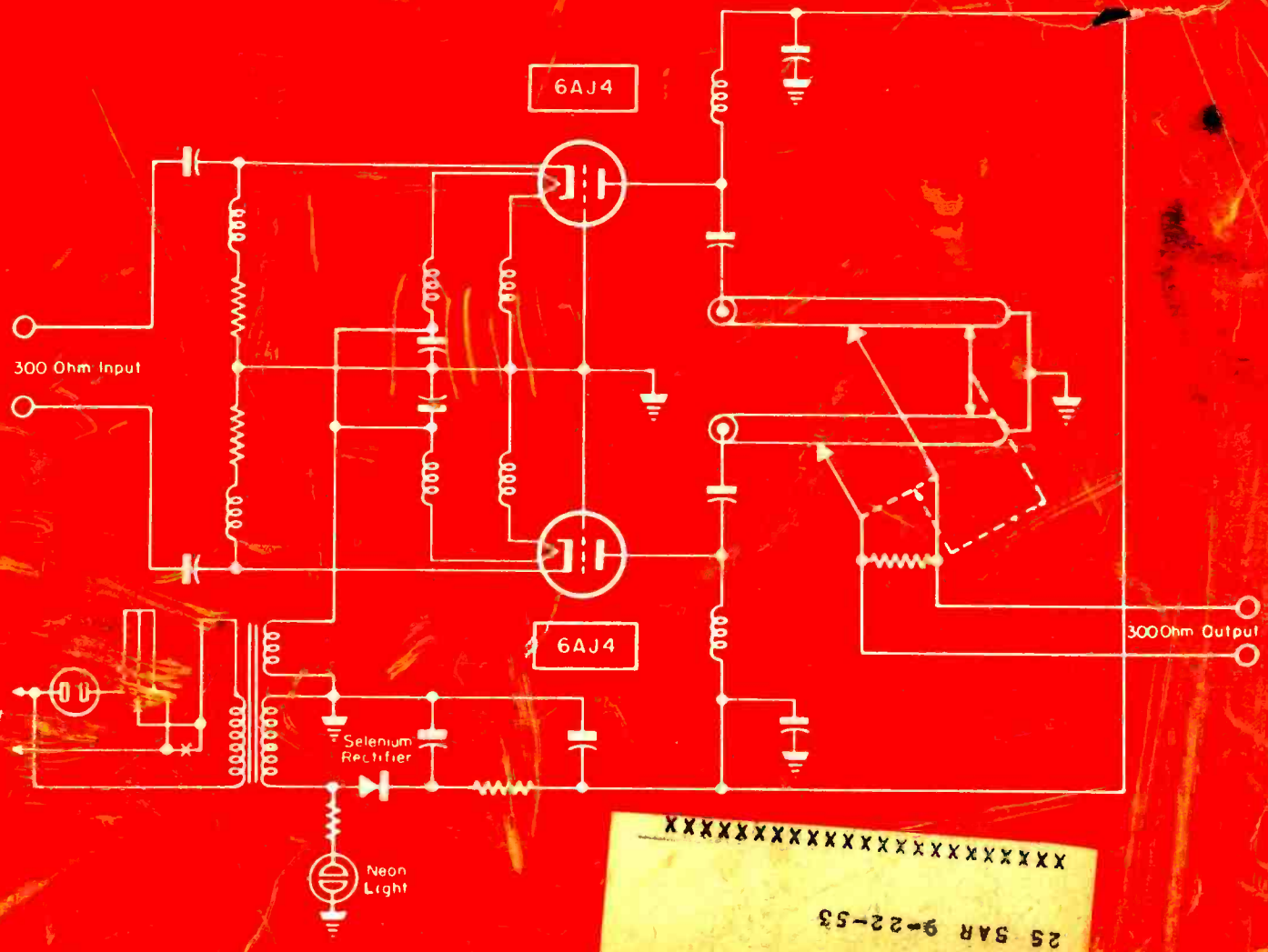
RADIO • TELEVISION • ELECTRONIC

SERVICE

VOL. 23

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

JANUARY 1954



UHF booster with grounded-grid triodes in push-pull circuit.
[See circuit analysis, this issue]

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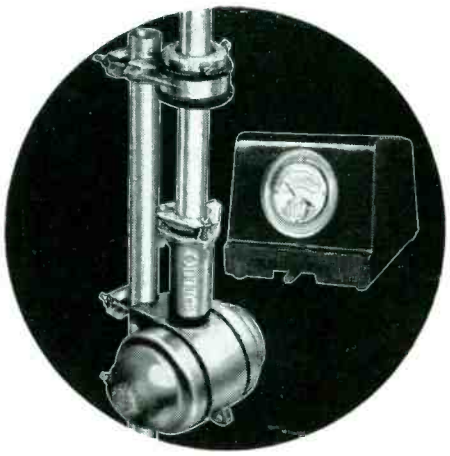
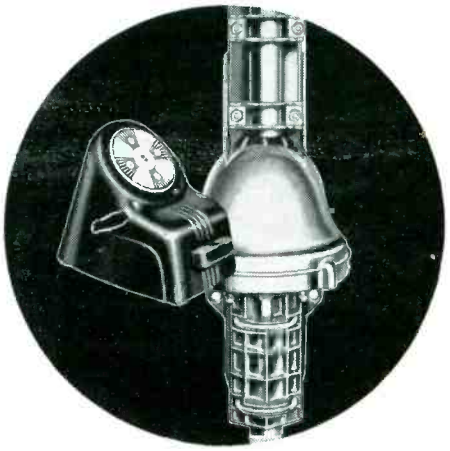
built to last

dependable

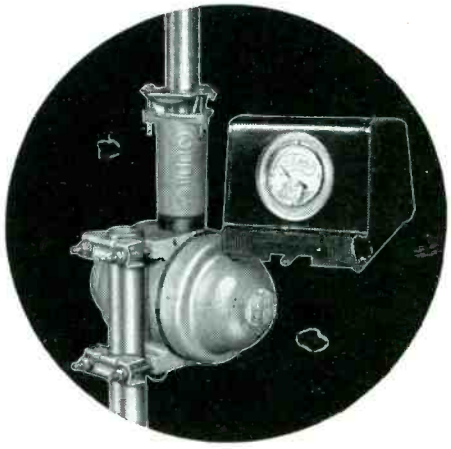
powerful



TR-12 . . *a special combination value consisting of complete rotor including thrust bearing . . . handsome modern design cabinet with meter control dial* **$47.95**



TR-2 . . . *the HEAVY DUTY rotor especially suited for special TV antenna installations. Complete rotor with "compass control" cabinet having illuminated "perfect pattern" dial* **$49.95**



TR-11 . . *the same as the TR-12 without the thrust bearing, complete with meter control dial cabinet* **$44.95**

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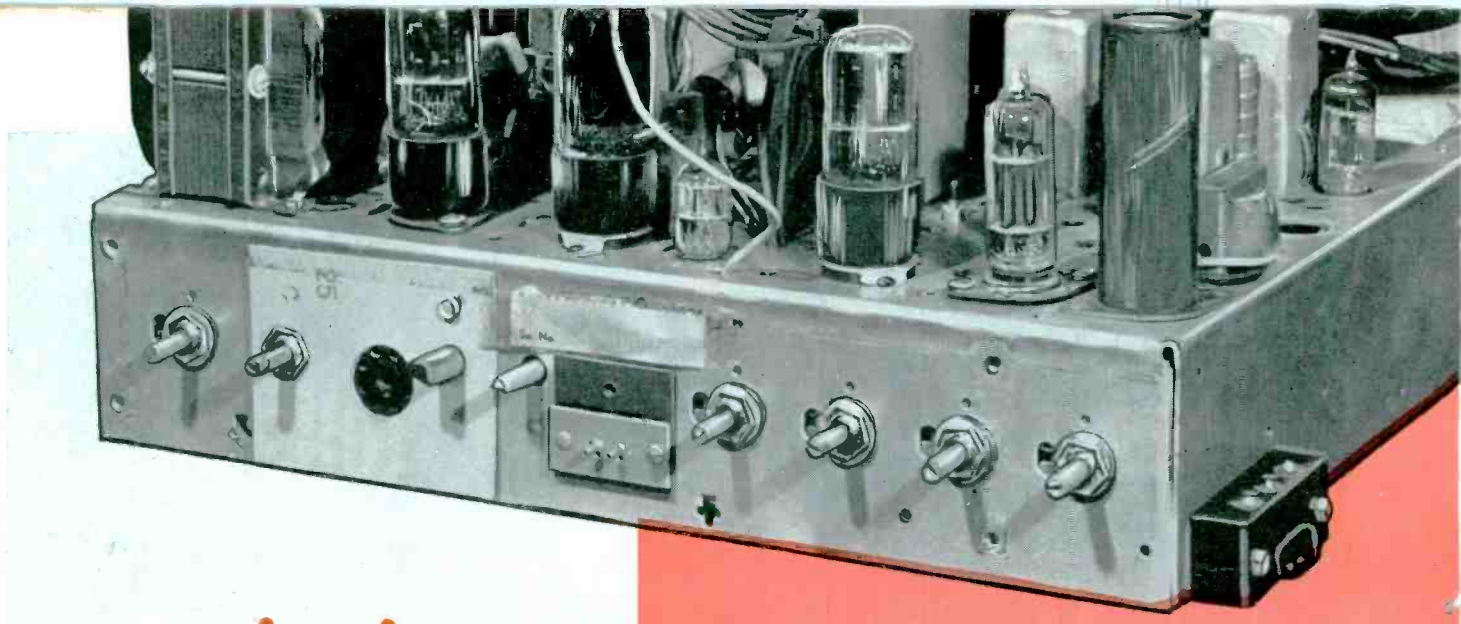

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Rugged, 100% insulated.
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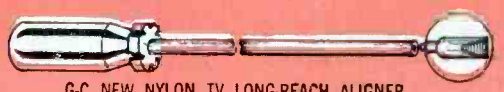

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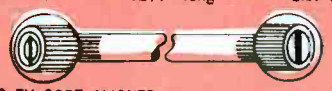

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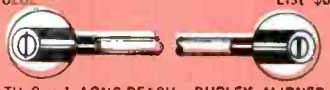

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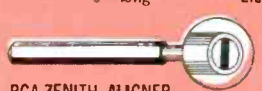

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Vol. 23, No. 1

RADIO · TELEVISION · ELECTRONIC
SERVICE

January, 1954

LEWIS WINNER
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B. BLOCK
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Including SERVICE—*A Monthly Digest of Radio and Allied Maintenance:* RADIO MERCHANDISING and TELEVISION MERCHANDISING. Registered U. S. Patent Office.

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Arthur Godfrey, famous CBS-TV star

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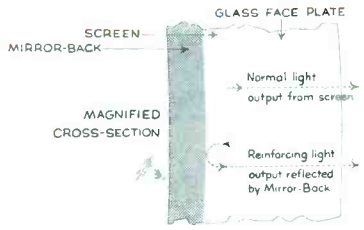

Mirror-Back (aluminized) screen mirrors *all* the light output to the viewer. Offers: Brighter pictures. Greater contrast. Better resolution. Reduced strain on other components. Full effective anode potential. Prevention of cross-burns. And longer life. For greater customer satisfaction . . . more profit, replace with original CBS-Hytron Mirror-Back tubes. Many types now available.

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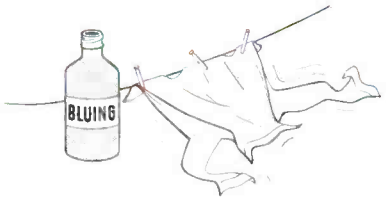

Ever notice how a shirt laundered with bluing appears whiter? With the CBS-Hytron Blue-White screen, whites are whiter; blacks, blacker. Expanded gray scale gives noticeably sharper pictures in fringe areas. No wonder CBS-Hytron's original Blue-White screen has become the universally preferred standard. Your customers, too, will prefer Blue-White screens.

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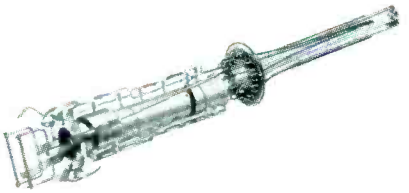

Smaller the spot produced by electron beam, sharper the picture. New lens focusing system of CBS-Hytron Small-Spot Gun reduces spot size 30 per cent. Prove it. Replace with a new CBS-Hytron Small-Spot tube. *See*, yourself, the superior resolution. Profit more. Combine all three: CBS-Hytron Mirror-Back . . . Blue-White Screen . . . Small-Spot Gun. Get and give that better-than-new-set thrill!

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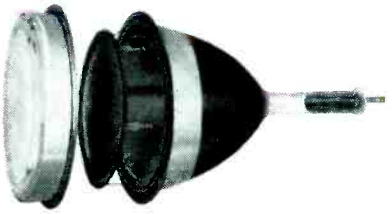

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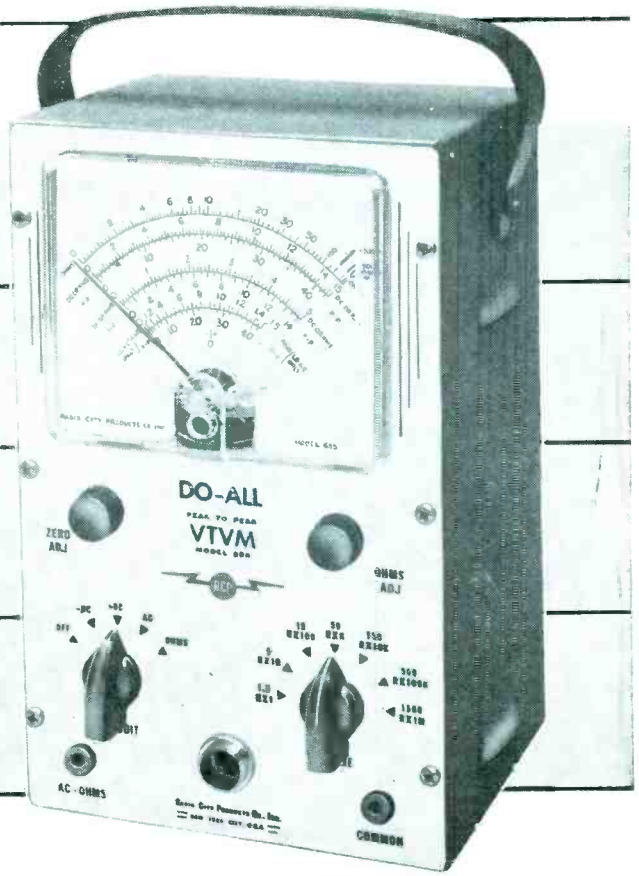

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...gives a true reading measurement of complex and sinusoidal voltages with necessary peak-to-peak or RMS value read directly, for the analysis of waveforms in video, sync and deflection circuits.

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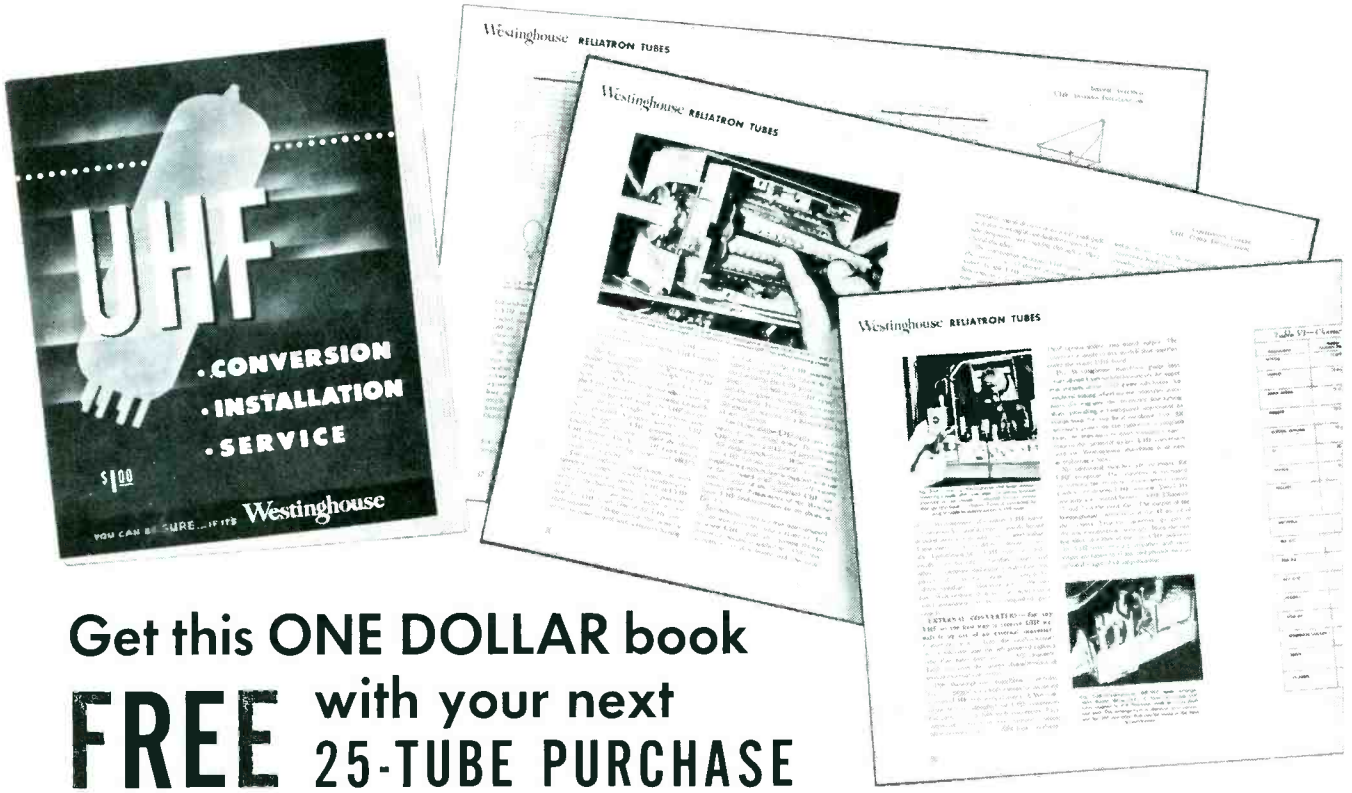

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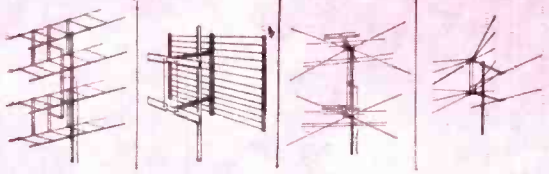

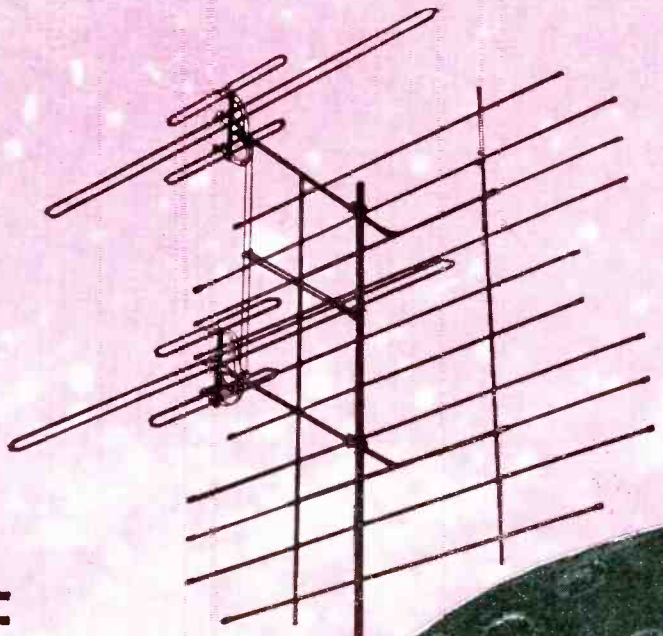

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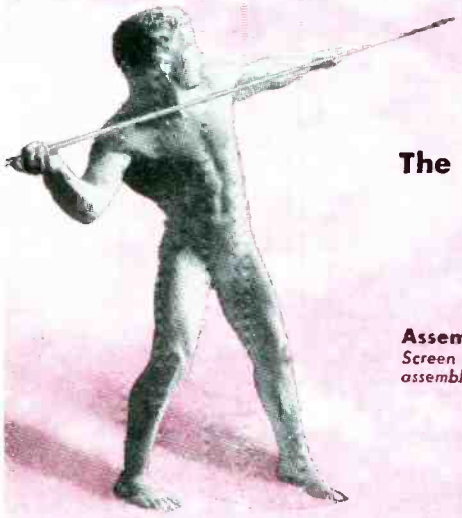
America's servicemen have spoken! In only 3 months, they've made the CHAMPION the nation's top-selling VHF antenna! It's the highest gain all-channel VHF antenna ever developed, and its performance has now been proven by over 50,000 outstanding installations.

Only the CHAMPION has the unique new "Tri-Pole", a *triple-powered dipole system* in which the Low Band dipole also functions as *three* dipoles tied together, in phase, on the High Band.

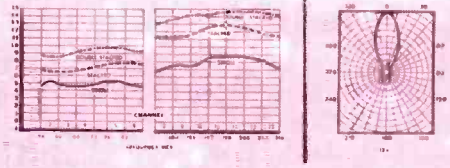
Folded dipoles throughout give close to 300 ohms impedance across entire band. Lightweight, all-aluminum construction. Available in one, two, or four-bays.



The stacked CHAMPION provides:

- **11-13 DB** *High Band gain*
- **6½-7½ DB** *Low Band gain*

horizontal polar pattern (relative voltage)



Assembles faster *than a five-element Yagi. Screen "Pops-Up" instantly. "Tri-Pole" assembly just snaps into place.*

model no.		list price
325	single bay	$20.83
325-2	two bay	42.36
325-4	four bay	88.[illegible]
Separate Stacking Harnesses		
325-3	2 bay harnesses	$2.08
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ELLENVILLE, N. Y.

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STACKED TWIN CORNER REFLECTOR model no. 406-2

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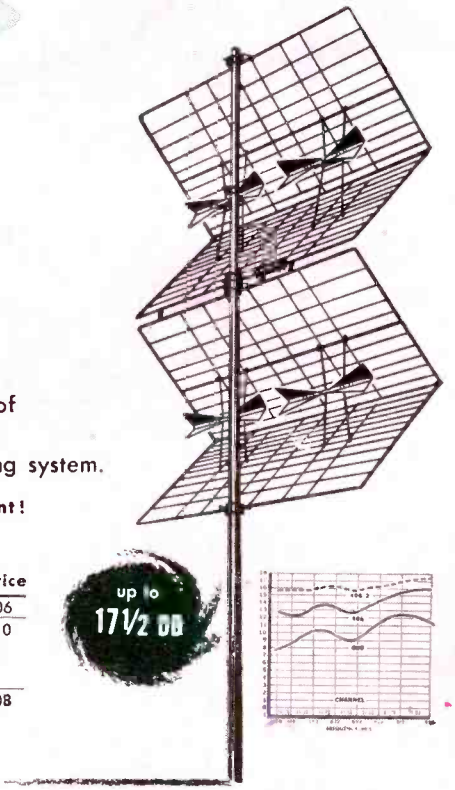
Another original Channel Master development!

Model No.	Description	List Price
406	Twin Corner Reflector	$18.06
406-2	2-Bay Twin Corner Reflector. Stacking harness furnished free.	36.10
406-3	Stacking harness only, furnished separately.	2.08



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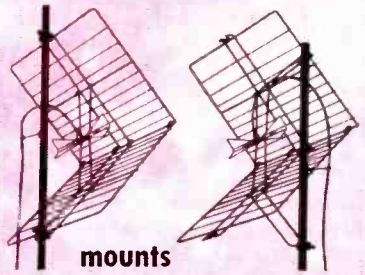

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Only CHANNEL MASTER'S CORNER REFLECTOR can be adapted to any kind of UHF installation — with or without VHF — at no extra cost. Every antenna contains all necessary hardware and braces for BOTH popular types of mounting. Sharp directivity and unusually high gain across entire UHF band.

Installs instantly! Original Channel Master assembly feature: Screen swings open like a book — dipole assembly snaps into place.

"SWEET 16" The World's First 16-Element UHF Yagi!

- Custom-designed for your particular area.
- Super-power! Sensational fringe area reception.
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- Wide band coverage, up to 21 channels.
- Average gain: 13 DB single
  16 DB stacked

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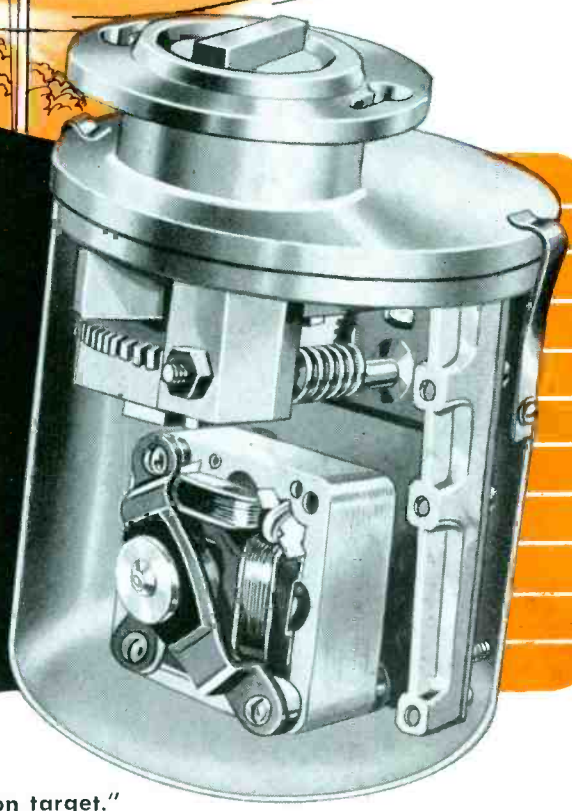

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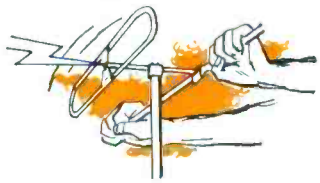

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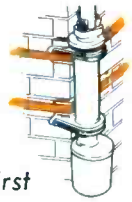

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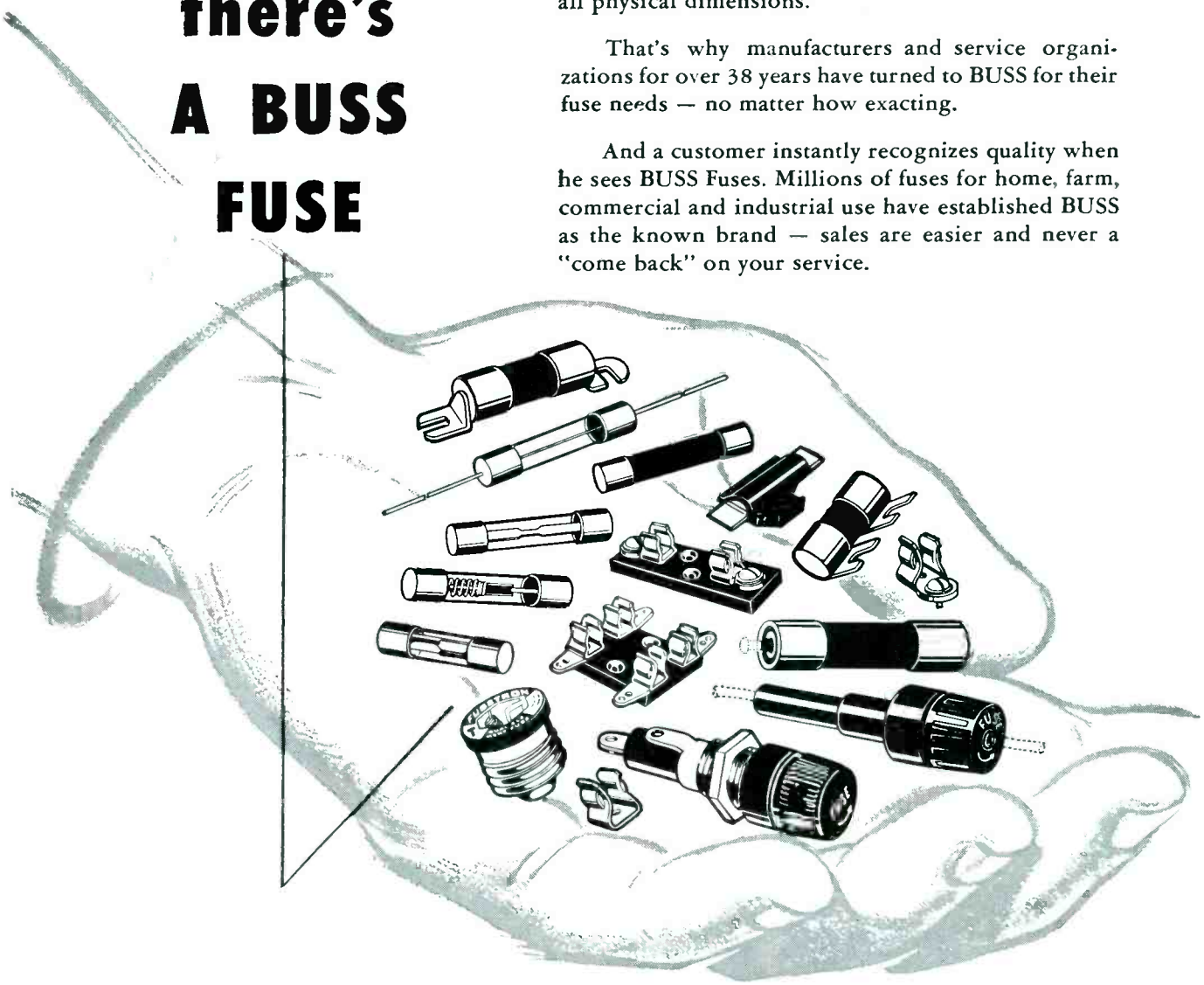

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SERVICE

BLESSED with an industry that is constantly steeped in exciting developments, and always surging forward, Service Men once more can look forward to a pace-setting year splashed with dynamic events that will offer a sterling opportunity to display the completeness of their knowledge, and their aptness in applying their know-how. There'll be many occasions, when those in the shop and in the field, too, will face a driving challenge to their skill and ingenuity. And those who meet the rugged tests will surely find a rich reward for their resourcefulness.

Color* will be a real proving ground for ability. For here there'll be a rash of problems to solve at the onset. Since actually the first runs of commercial receivers will be truly pilot models, subject to many field quirks, Service Men will be obliged to solve many odd difficulties such as color fringing, crosstalk, drifting, phase shifting, and, of course, the familiar assortment of b-w troubles that might obtain.

