiction . . . but if they are fact it wouldn't surprise us a bit to learn that some extra-terrestrial manufacturer has incorporated SELETRON Selenium Rectifiers and R. R. Co. Germanium Diodes into the design. That's because—as pioneers in the field of electronic development—we've had our hand in some of the most difficult projects and met some of the stiffest requirements ever cooked up! Making drawing board dreams come true are daily chores at Radio Receptor Co.!

GERMANIUM DIODES

Radio Receptor's new Germanium Diodes feature polarity at a glance combined with simplicity of construction and sound design principles. The tapered shape speeds assembly because operators can see at a glance the correct direction of assembly. Users are enthusiastic over the quality of the product which is currently being used in walkie-talkies, computers, TV sets, tuners and other electronic applications.



Germanium Diode shown enlarged.



Our Germanium Diodes and Seletron Selenium Rectifiers may hold the answer to many of your problems. Radio Receptor Engineers will be glad to study your requirements and submit their recommendations on both of these products.

Germanium Transistors available in limited quantities.



SELETRON RECTIFIERS

Seletron Selenium Rectifiers, in both miniature and industrial types, are in constant demand by an increasingly large number of engineers throughout the world because they are completely dependable under the most grueling conditions. Years of experience have given Radio Receptor Co. a deep insight into the idiosyncrasies of rectification.

Seletron and Germanium Division

RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics
SALES DEPT., 251 West 19th Street, New York 11, N. Y. • FACTORY, 84 North 9th Street, Brooklyn 11, N. Y.

Now JSC Announces . . . Expanded 300 Ohm TV Lead-in Wire Line!

JSC proudly announces a complete range for:

22 gauge copper	20 gauge copper
40 mil	40 mil
55 mil	55 mil
70 mil	70 mil
80 mil	80 mil
100 mil	100 mil

4-Conductor Rotor Wire

Perforated 300 Ohm Open Wire

JSC has highest quality wire at lowest possible prices.



Lithographic spools of orange and blue individually packed 1000 feet to the metal spool.

See your nearest JSC distributor who proudly displays the Blue and Orange disc of quality.

A NEW TOOL TO MAKE TV SERVICING *Easier,* *Faster, More Accurate* AND MORE PROFITABLE

No probes made anywhere do the job of SCALA oscillograph probes so efficiently, so easily. Use with your present scope . . . low cost will be paid ten times over in a month. Check your local distributor or write factory and specify model number:

BZ-1 SIGNAL TRACING PROBE . . . locates dead I.F. stages, marks ratio detector curve, calibrates marker generator, adjusts video amplifiers, checks output of sweep generator, views response of single I.F. stage, traces buzz pulse in sound I.F. strip. Can be used with V.T.V.M. Contains demodulator of low-capacitance, high-impedance design, useful to 225 MC.

BZ-2 LOW CAPACITY PROBE . . . makes it possible to trace video, sync or sweep waveforms through high-impedance circuits without causing waveform distortion due to circuit loading. Cuts the effective input capacitance of scope by a factor of 10 and gives an attenuation of 10 to 1.

BZ-3 100:1 VOLTAGE DIVIDER PROBE . . . is very useful in troubleshooting horizontal sweep circuits. It may be applied directly to plate of horizontal output tube or at the plate of the damper tube to check the operation waveforms and to measure their peak to peak voltages without impairing the wave shape or incurring danger to the oscillograph.

SCALA RADIO CO., 2814 - 19th St., San Francisco 10, Cal.

The Turner Co., 909 17th St., N.E., Cedar Rapids, Iowa, has released a 12-page catalog, 952, covering microphones, accessories and TV boosters.

Radio Merchandise Sales, 2016 Bronxdale Ave., New York 60, N. Y., has released the second issue of *TV Forum*. Discussions on master antenna installations, roof testing for antenna location and advantages of 1/2" versus 3/8" antenna elements are included.

Bussmann Manufacturing Co., University at Jefferson, St. Louis 7, Mo., has prepared a TV fuse list, which shows the proper fuse to use, how it is mounted and what the fuse protects. Auto radio fuses are also included.

CATALOGS, BULLETINS ETC.



Ward Products Corp., Division of Gabriel Co., 1523 E. 45th St., Cleveland 3, Ohio, has released a pamphlet, *Report on Portland*, describing ultrahigh antenna performance in the area, as well as specifications on uhf antennas.

Snyder Manufacturing Co., 22nd and Ontario Sts., Philadelphia 40, Pa., has issued a revised catalog detailing its '53 line of auto-radio antennas.

Standard Transformer Corp., 3580 Elston Ave., Chicago 18, Ill., has prepared a catalog, *Simplified TV Transformer Catalog and Replacement Guide*, listing replacement information on over 4,400 TV models.

Merit Coil and Transformer Corp., 4427 N. Clark St., Chicago 40, Ill., has prepared an 8-page replacement guide, *Form 3*, for transformers and *if-rt* coils used in auto radios.