At present, plans call for the shipment of the three-gun tubes separately, so that they'll have to be installed in the home. One will have to exercise quite a bit of dexterity in these installations. In a typical assignment, it will be necessary to place an insulating ring over the high-voltage anode, and then a heavy metal shield over the tube. In mounting the tube in the cabinet, painstaking care will be required to assure accurate positioning of the three guns. After the tube is in place, one will have to perform many tasks, such as alignment of a special yoke for gun focusing, locating a *purity* coil on the neck of the tube and adjustment of convergence magnets.

According to present plans, no color test patterns will be televised, and thus it will be necessary to create artificial color signals. For such test-pattern work, several types of generators will be available. Some will be known as color signal simulators, and others will be cross-hatch, color-dot, or color-bar generators.

Convergence adjustments on three-gun tube models will be a particularly delicate operation. To illustrate, if convergence is faulty, color fringing will appear on the b-w pictures. Such color fringing will be viewed as a double or triple image in the primary colors.

*For an additional report on color-set design, see *National Scene*, page 20, this issue.

Bustling Days Ahead

Receivers are also expected to feature color killers, which will eliminate color on b-w operation. If the circuits with this feature are defective, queer effects such as color splashing will appear.

Ghosts, smears, flutters, shimmers, and particularly snow, all somewhat tolerable in b-w operation, will be impossible to live with in color. As in b-w sets, inadequate antenna gain or faulty orientation of antennas will be found to be the basic problem here for most of these faults.

While practically all of the initial color sets will use 15-inch three-gun tubes which will provide an 11½-inch picture, some sets might appear with single-gun 21 and 22-inch round or rectangular tubes offering 17 and 18-inch pictures. In the single-gun tube receivers, convergence, fringing or signal drift will not be too serious, but unless the tubes are well shielded, severe radiation will occur, and in addition, defocusing and pin-cushioning might prevail because of yoke and focus-coil difficulties. Also, because of the coarse-line structure of the tube the reproduction of the reds and yellows might annoy some.

Of course, one should also remember that many b-w set owners will be content to wait until color gets a firmer foothold before they buy. During this trial era, b-w viewers will be more anxious than ever to keep their holdover sets in tip-top form; a tailor-made job for Service Men.

There'll be many challenging opportunities elsewhere, too. In communities, beyond the normal reception range of existing TV stations, which also lack a population density necessary to make the market attractive to prospective broadcasters, reception will continue to be provided by either community-TV systems, which are growing in popularity (over 240 have been installed), or either of two new types of retelecasters—satellites or boosters. Both of these new mediums will introduce lively markets for installation, service and maintenance, too. Satellite stations are actually low-power TV transmitters, but they employ no camera or other studio facilities, and instead derive their program material by retransmitting on a separate channel signals of selected TV broadcast stations. Booster stations intercept the signals of a mother station, amplify them, and retransmit the signals on the channel on which they were received. In both cases, the slave transmitters are of the unattended type, and will require service and maintenance, which can be performed by Service Men. To minimize interference, low power will be used by either satellite or booster, and thus receivers will normally require an outdoor antenna and the usual care in its installation to insure maximum pickup. Proponents of the retransmitting idea have told the Commission that there are thousands of communities who can readily use these new retransmitting services.

The recent competitive trends in marketing *hi-fi* have altered old concepts for selling custom-packaged component systems, and jobbers are now displaying a greater spirit of cooperation. And there are indications that the willingness to work with Service Men will grow. It has been found that Service Men can more readily survey a customer's needs, and certainly perform an installation and follow up service calls with striking efficiency. Many jobbers have already, or are in the process of including audio demonstration rooms or salons, openingly inviting Service Men to bring their customers to such studios to help consummate a sale. And ***hi-fi***, heretofore believed to be only limited to the classics, has begun to have its effect on the jazz and pop market, too. Bands, singers and instrumental groups have begun to apply the acoustical advantages of wide-band recording. As a result, there has been a tremendous upsurge of public interest, and prospects for installations have skyrocketed. But, only Service Men can engineer *hi-fi* systems so that they provide the brilliant reproduction the consumer is looking for and the manufacturer loudly claims it is possible to obtain from his equipment.

With color all set to make its glamorous appearance, b-w TV replacement[2] and installation needs still a roaring factor, and the requirements of the rest of the active radio-audio-electronic family as urgent as ever, Service Men truly face a whirling, busy period, which should sprinkle the ledgers of '54 with gilded entries.
—L. W.

[2] See *National Scene*, this issue.

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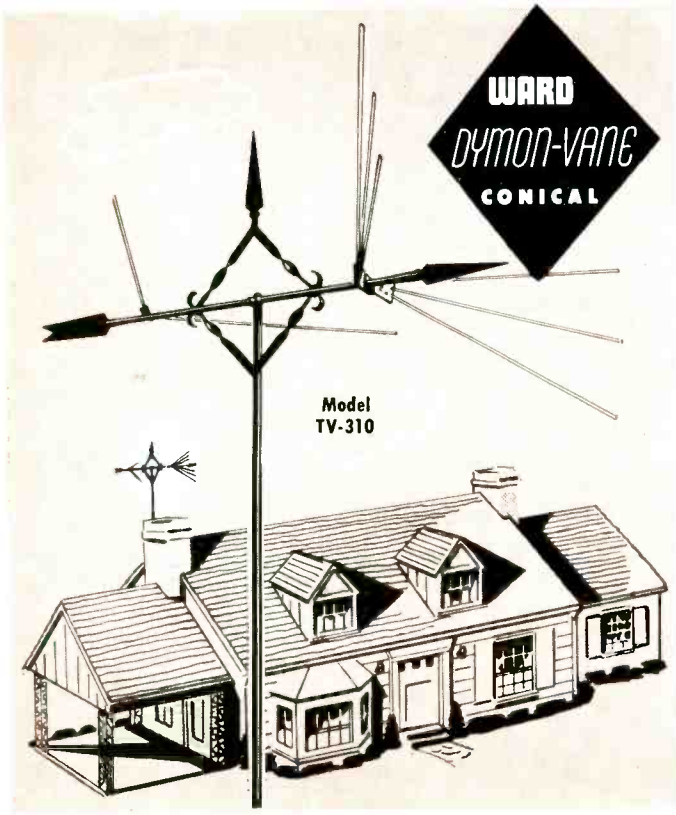

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SERVICE...The National Scene

STRIDENT PROGRESS TO CONTINUE IN '54, INDUSTRY EXPERTS PREDICT--The next 12 months will sizzle with activity, the heads of practically all set, tube and part makers have declared in their annual forecasts. They have based these predictions on the following bright prospects: From 200 to 250 more TV stations should begin telecasting during the next 12 months; this would bring the total number of active TV stations to well over 600. . . . Color sets will begin to roll off the lines in substantial quantities. . . . Hi-fi, disc-tape recording, home and auto radio interest will continue to grow, and there'll be a mounting need for commercial pa, two-way and industrial electronic gear.

ENTHUSIASM for station expansion is certainly well founded, with the FCC files bulging with over 800 applications still to be processed. A year ago it was believed that no more than 75 new stations would go on the air; to date, there are about 360 stations in operation, with about one-third operating on vhf, and the remainder on the ultra-highs.

ACCORDING to most guesstimates, over five million b-w chassis are expected to be made in '54, and from 100,000-150,000 color sets will probably be produced, too. There'll also be a continued strong demand for home, portable and auto sets, with a production of well over 10-million chassis scheduled to be made. This is a slight reduction over the entire '53 output; but percentage-wise more small portables, auto and clock radios will probably be made.

AN ESTIMATED $60-million worth of communications equipment will be sold in '54, including two-way and microwave apparatus. . . . Tube sales (covering all types) in '54, it has been predicted, will reach at least $700-million. . . . According to present schedules, 21-inch picture tubes will be used in about 70% of all the b-w receivers that will be made during the year; 17 inchers will account for 20%, and 24 and 27-inch models will make up the remaining 10%.

ALMOST one out of every seven TV sets in use today, and there are over 27-million now in operation, is expected to require a new picture tube in '54. This high replacement tube figure, it has been noted, represents a normal development with so many chassis growing older. Specifically, over four-million picture tubes should be replaced during the next 12 months, topping the '53 requirement by about 50%. . . . Incidentally, color picture tubes will take up about 2% of the industry's total picture-tube output during the year.

RADIO LISTENING will continue to be an extremely important factor in the home and on the road, and families will be just as anxious as ever to keep their sets in operation. At the beginning of the year, there were 110-million radio sets distributed throughout the country: 44,800,000 radio-equipped homes with 75-million sets; 26,200,000 auto radios, and 9-million receivers were in public places. And, through the year another 13,500,000 sets were bought for home and car use. It has been reported that there are now five-million homes out of 48-million families which have at least three radio sets. According to a network survey, over 41-million families, or about 92% of the nation's radio families, listen in for an average of of more than three hours a day. Commenting on this continuing interest in radio, one FCC Commissioner said that apparently TV has not displaced the demand for radios in the home; it has merely divided the living-room set into three parts, in most instances, and moved one to the bedroom, one to the kitchen, and one to the children's bedroom or recreation room.

UPPER NEW YORK STATE ASSOCIATION PROTESTS JOBBER-DISCOUNT PRACTICES--In a sharp note, sent out by the Radio and TV Service Association of Western New York (Buffalo), jobbers were asked to protect Service Men against retail purchasing at the wholesale level. A motion passed by the group, and distributed to parts jobbers and set distributors in the area, asked the merchants to display prominently a sign that would state that wholesale discounts will be given only to those individuals or organizations that hold sales tax exemption certificates, which, of course, are held only by those who operate shops. The only exception to this ruling would be hams who present an operating license as certification of their activity. According to the association's prexy, jobbers were asked to reply to this request, either by phone or letter. The association declared that it proposed to supply, at its own expense, signs with the tax-exemption discount information.

SERVICE...The National Scene

COLOR-SET OPERATION-DESIGN FACTORS DEFINED IN OFFICAL NTSC APROVAL--In its report and order approving compatible color, the FCC included pages of basic data on set design and operation that will probably be found in all future color manuals and textbooks. In a commentary on the inherent complexity of color signal specs, it was noted that the color tube and its attendant circuitry is very complicated and of intricate design, and will impose a substantially greater burden in instruction, servicing and maintenance. Finer adjustments of the tuner control will be required; to illustrate, by moving this control too far in either direction, a considerable change in the color balance of the picture will obtain. Color sets will also have a chroma control which determines the saturation of color; at one extreme position colors will be fully saturated, while at the other end colors will be washed out. Many models will also have controls for hue, convergence and color hold.

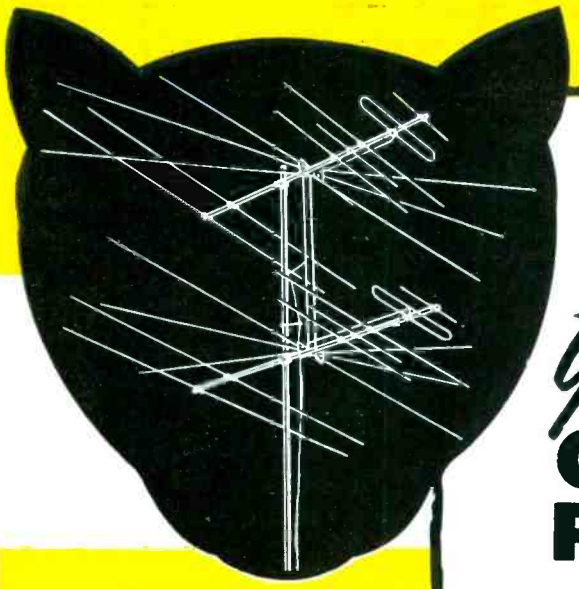
IN THE REPORT from Washington, it was said that the tricolor picture tube, the involved convergence circuitry, and special deflection yoke and hv supply, will require particular attention in manufacture and servicing, too.

INTERFERENCE, as noted earlier in these columns, remains as a key problem; color chassis are more vulnerable to interference which falls in the region of the subcarrier. Such interference to the receiver could originate from the additional sideband energy radiated by a color transmitter on the upper adjacent channel, or it could be caused by some other source--the receivers themselves. Receiver manufacturers will have to take every precaution to prevent such radiation by making full use of shielding, traps, and other known control methods.

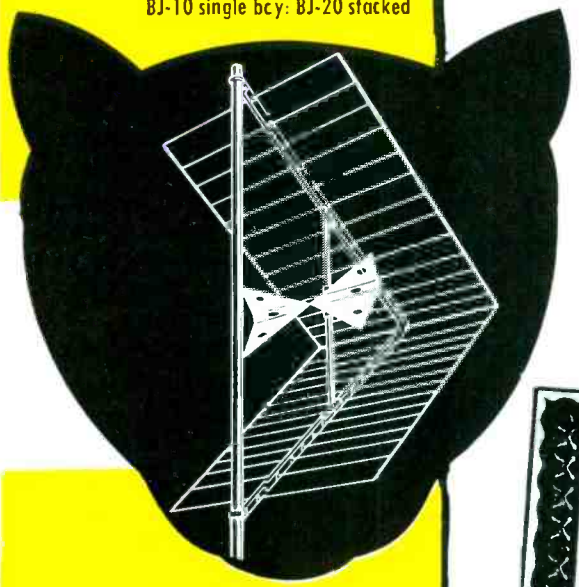
IN INSTALLING AND SERVICING color sets, Service Men will also have to be concerned with such factors as the brightness component. Since the eye is most sensitive to green, less sensitive to red, and least sensitive to blue, brightness is obtained by mixing signals in that order of proportion. Specifically, the values of the mixture are: 59% green, 30% red and 11% blue. Such a mixture produces shades of gray in pictures on b-w sets. However, in the color system, this mixture accomplishes the primary objective of transmitting with the correct intensity the brightness signal which is one of the two components of the color picture image.

THE CHROMA component will also be of particular concern to Service Men. When a composite color signal is received on a color set, the chroma component must be separated by special filters before it can be processed. This chroma signal is removed from the composite signal at about the third video amplifier, and then fed through a 1.8 to 4.3-mc bandpass filter. This filters out the video carrier frequency and lf components, leaving the color subcarrier and sidebands along with the hf components of the luminance signal. Actually, the modulations of the two-color difference signals on the subcarrier remain independent only when the modulated waves each consist of like upper and lower sidebands. . . . The output of these filters is fed to a chroma demodulator which recovers the original color-difference signals. And, the two color-difference signals which result are fed into a matrixing unit from which is recovered the third color-difference signal, or green minus brightness. In the case of the three-gun tube, the three-color-minus-brightness signals are routed to the three respective electron beams of the color tube, where they are combined with the brightness signal. The result is that we have color minus brightness, plus brightness, which equals color. That is, the original primary color is restored and projected on the viewing tube.

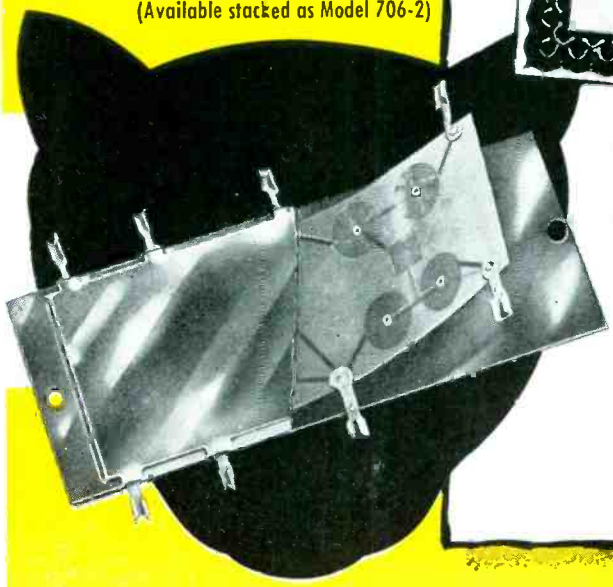
BBB TELLS CONSUMER ABOUT COLOR--In one of the most enlightening booklets ever published, the National Better Business Bureau has presented an extremely forthright report on the status of color today. Defined are compatability, availability of chassis, problems of conversion, picture-tube sizes, and the relative complexities of receivers. Answers are sincere, and in reply to questions that are expected to puzzle many consumers. Here, truly, is an extremely useful addition to the library of every service shop. Congratulations to those in the BBB for their vision in preparing and releasing this highly instructive booklet at this time.--L.W.



"BIG JOE" all channel VHF antenna
BJ-10 single bay: BJ-20 stacked



UHF Ultra Cor-Tenna, Model 706
(Available stacked as Model 706-2)



Model UV-3 Trip e-tie cross-over filter

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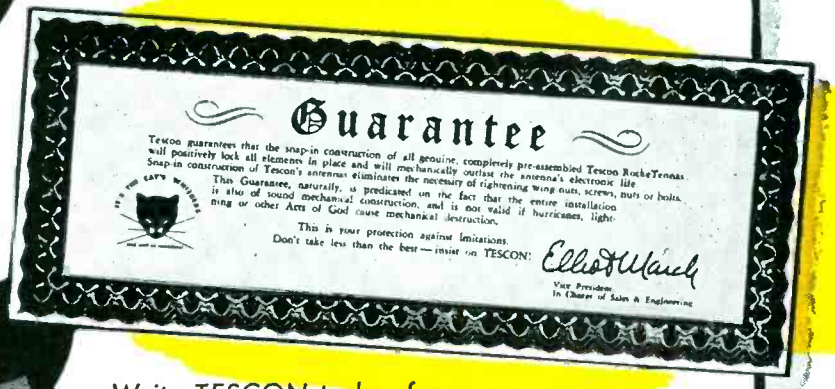
TESCON'S unique and exclusive engineering . . . rugged construction, spectacular reception, easy "snap-in" assembly, split-second installation, strongest signal . . . features that make these the most outstanding antenna values at any price! Regardless of the antenna requirement, there is a TESCON model available that will do the perfect job, with the highest gain. Leaders in the TESCON line are the "BIG JOE"—the first antenna to cover all VHF channels with tremendous db gain — and the Ultra Cor-Tenna — one of the most powerful UHF corner reflector antennas known with a gain of up to 14.8db!



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Better Audio From Radio and TV For the Hard-of-Hearing

by DONALD PHILLIPS

TV and Radio AF and Power Circuits Can Be Altered for Headphone Use to Provide Improved Sound Reproduction and Insure Safety, Too

Above, left: Multiple listening unit that can be used with hearing aid or headset; both speaker and headset or hearing aid can be operated with this device in circuit. As a safety feature item has a line-isolation transformer. (Philco)

MANY, who use hearing aids, have found that these devices do not provide completely satisfactory audio performance from radio and TV chassis. It has been noted that these persons do not hear the programs as clearly as they can hear *directly* the voices of others.

One reason for the inferiority of sound reproduction from a TV or radio receiver through the hearing aid has been attributed[1] to the fact that the audio signal must pass through two amplifier systems before it reaches the hearer. Inferior reproduction has also been found to be due to reverberation of the sound waves in the room, since the receiver is placed at a greater distance from the hearing aid than in normal conversation.

Headphones Instead of Hearing Aids

Whether or not the theories offered for the inferiority of sound reproduction are correct or sufficient, there is no doubt that hard-of-hearing persons often prefer to listen to audio by means of a pair of headphones plugged into the audio-output circuit of the receiver. It has been found that a tone control is very desirable to help accommodate the user's particular type of hearing loss.

The Safety Factor

Service Men who are asked to install earphones and tone controls actually shoulder a heavy responsibility. In the event of trouble which could result in a fatal shock to the user, the Service Man would first be accused. And there is more than one problem to the shock difficulty.

It might be supposed that if one terminal of the circuit to the earphone were grounded, the user would be safe from any shock due to trouble in the TV or radio receiver. With certain technical exceptions, this supposition is true. On the other hand, if the user should be wearing the grounded earphone, and reach for an electric switch in a faulty lamp, the trouble in the appliance could cause fatal shock. Again, the chassis of some TV receivers are *hot* when the power plug is inserted in the power outlet in one direction; contact of the user with a control shaft or faulty knob of the receiver could again result in fatal shock.

Chiefly for these reasons, various authorities maintain that the earphone should not be connected to ground in any manner, and that insulation, tested to withstand 2,000 volts, should be provided between earphone and the receiver output circuit.

Careful Inspection of Receiver Circuit

The output transformer in the radio or TV receiver may or may not have a chassis-grounded secondary. In some cases the secondary drives the voice coil of the speaker only, but in other instances the secondary also supplies a feedback voltage to the audio-amplifier circuit. Accordingly, whether the chassis of the receiver is connected to the power line or not, other considerations may prevent *floating* the secondary of the output transformer, to provide safety to the earphone user.

Circuit considerations do not end here. The secondary of the output transformer may be ungrounded in certain types of receivers, but may still be unsuitable for the intended application because of insufficient insulation between primary and secondary. Unless the output transformer can withstand a 2,000-volt test on a *dc* megger,* it should not be considered safe for the application, in the view of established authoritiy on this subject. Since the entire future of the installing Service Man may be at stake in case of a faulty job, too much attention cannot be given to safety considerations and to the background of experience which has been accumulated on the subject.

Circuit Considerations

In Fig. 1 appears an arrangement for an *ac/dc* chassis, in which one side of the earphone circuit is grounded. Far from providing protection to the user, the grounded earphone circuit can instead provide a shock circuit (between X and Y). Wet, frayed, or burned cords, cracked insulation or otherwise damaged phones and switches can provide the shock contact to the earphone user. Hence, it is clear that

[1]Wireless and Electrical Trader; May 23, 1953.

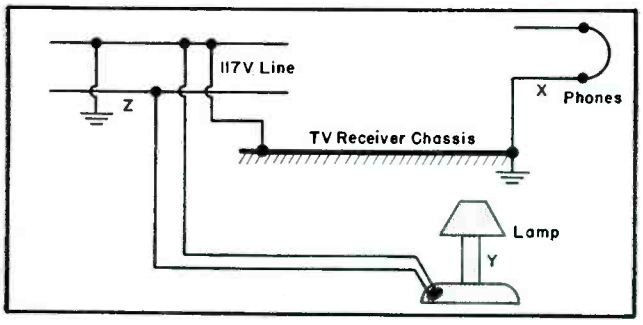


Fig. 1. Although one side of the earphone link is grounded in this circuit, the user could receive the full 117-volt line potential between points X and Y, in case line Z should come into contact with the metal structure of the lamp. Such contact often occurs in practice, due to frayed cords; contact can also result from damaged sockets or switches. The user may make contact at X due to frayed or burned insulation, wet insulation, or breakdowns in the earphone structure.

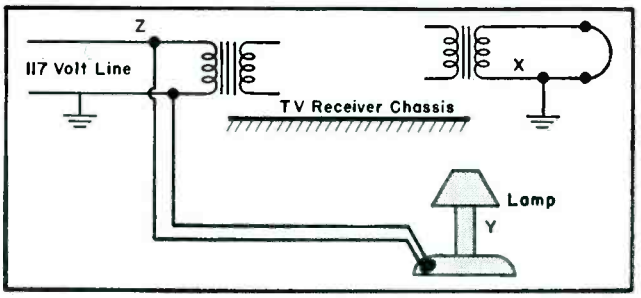


Fig. 2. The same possibility of shock to the earphone user noted in Fig. 1 also exists in a grounded-earphone circuit used with an ac receiver. This danger obtains because one side of the 117-volt power line is externally grounded. If line Z should make contact with the metal structure of the lamp, the listener can receive the full 117 volts between X and Y. Grounded earphone circuits are dangerous for use with any receiver.

grounded earphone circuits are a source of danger to the user.

Service Men must be careful to distinguish between the danger of shock from a *hot ac/dc* chassis, as contrasted with the danger of shock from a grounded earphone circuit to an electrical appliance. Fig. 2 illustrates an *ac* receiver of the transformer-coupled variety in which the TV chassis is floating. The earphone circuit is grounded to a water pipe for *safety*, but it is clear that the ungrounded chassis affords no protection over the arrangement shown in Fig. 1. The earphone user can still receive a shock between the earphone circuit and the lamp (or other appliance) in case of wet cords, frayed or burnt insulation, or other faults.

The danger to the user in such arrangements lies in the fact that one side of the power line is externally grounded by the power company. The shock which can be obtained from the earphones in the circuit of Fig. 2 is thus to be clearly distinguished from the shocks which can be received from *hot* chassis due to broken knobs, tampering by *fix-it-yourself* addicts, or similar misfortunes.

In Fig. 3 we have an output circuit for a receiver, in which neither side of the speaker is grounded. Hence, this is a suitable arrangement for providing a floating earphone circuit, provided of course that the output transformer and its associated speaker circuit is not leaky or subject to breakdown from transient surges. If the speaker and secondary of the output transformer can withstand a 2,000-volt megger test to chassis, the primary requirement is met. Nevertheless, the added margin of safety provided by a separate output transformer for the earphone circuit is too strong to be disregarded.

As an illustration of the wide variations in speaker circuitry which are encountered, Fig. 4 shows a speaker circuit which is grounded on one side, and returned to a feedback loop on the other side. It is sometimes found that the speaker circuit includes humbucking arrangements, as shown in Fig. 5 (p. 76). In most of these arrangements, it is possible to provide a ground to the secondary of the output transformer, as shown in Fig. 6 (p. 76), if one is not provided by the receiver manufacturer.

The secondary of the output transformer should always be grounded, when a separate earphone transformer is used, as shown in Fig. 6, to provide a margin of safety to the earphone user against leaking of $B+$ voltage from primary to secondary of the output transformer; leakage resistance, R, as indicated in Fig. 6, is clearly a separate source of shock to the user of an ungrounded earphone circuit. However, the combination of a grounded secondary in the output-transformer circuit, plus the installation of a separate earphone transformer rated at 2,000-*v* insulation between primary and secondary, insures the user against shock either from receiver faults, or from switching *hot* chassis on and off, or touching faulty electrical appliances.

Since Service Men will encounter speaker circuits in *ac/dc* receivers in which one side of the speaker line may *not* be grounded, it is important to provide for this situation. In such cases, two earphone transformers must be used in cascade, with the secondary of the first earphone transformer grounded, and the secondary of the second earphone transformer ungrounded. This provides the same safety factors to the earphone user as the arrangement shown in Fig. 6 (p. 76).

Volume control is a necessity, of course, and the basic arrangement

(*Continued on page 76*)

*A suitable megger for such tests is manufactured by El-Tronics Corp. Some replacement transformers, such as the Merit line, are rated to withstand a minimum of 1500 volts *rms* at 60 cps, which is equivalent to a *dc* rating of 4000 volts.

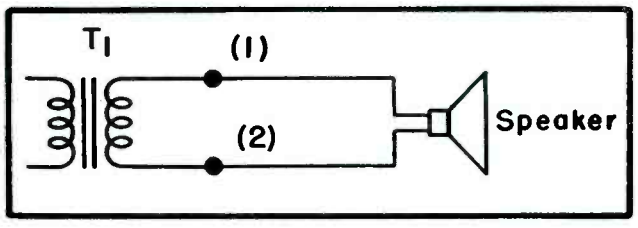


Fig. 3. If the earphones are connected between 1 and 2 in this arrangement, the first requirement of an ungrounded earphone circuit is met. Nevertheless, Service Men must ask whether the output transformer T_1, which is supplied with the receiver, may be safe, and whether the associated speaker circuit may likewise be safe. A test with a 2,000-volt megger between either 1 or 2 and chassis should be passed before this basic arrangement is utilized. A separate output transformer provides a margin of safety which cannot be disregarded.

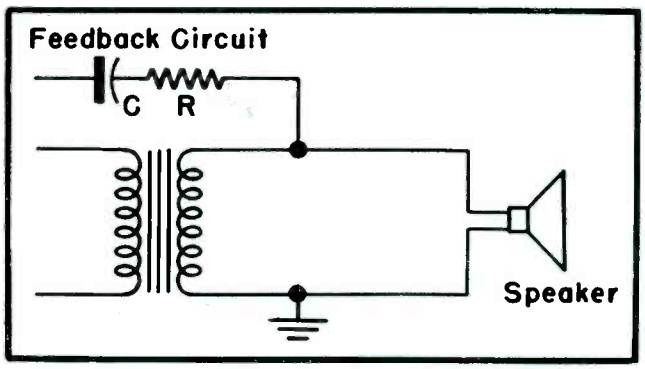


Fig. 4. Some receivers utilize a feedback circuit, in addition to grounding one side of the speaker circuit. It is the incidence of such unexpected arrangements that calls for the careful inspection of the circuit diagram before starting an earphone installation job.

Troubleshooting 60-Cycle Buzz in TV

by CLARK R. ALISEN

Step-by-Step Trace Guide

Buzz can be localized by turning controls on a TV set and supplementing these tests with specific component and wiring checks. In probing for buzz, the following step-by-step procedure has been found very effective.

1: The receiver should be switched to an inactive channel. If the receiver continues to buzz, an *untunable* distortion voltage is present; a typical untunable buzz pulse is shown in Fig. *1*, below.

2: If the buzz ceases when the receiver is switched to an inactive channel, *tunable* (sync) buzz is present. A typical tunable buzz pulse is shown in Fig. *2*. In case of tunable buzz, suggestions offered in step *21+* (p. 48) should be followed; in case of untunable buzz, step 3 is in order.

3: The vertical-hold control should be turned, listening to the pitch of the buzz. If the buzz changes in pitch, it can be concluded that the source of the buzz is in the vertical-sweep or vertical-oscillator circuit.

4: The volume control can now be turned and another listening test made, this time on the intensity of the buzz. If the intensity of the buzz does not change, sweep voltage is entering the audio circuits at a point past the volume control. And if the intensity of the buzz is changed by a setting of the volume control, then the sweep voltage is entering the audio circuits at a point prior to the volume control.

5: Volume control should be replaced if noisy, or if an ohmmeter check shows too high a resistance value; a defective volume control can pick up stray fields.

6: One should also check grounding of outer braid on shielded volume-control lead and lead dress. Even a shielded volume-control lead occasionally picks up buzz when dressed too close to the vertical-sweep circuits.

7: If untunable buzz persists, the first audio amplifier tube should be removed to determine whether buzz ceases; if buzz continues, the vertical-sweep voltage is entering the audio amplifier between the driver and output stage.

8: If the speaker has been replaced, one should check to see whether a hum-bucking coil is present, and correctly connected. A high hum level, simulating buzz, can enter at the speaker, if the hum-bucking terminals have been inadvertently reversed.

9: To distinguish between hum and *soft* buzz, the vertical-output tube should be removed to see whether the buzz stops. In some cases it may also be necessary to check the vertical-oscillator tube.

10: Buzz may be entering audio circuits through the *B* supply line. Here one should check the line with a 'scope to see whether it is *hot* or *cold*. If *hot*, decoupling capacitors in the audio and vertical-sweep circuits should be checked.

11: If the *B* supply line is not at fault, grounding of the vertical-output transformer core to chassis should be checked.

12: Arcing turns may develop in vertical-output transformer, developing excessive stray field. A substitution test should be made in case of doubt.

13: Shielding of audio-input stage should be checked; a metal-type tube should be used, or a shield provided for a glass-type tube.

14: Lead dress in the vertical-sweep circuit should be checked; output leads close to chassis should be dressed.

15: If the pitch of the buzz remains constant as the vertical-hold control is turned, it will be usually found that buzz voltage is entering via the *B+* line.

16: Line filter should be checked to make certain that the power line is not operating as an antenna. (Bypass capacitors should be shunted from each side of the line to chassis.)

(*Continued on page* 48)

Fig. 1. When a 'scope is applied at the output of the audio amplifier, an untunable buzz pulse, as shown here, will appear. A good 'scope is more sensitive than the ear, and it may not be possible to bring the pulse to invisibility on the 'scope screen.

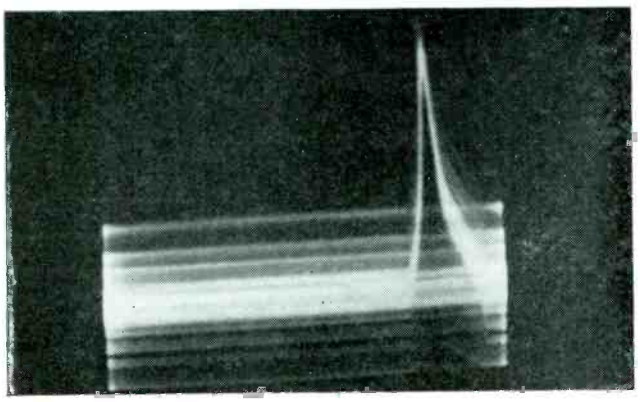
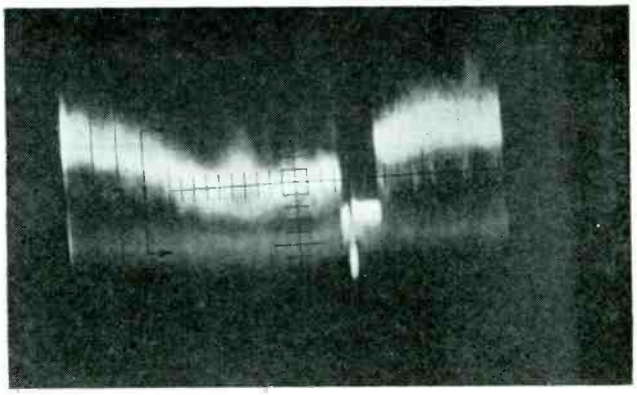
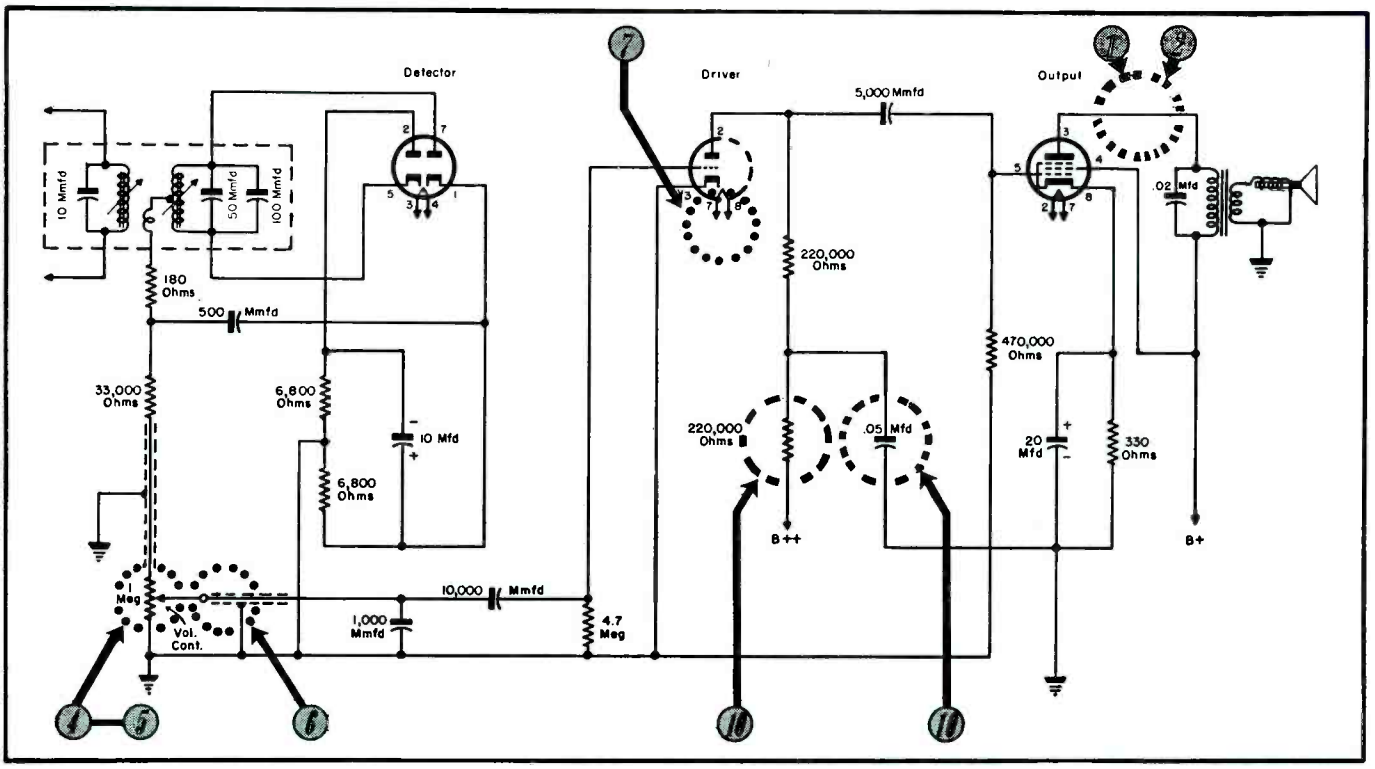


Fig. 2. Here we have a typical tunable buzz pulse as it appears on a 'scope. The tunable buzz pulse is derived from the video signal, while an untunable buzz pulse is derived from the vertical-sweep voltage.



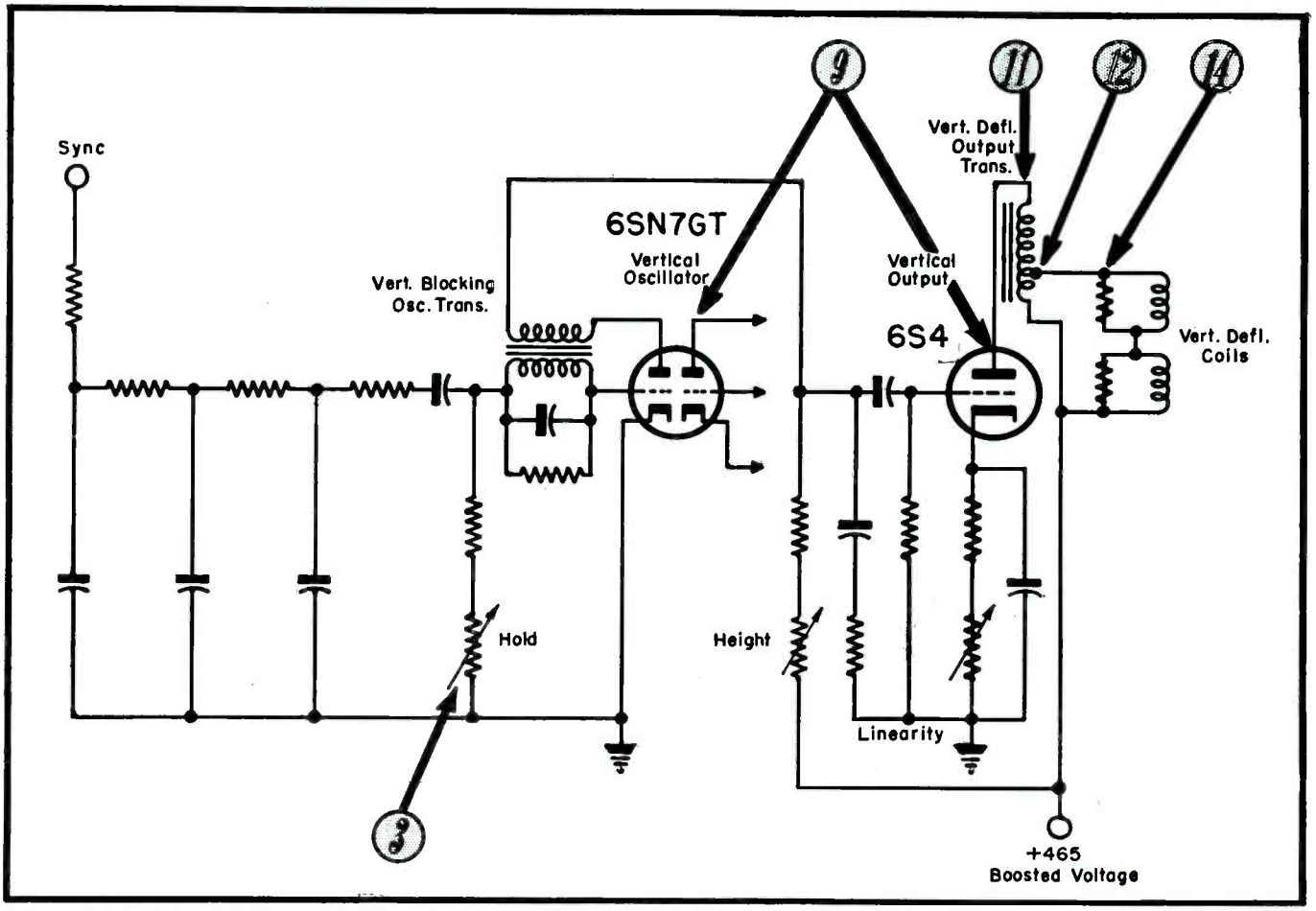


(Above)

Fig. 3. Check points for 60-cycle buzz: See detailed probe procedure at left.

(Below)

Fig. 4. Circuit illustrating where 60-cycle buzz may appear: See analysis with corresponding numerical references at left.



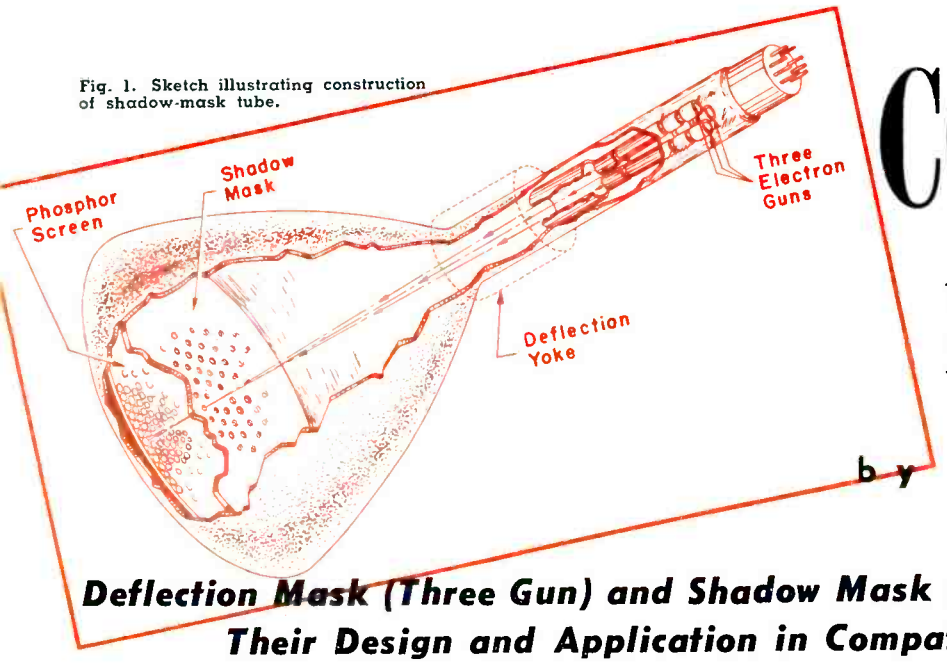


Fig. 1. Sketch illustrating construction of shadow-mask tube.

COLOR TV Picture Tubes

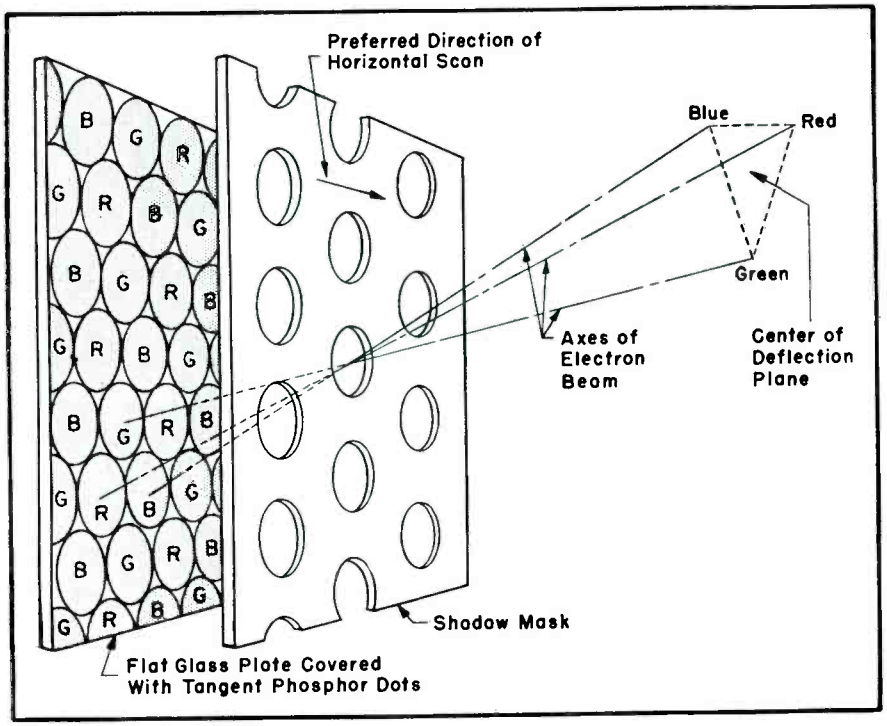
by W. L. ROBERTS
Westinghouse Research Laboratories

Deflection Mask (Three Gun) and Shadow Mask (Single Gun) Picture Tubes: Their Design and Application in Compatible Color Chassis

IN ITS EFFORTS to develop the best practical tricolor picture tube, industry has undoubtedly spent far more money than upon all the other aspects of color TV. This intensive research and development program has not been without success, for several successful direct viewing tubes have been demonstrated*. Among these are the deflection mask type where variation in color can be produced by deflecting the beam near the screen and the other is the shadow mask type utilizing three electron guns, each gun being capable of exciting phosphor dots on the screen of the color tube only.

The possible use in home receivers of three small projection picture tubes, one with a red, one with a green and one with a blue phosphor screen should not be ruled out. Such a color receiver has already been demonstrated. In it, the images of the three screens are optically superimposed on a ground glass screen. Such sets have two inherent problems. The first lies in the fact that exact registration or superposition of the three images is somewhat difficult. Moreover, the screen usually has directional qualities and must be viewed from a direction almost normal to it to see a picture of desired brightness. Their chief advantage lies in their ability to produce large size pictures and hence it seems probable that they will find more use in hotels, clubs and other public places rather than the home.

Fig. 2. Geometrical arrangement of beams, shadow mask and phosphor dots in shadow-mask tube.



The Shadow Mask Tube

The shadow mask tube is an extremely interesting type. Outwardly, it resembles a conventional black-and-white picture tube, except for its greater length from gun to screen and the larger diameter neck of the tube. Inwardly, however, it is a real triumph of engineering skill. The gun assembly consists of three accurately aligned electron guns located 120° apart around the tube axis, arranged so that at the center of the screen the convergence angle (or angle between each beam and the axis of the tube) is about 2°.

Mask Construction

Located just behind the screen of the tube is the shadow mask, a thin perforated sheet of metal or glass with a large number (approximately 200,000) of uniformly distributed holes, with center-to-center spacings of approximately .03″ and diameter of .012″. On the screen in front of each hole are three dots of phosphor each emitting a primary color when excited by the electron beam. These dots are so arranged that when a particular gun produces a beam, only those phosphor dots of the color associated with that gun are excited. The other dots are screened from the beam by the shadow mask. To produce white light, all three guns are switched on to pro-

*Tube News, SERVICE; November, 1953.

duce equal light output from all the phosphor dots.

Dynamic Convergence

Essentially, the three-gun shadow mask color tube may be visualized as three picture tubes built into one envelope; the three pictures produced by each gun must be exactly registered or superimposed on one or the other. This is facilitated to a great extent by the proximity of the guns to each other, by the use of a common-deflecting system for the three beams and by using small deflecting angles. However, to insure convergence of the three beams at the same point irrespective of their deflection, a system of dynamic convergence is used. This system utilizes a magnetic (or an electrostatic) convergence lens on the neck of the gun, and the focal length of the lens is changed with the angle of deflection of the beams. This is accomplished by modifying the vertical and horizontal scanning waveforms and applying them to the dynamic convergence coil located on the neck of the tube to the rear of the main deflection yoke. To enable the three beams to produce well-focused spots for all deflection angles, dynamic focusing must also be used. The circuit utilized in the early experimental models of the Westinghouse color TV receivers is shown in block schematic form in Fig. 4. Parabolic waveforms are first derived from the cathode circuits of the horizontal and vertical output tubes. After shaping and phasing, these waveforms are combined in series by means of transformers to form the dynamic convergence and focus waveforms which are applied to the tube.

Because of the use of three guns and a corresponding larger neck of 2″ diameter, a larger deflection yoke and greater scanning power is required. Moreover, to maintain color registration for various beam currents the high-voltage supply of the picture tube must be well regulated at approximately 20 *kv* and has to be capable of supplying a current of about 300 microamperes.

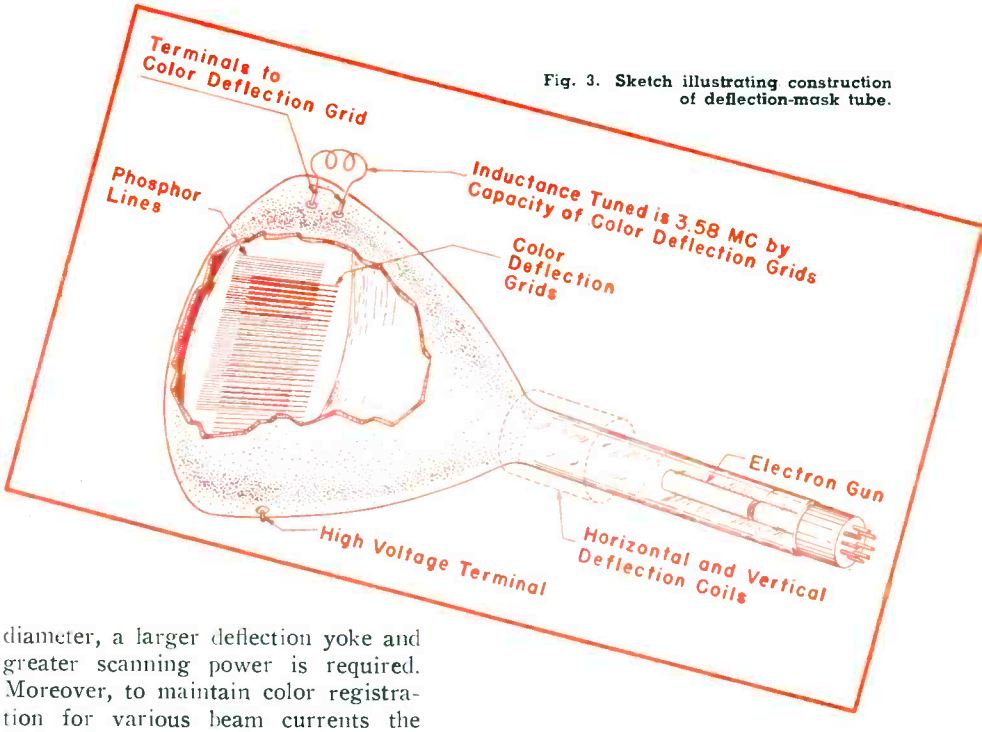


Fig. 3. Sketch illustrating construction of deflection-mask tube.

The Efficiency of the Tube

At first, it would appear that by using three typical electron guns with a total beam current of the order of 1 *ma* there would be no difficulty in obtaining bright pictures. However, only about 10% of the electrons get through the holes in the shadow mask, so that the number of electrons reaching the screen is only 30% of what would be obtained in a single gun black-and-white tube that requires no mask. By increasing the screen voltage, pictures of adequate brightness are obtained.

Application of Color Signals to the Shadow Mask Tube[1]

In using this tube, it is customary to put the wideband, E_Y, or luminance signal on all three control grids and the lower frequency $(E_B\text{-}E_Y)$, $(E_G\text{-}E_Y)$ and the $(E_R\text{-}E_Y)$ signals on to the appropriate cathodes. As far as the lower frequency components of the video signals are concerned, the resultant grid voltages of the guns with respect to their cathodes are E_B, E_G and E_R, respectively. This is due to the fact that if the signals are correctly phased, they are effectively added in the cathode-grid circuits. This is il-

(*Continued on page 74*)

[1]Geist, J. C., *Compatible Color Servicing Problems*, SERVICE; August, September, 1953.

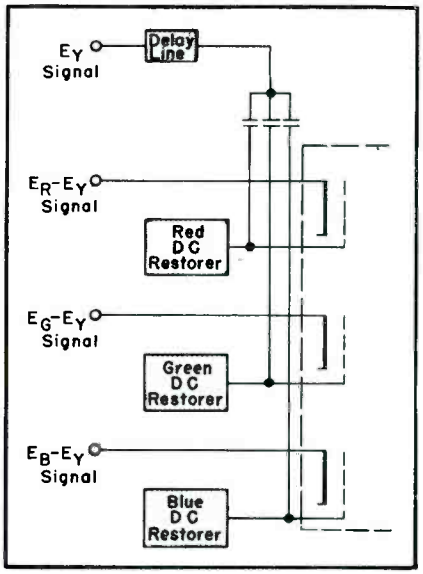


Fig. 5. Diagram illustrating application of video signals to the shadow-mask tube.

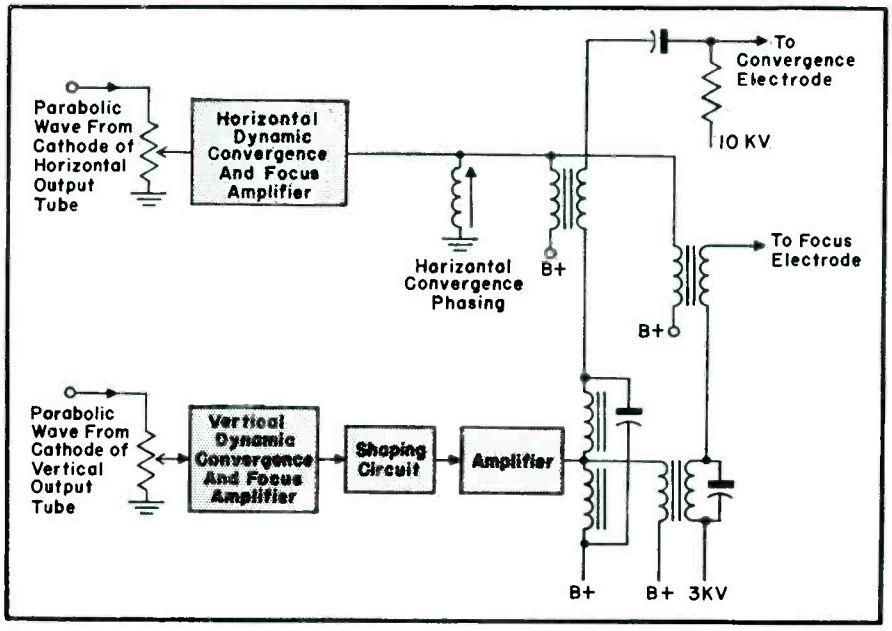
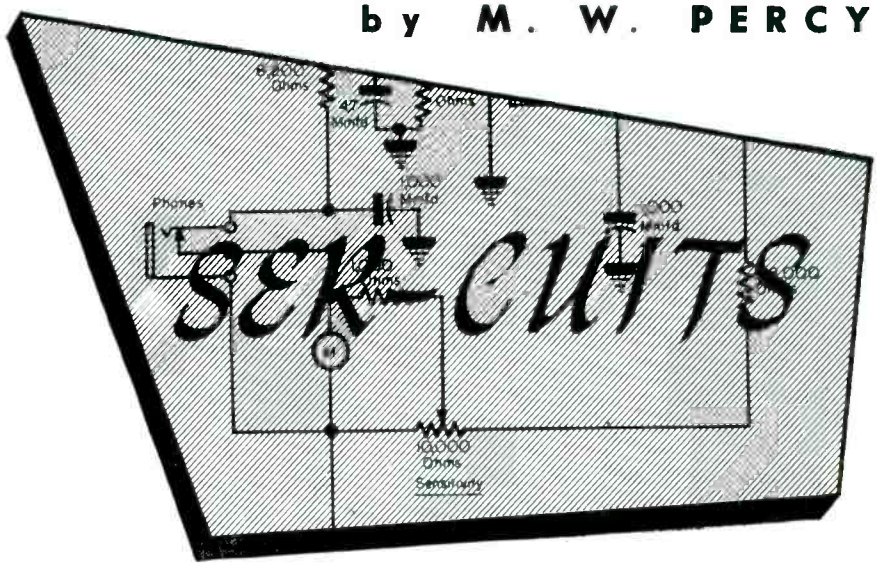


Fig. 4. Dynamic convergence and focusing circuits for use with the shadow-mask picture tube.

by M. W. PERCY



Analysis of Continuously-Tunable UHF Converter Using ¼-Wavelength Shorted Line for Tuning

WHEN *uhf* first came on the scene, most converters were basically similar in their tuning and tube layouts. With the advent of a new family of tubes that could be used in ultrahigh oscillators and *if* amplifiers, and the allied development of new techniques for tuning, many novel circuitry designs began to appear.

An illustration of this new era in design appears in the circuit shown in Fig. 1; a continuously tunable converter[1] which uses a quarter wavelength shorted-transmission line as the tuning element.

Tube Complement

The tube complement in this model consists of a 6T4 (or a 6AF4) as the local oscillator, a 6BK7A (or a 6BZ7) connected as a low-noise *if* amplifier and a special low-noise germanium diode.[2] Power is furnished by a selenium rectifier.

There are two sections in the unit; a pre-selector and an oscillator designed for proper tracking.

The design of the input circuit is such that the antenna is matched properly to the pre-selector. This results in a low-input standing-wave-ratio, which allows maximum power transfer from the antenna to the converter. The possibility of ghosts originating from reflections in the lines is also reduced by the match.

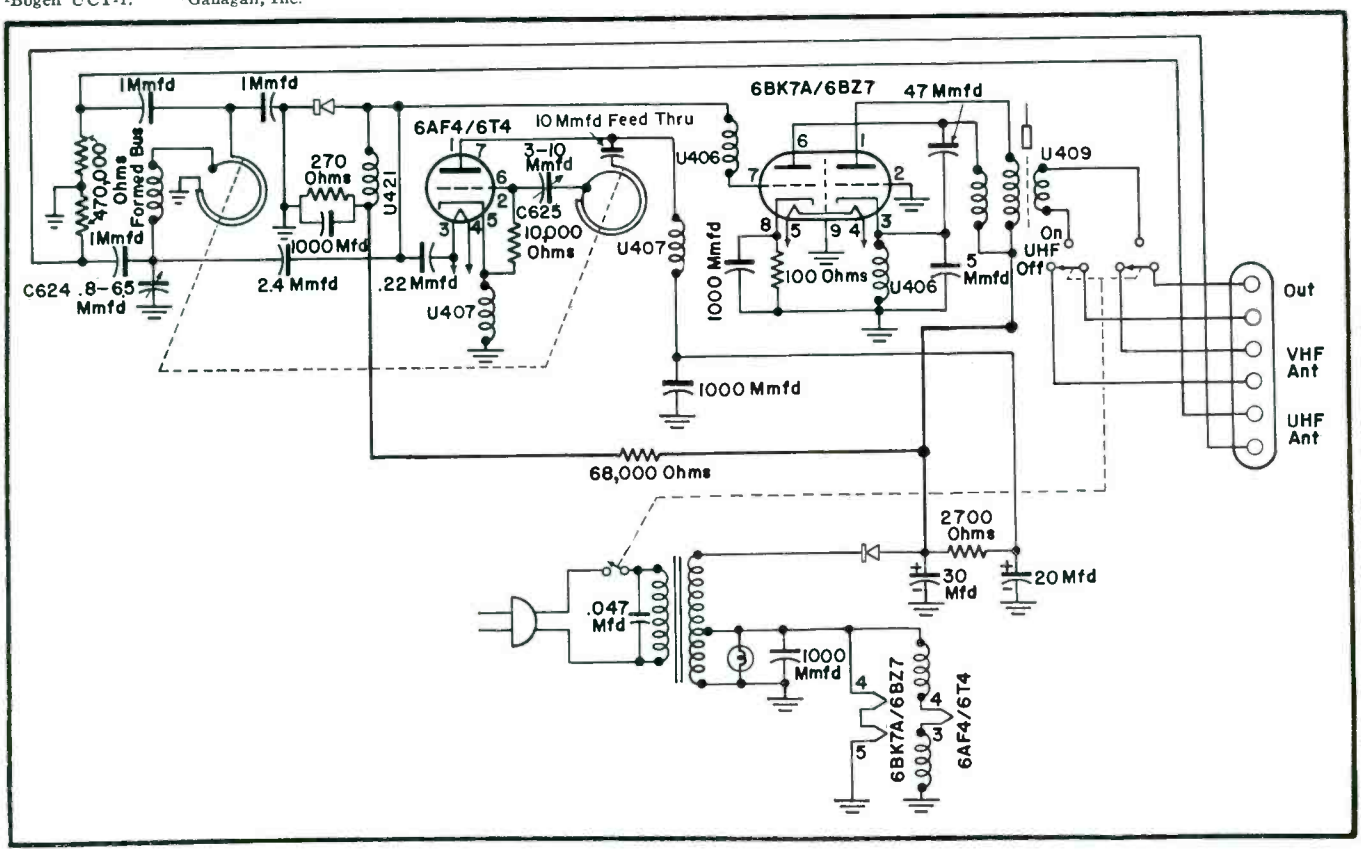
The impedance match is achieved by means of a network consisting of two 470,000-ohm resistors, three 1-mmfd capacitors, C_{624}, and a *formed buss*. The capacitors and the formed buss are adjustable to provide the proper input balance.