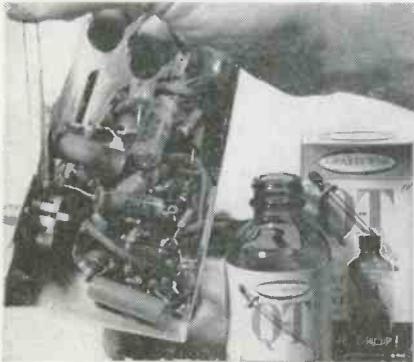
Division Lead Co., 836 W. Kinzie St., Chicago 22, Ill., has published a brochure, describing X-25 rosin-core solder that is said to contain an ingredient which provides flux activity at a temperature even before the solder is completely molten.

Tools . . . Instruments Parts . . .

GRAYBURNE PRESERVATIVE AND NOISE ELIMINATOR

A chemical solution, *QT*, for the elimination of noise and the preservation of moving contacts in home radios and TV sets, has been announced by the Grayburne Corp., 103 Lafayette St., New York 13, N. Y.

Formula, in 3-ounce bottles, is said to clean and preserve all controls and contacts without any harm to insulation and soldered joints.



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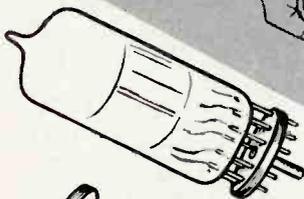
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Pat. Pending

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S/C LABORATORIES, INC., 37 George St., Newark 5, N. J.

RCP MINIATURE 'SCOPE

A miniaturized 'scope, 533M, featuring a 3" picture tube, has been announced by Radio City Products Co., Inc., 152 W. 25th St., New York 1, N. Y.

Measuring $11\frac{3}{4}'' \times 7\frac{3}{4}'' \times 5\frac{1}{8}''$, and weighing 9 pounds, model is said to have a vertical sensitivity of 20 millivolts (.020 v for 1" rms deflection on tube) and a horizontal sensitivity of .6 v. Frequency response is 2 db from 20 cycles to 180 kc. Input impedance: vertical, .5 megohm shunted by 50 mmfd; horizontal, 1 megohm shunted by 70 mmfd. Uses a 12AT7, 12AU7, 6J6, 11Z6 and 3MP1 crt.



* * *

AEROVOX MINIATURIZED PLATE ASSEMBLIES

Combinations of ceramic capacitors, resistors and printed conductors, in units called *plate assemblies*, have been developed by the Hi-Q division, Aerovox Corp., Olean, N. Y.

Unit sizes measure $1\frac{1}{8}''$ long by $\frac{1}{8}''$ or $\frac{1}{16}''$ wide and $\frac{1}{16}''$ thick, and are assembled for use as vertical integrators, vertical integrator and coupler units, audio plate-grid couplers, second detector and audio amplifier couplers, pentode second detector and audio amplifier units, and pentode plate coupler and screen supply units.

* * *

INSULINE MULTIPLIER PROBE

A multiplier probe, 100X, that is said to extend the dc voltage ranges of standard vtoms 100 times, is now available from Insuline Corp. of America, 3602 35th Ave., Long Island City 1, N. Y.

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Y-11	Y-19
Y-12	Y-20
Y-17	



TYPE P

HORIZONTAL OUTPUTS: (Flybacks)

D-1	D-15
D-11	DA-20
D-14	



CASE Y

VERTICAL BLOCKING OSCILLATORS:

A-97X	A-97Y
A-97K	



CASE X

FILTER CHOKES:

C-11X	C-21X
C-13X	C-23X
C-17X	

VERTICAL OUTPUTS:

A-99X	A-103X
A-101U	A-107X
A-102X	

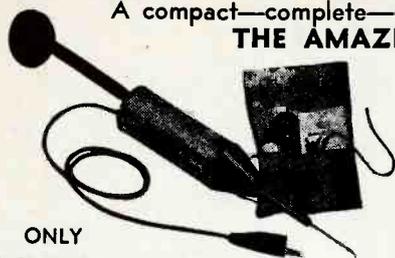
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Tests Resistors 2 ohms - 20 megohms
2 Capacitance Sub ranges .01-.1 & 4-40 mfd.
3 Resistance Sub ranges 50-500 ohms, 5k-25k, 100k-1 meg.

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HUNTINGTON, INDIANA

A WHOLLY OWNED SUBSIDIARY OF NEWPORT STEEL CORPORATION

Tube News

(Continued from page 40)

able *pa* system with self-contained battery supply, instantaneous warm-up, and relatively light weight was constructed. The experimental amplifier was demonstrated and noted as being able to deliver 1.4 watts to a 12" speaker, when operating off a 22½-volt battery supply with an estimated life of 25-50 hours. Six developmental and experimental junction transistors were used on the amplifier.

To solve initial circuit problems in

small, portable radio receivers, a personal radio was built in a standard personal receiver case, retaining the first tube (converter) but using junction transistors in all other circuits. Use of transistors enabled a three-fold reduction in the size, weight and cost of the batteries needed, without reduction of standard 100-hour operating life.