The oscillator is a modified Colpitts. The tuning unit furnishes the resonant circuit. The capacitor divider consists of the grid-to-cathode and plate-to-cathode capacities in the tube: C_{625} is an adjustable oscillator control. The 10-mmfd feed-through acts as a *dc* blocking unit and also as part of the plate-to-cathode capacity. The U_{407} coils serve as *rf* chokes. In the plate circuit U_{407} and the 1000-mmfd capacitor represent the *rf* decoupling network. The coil in the cathode circuit provides the *dc* path for the tube's plate current. A 10,000-ohm resistor is

(*Continued on page* 50)

[1]Bogen UCT-1. [2]Gahagan, Inc.

Fig. 1. Schematic of continuously-tunable uhf converter.



Simplified Explanation of Electronic Computers and Their Circuitry*

Service Engineering — field and shop notes

by THOMAS K. BEAMER

MODERN ELECTRONIC computers are gigantic multi-tube monsters using as many as 18,000 tubes and capable of adding and subtracting as many as 1900 eleven-digit numbers per second. However, when analyzed, any computer will be found to be composed of various combinations of basic circuits or, as they are sometimes called, elementary potential digital computing components (*epdcc*). (An *epdcc* represents a circuit which may assume any one of a number of predetermined stable states, and in the process of changing its state can bring about a change in the state of other components or *epddc*'s.)

Computer circuits utilize pulse techniques and circuits which are surprisingly similar to those used in radar systems, but have the advantage of requiring few circuits that operate at high radio frequencies; this also simplifies troubleshooting. With the increasing use of electronic computers in modern commerce and industry, one should begin now to acquire at least a friendly acquaintanceship with these *super brains.*

Basic Computer

An extremely simplified block diagram of a typical computer system is shown in Fig. 1. The computer itself is one part of a system consisting of an input, a memory, a central computer, and an output. The function of the input circuits is to receive information pertaining to a problem, and to convert that information into a predetermined series of coded pulses which are capable of energizing the *epddc*'s. In order that a problem may be entered into the input system while the computer itself is solving an entirely different problem, it is desirable to store the input information for long periods of time. Therefore, a flexible computing system is used to record the coded pulses on some long-term storage device such as punched cards or *magnetic tape*. The memory circuits are designed to store both the coded pulses from the input system and the results of the computer calculations which must be held until a later stage in the solution of the problem. The output system converts the coded pulses into words and figures.

For the most part, computing circuits do not utilize tubes operating on the central portion of the E_c-I_p curve, but rather employ the two stable states of a vacuum tube: cutoff and saturation. Hence, no errors are introduced into the computation by changes in tube parameters with age. By far the most common type of *epdcc* in use is the Eccles-Jordan multivibrator, or, as it is more familiarly known, the *flip-flop*. The flip-flop circuit utilizes two tubes, one of which is conducting heavily (saturated), and by its action holds the second tube at cutoff. A trigger pulse of the correct amplitude and polarity will reverse the condition of the circuit, so that the first tube is held at cutoff by the second tube, which conducts heavily.

Counting-type Computers

The basis of any type of counting device, whether it is mechanical, electrical, or electronic, is a mechanism which is capable of assuming any one of a discrete number of stable conditions. The popular, pocket-type adding machine exemplifies a mechanical counting mechanism which fulfills this condition. This mechanism consists of a series of identical number wheels each of which has 10 gear teeth on the outer periphery so that the wheel can be positioned in any one of 10 stable states. Each state, of course, represents a decimal digit. When the wheel on the extreme right has passed through all ten positions, a cam engages a gear tooth on the second wheel and advances that wheel one position. The adding process that takes place in this device, assuming that *8* and *6* are to be added together, is: The number *8* advances the wheel eight steps; then the number *6* advances the wheel six additional steps, carrying the first wheel four digits beyond position *10*. The result of the addition of *8* and *6* is *4*, with a carry-over of *1*. Therefore, the first wheel indicates the additive value of *4*, while the second wheel indicates the carry value, or a total of *14*. This process

(*Continued on page* 52)

*Based on data prepared by *Warren Kitter*, Philco Corp.

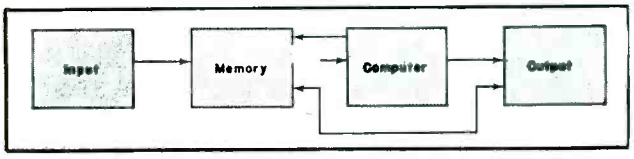


Fig. 1. Block diagram of typical basic computer.

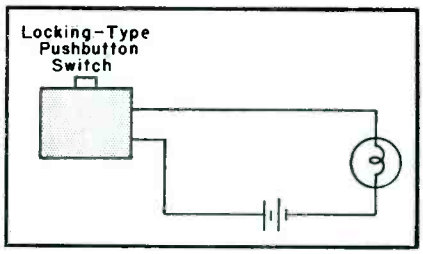
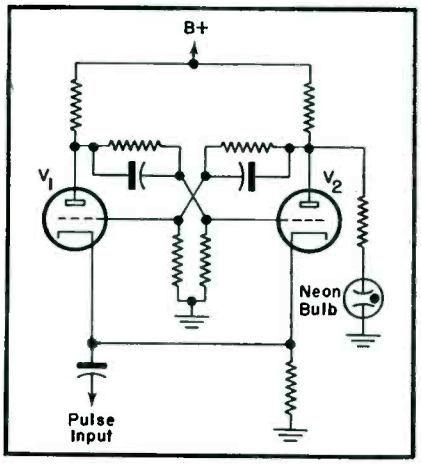


Fig. 2. Simple counting circuit which indicates whether button has been pushed an odd or even number of times.

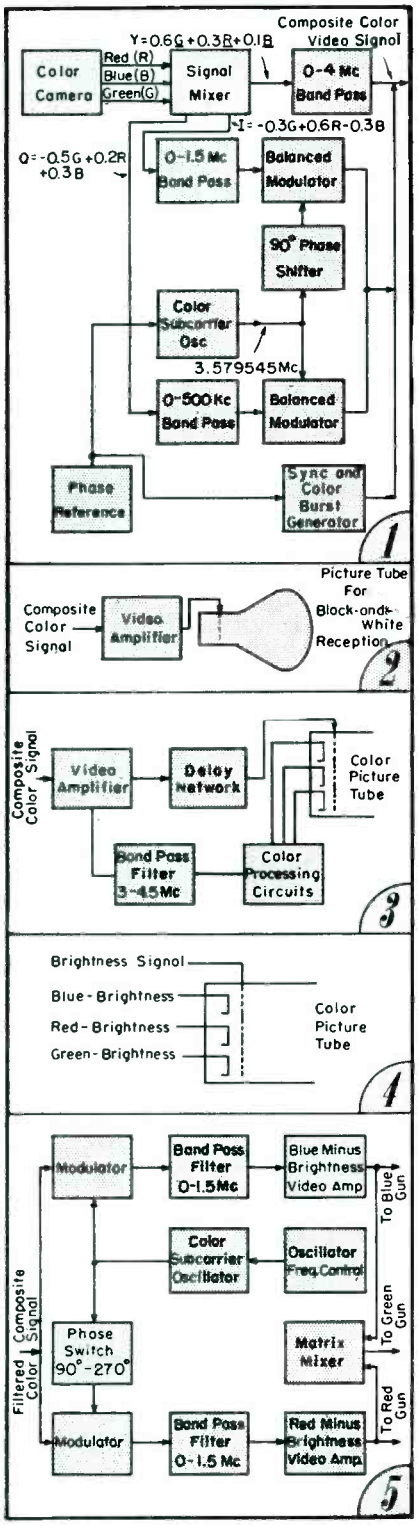
Fig. 3. Basic decision (flip-flop) oscillator circuit.



TELEVISION

How NTSC Color Signals are Applied at Transmitter and Translated at Receiver

by W. KAY BROWNES



(1)

THE COLOR CAMERA at the transmitter uses color filters to obtain the red, blue and the green portions of the image separately. The *brightness* signal is obtained by mixing the red, green, and blue portions of the image in the right amounts. The signal mixer also develops the red color-difference signal, and the blue color-difference signal, as explained in the block diagrams. Of course, proper amounts of signals must be used in this subtractive process; these are indicated in the accompanying diagram. The balanced modulator is used to suppress the color subcarrier, as explained[1], and to pass the color sidebands. The 90° phase shifter permits the two color subcarrier components to be modulated individually; one by the blue color signal, and the other by the red color signal. TO SUMMARIZE: (1) The color subcarrier has two components, which are 90° out of phase with each others. (2) These two components are separately modulated. (3) One component is modulated by the blue color-difference signal. (4) The other component is modulated by the red color-difference signal. (5) The green portion of the image is not transmitted as such, but is developed at the receiver by a suitable combination of the transmitted information.

(2)

THE SIGNAL radiated by a color TV transmitter is termed a composite color signal. When the composite color signal is applied to the grid of the picture tube in a conventional monochrome receiver, a black and white picture is obtained.

(3)

WHEN THE COMPOSITE color signal is utilized by a color TV receiver, the output from the video amplifier is applied to the grids of the color picture tube through a delay network, to permit the color signals to arrive at the cathodes of the picture tube through color-processing circuits at the same instant of time. That is, there is a transit time of the signals through the various circuits, and it is necessary that the video signals be impressed simultaneously on cathodes and grids. A bandpass filter is utilized between the video amplifier and the color processing circuits to remove all monochrome signals except those which are necessarily interleaved with the color signal.

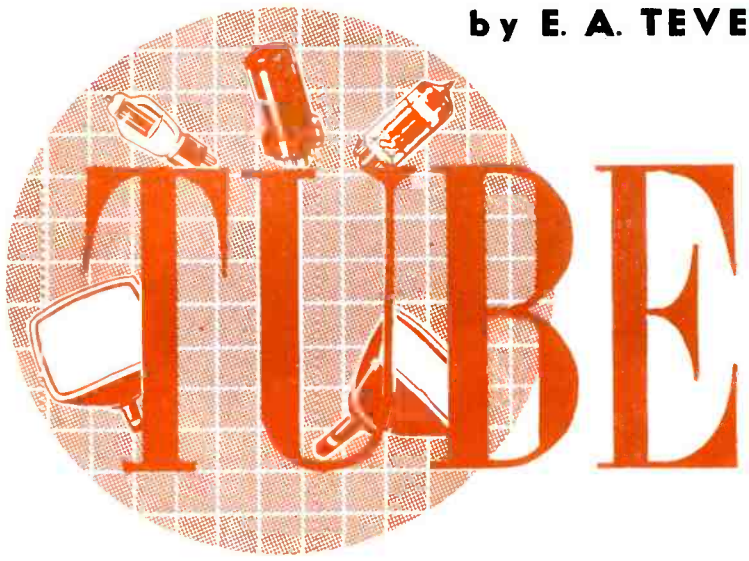
(4)

THE COLOR PROCESSING circuits apply a blue-minus-brightness signal to one cathode of the color picture tube, a red-minus-brightness signal to the second cathode of the picture tube, and a green-minus-brightness signal to the third cathode of the picture tube. The brightness signal is added to the color signal via the grids of the picture tube.

(5)

SYNCHRONOUS DETECTION is the process of separating out the various color signals from the composite color signal. Synchronous detection is accomplished by supplying a carrier frequency which is in phase with the component of the color subcarrier which is to be demodulated. Thus, the color subcarrier is applied directly to one modulator, but through a phase-shifting circuit to the other modulator. Thus, blue information and red information are recovered. The 90°-270° phase switch is an electronic device which is required because color phase alternation is used at the transmitter. Color phase alternation reduces distortion, and will be reviewed in a subsequent color-reception analysis.

[1] *Color TV*, SERVICE; October, November, December, 1953.



News

Surface-Barrier Transistor Construction and Circuit Applications

by E. A. TEVERSON

TRANSISTORS, because of their low-power consumption characteristics, have made it possible to extend the uses of many circuits and allied systems, heretofore restricted by the higher power requirements of vacuum tubes.

To illustrate, the point-contact transistors, which normally require a collector-supply power of 25 mw or more from a power source of 10 volts, when operating at *hf*, have been employed as *hf* oscillators and amplifiers at frequencies running up to over 100 mc. The junction tetrode types have been successfully used as amplifiers above 50 mc and as oscillators at frequencies above 100 mc. These transistors require but a 15 volt+ source; here the total power-supply requirement is about 50 mw.

Now there has been developed another type of transistor which for some applications requires a total power-supply drain of slightly over 2 mw, with a maximum collector-supply voltage of 3 volts. This new item, known as a surface-barrier transistor,[1] is capable of operating above 50 mc and with a gain bandwidth product approaching the 60 mc of the 6AK5. The production of this transistor is based on the discovery that broad-area, metal-to-semiconductor contacts, when properly prepared using a metal such as indium or zinc, can produce excellent rectification characteristics and have good hole injection on *n-type* germanium.

These units are fabricated by a novel electrochemical jet process. Two axially aligned glass nozzles squirt jets of a metal salt solution at opposite sides of a germanium wafer .003" thick. During the first part of the cycle the germanium operates as the anode for electrolytic etching; the solution is maintained at a negative potential by an electrode sealed into the jets.

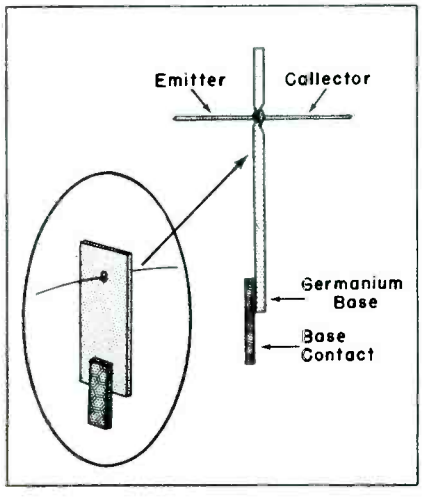
The electrolytic etching process *machines* a pair of opposing pits in the germanium wafer. When the thickness of the semiconductor between the pits has been reduced to .0002", one-tenth the diameter of a human hair, the polarities of the solution and the germanium are reversed, causing the metal ions to plate out of the solution onto the germanium. The electroplated metal contacts *are* the emitter and the collector of the final transistor. The entire process is carried out at room temperature; no heating or *forming* is required. The completed transistor is mounted on a glass stem

(*Continued on page* 49)

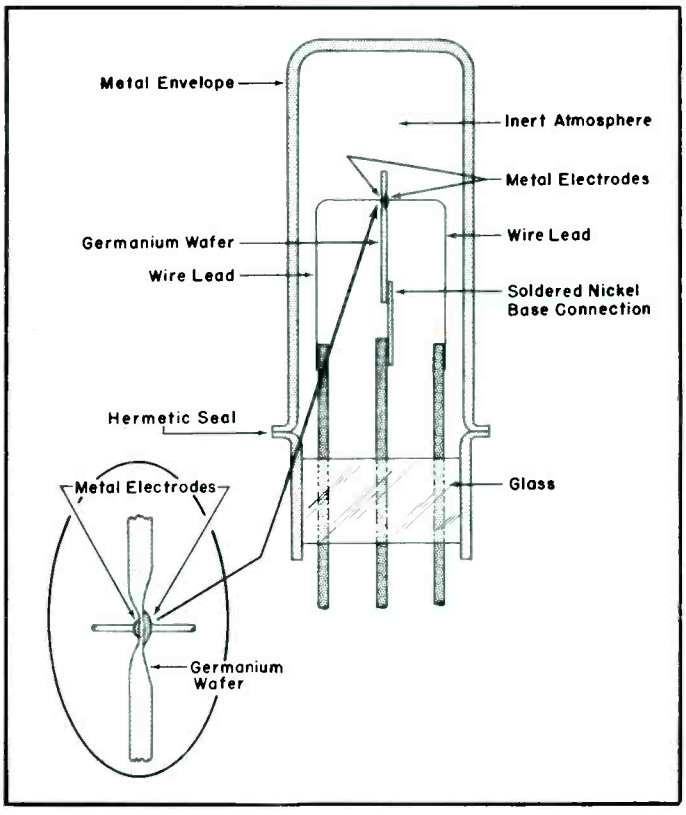
[Philco.

(Below)
Geometry of the recently-developed surface-barrier transistor.

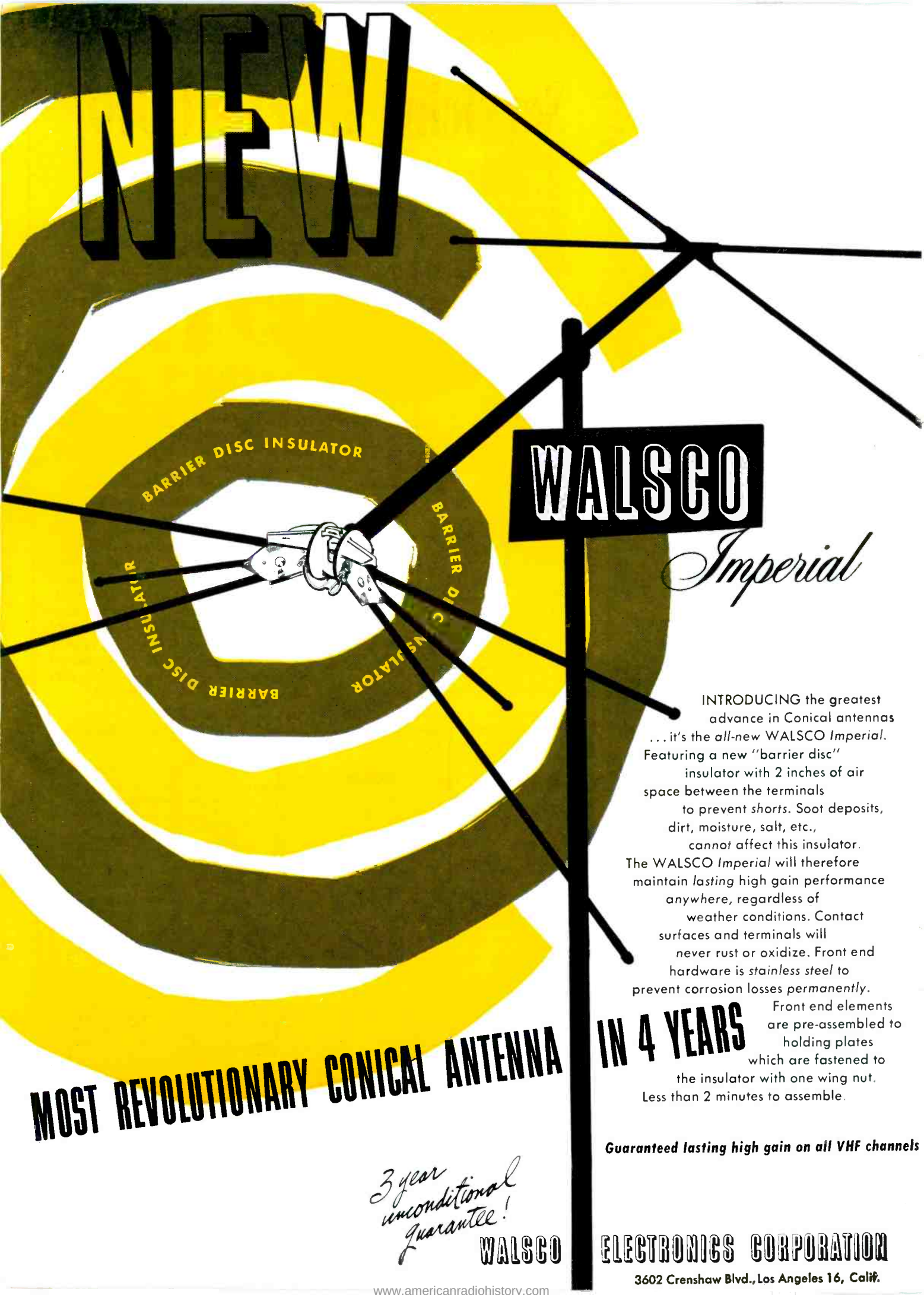
[*All surface-barrier transistor illustrations, courtesy Philco.*]



(Right)
Surface-barrier transistor cutaway view showing detail of the active elements including the emitter, collector and germanium base. Transistor is shown mounted on the glass stem and hermetically sealed in a metal container. Finished transistor is approximately 2/10" in diameter and 4/10" long.



NEW



INTRODUCING the greatest advance in Conical antennas ... it's the *all-new* WALSCO *Imperial*. Featuring a new "barrier disc" insulator with 2 inches of air space between the terminals to prevent *shorts*. Soot deposits, dirt, moisture, salt, etc., *cannot* affect this insulator. The WALSCO *Imperial* will therefore maintain *lasting* high gain performance *anywhere*, regardless of weather conditions. Contact surfaces and terminals will *never* rust or oxidize. Front end hardware is *stainless steel* to prevent corrosion losses *permanently*. Front end elements are pre-assembled to holding plates which are fastened to the insulator with one wing nut. Less than 2 minutes to assemble.

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Servicing HI-FI AUDIO

by MARK VINO

Minimizing Tunable and Mixer Hum . . . Checking Speaker Defects . . . Artificial Aging of Speaker Suspensions . . . Remedies for Fixed Equalizer and Preamp-Equalizer Circuit Difficulties

THE INSTALLATION OF additional signal input jacks and selector switches can involve the danger of hum pickup from chassis currents. The physical point for ground returns on the chassis or bus bar should be determined experimentally, from the point of view of minimum hum, rather than chosen at random. It may be necessary to insulate the signal jack from the chassis and to run a ground wire to some other chassis location for a low hum level. It may also help to ground the metal frame of a record changer, or to reverse the power plug for the changer motor.

Modulation or tunable hum results from the mixing of hum voltages with the *rf* signal carrier, either AM or FM, and is recognizable by the fact that it appears only when stations are tuned in. This effect may take place due to an interaction between the line and the antenna circuit, or to coupling in the mixer stage of a superhet receiver. The former is corrected by line bypass capacitors, usually of .05-mfd capacitance, and by earthing of the chassis. Mixer hum is treated by taking all of the hum precautions in the mixer stage that one would take in a low-level audio stage, especially with regard to heater-induced hum.

Speaker Trouble

The best method of checking for defects in a speaker is temporary substitution of a test speaker, and comparison of the performance of the two by ear. However, there are certain precautions which must be observed with this procedure. If the test speaker has a more limited frequency range than the original, defects in the original system associated with frequency extremes may not show up in the test. Thus high-frequency amplifier distortion or oscillation, which the original speaker reproduces perfectly, may be attenuated or absent in the output of the test unit.

A speaker can be checked manually for rubbing of the voice coil in the gap, a fault that causes rattling and high distortion levels. The cone should be moved gently with the fingers, applying the force near the apex and taking care to press evenly around the entire surface. Rubbing will be heard as a scratching noise, or felt by the fingers as a rough, intermittent vibration. With a perfect speaker the motion will be entirely smooth.

A variable-frequency audio-signal generator, or a glide-tone test record, is very valuable in checking for a defective speaker. (It is assumed that the amplifier feeding the speaker has already been eliminated as a possible source of trouble.) Tone signals varying from about 50 to 10,000 cycles or higher should be fed to the speaker. This test is almost valueless as a frequency response check, because of room resonances and non-uniform hearing sensitivity, but it will reveal speaker defects that only appear at certain frequencies.

An elusive, intermittent rattle or buzz in a sound system, for example, can be pinned down to definite, continuous speaker distortion at one particular frequency or set of frequencies, at which the pure test tone becomes rough or broken up. It must be remembered that rattling or boominess in the bass may be caused by mechanical or acoustical resonances of the speaker enclosure, rather than by defects in the speaker itself.

Occasionally it may be necessary to have a cone and voice coil replaced due to mechanical damage. Whenever possible it is advisable to secure *exact* replacements for high-quality speakers. High-fidelity speakers often use cones of special construction, edge-wound aluminum voice coils, etc., for which the standard speaker replacement parts cannot be properly substituted. The latter are fine for ordinary commercial speakers, but were not meant for high-fidelity applications.

Artificial Aging of Speaker Suspensions

When a cone has just been replaced its suspensions will probably be stiffer than the old suspensions. This raises the resonant frequency of the speaker and causes low frequency response to suffer. Some speaker manufacturers artificially *age* their new speakers prior to shipping them out to avoid this effect.

The suspensions of a newly repaired speaker can be loosened up quite a bit by a simple method which may, how-

(*Continued on page* 55)

Fig. 1. Bass boost equalizer employed in G.E. preamp.

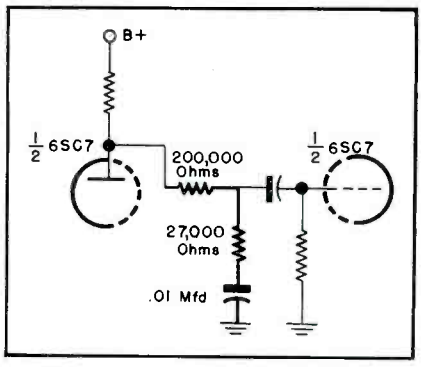


Fig. 2. In a appears an FM treble deemphasis network. A frequency response curve of deemphasis network, and final receiver output, is shown in b.

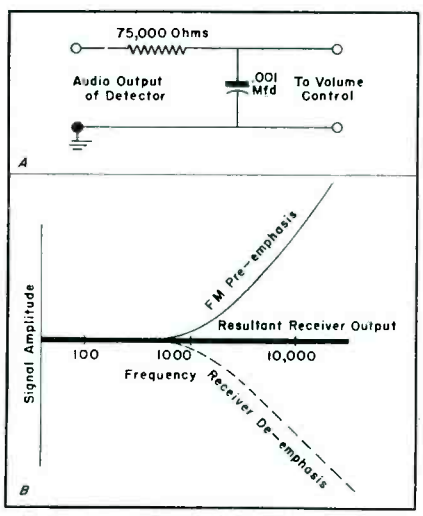
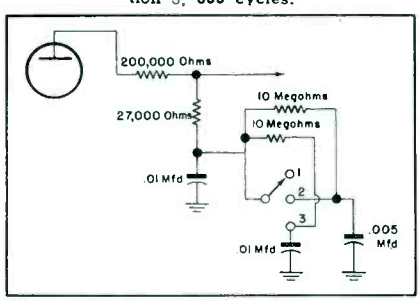


Fig. 3. Modification of equalizer of Fig. 1 to provide three bass-turnover points. The approximate turnover frequencies are: position 1, 600 cycles; position 2, 400 cycles; and position 3, 300 cycles.



by T. L. GILFORD

Servicing Helps

TV Tuner Repairs[1] ...Adapting Cascode or Pentode Tuners to Split-Sound Systems . . .

BASICALLY THERE are three types of tuners used in TV chassis. All have *rf*, mixer and oscillator sections.

The drum tuner or the turret type is probably the most popular of the tuners. On the drum are channel-selector coils. Contacts on the drum and the stationary contacts are silver plated to assure the least resistance. And often this silver plating will tarnish just as household silver will; thus a resistance between contacts occurs. Also dust and dirt usually work their way into the tuner; the results are weak and showy pictures or flashes in the picture which can be aggravated by a slight movement of the selector knob. A soft lintless cloth can be used to clean this tarnish from the contacts. As an aid, a contact cleaner can be absorbed in the cloth to speed up the cleaning process. A very light film of tuner lubricant will insure smoother movement or slide of the contacts. The contacts should not be touched after cleaning and lubricating since the acid oils from the skin will return the tarnish effects.

The stationary contacts provide spring tension and these may be a little weak. They should all be repositioned so that they all engage at the same time.

A slight application of dustless grease to the end bearings and detent is desirable for friction-free rotation.

The next type of tuner employed in TV front ends is the wafer type which utilizes flat rotating silver contacts sandwiched between two sections for each rotating contact.

These tuners also require tarnish and dirt cleaning. A pipe cleaner saturated with a combination cleaner and lubricant can do a good job of cleaning. Particular attention should be paid to the oscillator section. If the individual wafers are separated by spacers with long screws holding them in position, they must be tightened for a snug fit. In general, on all types of tuners, all mounting screws and nuts must be tightened. In some cases the screws and nuts provide grounds for circuits, and loose contact with the tuner chassis can give trouble.

The detent should be lubricated with dustless lubricant.

Continuous Tuner

The third basic type is the continuous tuner. These may use either rotating coils or air capacitors for selecting tuned circuits. Both depend upon good contact either to the coils or proper grounding of the rotator with the air capacitor. Again a combination lubricant and cleaner is recommended. It should be used sparingly so that the dirt and dust will not be washed into hard-to-get-at places.

The end bearings should be lubricated with a *tuner* lubricant. The dustless grease may not provide positive grounding.

Some set manufacturers use a gear train from the channel selector knob to the tuner proper. Slight oiling of the bearings and a little dustless grease will insure easier rotation.

After the tuner is cleaned and lubricated, and defective tubes and parts have been replaced, a final check should be made by a voltage reading at the mixer grid. Better tuners provide such a test point and it is frequently called the *looker point*.

With or without a signal being received and the channel selector turned to a low frequency channel, a negative voltage will be recorded. By tuning to the higher channels a similar negative reading will appear. This check should be made because some local oscillator tubes will not eject enough voltage to the grid of the mixer to provide proper bias of this stage. This is especially true at *uhf*. With low bias the conversion efficiency falls off and a weak picture will obtain. A new tube that has been carefully checked should be substituted.

Alignment

The last step in *rf* mixer and oscillator repair and adjustment involves alignment.

In tuner alignment, the circuits involved are the input to the *rf* amplifier, possibly the output and the mixer grid. The mixer output can be accounted for in the video *if* alignment at 25 to 45 mc.

The output impedance of the sweep generator required for alignment must match that of the antenna terminals of the receiver. Since most generators use a low impedance output of 75 ohms unbalanced and the majority of receivers use a 300-ohm balanced input, a matching unit is required. Three carbon ½-watt resistors can be used here (Figs. 2 and 3). Lead lengths should not exceed 1" for maximum stability.

Incidentally, the vertical input to the 'scope is connected to the *looker* point. A high-frequency probe is not necessary for detection here, since the mixer

(*Continued on page 63*)

Fig. 1. Looker-point location in mixer-grid circuit.

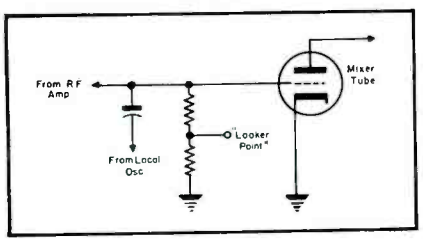


Fig. 2. Layout of alignment matching unit, shown in the Fig. 3 schematic.

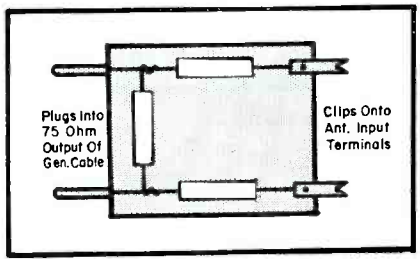
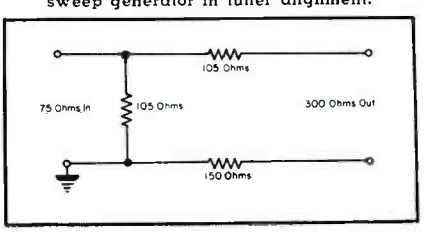


Fig. 3. Circuitry of matching unit connected to sweep generator in tuner alignment.



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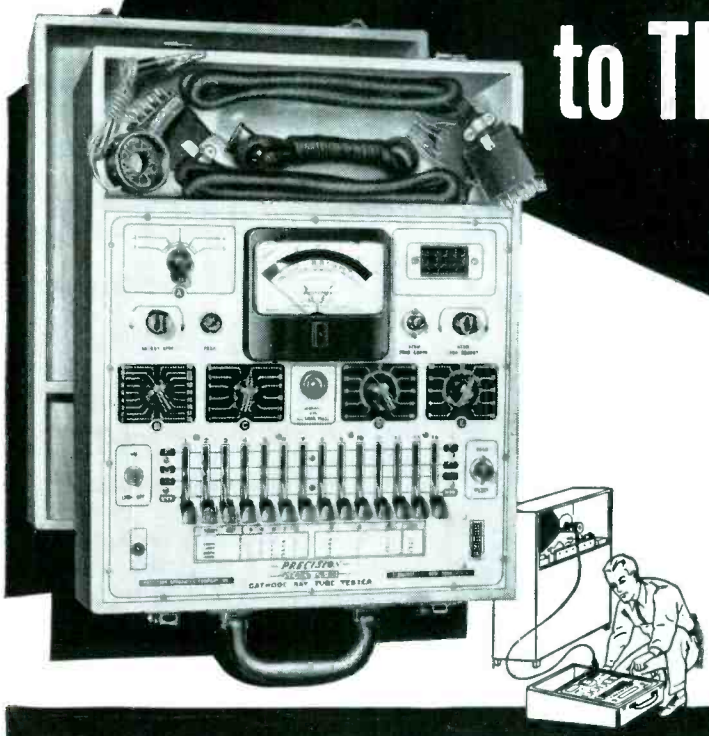

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ELECTROSTATIC FOCUS ELEMENT
ELECTROSTATIC DEFLECTION PLATES
ELECTROMAGNETICALLY FOCUSED GUN
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ETC., ETC., ETC.

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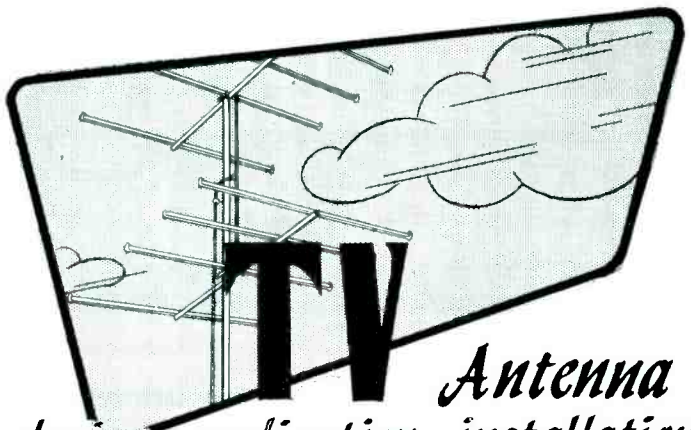


TV Antenna Digest

design..application..installation..service

Broad-Band VHF Compound Yagis: Design Features and Applications ‡

by **RALPH G. PETERS**

YAGIS, originally developed for single-channel operation, have now undergone several interesting phases of design permitting them to be used for broad-band applications.

In one such re-design, a compound type[1] was evolved, with electrical intercoupling and an improved low-loss frequency segregation network.

In Fig. 1, the general configuration of a nine-element mono-planer yagi is shown. The five elements of the forward section have been cut to cover channels *7-13*. At the rear are four wider elements responsive to the channels *2-6*. Analyzing the basic element layout, we find that the reflector (*1*) at the rear has been cut for channel *2*, so that it contributes a high front-to-back ratio for the low channel section. In front are two *T* matched main radiators (*2* and *3*) cut for the audio-carrier of channels *2* and *5*, respectively. This double-driven radiator section has been phase-linked by a transposed 300 ohm coupling line, which in turn is connected to the network. A director (element *4*) cut for the audio-carrier of channel *6* also serves as the low channel director. In addition, this element has a dual function of serving as a reflector for the low end of the high channel spectrum. In the high channel section, a reflector (element *5*) is resonant to channel *7* and was introduced as the control element for establishing correct impedance matching. A pair of double-driven main radiator elements (*6* and *7*) were introduced to drive the high or forward section to provide broad-band coverage. Both of these elements are *delta*-matched; *6* being cut for the video-carrier of channel *7*, and *7* resonant to the audio-carrier of channel *12*. In addition, the former radiator (*6*) also acts as a reflector for the high end of the spectrum, or channels *10-13*. Coverage for the lower end of the high channel band (i.e. channels *7-9*) has been gained through dual use of *7* as a director. Elements *8* and *9* were cut for emphasis as directors for channel *13*; however, they also serve as directors for the channels *7* through *13*.

As noted, both pairs of driven elements were coupled together with a short length of 300-ohm line transposed for proper phasing and impedance match. The forward driven element of the low and high channel section was then connected to respective inputs of a frequency-segregation network featuring a printed circuit type of high-low net. It is enclosed in a weatherproof plastic case homogeneously bonded and neoprene rubber sealed at the terminals. Standoff type of terminal posts were also included to prevent signal attenuation due to leakage during operation in rainy weather.

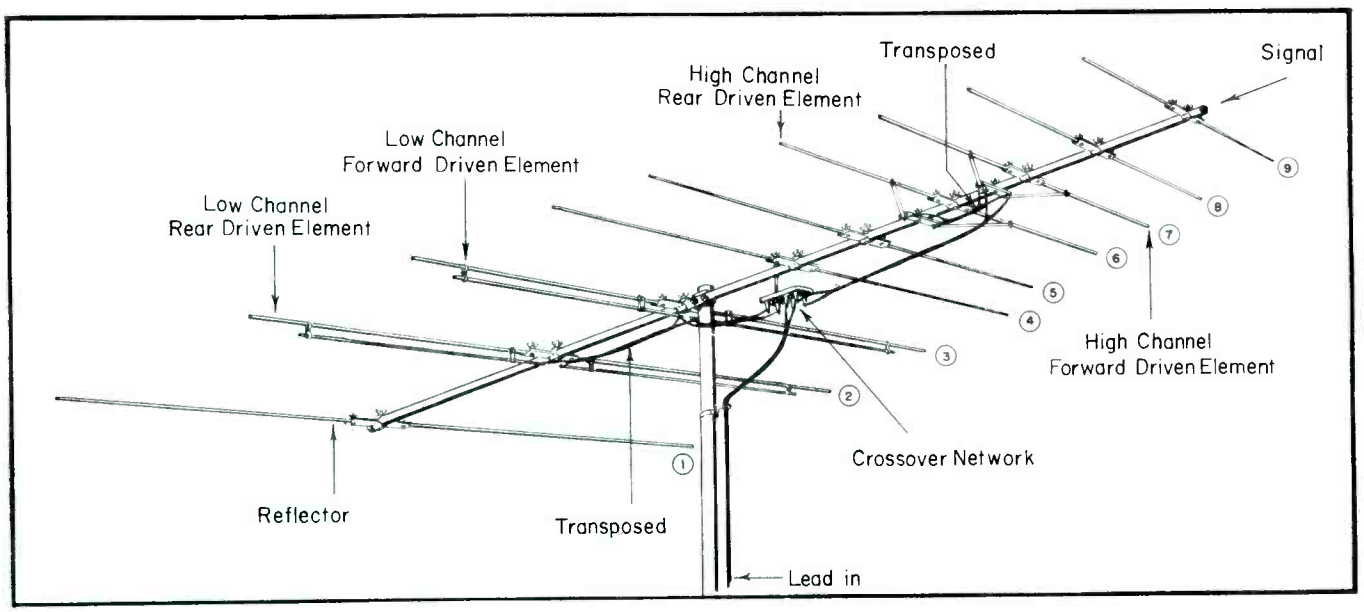
For outlying fringe areas, two of these yagis may be stacked, over and under, as shown in Fig. 2 (p. 70). It will be noted that tubular stacking bars are employed to shunt both antennas in parallel. When antennas are superposed upon a common mast, a spacing of 84" results from the use of the 3/8" bars to assure reinforcement, fore and

(*Continued on page 70*)

‡*From notes prepared by* ***L. F. B. Carini,*** *Assistant Chief Engineer, La-Pointe Electronics, Inc.*

Fig. 1. Nine-element mono-planar yagi. (Courtesy Vee-D-X)

[1]Vee-D-Xtra Special.



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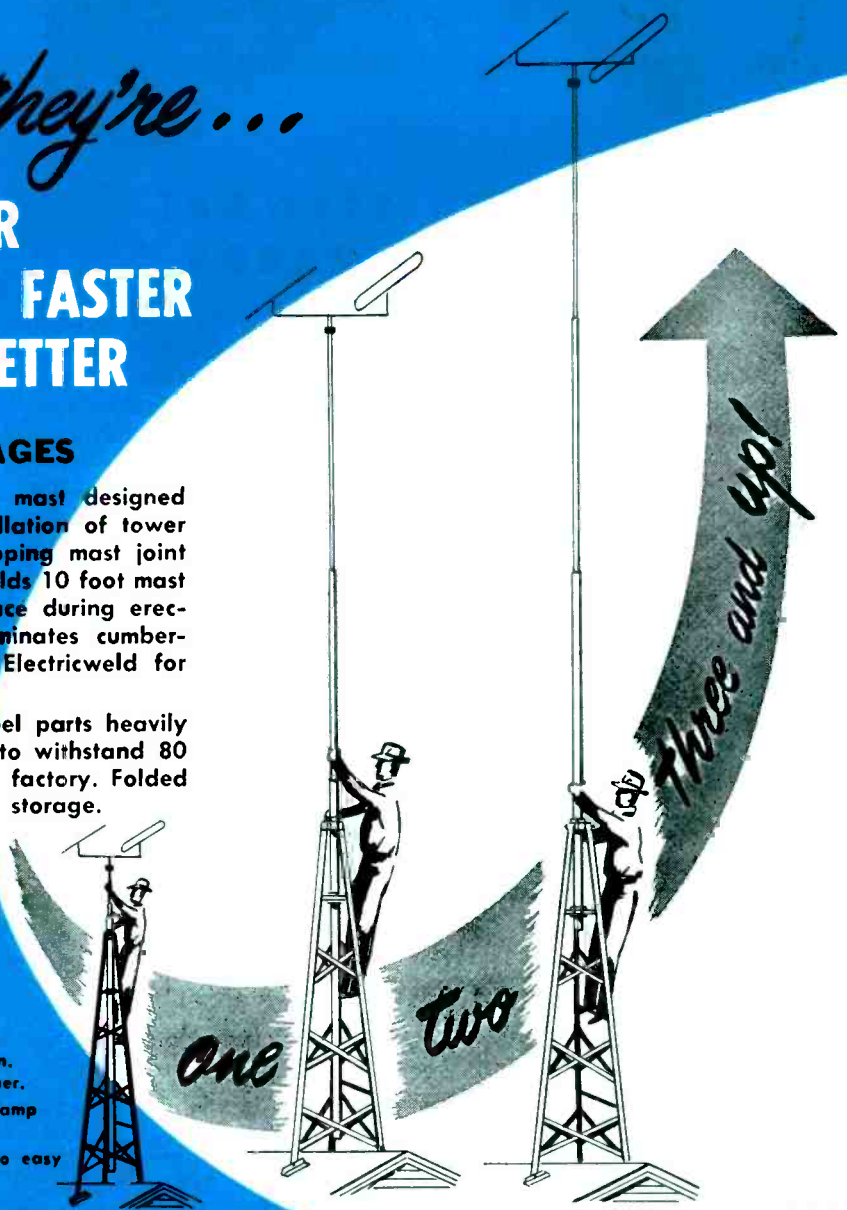

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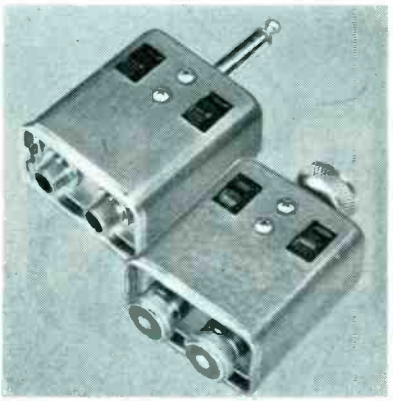
Miniature 2-Input Audio Mixers ‡ ...Capacitive Hi-Fi System...Intermodulation*



Miniature 2-input audio mixer which accommodates two high-impedance inputs. Model at left has phone jack inputs with a phone plug output fitting standard jacks. At right is another type with microphone connector inputs and output mating with standard microphone connectors. (Mini-Mix; Switchcraft)

by KENNETH STEWART and PAUL EDWARDS

EARLY DESIGNS of wire, tape or disc recorders and audio amplifiers provided for a multiplicity of *inputs*.

For example, some of the early equipment featured jack inputs for microphones and separate jack inputs for radio attachment devices or phono pickups. In these instances, either a mixer circuit inside the recorder or a switching circuit was necessary. Usually a switch to pick the proper input was provided, but if an inexperienced operator failed to set the switch for the input in use, the program material wanted in a recording might be lost.

A more recent trend in the design of recorders, whether tape, wire or disc, has been to provide only one audio *input*. This step was taken to overcome the *fear complex* that it was felt would obtain in using such equipment with a multiplicity of *inputs*. In general, the new design provides a single receptable *input* that serves as a *microphone input* or *radio attachment* or *phono input*. The change has simplified operation and reduced the period required to train or learn one how to operate a recorder to a minimum.

Often, many desire to record more than one signal simultaneously. For example, one might want to record an orator with background music, thus requiring two independently controlled inputs. Several sound sources could be fed into a single input by using commercially available *Y* connectors, etc. However, this has not been found to be too practical, because one normally wants to vary the relative loudness of the two signals.

This requirement led to the development of a miniature, 2-input audio mixer.[1]

Basically the unit, included in a metal housing about $2\frac{1}{16}$" x $1\frac{13}{16}$" x $1\frac{1}{16}$", has *2 inputs* at one end and a single output at the other end. This housing encloses the necessary connectors and resistance network. The design utilizes a miniature chassis to which are mounted two *mixing controls* (volume controls), assembled into the housing, so that only a portion of the control knob extends through rectangular slots, in direct line with their respective inputs.[2]

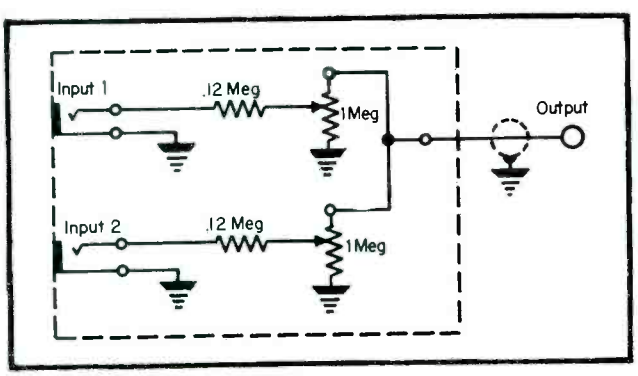
Isolating resistors have been included to reduce to a minimum the signal loss of one input, while varying the intensity of the other signal. The volume controls used are the *hearing aid* type with a 1-megohm resistance; therefore quiet control of the low-level (high-impedance) circuits is afforded. The metal enclosure provides an effective shield for the jacks (or connectors), resistors, and volume controls; the very design necessarily reduces lead lengths and their enclosure in the shield eliminates any stray signal

(*Continued on page 46*)

[1] *Mini-Mix (Pat. Pending)*: Switchcraft, Inc.

[2] Currently models are available with *jack* inputs and plug output, or regular connector inputs and output.

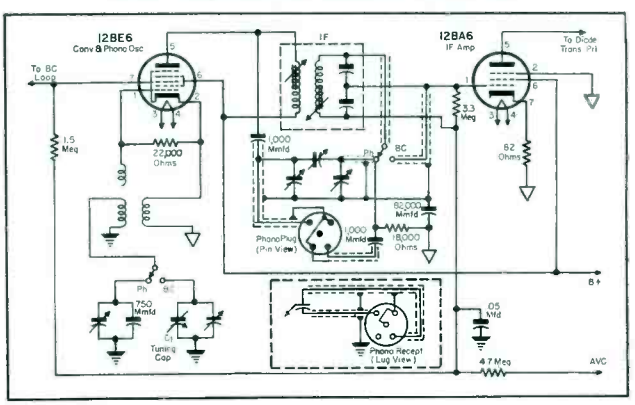
‡ *From notes prepared by* **Wilfred L. Larson**, *president and general manager, Switchcraft, Inc.*



(*Above*)

Circuitry of miniature 2-input audio mixer.

Record-changer connections and switching in Motorola chassis 53F2, using capacitive af system; see p. 46.



". . . helping to keep the business cycle on an even keel . . ."

HARRY B. HIGGINS
President, Pittsburgh Plate Glass Company

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Payroll Savings—the plan that protects—pays the employer *triple* benefits:

- it makes a good employee a better one—a serious saver with a definite plan for personal security.
- as enrollment on the plan goes to 60%, 70% employee participation, productivity increases, absenteeism decreases and accident records go down.
- and as Mr. Higgins points out, the systematic purchase of Defense Bonds through the Payroll Savings Plan is building a tremendous reserve of purchasing power.

Let's point up the third employer benefit with a few figures:

- On September 30, 1951, individuals held Series E Bonds totaling $34.6 Billion—more than $4.6 greater than on V-J Day.
- During the five calendar years (1946-1950) Defense Bonds sales provided:

—*Cash* to retire $3 Billion A-D Savings Bonds (maturing Series).

—*Cash* to meet $24 Billion redemptions of E, F and G Bonds.

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And the figures are getting better every day—between January 1, 1951 and November 1, 1951, 1,200,000 employed men and women joined the Payroll Savings Plan.

If the employee participation on your Payroll Savings Plan is less than 60%, phone, wire or write to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D.C. Your State Director will be glad to show you how you can participate in the triple benefits of the Payroll Savings Plan.

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SERVICE

Rep Talk

G. S. MARSHALL Co., 40 S. Los Robles Ave., Pasadena, Calif., recently held its second annual technical show at the Los Angeles Statler Hotel; more than a score of factories were represented. Among those present at the manufacturers' booths were: *Frank Braugh*, chief engineer of Helipot Corp., South Pasadena, Calif.; *C. B. Dewey*, vice president of Reeves Instrument Corp., New York; *Ed Sawyer*, general manager of Crescent Engineering and Research, South Pasadena, and *Andrew Kay*, president of Non-Linear Systems, Inc., Del Mar, Calif. . . . *Roy J. Magnuson*, head of the by-laws committee of The Reps, reported that the annual election of officers of the Chicagoland chapter will take place at the May meeting instead of the December meeting. . . . *Beebe Associates* have moved from 5707 W. Lake St. to 1155 Waukegan Rd., Glenview, Ill. . . . *Rene Bluzat* is now located at 2842 N. Cicero Ave., Chicago, Ill. . . . *Ray C. Hitchkock* has moved to 160 E. Grand Ave., Chicago, Ill. . . . *Al J. Rissi*, newly elected vice president of the Los Angeles chapter, has moved to new quarters at 2724 S. Peck Rd., Monrovia, Calif. . . . *F. X. Brennan Co.*, is now located at larger quarters at 180 Glenridge Ave., Montclair, N. J. . . . *Ben Joseph* has moved to 521 Fifth Ave., New York, N. Y. . . . *George Davis* has been elected president of the Los Angeles chapter of The Reps. *Frank A. Emmett* was elected secretary-treasurer. . . . *George G. Scarborough* is now president of the Mid-Lantic chapter. Others elected were: *John J. Mahoney*, vice president; *David G. Quinlan*, secretary; and *Ken Randall*, treasurer. . . . The Missouri Valley Chapter has changed its name to the *Heart of America Chapter*. *Clyde H. Schryver* was elected president of the group. *Fred Somers, Jr.*, was named vice president. . . . *I. N. Drucker* has joined the Wilson Sales Agency, 2750 W. North Ave., Chicago 47, Ill., and will call on the distributor and jobber accounts. . . . *John B. Tubergen Co.*, Los Angeles, Calif., will handle replacement sales for tubes and tube parts to jobbers for Allen B. DuMont Labs., Inc., in southern California and Arizona. *Jack Carter* and *Robert L. Bray* have become associates in the firm. . . . *George Davis Sales Co.*, Los Angeles, Calif., has been named rep for Vaco Products Co. in southern California, Arizona, and Las Vegas, Nev. . . . *R. Gordon Dougherty*, formerly a field rep for the Regency division of I.D.E.A., has become a principal in the firm of Hagerty-Scott Co., 10116 Puritan Ave., Detroit 38, Mich. He will headquarter at 2339½ S. Cedar St., Lansing, Mich. . . . *Martin Vogt*, Royal Oak, Mich., has been appointed rep for the Mark Simpson Manufacturing Co., in Michigan.

F. G. Dougherty

Martin Vogt

Audio

(*Continued from page* 38)

pickup. The direct connection of the entire shielded mixer to a recorder is, of course, especially important in high-impedance input circuits.

This device has no external cables and can be placed in the accessory compartment of a recorder, when the instrument is not in use.

Capacitive Hi-Fi System

In conventional *af* systems only the audio stages of the receiver are used for amplification. This approach makes it necessary to use a cartridge with a high signal output.

New Approach

Recently, there has been developed a method[3] which makes it possible to use the entire receiver for *af*. In this system, the local oscillator of the receiver is switched to a fixed frequency of 455 kc, which is fed through the entire *if* system, demodulated at the second detector, and amplified through the audio amplifier. A cartridge with a small mass acts as a variable capacitor, which varies the amplitude of the carrier as it passes through the first *if* transformer.

To amplitude modulate the 455 kc carrier, the first *if* transformer, designed with a low mutual inductance, is operated at a point somewhat below critical coupling. With this low value of mutual inductance, capacitance between the primary and secondary windings has an appreciable effect upon the overall coupling. Actually, a small value of fixed capacitance is switched across the high end of the primary winding and the high end of the secondary winding. The value of this capacitance has been adjusted just above the point where the component of current transferred by the fixed capacitance cancels out the component of current transferred by the mutual inductance between the two windings. This has been done to take advantage of the linear portion of the response curve of the *if* transformer. The cartridge, connected in parallel with this value of fixed capacitance, provides a small amount of variable capacitance. Near the null point of operation, a small change in capacitance will produce a relatively large change in carrier. The spacing of the fixed plate and a movable plate in the cartridge can be adjusted, it has been found, so as to realize nearly 90% modulation; however, in actual practice, modulation percentages in the order of 5% or 10% are all that is necessary because of the strong carrier available.

The cartridge is connected directly across the *if transformer*. The needle or movable plate is connected to the grid of the first *if* amplifier tube and the fixed plate is connected through a large value isolating capacitor to the plate of the mixer tube. The action of the cartridge is such that it varies the coupling between the primary and the secondary of the first *if* transformer. This results in amplitude modulation of the carrier. This carrier is then amplified through the *if* amplifier, demodulated at the second detector and amplified through the audio amplifier as in a conventional radio circuit.

*Intermodulation Effects and Reproduction**

There is a special variety of intermodulation effect that occurs in amplifiers which employ power drive for the output tubes. The trouble is not intermodulation, in the accepted

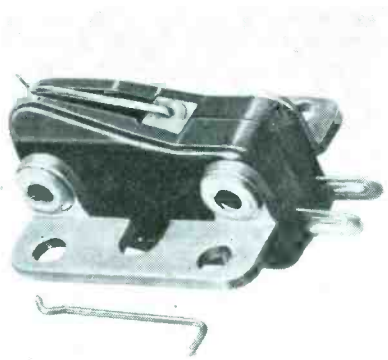
(*Continued on page* 62)

[3]Motorola; Patented.

From an exclusive report prepared for* Service *by* **Norman Crowhurst, *audio consultant.*

Pictorial Review of New Audio Components and Accessories

Anti-static record cloth, which it is said serves to deposit a microscopic film of silicones in the record grooves to lubricate and lessen friction between needle and record. (Silcloth; Jensen Industries)



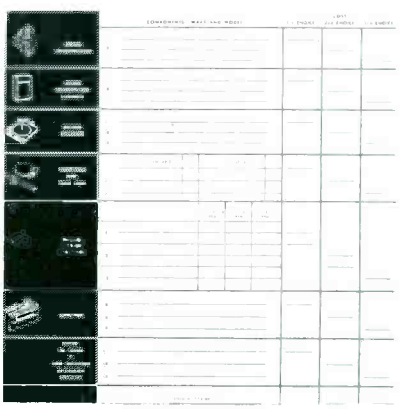
Ceramic phono cartridge featuring a removable needle with a truncated-cone tip for playing all size grooves. One-mil and three-mil removable sapphire needles are also available. (Tilone Playal; Sonotone).

Four-speed portable phono: 16, 45, 33 1/3 and 78. Unit plays all record sizes including 12"; supplied with 45 rmp adapter. The 16 rpm speed is for the recently released talking book records. (Model 121; V-M)

Sound system equipment for buses, trucks and cars. Includes microphone, remote control head, cables, speakers or reflex trumpets, and a shock-mounted amplifier housed in welded steel. Operates on 6 or 12 volts dc. Has a push-to-talk microphone switch. Shoulder mount or stationary mount are available for the mike. Remote control head governs volume. (Model 31-A; Electronics Division, Z & W Machine Products, Inc., 5100 St. Clair Ave., Cleveland 3, O.)

Section of a hi-fi system proposal form which provides space for first, second and third choices of such hi-fi components as speaker, cabinet, record changer, turntable and tone arm, phonograph pickup cartridge, amplifier and other special equipment such as FM tuner, TV or tape recorder. Forms have space for imprinting distributors' and dealers' company names. (Form EJ; Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, Ill.)

Portable 3-speaker (two 6" and one 4" pm) tape recorder with two-speed recording in both directions; inputs for microphone, phono or radio; five-tube amplifier; and magic eye volume level indicator. Circuit includes bass and treble boost during playback and bass compensated volume control. Amplifier is coupled to tape speed control to provide automatic equalization for 3¾" tape speed. Output selector switch connects audio output at 500 ohms impedance or up to 10 volts at high impedance to output receptacle to couple model to larger speaker system or phono input of radio or amplifier. (Model 2030; Webster-Chicago).



60-Cycle Buzz in TV

(*Continued from page 24*)

17: If a hum-backing metal band is used around transformer core, one should check for a broken solder joint in band.

18: Power transformer should be checked for overheating; this can be caused by excessive power-supply drain, or by shorted turns in the power transformer. Overloading of transformer increases the intensity of the stray field, which is occasionally a source of trouble not only in the sound, but also in the picture.

19: To run down overload trouble, a wattmeter check should be made of the power-line load, and the behavior of the meter watched as the receiver is switched on from a cold start. An immediate overload indicates shorted turns in the transformer; a delayed overload indicates that the trouble is beyond the rectifier tube.

20: One must make sure that the ratio-detector shield is well grounded. If required, one should spot solder.

21: Channel-selector should again be switched to an inactive channel; if receiver stops buzzing, the interference is of the *tunable* variety; the channel-selector should be turned back to the active channel.

22: To determine the location of the trouble, one should listen to the buzz level while turning the receiver controls, as follows:

23: The brightness control should be turned throughout its range; if the buzz stops at the dark-screen position, the high-voltage circuit is the source of the buzz.

24: One should check for a defective volume control; this can be the point of entry of the high-voltage field.

25: Dress of the second-anode lead of the picture tube should be checked, keeping it away from the ratio-detector and audio tube.

26: Now the hair-pin grounding springs to the outer coating of the picture tube should be checked.

27: If the receiver is of the type which utilizes a limiter, electrode voltages on limiter tube should be checked.

28: One should also check for a leaky coupling capacitor in the grid circuit of 4.5-mc driver circuit.

29: It is also important to check for an open high-voltage filter capacitor. A substitution test is usually quickest and easiest.

30: An imperfectly grounded high-voltage cage might be the trouble and thus should be checked.

Tube News

(*Continued from page* 31)

and hermetically sealed into a metal can.

The steps of establishing the base region geometry and of positioning the emitter and collector barriers are completely independent in the *sbt* fabrication process. This is contrasted with the alloy process by which the majority of commercially available *pnp* junction transistors are made. In this process, the forming of the *pn* junctions within the crystal and the establishment of the final transistor junction-to-junction spacing takes place simultaneously.

The mechanical precision of the *sbt* process is claimed to be about 50 times better than that of the alloying process. This makes possible the 50-mc operation of the *sbt* compared with 1 mc for the *pnp* junction transistor.

Applications

Typical *sbt*'s operate at 1.5 to 3 volts with .5 to 1 ma of collector current. The ability to perform at 50 mc on 1 to 2 mw per stage will make it possible to design *vhf* communications receivers with a total power drain on the order of 10 mw, capable of operating for several months on 2 flashlight cells.