A push-button tuning transistorized auto radio was also placed in operation. This experimental receiver employed eleven developmental and experimental junction transistors to provide an audio output comparable to

that of present-day automobile radio receivers. It was noted that an important feature of this all-transistor set was the absence of the high-voltage power supply common to present auto receivers. This power supply, comprising a vibrator, transformer and rectifier, which represent a substantial fraction of the total cost of the set, was not necessary in this transistor receiver since the transistors operated directly off a six-volt auto battery.

This experimental receiver was said to use one-tenth the current of present auto sets.

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Audio

(Continued from page 38)

itudinal motion of the needle frequency-modulated a 50-mc oscillator. Two small metal plates were mounted near the steel needle in such a way that the capacity between the plates varied with longitudinal motion of the needle but not with lateral motion. The plates were connected across the tank coil of the oscillator, and the resulting FM signal was picked up on a standard FM receiver a few feet away.

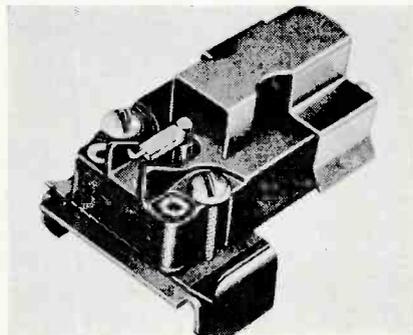
With proper tuning, the instantaneous output of the receiver varied with the instantaneous longitudinal position of the needle tip.

Various test records were reproduced with this experimental equipment. Tests were made with recordings of pure tones ranging from 20 to 10,000 cycles per second, of two different tones recorded simultaneously, and of music. The unrestrained needle showed significant longitudinal motion, substantially verifying the original hypothesis.

Although the effects of drag distortion can apparently be serious with some pickups, the NBS investigators pointed out that the styli of the better modern pickups have high longitudinal stiffness; with such pickups, drag distortion is probably negligible.

Although no tests were made on hill-and-dale (vertical) records and pickups, it was said that the same general considerations should apply as with lateral recordings and reproducers. It appears probable also that a form of drag distortion may arise in the recording operation if the recording stylus is not sufficiently rigid.

Replacement plastic cartridge for RCA automatic record changers and Columbia record players. Can be installed in RCA, Columbia or standard 1/2" mounting arm. Furnished with a 1-mil osmium tipped needle for 45 or 33 1/3. Features *dri-seal* crystal. (Model BX; Webster Electric Co., 1900 Clark St., Racine, Wis.)



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JOHN MILLER

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No antenna manufacturer has the absolute answer to UHF for all areas. However, Miller Television, after careful experiments in UHF in Los Angeles and Portland, now offers a UHF Kit with correct component parts in the six basic designs known today, priced reasonably.

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JOTS AND FLASHES

THERE ARE OVER 100,000 TV SETS now in operation in Canada; notwithstanding that there are only two TV stations in operation. Interest is so keen that it is estimated that by the end of '53 this figure will be tripled. TV transmissions were officially inaugurated in Montreal, Que., and Toronto, Ont., early in September. Since that time, programs have been broadcast an average of 3 hours per day, mostly at night. In Montreal, since 70 per cent of the population are French speaking, most of the programs originating here are in French. In Toronto, on the other hand, programs are in English. All TV broadcasting to date is under the control of CBC, a Crown company sponsored and controlled by the government. . . .

IRC has purchased a 66.4-acre site in Asheville, N. C. A \$200,000 plant is currently under construction. . . . **Consolidated Appliances, Inc.**, 615 S. Taylor St., Amarillo, Texas, has been franchised as a distributor for DuMont TV receivers in the Amarillo-Lubbock area. . . . **Frank J. Hogan** has been named manager of the Chicago factory distributorship of the DuMont receiver division. . . . **Hytron Radio and Electronics Co.** has begun construction on 150,000 square feet of additional space for both manufacturing and warehousing of CBS-Hytron TV picture tubes at its Newburyport, Mass., site. The eastern sales office of the company is now at 32 Green St., Newark 2, N. J. . . . **Slate and Co.**, 2755 Webster Ave., Bronx, N. Y., and **Lincoln Electronic Supply Co.**, 876 Commonwealth Ave., Boston, have been appointed authorized Magnavox parts jobbers. . . . **Jim Brent** has been named advertising manager for Mercury TV and Radio Corp., 1241 S. Hill St., Los Angeles. . . . **Richard A. Wilson** has been appointed a vice president of Magnavox. . . . **William Wight** has been named director of public relations of Philco Corp. . . . **Col. John R. Howland** has been named commercial sales manager of Stewart-Warner Electric. . . . **Maurice Despres**, Admiral's first distributor and a member of the board of directors, was honored recently for his long service by the presentation of a plaque signed by every Admiral executive. . . . **Louis Bros.**, 3543 E. 16th St., Los Angeles 23, Calif., has released a catalog, *3 Years Ahead*, featuring a line of antennas and accessories. Also described is a *chassis cradle* which can be used as workbench space (chassis is bolted down and can be swiveled for under-chassis work) and rolling finished jobs from shop to truck, and vice versa.

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