The junction transistor performs well in audio circuits such as hearing aids. But the *sbt* extends the useful operating range of low-power-drain transistor circuits to *vhf* and wideband video applications.

well in audio circuits such as hearing video amplifiers with 5-mc bandwidths and tuned amplifiers at 30 mc. In such applications, it has been found possible to achieve gains of 15 db or more. It has also been found possible to use the *sbt*'s in oscillators at 70 mc. A 9-mc bandwidth 28-db gain video amplifier has also been constructed with the surface-barrier units. The *sbt*'s have also found use in multivibrator and flip-flop circuits.

References

Angell, J. B., and Keiper, F. P., Philco, *Circuit Applications of Surface Barrier Transistors*; IRE Proceedings, December, 1953.

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CORRECTION

THE ANNUAL Electronics Parts Show, which will be held at the Conrad Hilton Hotel, May 17-20, 1954, will be co-sponsored by *five* associations: RETMA, SMC (Eastern Division), AEPGM, WCFMA and *NEDA*. Serving on the fourteen-man board of directors are seven representatives of NEDA.

Ser-Cuits

(*Continued from page* 28)

the grid leak which supplies oscillator bias.

Optimum performance can be obtained from a germanium crystal (used here as a mixer diode) when it is properly biased. The bias for this mixer is developed by a voltage divider consisting of 270-ohm and 68,000-ohm resistors from B+ to ground. This arrangement provides a .25 *v* bias on the crystal in the forward direction.

U_{421} is the *if* load for the crystal. Sufficient stray capacity exists across this coil to bypass the *rf* to ground. Coupling to the mixer from the preselector is accomplished by a 2.4-mmfd capacitor. And oscillator injection is achieved by means of a .22-mmfd capacitor connected to the filament of the 6T4. This method of coupling has been found to result in least loading of the oscillator and at the same time provides ample oscillator injection current. The value of the coupling capacitor was chosen to limit the crystal current to approximately .5-1.5 ma. It has been found that higher crystal currents deteriorate the crystal noise figure.

The 6BK7A *if* amplifier is connected in a shunt-cascode circuit. The cascode amplifier is inherently a high-gain, low-noise amplifier. The output of the *if* stage is centered at 82 mc and is sufficiently broad to cover channels *5* and *6*.

The input to the grounded cathode section consists of U_{408} coupled to U_{421}. This coupling was designed to match the crystal impedance to the input to the 6BK7A for best gain and noise figure. The output of the first triode is fed to the cathode of the grounded grid section by the 47-mmfd capacitor. A resonant network, consisting of U_{408}, in parallel with a 5-mmfd capacitor and the stray capacities, serves as the plate load of the first section. A 1-*uh* choke supplies plate voltage to the first triode. The output of the grounded grid section is fed to U_{409}. The secondary of this transformer has been designed to operate into 300-ohm antenna terminals.

Servicing the Converter

In all TV work and especially in the *uhf* band, the condition of the antenna and leadin wire is critical. Corrosion and dust accumulation on the antenna and leadin result in attenuation of the signal. Therefore, before attempting to service a converter, an examination of the antenna system is imperative. Faulty antenna installation or orientation can result in weak (snowy) pictures, sound distortion, poor definition or ghosts.

Actually, the major part of service work on this unit will revolve about the replacement of defective tubes and mixer diodes. Replacement tubes must be of the same type as those used originally in the unit.

Since the diode is biased, it is important to note the crystal polarity. (The negative or minus side is the one with the black band.) To test the crystal, a *vtvm* should be placed between the positive end and the chassis. With the oscillator tube removed, the meter should read approximately .25 volt positive. With the oscillator tube replaced in its socket, the meter should read from .5 to 1.5 *v* over the tuning range. A reading outside these limits usually indicates a defective crystal.

Occasionally one will find a noisy or intermittent tuner, usually caused by dust inside the tuning unit. When this is the cause, the tuner dust cover should be removed; with the use of a soft brush, the tuning elements should be cleaned with carbon-tet or a good silver cleaner. After cleaning, the tuned lines and the shorting bar should be lubricated with a high grade lubricant.[3]

C_{624} and C_{625} are factory-aligned high-end adjustments and one should not try to readjust them. The correct settings do not vary with time and so need no further touch-ups.

[3]Such as the sulphur-free lubricants made by *Gulf Oil, Cities Service,* etc.

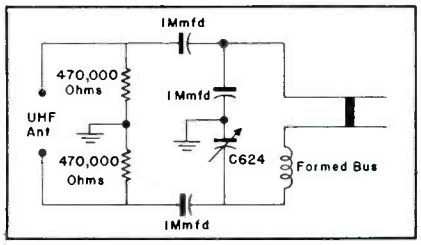


Fig. 2. Input network for the converter.

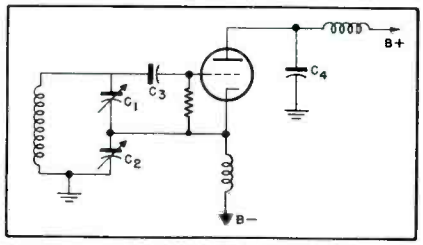
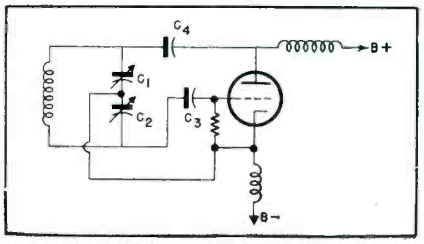


Fig. 3.

Fig. 4.



Figs. 3, 4, 5 and 6 (top and below): Successive modification stages made in Colpitts oscillator used for uhf converter. Circuit in Fig. 3 is a standard Colpitts, while the circuit shown in Fig. 4 represents a re-drawn version. A modified schematic appears in Fig. 5; in this form circuit is an ultra-audion. The final step appears in Fig. 6, with the coil replaced by a shorted line; tube capacities are not shown.

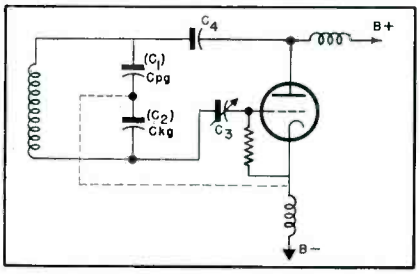
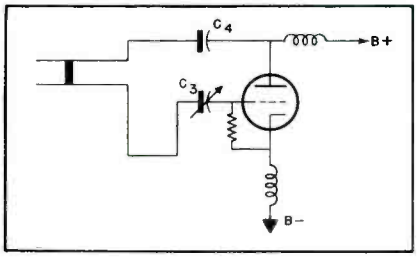


Fig. 5.

Fig. 6.



Credits

Data in this analysis are based on a report prepared exclusively for SERVICE by *Oscar Levine* and *Leonard Lieberman*.

Service Engineering

(*Continued from page 29*)

can be expanded to handle sizeable sums by incorporating additional number wheels. This is similar to the process used in the addition of numbers by electronic computers.

The type of adding machine described has limited usage in the scientific and commercial fields because of the time required to feed information into it, and also because of the relative slowness of each individual operation. These characteristics render this type of machine practically valueless (even when electrified and developed into a calculating device) when large amounts of raw data must be handled, such as in the analysis of a census or survey or in the compilation of shell trajectories. High-speed electronic computers are ideally suited for these operations.

The simplest type of counting circuit which consists of a locking push switch, a lamp, and a battery connected in series, is shown in Fig. 2 (p. 29). This elementary circuit is an odd-even type of counter, indicating by one of the two stable conditions of the lamp whether the push switch has been pushed an odd or an even number of times. Relay circuits have been devised which can perform counting functions, and entire computers have been based upon relay operations. However, the shortest time in which an ordinary relay can operate is about 5000 microseconds. In contrast to this, electronic counting circuits composed of flip-flop, or decision, oscillators can produce the same result in less than one microsecond. This means an increase in operating speed of 5000 to 1.

The basic flip-flop circuit is shown in Fig. 3 (p. 29). In this circuit, it is assumed that component values have been selected so that V_2 conduts a trifle more current than V_1 at the instant plate voltage is applied to both tubes. This extra conduction causes a lowering of the plate voltage of V_2, and the voltage drop is passed on to the grid of V_1 by means of the coupling capacitor and resistor network. The lowering of the grid potential of V_1 causes a decrease in plate current and a resultant increase in plate voltage, which is fed back to the grid of V_2, further increasing its plate current. The condition of instability continues until V_2 is conducting heavily at plate-current saturation, while V_1 is held at cutoff because of the large voltage developed across the common-cathode resistor (by virtue of the heavy current flow through V_2). This condition is reached practically instantaneously. The neon bulb connected from the plate of V_2 to ground lights only when the tube is cutoff (or during the period of highest plate potential). This bulb provides a visual indication of the condition of the circuit. If the circuit components are chosen so that the positive voltage applied to both cathodes is sufficiently higher than the grid potential of the nonconducting

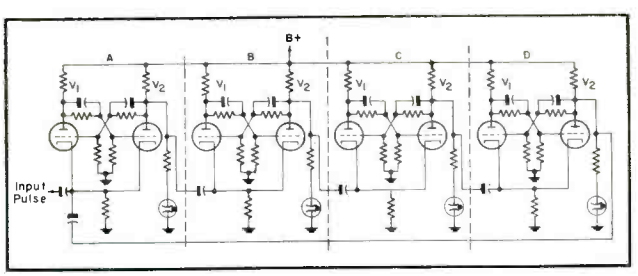


Fig. 4. Radix-2 counter, capable of counting to 15 and resetting to zero.

tube, the circuit remains fixed in a stable condition with V_2 conducting heavily; the unlit neon bulb indicates the fact that V_2 is operating at saturation. If a negative pulse of correct amplitude is applied to the pulse-input lead connected to the common cathodes, it can have no effect in V_2, which is already at saturation. However, V_1 is driven into conduction and its plate voltage drops. This reduction in plate voltage is applied to the grid of V_2, thus tending to lower conduction in V_2, with the resultant rise of V_2's plate voltage causing still more conduction in V_1. This action continues very rapidly until V_1 is operating at saturation and V_2 is operating at cutoff, by virtue of the bias conditions produced by the current flowing through V_1. At this point, the neon lamp lights because of the rise in voltage at the plate of V_2. A series of negative pulses applied to the input lead will cause the circuit to alternate between its two stable states, while the neon bulb will indicate whether the total number of applied impulses has been odd or even. This type of circuit is known as a *modulo-2* counter, since *2* is the standard of measurement in determining odd or even.

If several modulo-2 counters are connected in cascade, the system is known as a *radix-2* counter. Fig. 4 illustrates a radix-2 counter which, is capable of counting up to 15 and then resetting to repeat the cycle. The four flip-flop circuits, labeled *A*, *B*, *C*, and *D*, are identical. The plate lead of tube V_2 in one stage is connected to the cathode input lead of the flip-flop circuit in the next stage. In all the flip-flops, the circuit constants are such that when the circuit is first energized, V_2 conducts first. Hence, V_2 always goes to plate-current saturation, V_1 is driven to cutoff, and none of the neon lamps is lit when the circuit is first energized.

Radix-2 Counter Operation

How the radix-2 circuit counts can be easily understood by following the operation when a series of negative pulses is applied to the common cathode lead of counter *A*. When the first negative pulse is applied, it causes V_1, which is at cutoff, to conduct, driving V_2 to cut off. Since the plate-voltage pulse applied to counter *B* is in a positive direction, there is no change in state of counter *B* or any of the following counters. The neon bulb in counter *A* is now lit, indicating that a binary pulse has been stored in it. If the order of the lamps is transposed from left to right, the lamps now indicate binary number 0001 (or numer-

(*Continued on page* 54)

(*Continued from page* 53)

ical value 1). When the second negative pulse is applied to the pulse input line, the state of counter A is again reversed, causing the lamp to go out. Inasmuch as the plate voltage of V_2 in counter A has dropped, a negative pulse is transmitted to counter B, creating the condition necessary for a reversal of this flip-flop circuit, and the neon lamp lights as the circuit reverses. The conditions of the lamps in the four counters are now as follows: counter D out, counter C out, counter B lit, and counter A out. This set of lamp conditions indicates binary number 0010, or numerical value 2. The third negative pulse again lights the counter A lamp but has no effect on subsequent counters, indicating binary number 0011, or numerical 3. The fourth negative pulse puts out the lamps in counters A and B, but lights the lamp in counter C, indicating binary number 0100, or numerical 4. As other negative pulses are applied the radix-2 counter continues to count until it reaches binary number 1111, or 15. At this point all the lamps are lit; the next negative pulse causes a reversal of the states of all counters (the negative pulse being passed from one counter to the next), so that all lamps go out and the circuit is returned to its starting, or zero, condition. Counting to higher numbers is possible by adding additional modulo-2 counters. Each additional counter increases the counting range by a power of 2. In a long string of modulo-2 counters, the highest limit of counting is equal to 2^n-1, where n is equal to the number of counters in the radix. If it is designed to count in the decimal system, decades of four modulo-2 counters (previously connected so that the 10th pulse restores the circuit to 0000) may be employed. Each decade equals *10*, and feeds the 10th, or carry, pulse into the next decade.

●

CHARLES H. BUNCH

CHARLES H. BUNCH, chairman of the board and treasurer of Acme Electric Corp., Cuba, N. Y., died recently at a Los Angeles hospital. He was 61.

Bunch started his engineering career with the Electric Products Co., Cleveland, O., and in 1917 became one of the founders of Acme Electric. He was a member of the AIEE, member of the IES and other professional and engineering organizations.

Charles H. Bunch

Servicing Hi-Fi Audio

(*Continued from page 33*)

ever, prove very tiring on the nerves. The speaker terminals are connected directly to a low-voltage *ac* source; a 6.3-volt filament winding is usually appropriate for the kind of speakers used for home reproduction. The speaker is then reproducing a high-power, 60-cycle signal, and since the voice coil excursion increases inversely with frequency, the suspensions are being given a hard workout. The speaker should be allowed to continue to reproduce the 60-cycle signal for about 12 hours, with possibly a few breaks to guard against overheating of the voice coil. There will be no danger of damage if the speaker has at least ten watts steady power capability.

There remains the problem of the very loud and very annoying 60-cycle hum. (The speaker can be muffled with pillows and put away in a closet or cellar for the duration of the treatment.) This procedure should *never* be applied to industrial horn-type speakers, or to tweeters or mid-range speakers of any type. It applies only to units capable of reproducing very low notes at high power.

Repair of the Speaker Cone

Minor tears and even holes in the speaker cone can be repaired with little or no loss of quality. Such repairs *must not be made haphazardly,* though, because the physical action of the cone is an important element of audio reproduction. Above the bass region the cone does not vibrate as a unit, but *breaks up* and forms standing waves in the various modes and configurations.

One common mistake made by laymen is to repair torn cones with a type of glue or tape that becomes stiff after drying. Scotch tape and mucilage are good examples of mending material *not* to use. Special speaker cement may be purchased, and speaker patch material, sold in convenient sizes, can be used with good effect. The compliant patch does not get stiff, so that it provides minimum interference with the normal modes of cone flexure. The patch has the further advantage that it does not tend to draw or shrink the cone; a process which may create off-center warping and introduce the danger of fubbing.

In general, speakers used exclusively as woofers can better afford to have patch material than units covering both bass and treble, because cone breakup

(*Continued on page 56*)

(*Continued from page* 55)

is not as much involved in the woofer performance. All patches should be applied with the edges pressed firmly to the cone. A loose edge can form a small resonant system of its own which buzzes audibly whenever it is stimulated in the right frequency band.

Tone Control and Equalization

In the servicing of commercial AM, FM or TV receivers the audio stages are generally considered the least complicated. When the initial diagnosis of a faulty receiver localizes the trouble in the audio section rather than in converter, detector, or sweep circuits, the Service Man usually looks forward to a relatively simple and rapid repair job.

The circuits of high-fidelity sound systems, however, are a different matter. The audio field has developed specialized circuit designs of its own, and the intelligent servicing of modern audio amplifiers requires a knowledge of these special circuits.

Audio amplifiers are rated as having an essentially *flat* frequency response within given limits, which means that they are able to amplify signals of different frequencies in a uniform manner. Certain circuits, however, are expressly designed for the purpose of creating non-uniform response to signals of different frequency. Such circuits may be categorized into three types: the fixed equalizer circuit, which introduces a constant frequency discrimination in compensation for known conditions; the variable tone-control circuit, which enables the operator of the system to adjust the relative bass and treble response of the amplifier; and the automatically-variable circuit, such as is used in a loudness control, where the operation of a control is determined by the position of the volume control slider.

Fixed Equalizers

The most universally-used fixed equalizer is the FM deemphasis network. Although this network is found in the FM tuner, it is inserted after the detector and may be considered a part of the audio circuits. Figure 2 (p. 33) illustrates an FM deemphasis network, with typical component values, and the curve of treble attenuation that it produces. This treble attenuation is in compensation for the treble preemphasis required by the FCC of all FM broadcast stations, and the final frequency response curve of the tuner output signal is essentially flat.

Different values for the resistor and capacitor of the deemphasis network will be found in different receivers, but the correct time constant of the two is always the same; that is, the product of the resistance, in ohms, and the capacitance, in microfarads, will always be equal to the standard 75 microseconds.

If the shunt capacitor should open up, effect would be a constant-treble boost, following the curve of the treble preemphasis in the received FM signal. This treble boost would tend to produce a shrill tone, with unnatural emphasis of the higher musical overtones and of the *s* sounds in speech. It should be clear that replacement components for the deemplasis network must have exactly the same value as the original; the capacitor cannot be treated as a bypass unit, whose replacement does not have a critical value so long as its capacitance is at least as large as that of the original.

Phono Preamp Equalizers

The signal output of a magnetic pickup has been doctored, relative to

frequency distribution, in much the same way as the FM signal. Treble preamphasis and bass pre-attenuation are both applied, although the characteristics of this doctoring have unfortunately not been standardized.

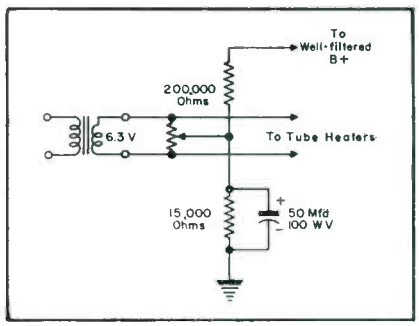
The *rc* or resistance-capacitance network is almost universally used to equalize the pickup signal fed to the main amplifier. The equalization network of the G.E. preamp, providing compensatory bass boost for recording characteristics, is illustrated in Fig. 1 (p. 33). A 6,800-ohm resistor across the preamp input terminals (and therefore directly across the pickup itself) introduces treble droop by virtue of the effect of resistive loading on the magnetic pickup.

Here, too, as in the FM deemphasis network, all replacement components must be of a value carefully matched to the original. Furthermore, these circuit components are in an extremely sensitive part of the amplifier, and only the very highest quality resistors and capacitors should be used; an initial saving of a few pennies may be paid for with costly future trouble. Small defects in replacement parts, that would have no significance in ordinary low-gain circuits, may create annoying intermittent noise in the phono preamp.

The preamp circuit illustrated in Fig. 1 provides a single transition frequency or turnover point for its bass boost, but many records use a lower turnover frequency. The signal from such records may be approximately compensated by using the tone controls of the main amplifier to introduce a certain amount of bass attenuation, or a simple variable-turnover circuit may be added, requiring only a switch plus a capacitor and 10-megohm click-suppressing resistor for each added position. Fig. 3 (p. 33 illustrates the addition of such a circuit to the G.E. preamp equalizer, providing three turnover frequencies that can be selected for the most natural sounding bass of the record being played.

Correction

THE CIRCUIT appearing in the Vino paper on audio maintenance in the Dec. 1953 issue of SERVICE should have been presented as shown below, with B+ applied through a dropping resistor.



On Book Row

NBC Handbook of Pronunciation. . . . By James F. Bender: A dictionary of more than 15,000 hard-to-pronounce words of the English language which might be encountered by service personnel involved in *pa* work or broadcasting. Features *three-way approach*: word is spelled; then respelled to show pronounciation; and finally, printed in phonetics. Entries include names of places, names of people, words in the news, musical terms, and thousands of common everyday words.—*372 pages (Second Edition), priced at $4.50, Thomas Y. Crowell Co., 432 Fourth Ave., New York 16, N. Y.*

* * *

High Fidelity Techniques. . . . By John H. Newitt: In this treatment of *hi-fi*, a practical working knowledge from which to evaluate, install, and maintain equipment is provided. Amplifiers, tuners, preamps, phono cartridges and arms, tape recorders, loudspeakers, baffles and crossover networks are described, and their design and performance analyzed, with charts and schematics showing examples of typical circuits, construction practices and installations. Design data and dimensions for constructing infinite baffle, reflex, horn, labyrinth, or other speaker cabinets, are also included. Also available are details on volume expanders, noise suppressors, resonant and nonresonant tone controls, and binaural or stereophonic audio systems.—*512 pages, 6" x 9", priced at $7.50; Rinehart Books, Inc., 232 Madison Ave., New York 16, N. Y.*

* * *

RCA Reference Book. . . . 1954 Edition: New edition of this standard reference book, with data on over 20 subjects. Includes information on receiving tube characteristics (charts); picture tube characteristics (charts); semiconductor devices; interchangeability directory of tubes for communications and industry; battery characteristics (chart) and interchangeability guide; battery socket and terminal, and replacement guide; deflection components; speakers; TV components; test equipment and lightning arresters. Also offered are notes on alignment and the use of test patterns. Book also includes a diary and color maps.—*120 text pages, plus diary and maps, 3¼" x 5¼", priced at $1.00; Radio Corp. of America, Tube Dept., Harrison, N. J.*

* * *

How To Troubleshoot A TV Receiver. . . . By J. Richard Johnson: Described in this text are the mental and physical processes involved in troubleshooting TV receivers. Presented are step-by-step troubleshooting procedures, and an interpretation of circuit symbols. Analyzed are the antenna system, *rf* tuner, video *if* and detector sections, video amplifier sections, picture tube, deflection and sync circuits, high and low-voltage power supplies. Book includes a chapter on the setting up of a service shop, detailing the kinds of tools and test equipment required for field as well as shop-servicing activities. Also tabulates the kinds of tubes and types of components which should be kept in inventory.—*128 pages, 5½" x 8½", paper bound, priced at $1.80; John F. Rider, Publisher, Inc., 480 Canal St., New York 13, N. Y.*

* * *

Basic Radio Manual: A 248-page syllabus outlining a 36-lesson course on basic radio, with a practical shop project section demonstrating theories in action. Can be used as a text for the student and instructor. Presented in two sections: the first is theory; the second projects.—*8½" x 11", priced at $5.00; Howard W. Sams and Co., Inc., 2201 E. 46th St., Indianapolis 5, Ind.*

Catalogs and Bulletins

FEDERAL TELEPHONE AND RADIO Co., 100 Kingsland Rd., Clifton, N. J., has published the second edition of their *Selenium Rectifier Handbook*. An 80-page book, it covers selenium rectifier designs and power supply circuits for phonos, audio amplifiers, mobile radios, photocell amplifiers, intercom systems and other *dc* power supply requirements. Features servicing information, and troubleshooting tables with proper procedures to be followed in checking rectifiers under varying circuit conditions. Priced at $.50.

* * *

HEATH Co., Benton Harbor, Mich., has released a 40-page '54 catalog, which describes test equipment, amplifiers and receivers in kit form. Items covered include *ac vtvm*, antenna impedance meter, *af* generators, oscillator and wattmeter, bar generator and capacitor checker.

* * *

ADMIRAL CORP., 3800 Cortland St., Chicago 47, Ill., has issued a 16-page catalog, describing a line of antennas and accessories. Included are all-channel antennas, indoor types, yagis, transmission line and groundwire, mounting hardware, masts and towers, and tables and bases.

* * *

GENERAL INSTRUMENT Co., F. W. Sickles Division, Chicopee, Mass., has released a 12-page catalog, *AT-53*, detailing specifications and data on air dielectric trimmers.

* * *

ELECTRONIC INSTRUMENTS Co., INC., 84 Withers St., Brooklyn 11, N. Y., has issued a 12-page catalog, describing a line of 30 kits and 33 factory-wired instruments. Features, specifications and applications of each instrument are offered.

* * *

TELEX, INC., Dept. KP, Telex Park, St. Paul, Minn., has prepared a catalog sheet on the *Twinset*, a twin-magnetic receiver, weighing 1.6 ounces. Sheet lists specifications and explains professional, business and technical uses.

* * *

AUDIO-MASTER CORP., 17 E 45th St., New York 17, N. Y., has released a catalog describing a line of audio equipment, ranging from a small phono to a transcription player combination with *pa* system.

* * *

PLASTIC CAPACITORS, INC., 2511 W. Moffat St., Chicago 47, Ill., has issued a catalog, describing a line of plastic-film capacitors, as well as hermetically-sealed power packs.

* * *

PRECISION EQUIPMENT Co., 3702 N. Milwaukee Ave., Chicago 41, Ill., has released a 24-page catalog, detailing steel and aluminum equipment, including shelving, folding tables, cabinets, bins and lockers. Other equipment described include ladders, storage and maintenance gear, rotating bins, utility trucks, work benches and instruments.

* * *

AMERICAN MICROPHONE Co., 370 S. Fair Oaks Ave., Pasadena 1, Calif., has prepared a catalog sheet describing hand-held dynamic and carbon microphones for use in mobile radio, paging and intercom systems.

* * *

UNITED CATALOG PUBLISHERS, INC., 106-110 Lafayette St., New York 13, N. Y., has issued the 18th edition of their Radio's Master buying guide with 1,370 catalog pages. Descriptions, specifications and prices are accompanied by better than 8,000 product illustrations. Organized in 18 sections. More than 85,000 items are cataloged. A few of the products cataloged include: tubes, test equipment, tools, service aids, TV and audio components, antennas and accessories, recording and PA systems, and *hi-fi* equipment. Priced at $6.50.

ASSOCIATIONS

LITRTG, Long Island, N. Y.

AT THE ANNUAL election of officers of the Long Island Television and Radio Technicians Guild *Henry Wawryck* was elected prexy. Others now on the officer roster include *Arthur Cyr*, vice prexy; *John Wheaton*, treasurer; *Murray Barlowe*, corresponding secretary; *Al. Weil*, recording secretary and *Earl Horton*, sergeant-at-arms. Trustees were added to the executive board for the first time; *Jack Buck*, three years; *Dick Bishop*, two years, and *Bill Allen* and *Ralph Milne*, one year each. The election was followed by the first in a series of color lectures by *Murray Barlowe*, who was affiliated with CBS during development of the sequential color system, and who has since followed color TV's program closely. The meeting also featured the announcement of the formation of two special committees: one (consisting of *Arnold Corbyons* and *Bob Bloom*) to develop a form of diploma to be awarded to all members who attend six or more of the color lectures, and another (with *Jack Buck* and *Earl Horton*) to handle publicity.

TRT, Kansas City

FLOYD G. CONKRIGHT, Lee Wholesale Co., and *F. W. Ragan*, Jenkins Music Co., have been elected to the executive committee of Television and Radio Technicians, Kansas City, Mo., for three-year terms.

David Doss, general manager of Hoffman Sales Corp., spoke to the group at a recent meeting on Hoffman's expansion to the middle west and east coast, and explained what this expansion would mean to the electronics industry in the Kansas City area. Doss reported that the north Kansas City plant would start with the production of radios, and then expand its facilities to include TV receivers by about May. He predicted that about 1000 TV sets a day would eventually be produced.

ARTSNY, New York, N. Y.

A NEW SLATE of officers has been elected by members of the Associated Radio-Television Servicemen of New York.

Phil Goldfarb is the new prexy. *Arthur Rhine* was reelected executive secretary, and *George Kimmel*, treasurer. *Edward Eisen* was named chairman of the business chapter, and *Jacob Allen*, recording secretary. *Herman Bruck* now is financial secretary, and *Kingsley Sherwood* was selected as the corresponding secretary. *John Wagonny* is sergeant-at-arms.

Six were named to the board of directors of the business chapter: *Max Liebowitz, Jack Spegal, Karl Mertel, Peter LaPresta, Harold Kanfield*, and *Stephen Pokal*.

On the technical chapter, *Joseph Witlin* was named chairman; *Jacob Allen*, recording secretary; *Martin Boxer*, corresponding secretary; *Harry Temler*, financial secretary; and *Ben Cohen*, sergeant-at-arms. Eight were named to the board of directors of this chapter: *Robert T. Olson; Warren Metz; Henry Levine; Henry Kaye; Harry Oxer; Harold Levenson; Sidney Perlin*; and *Jerry Maccherone*.

Max Liebowitz, who served for seven terms as prexy of the association, was elected permanent chairman of the board of the entire group.

CTID, Rockford, Ill.

ROY W. PEARSON has been reelected president of the Certified Television Installation Dealers, Rockford, Ill., and *C. T. Van Ausdall* was renamed secretary.

New officers include *Harry Harris*, vice president, and *Ray Dean*, treasurer.

At presentation of NATESA's Friends of Service Management Award to **G.E., Schenectady, the fifth award received by the company for its public relations program in behalf of TV service:** Bertram L. Lewis, **left, Rochester, N. Y., NATESA eastern vice-president;** John T. Thompson, **center, manager of replacement tube sales for the G.E. tube department;** Frank J. Moch, **right, Chicago, president of NATESA. Previous awards to G.E. came from NATESA, Associated Radio and Television Service Dealers, Inc., Columbus, Ohio; Federation of Radio Servicemen's Associations of Pennsylvania, and the Radio Technicians Guild of Boston.**

TISA, Chicago

FRANK J. MOCH, *NATESA* prexy, has been reelected head of the national association's Chicago affiliate, Television Installation Service Association of Illinois.

Other TISA officers reelected include: *John Cecich*, first vice-president; *Jerome Man*, treasurer, and *Rubin Sarner*, secretary.

Ralph Friedman has succeeded *Sidney Terman*, as second vice president, and *Russ Havill* is now sergeant-at-arms, succeeding *Fred H. Levine*.

Milton Stone now heads a training committee; *George Hingson*, fraudulent practices, and *Leonard March*, advertising.

It was also announced at the election that *Moch* presented NATESA awards to RCA and G.E., in Camden and Schenectady. At the Camden ceremonies the award was presented to Charles M. Odorizzi, executive vice prexy of RCA, by *Moch* and *Harold Rhodes*, awards chairman.

Other RCA officials attending the ceremony were *E. C. Cahill*, president of RCA Service Co.; *Dan Creato*, vice-president; *D. H. Kunsman*, vice president in charge of consumer products service; *R. M. Baggs*, general sales manager, and *J. W. Zaun*, quality division manager.

TEN YEARS AGO

BOND GEDDES, executive vice-president and general manager of RMA, reported that there would be no civilian production of receivers in 1944. . . . The WPB set up a program calling for the production of at least 4½ million hard-to-get tubes during the first quarter of '44; 12SA7, 12SQ7, 12SK7, 50L6, 35Z5, 35L6, 1H5, 1A7 and 80. Tubes were to be marked *MR* for maintenance, repair, and operating supply purposes. . . . The job that Service Men did on overseas assignments in '43 was reviewed by *W. L. Jones*, RCA Service Co. vice president and general manager. . . . On the front cover a wide-range *af* meter with a keying amplifier and square-wave generator providing coverage of ten linear ranges from 50 to 50,000 cycles (*RCA 306-A*), was presented. . . . *Meyer Eisenberg*, Plaza Radio Shop, Brooklyn, N. Y., won a $25 war bond from the Proctor Electric Co. for an electric-cord repair suggestion. . . . *Orrin E. Dunlap, Jr.*, was appointed director of advertising and publicity by Radio Corp. of America. . . . *American Radio Hardware Co.* opened a new factory in Mt. Vernon, N. Y. . . . *C. L. Pugh*, formerly jobber sales manager of Stancor, organized his own rep firm in the Middle West. . . . *David Gross* was named sales director of the materials test division of DuMont. *Samuel H. Cuff* was appointed sales promotion manager for TV. . . . *William C. Speed* was named vice president in charge of manufacturing of Reeves Sound Labs. . . . *William J. Massey* was appointed general lamp sales manager by Westinghouse, Bloomfield, N. J. . . . Army-Navy E Award winners: Erie Resistor Corp., Erie, Pa.; Bell Sound Systems, Inc., Columbus, Ohio, and Sylvania's Williamsport, Pa., plant. . . . JFD published a 100-page manual on fabric belts and ballasts. . . . *Al Ghirardi* described 'scopes and their applications in a 4-page feature report. Instruments detailed were Hickok's RFO-4, Dayrad's 65, RAC's 155C327A and various models made by DuMont.

Audio

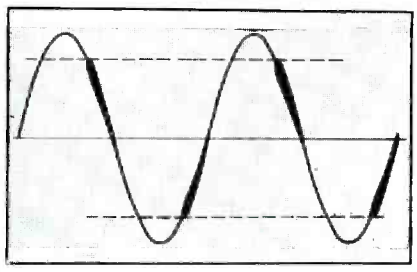
(*Continued from page 46*)

sense, but it has a similar effect on the reproduction. Stages of this type require a drive stage giving a low source impedance, so the onset of grid current does not produce waveform distortion. If the source impedance *is* too high, this can produce regular intermodulation distortion, as well as a rather objectionable form of harmonic distortion. But because a satisfactory drive stage has low source impedance, these amplifiers sometimes run into parasitic oscillation at *rf*. Sometimes, though, the circuit does not have high enough *Q* to generate continuous oscillations, merely showing a very high peak in response well above the audio range, verging on oscillation. When this happens, cessation of the grid current can excite a damped train of oscillations at the resonant (*rf*) frequency. The resultant output waveform for a single sinusoidal input appears in Fig. 1. As the *rf* component of this wave is inaudible, its presence would not be detected in this case. But when another waveform is superimposed on the one exciting the parasitic, the grid current varies the damping on the *rf* with the waveform of the secondary *af* signal; thus this secondary waveform effectively modulates the *rf* damped train. This results in the absorption of energy from the modulating waveform, so that during these periods its amplitude is reduced. The resultant sound is very similar to intermodulation, except that it will become evident quite suddenly as level rises, because it does not show up at all, until grid current commences.

Break Through

Often reproduction sounds as if it is being forced through some barrier, and it only succeeds in doing so in spurts; generally these spurts are considerably distorted. Sometimes only the very loudest passages succeed in breaking through, leaving silence between, and sometimes almost all the signal gets through, but it gives the same general impression. This form of

Fig. 1. Example of waveform produced by parasitic rf oscillation excited by grid-current pulses. Dotted lines indicate point where grid current starts and finishes.



distortion is due to parasitic *rf* oscillation, which loads the amplifier, or some stage of it, up to maximum level, so that the normal audio signal cannot get through. However, a high-amplitude audio signal injected with the *rf* will push the combined grid potential much more positive momentarily and damp down the *rf* level, so that the oscillation has to build up again to a saturation point. During this build-up interval, some of the *af* signal will become amplified, until the *rf* again *blocks* the channel.

When this trouble occurs, the amplifier will be found unusually quiet in the absence of signal, hum and tube hiss being undetectable, even by crawling into the loudspeaker. This is so, because the blocking action stops the spurious forms of signal, as well as the regular program signal.

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Servicing Helps

(*Continued from page* 34)

and first detector provide a rectified signal.

With this arrangement alignment can be performed in the cabinet or on a non-metallic bench top.

In checking for stability one can touch the chassis near the tuner or slide the hand along the sweep output cable and observe if the shape of the curve changes.

To offset the *agc* developed from the sweep signal, the first *vif* tube should be pulled out of its socket. Then proper bias can be applied to the *rf* and mixer tubes.

The sweep generator and bias should be adjusted until there isn't a change in the curve shape with a decrease in sweep input or an increase of the bias. This will prevent overloading the stages which could result in limiting or clipping of the response curve.

Tuner Replacements

WHEN TUNERS are to be replaced with cascode and pentode types,* chassis should be checked to be sure that they use intercarrier or that the sound take-off is not within the tuner circuit (at mixer output).

For those systems which previously required the use of a 21.25-mc *if* sound take-off coil connected to the tuner converter plate circuit, a coil[1] has been developed; this can be mounted on the TV chassis and connected as shown in Fig. 4. Where more audio output is required, an alternate method can be employed, as illustrated in Fig. 5 below.

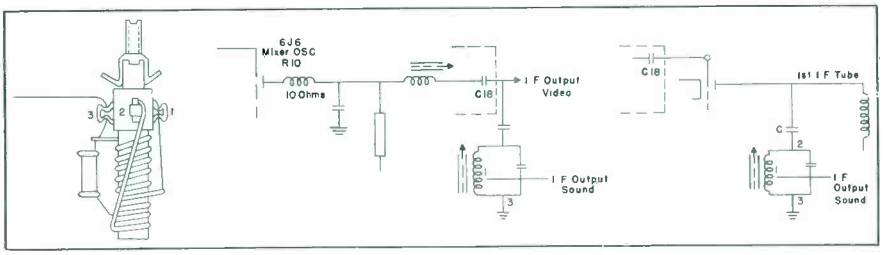
Some TV sets may not have enough sound rejection built into the *if* system and will require more trapping than the sound take-off coil will provide. In these sets an additional trap at sound-*if* frequency should be included in the *if* system.

*Standard Coil TV-2232 (cascode) and TV-1532 (pentode). [1]Part XM-752.

Credits

[1]From notes submitted by *M. Martynec.*

Figs. 4 and 5. Circuits illustrating application of Standard cascode and pentode tuners to split-sound if-system chains. Method of adaptation, shown in Fig. 5 can be used where more audio output is required. C = gimmick or capacitor approximately 2 to 4 mmfd.



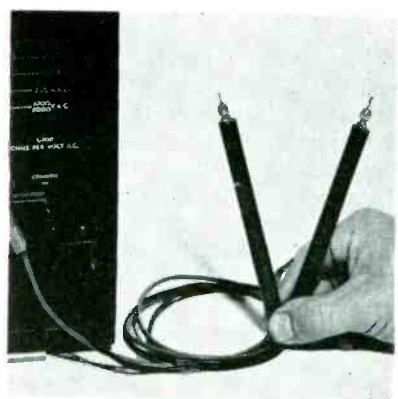
Tools . . . Instruments Parts . . .

INSULINE TEST LEADS

A pair of lucite handle test leads, *304*, for use with standard voltmeters, multimeters, *vtvms* and similar measuring instruments, has been introduced by the Insuline Corporation of America, 3602—35th Ave., Long Island City 1, N. Y.

Handles are 5" long and ⅜" in diameter. Ends are fitted with small threaded chucks which take phono-needle test tips. Needles can be inserted with either the blunt or the sharp points outward.

Handles are colored red and black, respectively, and carry 45" lengths of kinkless, flexible leads with molded right-angle phone tip plugs.



Insuline Test Leads

* * *

CENTURY SERVICE CASE

An all-steel carrying case, designed for radio and TV Service Men, has been introduced by Century Display Manufacturing Co., Chicago, Ill.

Featuring six plastic-clear boxes for small parts, a seven partition removable metal tray, four partitioned bins on one side, two extra large on the other, case is 21" x 12" x 7½". Includes a full-length hinge, cylinder lock with two keys and metal handle.

Century Display Service Case

XCELITE REAMER

A super-hard reamer, *99-71*, that reams from ⅛" to 5/16" in wood, sheet metal, and plastic, has been announced by Xcelite, Inc., Orchard Park, New York. Available with detachable handle.

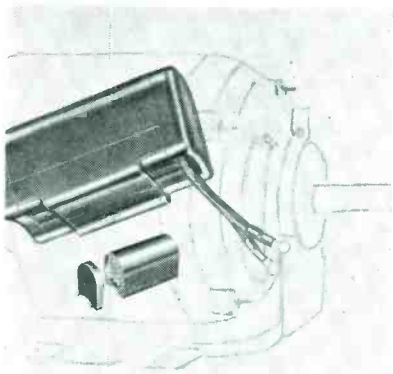
* * *

C-D MOTOR STARTING CAPACITOR

A motor-starting electrolytic capacitor, *EXWCB*, featuring a compact case design that is said to mount securely on the motor frame and blend into its contour, has been developed by Cornell-Dubilier Electric Corp., South Plainfield, N. J. Entire unit is less than four inches long.

Unit is made of black molded baklite, and two parts comprise the assembly: the body and cap. Latter is fastened to the body by two self-tapping screws, providing accessibility to the capacitor terminals. Container is hermetically sealed by means of a steel spider-ring which presses against a rubber bakelite washer; rubber lining of washer in turn presses against the inner ledge of the container.

Also provided with a tempered steel mounting clip, shaped to conform to the curvature of the motor frame, to which it may be fastened by means of two round head machine screws. Opening in the bottom of the case cap permits connecting wires to pass from capacitor terminals into the motor housing. Case cap is removable for testing at the terminals without the necessity of unclipping the case from the mounting or motor frame.



C-D Motor Starter Capacitor

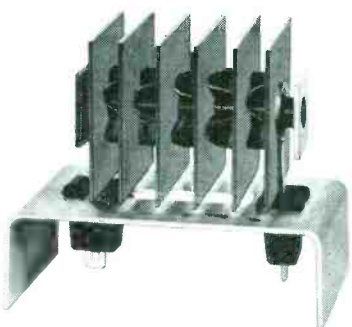
* * *

TARZIAN SELENIUM PLUG-INS

Selenium rectifiers fitted with polarized lugs, for mounting in a socket, have been developed by Sarkes Tarzian, Inc., Rectifier Division, 415 N. College Ave., Bloomington, Ind.

Plus lug has a 90 degree twist for polarization. Socket placement determines the rectifier size. Rectifier lugs snap into place and won't fall out.

Sockets are being made by the Cinch Manufacturing Company, Chicago.



HOLUB TEST LIGHT AND FUSE PULLER

A test-light and fuse puller combination, that is said to eliminate the danger of inserting or removing cartridge fuses by hand; prevent the bending of clips through improper removal, and can be used for handling live electrical parts up to 600 *v ac-dc*, has been introduced by Holub Industries, Inc., Sycamore, Ill.

Made of red plastic, jaws are shaped to hold cartridge fuses up to 100 *a*-size; inside of jaws are serrated. Handles are formed to fit the fingers and corrugated to prevent slipping. Two 24" leads are furnished with each tool. One lead has a 4" plastic handle prod, and the other a spring clip. Test light is of the neon type with a resistor.

UTICA CUSHION THROAT PLIERS

A safety-idea for pliers, *cushion throat*, which it is said acts as a third hand to hold the short end of the wire during and after cutting, has been developed by Utica Drop Forge and Tool Corp., Utica, N.Y.

The *cushion* is rubbery red *Plastisol*, bonded in the throat beside the pliers' cutting edges. As the pliers close, cushion grips the short end of the wire tightly, holding as the cut is made. Generally, pliers must be opened to release the cut wire end. It is claimed that cuts can be made inside a chassis without danger of the snips of wire falling into the set. On *live* work, this helps prevent short circuits. While cutting springs, the safety feature keeps wire from flying.

CARTER VOLTAGE CHANGERS

An addition to a line of power supplies, *Change-A-Volt Dynamotor,* that is said to make it possible to operate 6-volt two-way radio equipment from 12-volt systems without any rewiring or modifications, has been introduced by the Carter Motor Co., 2644 N. Maplewood Ave., Dept. 17, Chicago 47, Ill. Unit is supplied complete with starting relay and switch, 12-*v* fuse block, and wiring to convert directly a 12-*v* battery to a 6-*v* radio supply.

For transmitters up to 30 watts output, model *B615V* is available. It delivers 15 *a* continuously for receive and 45 *a* for transmit. It is also available in 24, 28, 32, 48 and 64-*v* inputs to change directly to 6 or 12 volt. Unit can also serve as a battery equalizer when operating low-voltage equipment on several cells of a higher-voltage battery system.

* * *

IRC MOLDED BORON-CARBON RESISTORS

A film-type, ½-watt resistor, that incorporates the advantages of a fully insulated unit, has been developed by the International Resistor Co., 401 N. Broad St., Philadelphia 8, Pa.

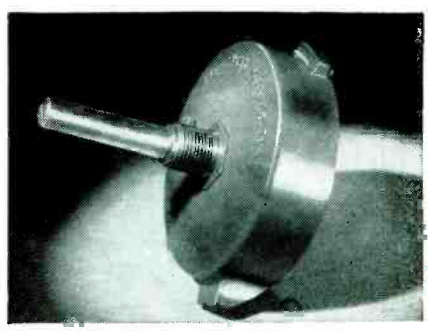
Resistors are said to be suited for applications where unmolded boron or deposited carbon units cannot be used due to the risk of mechanical damage to their coating, insulation breakdown, or high moisture change. Available from 100 ohms to .51 megohm.

* * *

CLAROSTAT HV HIGH-RESISTANCE CONTROL

A high-voltage, high-resistance, composition-element control, *series 51,* to control voltage for electrostatic-focus TV picture tubes, and for use too with three-gun color TV tubes, and photoelectric circuits, has been announced by the Clarostat Manufacturing Co., Inc., Dover, N. H.

Housed in low-loss phenolic case with a phenolic disk back that separates the terminals for maximum insulation, control is said to withstand 10,000 volts *dc* breakdown test between terminals and mounting bushing. It measures 2" in diameter by 5/8" deep. Available in resistance values from 5000 ohms to 50 megohms linear, and rated 1 watt. Tapers available to meet requirements. Tolerances of plus/minus, 20% to 1 megohm, 30% above 1 megohm.



* * *

NEXT MONTH

THE CONCLUDING installment of the *Geist* series of articles on *systematic servicing* will appear in the February issue of SERVICE.

REP REAPPOINTMENT

Dick Morris (left), general sales manager of Snyder Manufacturing Company, Philadelphia, at recent renewal rep signing contract session with Maury Miffelman, Miffelman Associates, Los Angeles.

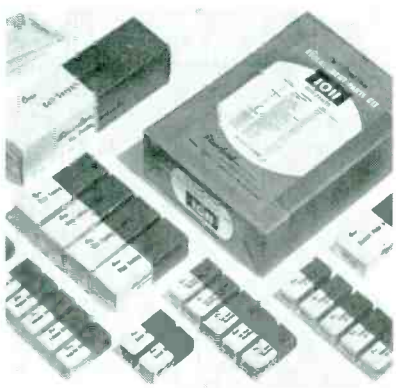
•

CAPACITOR AD-PLANNING SESSION

J. K. Poff, Pyramid jobber sales manager (right), discussing ad and promotion campaign for Pyramid capacitors with Burton Browne, head of the Chicago agency now handling the account.

•

TV TUNER REPLACEMENT PARTS KIT



Tuner replacement parts kit developed by Standard Coil Products Co., Inc. Included are 104 of the most-called for parts servicing TV-200, TV-1500, TV-2000 and TV-2200 series Standard tuners. Majority of parts are individually boxed.

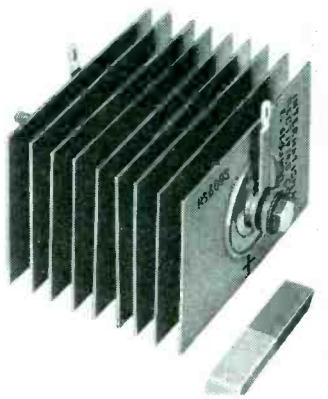
TV Parts... Accessories

INTERNATIONAL RECTIFIER COLOR-TV SELENIUM STACKS

A series of selenium rectifier stacks with 2" x 3" plates for color-TV sets, designed for capacitive loads of 600, 700 and 750 ma, and produced for maximum input voltage ratings of 130, 172 and 195 volts *rms*, have been developed by the International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

Construction of this series differs from regular radio and TV selenium rectifiers in that a bellows-type spring contactor, as used in industrial rectifiers, is employed in the assembly of this series. Spring contactor is said to afford a lower forward drop, lower temperature rise and longer life.

Bulletin ER-178 supplement covers the electrical and mechanical specificaticns.



IRC Color-TV Chassis Rectifier

* * *

KIRBY FLYBACK TESTER

A flyback transformer tester, *98*, designed to indicate shorted turns within the flyback transformer, while transformer is in a TV set, by the power absorption method, has been introduced by Kirby Products Corp., 20 E. Herman Street, Philadelphia, Pa.

Unit is said to supply an indication on as low as one shorted turn anywhere in the flyback transformer, and test for continuity on yokes, transformers, switches, etc.

HICKOK TV HETERODYNED MARKER ADDER

A marker unit, *691*, designed for use with any sweep marker equipment that has an output of 50,000 microvolts or more, has been introduced by The Hickok Electrical Instrument Co., 10521 DuPont Ave., Cleveland 8, Ohio.

Unit provides a marker, visible at all times (including trap points), that it is said will not change in amplitude or distort the response curve. Output of the sweep generator and marker generator is heterodyned and applied to a 'scope in such a manner that the marker signal does not pass through the receiver itself, and thus cannot cause overloading. Provides output marker voltage up to 3 *v*; variable attenuation of markers from 0 to 60 db.

FEDERAL UNIVERSAL SELENIUM RECTIFIERS

A *universal* line of selenium rectifiers, designed for replacement in any radio or TV receiver now equipped with this component, has been introduced by the Federal Telephone and Radio Co., 100 Kingsland Rd., Clifton, N. J.

Universal rectifiers are of eyelet construction and equipped with mounting hardware for simplified installation into the radio of TV chassis. Code numbers and ratings of selenium rectifiers available are: *1236A*, rated at 300 *ma*; *1238A*, rated at 350 *ma*; *1241A*, rated at 400 *ma*; and *1237A*, rated at 500 *ma*.

* * *

RCP FLYBACK AND YOKE TESTER

An instrument, *123 Flybacker*, for testing the condition of flyback transformers and yokes in horizontal output circuits, has been developed by Radio City Products Co., 152 W. 25th St., New York, N. Y.

Tester detects a single shorted turn or a number of shorted turns in both the flyback and yoke, and also shows up circuited windings. To use the instrument, the flyback plate caps are removed, switches set, and leads applied to the component; results are read on a *good-bad* scale.

RCP Flyback/Yoke Tester

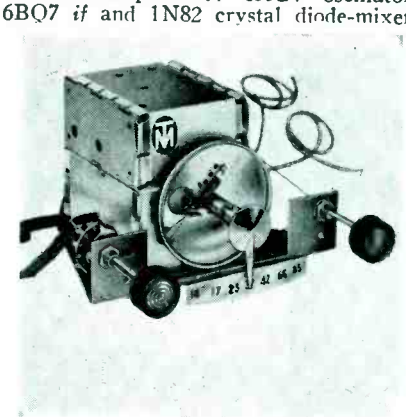
* * *

TECH-MASTER 70-CHANNEL UHF SELECTOR

A uhf selector, *TV101-U*, designed for 630-type TV receivers, as well as Tech-Master receivers, models 2430, 2431P, 2430-9, 1930 and C-30, is now available from Tech-Master Products, 443 Broadway, New York 13, N. Y.

Selector fits into the front recess of the 630-type chassis, and is said to require no cabinet alterations. Three high-*Q* resonators are said to provide high gain sensitivity; cascode *if* stage is completely shielded.

Tube complement: 6AG4 oscillator, 6BQ7 *if* and 1N82 crystal diode-mixer.

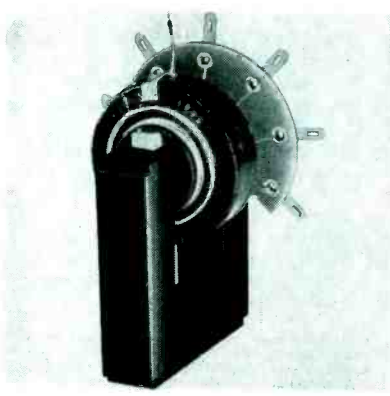


STANCOR EXACT SYLVANIA REPLACEMENT FLYBACKS

Exact replacement flybacks, *A-8227*, *A-8228*, *A-8229*, that it is said covers almost 90% of all Sylvania production up to 1953, have been announced by Chicago Standard Transformer Corp., Standard Division, Addison and Elston, Chicago 18, Ill.

Supplied as coil and core for installation to the original brackets which are a permanent part of the chassis. New filament leads are packed with each transformer.

Bulletin 478 lists over 170 Sylvania models and chassis using these transformers.



TV Antenna Digest

(*Continued from page 36*)

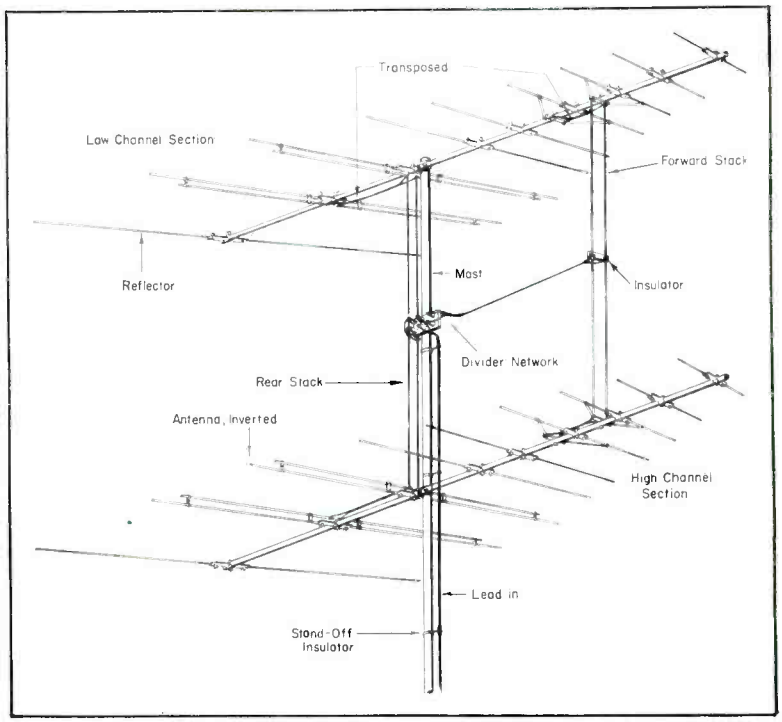


Fig. 2. Stacked yagi system. (Courtesy Vee-D-X)

aft, in supporting the booms in a coplanar position. A spacing insulator, placed on the stackers midway between the antennas, serves as a terminal block for attachment of the interconnecting harness to the network. The output of the network is terminated for 300-ohm impedance to accommodate the standard types of transmission lines.

Fig. 3 illustrates the forward horizontal directivity of the yagi. One of the interesting properties of this compound yagi, it is reported, is that the pattern configuration for both single and stacked bays is said to remain essentially the same.

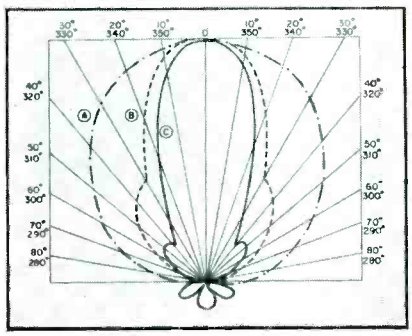
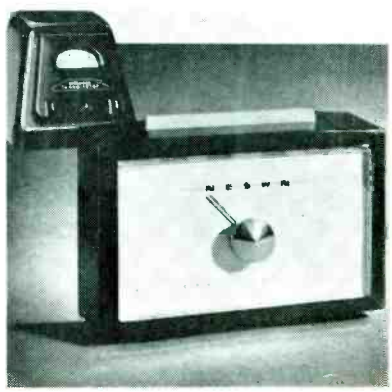
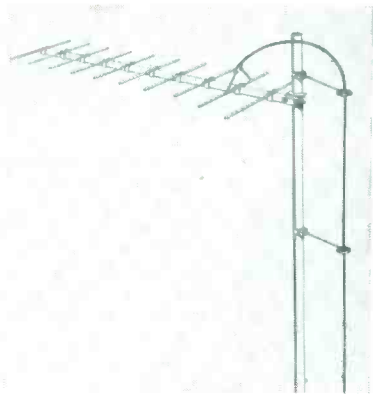


Fig. 3. Horizontal radiation pattern of yagi: A = channel 2; B = channel 7 and C = channel 11.

Transfer switch for vhf/uhf **featuring a wafer component with widely separated contacts said to assure positive** make-break **characteristics. Switch case uses low-carbon compound called** mesonetic **plastic.** (Plymouth Electronics Corp., 50 Kingsbury St., Worcester 10, Mass.)

Old and new: At left, old pyramid-style rotator, in contrast to new rectangular shape model below. New model provides control bar across the top. Pressing on one end of the tilt bar turns rotor one way. Pressing on the other end of the bar turns rotor in opposite direction. Selects and shows the actual direction to which antenna is pointed (Model T-10; Alliance).



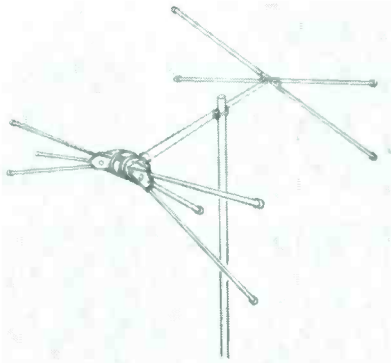


(Above)

A 10-element uhf yagi that is said to be plated with 24-carat gold. Yagi is custom-made for each location, and designed for either single channel or broad band (15 channels or more) bandwidth. (Walsco.)

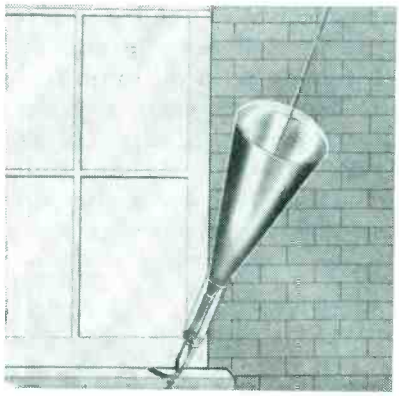
(Below)

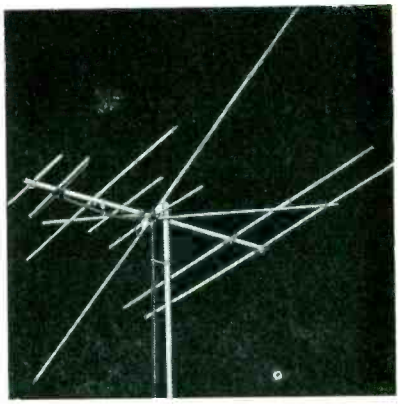
Conical vhf antenna which utilizes barrier-discs and 2" of air space between terminals. Insulator containing barrier-discs is said to prevent shorts. Front end hardware is stainless steel. (Walsco.)



(Below)

Single-wire transmission line for uhf which consists of an impedance-matching unit at each end called launchers, which match 300-ohm balanced line connection at the antenna to single wire which carries the signal to TV set. Near the TV set, a second launcher matches the single wire to a short length of 300-ohm twin line attached to the receiver. Losses of the line are said to be one db per 100' in the uhf band. The launchers each introduce ½ db loss. Kit is available; consists of two launchers, 150' of wire, and two standoff brackets. (G-Line and GL kit; David Bogen Co., Inc., 29 Ninth Ave., N. Y. 14.)





(Above)

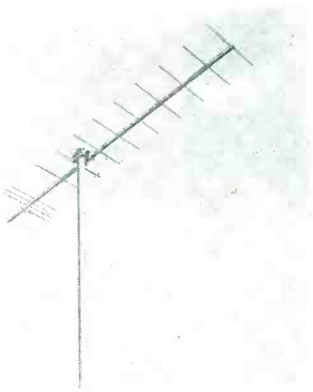
Conical yagi antenna for vhf. Has 5 elements on low channels, and 4 on the highs. Low channel section consists of a conical driven element using vari-con adjustable head, plus dual reflectors and a director. High channel section uses two separate driven elements and a director for each. One driven element and director operates across channels 7-8-9, the other pair being most effective across channels 10 to 13. Entire array is fed with a single 300-ohm line. (Model 88; Falcon Electronics Co., Quincy, Ill.)

(Below)

Automatic signal equalizer designed for locations where signals from low-frequency channels cause overloading and the high-frequency channels are not strong enough to tolerate any attenuation. (Model AT-25; Tele-Matic Industries, Inc., 1 Joralemon St., Brooklyn, N. Y.)

(Below)

Ultrahigh 12-element yagi designed for deep-fringe reception of single channels. Model also said to pick up adjacent channels due to mean-frequency pick-up. Yagis are one-piece, welded and plated with Bronzidite. (Model UHF812; JFD Manufacturing Co., Inc., 6101 Sixteenth Ave., Brooklyn 4, N. Y.)



NEWS

FINNEY WINS MISREPRESENTATION COURT DECISION

A court judgement for damages and a permanent injunction against a Canton, Ohio, service company, that had been selling another-type antenna as a genuine Finco, has been obtained by the Finney Company, 4612 St. Clair Ave., Cleveland 3, Ohio.

Decision of the Court stated that . . . "The defendant has engaged in unfair competition by passing off unto its customers . . . as *Finco* antenna . . . other antennas of similar appearance which were not genuine *Finco* antennas . . . and which were not products of the Finco Co. . . . and a final and permanent order, restraining defendant from further unfair competition, is granted."

After the decision was rendered, Finney, in a newspaper ad, reproduced a paragraph from the court decision and warned the Canton public against the possibility of being victimized in the future by the few and isolated service companies who engage in unscrupulous substitution practices.

Commenting on the decision, M. L. Finneburgh, Finney vice prexy, stated that . . . "If the electronics industry and, especially, antenna manufacturers are ever to achieve recognition as an honored and stable part of American industry, they must mature and aspire to standards of ethics, integrity, and dignity followed in other industries. Deception, substitution, and misrepresentation must be stopped."

* * *

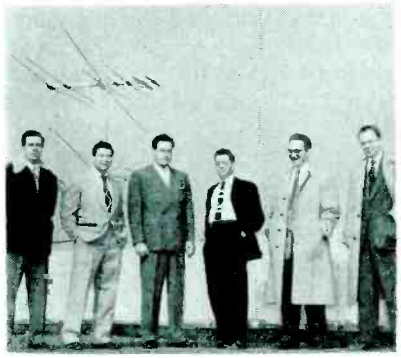
S/C RECEIVES GUIDE-A-TUBE PATENT

Patent 2,659,061, for a low-loss plastic wafer designed to guide miniature tubes into their respective sockets, has been issued to *Frank D. Mirabella* and *Nicholas Zanzano* of S/C Laboratories, Inc., 37 George St., Newark, N. J.

Wafer is slipped over the tube pins and the tube then inserted into the socket.

* * *

TV ANTENNA ENGINEERS MEET



TV antenna engineering staff of JFD during a recent field test, left to right: Sal Gambardella, chief machine design engineer; Hal Bloomberg, assistant chief antenna development engineer; Douglas H. Carpenter, chief antenna development engineer; Simon Holzman, formerly with Federal Radio and Eng. Corp., who has joined JFD as a field engineer; Jack Goodman, chief production engineer of electronics division, and Arne Benson, chief mechanical development engineer.

Color TV Picture Tubes

(*Continued from page 27*)

lustrated by Fig. 5, which also shows how the *dc* restorers are connected from the common E_Y signal to the respective color difference signals. Thus, the signals appearing across each restorer correspond to the primary colors, namely E_B, E_G and E_R. Because the higher-frequency components are not cancelled, high black-and-white definition is provided by the E_Y signal.

Since the luminance signal applied to the control grids passes through a 0-4 mc filter, and the color difference signals have been obtained through circuits with smaller bandwidths, color difference signals experience a slightly longer delay than the luminance signal in reaching the picture tube. To compensate for this, the luminance signal is applied to the tube by means of a 1-microsecond delay line having a bandwidth of 4 mc.

The Deflection Mask Tube

The single-gun direct viewing tricolor picture tube using a deflection mask also resembles an ordinary black-and-white tube except in screen structure. On the screen of the tube, the phosphor is deposited in the form of strips, each phosphor strip emitting a primary color. To the rear of the screen is a beam deflecting structure consisting of two intermeshed wire grids. If no potential difference exists between these grids, the electron beam passes through them essentially undeflected to impinge on a phosphor strip emitting green light. However, if one grid is positive with respect to the other, the beam is deflected as it passes the wires and as a result excites, let us say, the red phosphor. If the polarity of the voltage existing between the two grids is reversed, then the beam excites the blue phosphor. If the deflection grids are operated at potentials lower than the final screen, then a focusing effect can be produced at the screen.

Since the grids to the rear of the screen in the deflection mask tube are solely for deflection and not for masking purpose, the beam is used with high efficiency.

Circuit Arrangement with the Deflection Mask Tube

In the three-gun shadow-mask tube, information relating to the three primary colors is presented simultaneously. (However, the tube could be used with field, line or dot sequential operating only one gun at a time.)

The deflection-mask tube, on the other hand, utilizing only a single gun must present its colors sequentially to conform to field, line or dot sequential systems. When used with the NTSC compatible system with a 60-cps field rate, it is not feasible to use the tube with field-sequential switching because the flicker would be highly objectionable. Line sequential operation of the tube is relatively easy to perform, but an objectionable effect known as *line crawl* would be observed. In this effect, colored lines appear to move systematically across the face of the tube.

When used dot sequentially, the capacity between the two sets of deflecting grids becomes very important because for this type of operation, a color-switching frequency of 2-10 mc must be used. At these frequencies, the inter-grid capacity presents a very small impedance and the reactive power to drive the grids is large. A sine wave switching signal must be used; green dots occur twice as regularly as the red and blue dots but they are of only about half the duration.

A 3.58-mc signal (synchronized with the local color subcarrier oscillator) is used for this dot switching. The use of such a frequency has certain advantages, the primary one being that it provides a dot interlace in the presentation of the color information

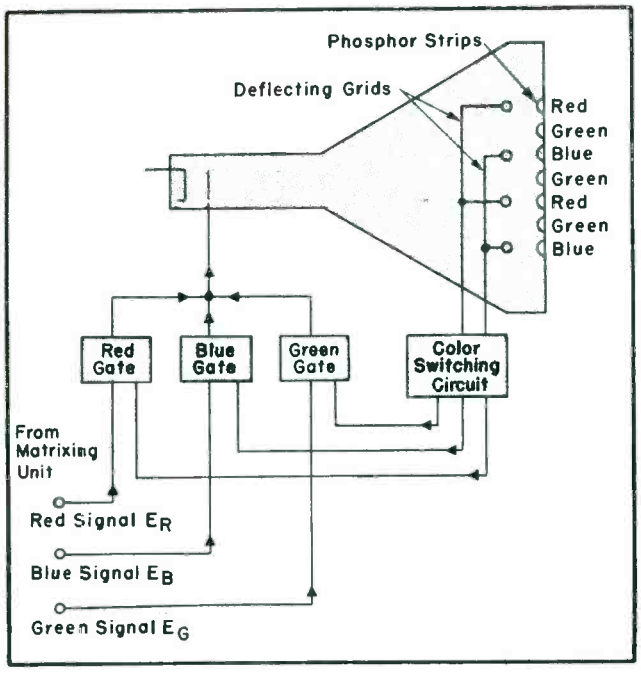


Fig. 6. Diagram illustrating application of video signals to the deflection-mcsk tube

since the color subcarrier is synchronized to the line frequency. Moreover, since the color subcarrier is present on the luminance signal, the use of this frequency eliminates beating effects.

Gating Pulse

In the deflection mask tube, color signals are always fed to the grid of the tube through gating tubes. Fig. 6 illustrates the required circuit arrangement, showing the use of three gates, one for each signal corresponding to a primary color. The gating pulses fed to these gates must be synchronized to the color switching signals applied to the deflection grids. Thus for example, when no potential difference exists between the color switching grids and the beam falls on the green phosphor, the green gate is opened, allowing the E_G signal to be applied to the control grid. Similarly, when a deflecting potential is applied to the grids to deflect the beam on to the red phosphor, the gate in the E_R signal circuit is opened up.

Future Developments

In the not-too-distant future it is highly probable that many other color picture tubes will be demonstrated. Scores of patents have been issued on such tubes but the technical difficulties of developing and fabricating these tubes have hindered their introduction. However, there is good reason to hope that modern technology will expedite their development. So far it is only possible to speculate on the nature of future tubes. It seems almost certain that they will feature only one gun; will not require dynamic focusing or convergence; will require only low power color switching circuits; will exhibit no color contamination but present a really bright picture and probably most important of all, be low in cost.

WHEN YOU CHANGE YOUR ADDRESS

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Coming Events

1954 Pacific Coast Audio Fair: Feb. 4-6
Alexandria Hotel, Los Angeles, Cal.

Radio Engineering Show: Mar. 22-25
Waldorf-Astoria Hotel and Kingsbridge Armory, New York City.

1954 Electronics Parts Show: May 17-20
Conrad Hilton Hotel, Chicago, Ill.

Better Audio

(*Continued from page 23*)

shown in Fig. 7 has been found to be preferred, because it lessens the change of impedance across the earphone transformer as the volume level is changed. Impedance changes often lead to puzzling distortions, and certainly if a low-impedance volume control is used with a high-impedance pair of earphones, as shown in Fig. 7, practically constant loading can be maintained across the earphone transformer. Treble and bass boost tone-control circuits are often desirable, in addition to the volume control.

It should be noted that when an impedance Z_1 is shunted across another impedance Z_2, the resultant impedance is equal to $Z_1Z_2/(Z_1+Z_2)$. In the simple case in which $Z_1=Z_2$, the resultant is $\frac{1}{2}Z_1$. This is a consideration of central importance, because the output transformer in a receiver is designed to reflect the speaker impedance back into the plate circuit of the output tube as an increased value which constitutes a low-distortion plate load. When the earphone transformer is shunted across the secondary of the output transformer, the effective plate load presented to the output tube is lowered. The simplest way to avoid distortion due to impedance lowering is to utilize an earphone transformer, which reflects the impedance of the volume control back

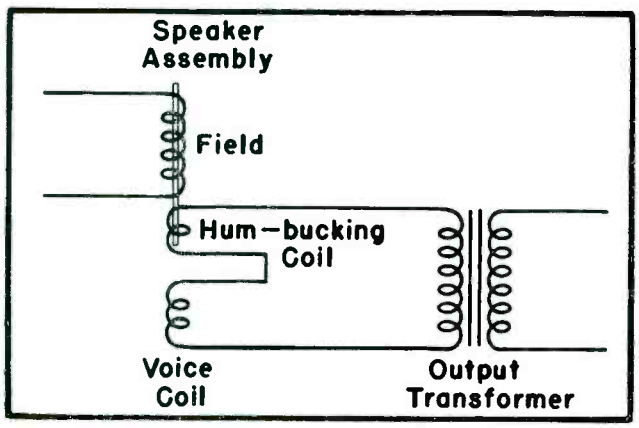


Fig. 5 (left). The secondary of the output transformer is sometimes associated with a hum-bucking coil as well as the voice coil. The likelihood of the secondary withstanding a 2000 volt megger test to chassis is considerably lessened in an arrangement of this type.

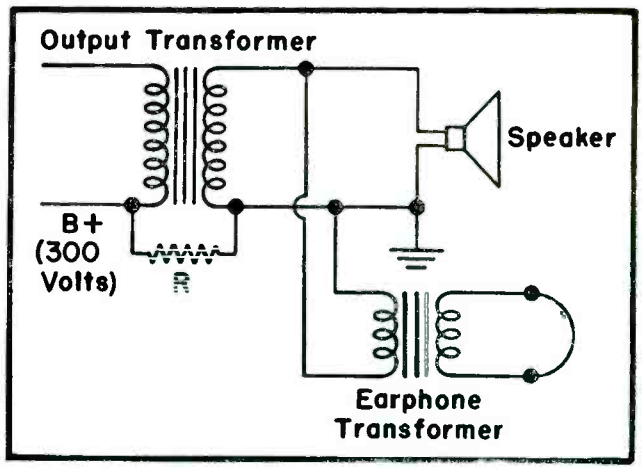


Fig. 6. A preferred basic arrangement for connecting earphones into receiver circuit. When the secondary of the output transformer in the receiver is grounded, the secondary cannot receive B+ voltage, in the event of leakage between primary and secondary. By use of a separate earphone transformer, the earphone circuit is ungrounded, affording safety to the user in switching lamps off and on, as well as in switching a hot chassis receiver off and on. The dotted resistance R indicates a B+ leakage path which can inject plate-supply voltage into the speaker circuit.

into the secondary of the output transformer, with a value at least five times that of the speaker impedance. The speaker impedance is commonly assumed to be equal to 1.3 times the *dc* resistance of the voice coil; Fig. 8.

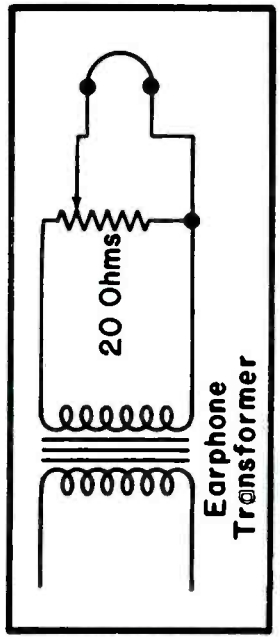
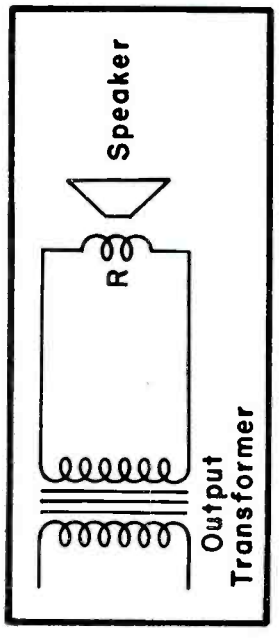


Fig. 7. Volume control in the earphone circuit arranged as a bleeder across the transformer secondary to minimize impedance change across circuit as the volume level is varied. Use of high-impedance earphones further minimizes undesirable impedance changes.

Fig. 8. The ac impedance of the speaker is roughly equal to 1.3 times the dc resistance, R, of the voice coil. The turns ratio of the output transformer steps up this impedance (reflects the impedance) to the primary winding with a value which provides a low-distortion plate load for the output tube. Tube manufacturers publish recommended plate load values in tube manuals. One should note that when the winding of another transformer is shunted across the secondary of the output transformer, the effective plate load for the output tube is lowered; the incorrect plate-load impedance can result in noticeable distortion. Suitable arrangements can be used to maintain proper plate-load impedance.



SPRAGUE CAPACITOR GUIDE AND PLASTIC PACKAGE

A capacitor replacement guide, *C-452*, designed to hang on the wall, has been prepared by the Sprague Products Co., 61 Marshall St., North Adams, Mass.

Featuring flip-type pages, guide lists all Sprague capacitors and provides data on capacitance, *wvdc*, diameter and length, catalog number and price.

A replacement line of ceramic capacitors, furnished in clear molded Plasti-Pak polystyrene boxes, has also been announced.

Rigid reuseable containers have a hinged lid and a snap lock. Also available for printed circuit units, with labels showing complete circuit diagram and application notes.

* * *

RCA DEVELOPS COLOR TV TRAINING PROGRAM

A training and educational program, designed to provide complete information on the theory and practice of installation and service for color TV receiving equipment, before the first commercial color sets reach the public, has been announced by the RCA Service Co.

The program is divided into four major elements. One is a series of two-day technical clinics to be held in 65 key cities across the country, starting early in February. Clinics will be conducted by technical specialists of RCA Service using textbooks, test equipment, and other instructional materials developed, especially for the clinics by the company. Service dealers and Service Men in each city will be invited to attend.

RCA Service has also prepared a textbook, *Practical Color Television for the Service Industry*, illustrated by photographs in four colors, which graphically depicts service techniques for color TV receiver installation and maintenance.

Copies of the book will be available to Service Men completing the clinics. It will also be made available either through RCA parts and tube distributors or directly from the RCA Service Co., Camden, N. J., at $2.00 per copy.

* * *

FEDERAL OPENS REGIONAL WAREHOUSES

A regional program of warehouse facilities for the distributor market, with the opening of a New England outlet at 292 Main St., Cambridge, Mass., has been announced by the Federal Electric Corp., Clifton, N. J.

Outlets will facilitate the flow of selenium rectifiers, coax cable, TV leadin, picture tubes and germanium diodes, manufactured by FTR. Orders on the warehouse are being handled through *Abbett and Hustis*, 1105 Commonwealth Ave., Boston, Mass. Warehousing facilities are already in operation on the west coast and in the southwest.

ALL-CHANNEL APPOINTS BING CROSBY ENTERPRISES COAST DISTRIBUTOR

Bing Crosby Enterprises, Inc., has been appointed exclusive west coast distributor to handle the line of motorless all-direction antennas produced by the All Channel Antenna Corp., 70-07 Queens Blvd., Woodside, N. Y.

Bing Crosby Enterprises has established dealer franchises.

* * *

SYLVANIA REVISED PICTURE-TUBE COMPARISON WALL CHART

A new version of the *TV Picture Tube Comparison Chart*, has been announced by Sylvania.

Over 160 different picture tube types are listed on the chart. Added informational features in this new chart include ion trap listings and base diagrams. Face, body, focus, deflection angles, basings, and length in inches on all tubes are also included. Can be obtained free from Sylvania advertising distribution department, 1100 Main St., Buffalo, N. Y.

* * *

PROFIT-SHARING AWARD

Harry Resnick (left), president of Channel Master Corp., presenting check for $332,531.43 to the trustee of the company's employee profit-sharing retirement fund. The amount, 15% of the year's earnings up to September 30, '53, of the 574 participants employed, was said to be the maximum contribution permitted by law. Contributions to the fund, based solely on Channel Master's profits, consist of 10% of the first $125,000 of net profits and all profits above that, up to the maximum limit.

JOTS AND FLASHES

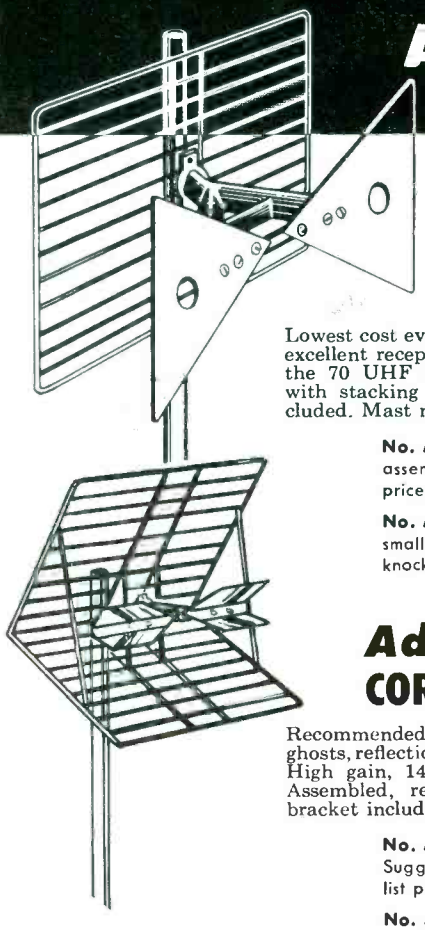
COLOR TV chassis will not only employ a host of new components, but special types of tubes, too. G.E. has already announced the development of a miniature triple diode, coded 6BJ7, whose primary application is as the *dc restorer* for the three signal channels of color receivers. The electrical characteristics of each section of the 6BJ7 are similar to those of each section of the 6AL5 twin triode. . . . *Ludwig Arnson,* 70-year-old prexy of Radio Receptor Co., Inc., was honored recently by the VWOA on the 50th anniversary of his key-clicking of the first distress call by wireless from S.S. Kroonland. . . . *Dick O. Klein,* vice president and general manager of Raytheon Distributors, Inc., has been appointed director of marketing for the TV and radio division of the Raytheon Manufacturing Co. . . . *Don G. Mitchell,* chairman of the board of Sylvania Electric Products, Inc., has been named Commerce & Industry chairman for the 1954 campaign for members and funds of the New York Chapter, American Red Cross. . . . *Dr. Allen B. Du Mont* was recently selected for the *Hall of Fame in Distribution* by the Boston Conference on Distribution. The citation was made for distinguished contribution to the advancement of distribution through TV in the last quarter century. (The Boston Conference is a permanent group sponsored by the Boston Chamber of Commerce in cooperation with leading Massachusetts universities and colleges.) . . . Five RCA Fellowship awards by RCA to young scientists and graduate engineering students for the 1953-1954 college year were announced recently by *Dr. C. B. Jolliffe,* vice president and technical director of RCA. The fellowship grants, which range from $1,800 to $2,700, went to *Harold S. Rothman, Robert C. Miller, William Y. Stevens, Peter H. Lord,* and *Robert A. Kudlich.* . . . A community TV system has been installed in Vancouver, by *Spencer-Kennedy Lab's* licensee in western Canada, Research Industries, Ltd., for Tru Vu Television Ltd. The system will be expanded to service eventually 100,000 sets. In full operation, channel *2* from Vancouver, channels *4, 5,* and *7* from Seattle, channel *12* from Bellingham, and channels *11* and *13* from Tacoma, and a closed loop channel will be distributed. To date, 30,000' of K-14, 50,000' of RG-11/U, and 25,000' of RG-59/U cable have been installed in the initial section of the city. The longest run from the antenna will be 14 miles and total area to be served will be 20 by 8 miles. At present, 2,500 dwelling units are being serviced. . . . *Webster-Chicago Corp.* will establish a branch assembly plant at New Ulm, Minn., early in '54, it was reported recently by *R. F. Blash,* president. . . . . Electro Products Labs have expanded production area at their plant, 4501 North Ravenswood Ave., Chicago, adding 30 per cent more floor space. . . . *Bob Middleton,* formerly with RCA and Precision Apparatus, has joined the sales-engineering division of Simpson Electric Company, Chicago. In his new position, Middleton will conduct lectures for Service Men throughout the country A novel twist will be an open invitation to all who attend the meetings to bring their *can't-fix-it* repair problems to the sponsoring jobber the following morning. Bob will personally tackle each repair problem with Simpson test equipment.

ADVERTISERS IN SERVICE, JANUARY, 1954

Admiral

ALL-CHANNEL UHF ANTENNAS

HIGH GAIN LOW COST



Admiral BOW TIE

Lowest cost ever for a quality UHF antenna. Gets excellent reception in good signal areas on any of the 70 UHF channels. Each antenna furnished with stacking bar. Mast mounting brackets included. Mast not included.

No. AN65A—Deluxe—Shipped completely assembled. Suggested list price **$5.95**

No. AN65B—Standard—Similar to above, smaller reflector screen. Shipped knocked-down. Sug. list price . . **$3.95**

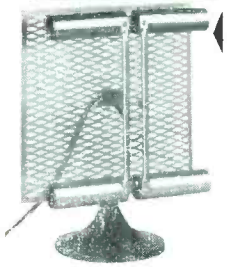
Admiral CORNER REFLECTOR

Recommended for troublesome locations where ghosts, reflections and interference are encountered. High gain, 14db. Front to back ratio 15 to 1. Assembled, ready to put up. Mast mounting bracket included. Mast not included.

No. AN56A—One bracket mounting. Suggested list price **$11.25**

No. AN56B—Same as above, front mounting. Suggested list price **$11.25**

INDOOR UHF ANTENNAS



Admiral Super

Recommended for troublesome locations. Exceptionally high gain . . . over 7 db. . . . excellent ghost suppression. Only 12 inches wide. Weighted and felt padded base.

No. 94A10-6—Complete with lead-in. Suggested list price . . **$12.95**

Admiral Target

Smartly styled in rose-gold colored anodized aluminum with mahogany phenolic base. Stands only 10 inches high. Base is weighted and felt padded . . . can be placed on top of receiver . . . picks up all UHF channels.

No. 94A10-7—Complete with lead-in. Suggested list price. **$4.95**

You'll make an *extra profit* on every installation using these high gain UHF antennas. Ask your Admiral distributor about the *extra large discounts* from the list prices quoted here.

You'll be giving your customer extra value, too! All these antennas are finest quality . . . made with aircraft aluminum antenna elements and vibration-proof reflectors. "A-frame" insulators provide plenty of free air space around elements. The units have high mechanical strength and low resistance. They are *double* plated for extra resistance to weathering . . . first zinc plated, then dipped in zinc dichromate which gives them a beautiful gold finish. These antennas can be easily fastened to existing masts and towers. Order by part number from your Admiral distributor.

Ask your *Admiral* distributor for

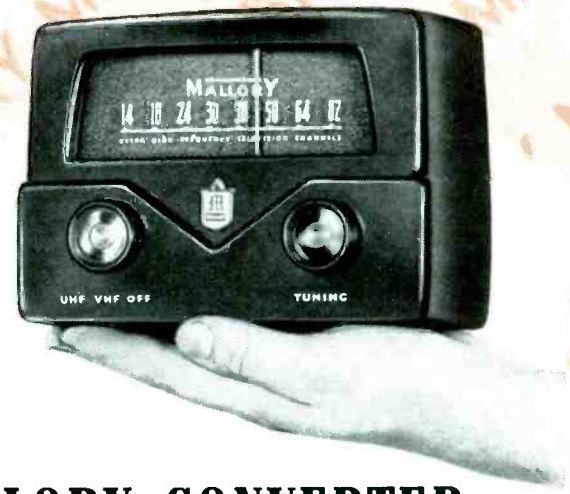
FREE CATALOG

with complete line of *Admiral* TV antennas and accessories

Admiral Corporation
Accessories and Equipment Division,
Chicago 47, Illinois

Depend on Mallory
for
Approved Precision Quality

The sales leader—
proved in every UHF area



Now... The MALLORY CONVERTER Packs *ALL* Features in Half the Size!

The new Model 88 has these important Sales Advantages originated by Mallory:

Less than half as large . . . measuring only 7⅝" wide x 5⁹⁄₁₆" high x 4⅝" deep . . . yet full Mallory quality.

It has linear tracking. Tuning is easier, more exact than ever. No bunching of channels.

The Preselector in the new 88 protects against image interference, oscillator radiation and interference at the IF frequency. It insures better selectivity.

The Mallory 88 Converter adds *all* UHF channels to *any* TV set without sacrificing a single VHF channel.

Design refinements and precision quality of the 88 assure high quality picture definition and easy tuning.

The customer has nothing more to buy, no adjustments to make for additional new channels . . . even if he moves to another area.

Installation is easy. It only takes a few minutes to connect the antenna and power leads from the Converter to the set. It can be done right in the customer's home.

ASK YOUR MALLORY DISTRIBUTOR *for complete details of the new, handsome, compact Model 88 Converter. It can be your answer to bigger profits . . . just as all Mallory Converters have been for dealers in areas where UHF is already on the air.*

P. R. MALLORY & CO. Inc.

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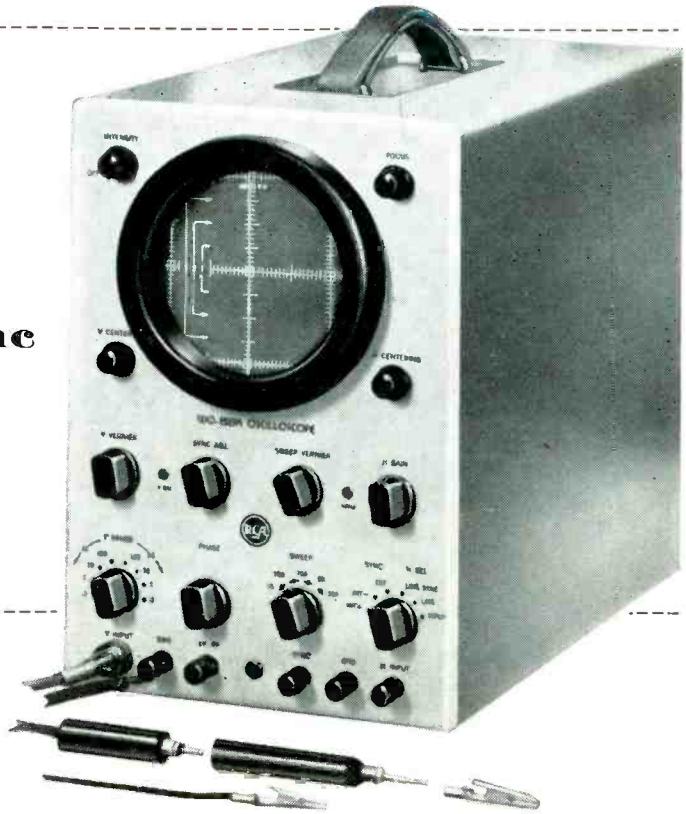
Now... only $149.50
Suggested User Price

the popular RCA WO-88A

featuring . . .

- ✓ **Voltage-Measuring Facilities**
- ✓ **"Plus" and "Minus" Sync**
- ✓ **High-Input Resistance**
- ✓ **Low-Input Capacitance**



Check these "extra" features

- Direct-coupled vertical amplifier
- 5" Cathode-ray tube with magnetic shield
- 60-cycle sweep with wide-angle phasing control
- Frequency-compensated attenuators
- "Voltmeter-type" vertical attenuator
- "Voltmeter-scale" type graph screen
- 1-volt peak-to-peak calibrating voltage
- 'Scope is completely stable—even at maximum sensitivity of 25 millivolt-per-inch
- Quick "recovery" time, freedom from line "bounce"
- Completely shielded input cable eliminates hum and noise pickup

Specifications—

- **Deflection Sensitivity:** (vertical amplifier) 25 rms millivolts or better per inch.
- **Vertical-Amplifier Frequency Response:** Flat from dc to 100 Kc; within —3 db at 500 Kc; within —10 db at 1 Mc.
- **Input Resistance and Capacitance:** 10 megohms and 9.5 uuf with WG-216B Low-Capacitance Probe.
- **Sweep-Circuit Frequency (four ranges):** 15 cps to 30 Kc.
- **Square-Wave Response:** Negligible tilt and overshoot.
- **Average Rise Time** (Vert. Amp.): 0.5 microsec.
- **Power Supply:** 105-125 volts, 50-60 cycles.
- Size 13½" high, 9" wide, 16½" deep. Weight only 25 lbs. (net).

The WO-88A has *built-in* voltage calibrating facilities which permit *simultaneous* waveshape display and peak-to-peak voltage measurements. Frequently, the *shape* of the TV waveform under observation will be correct but its *amplitude* will be low and, consequently, cause improper operation. Therefore, a TV 'scope is complete only if it can measure the peak-to-peak voltage of the displayed waveform. *Check this feature on the "88"!*

On the WO-88A, sync polarity may be reversed instantly by simply clicking a front-panel switch. This feature is important because TV pulses may be either positive or negative, depending upon where the 'scope is connected. To avoid waveshape "jitter" or distortion, use a 'scope which will "lock in" readily on all types of TV waveforms. *Check this feature on the "88"!*

When you use the low-capacitance probe supplied with the WO-88A, the over-all input resistance is raised to 10 megohms! Because many TV circuits are extremely sensitive to resistive loading, normal circuit operation may be seriously disrupted by loading of the average 'scope. With the low-capacitance probe, however, loading problems are minimized. *Check this feature on the "88"!*

In addition, the low-capacitance probe supplied with the WO-88A decreases the over-all input capacitance to less than 10 uuf! Excessive capacitance loading can cause the horizontal oscillator to change frequency or stop oscillating. When the WO-88A is connected, the low over-all input capacitance leaves receiver operation essentially unaffected. *Check this feature on the "88"!*

Get full details today from your RCA Distributor or clip coupon and mail to:

RCA Commercial Engineering
Section A-44-W, Harrison, N. J.
Please send me your new folder on the RCA WO-88A Oscilloscope.

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