RADIO • TELEVISION • ELECTRONIC

SERVICE

VOL. 23

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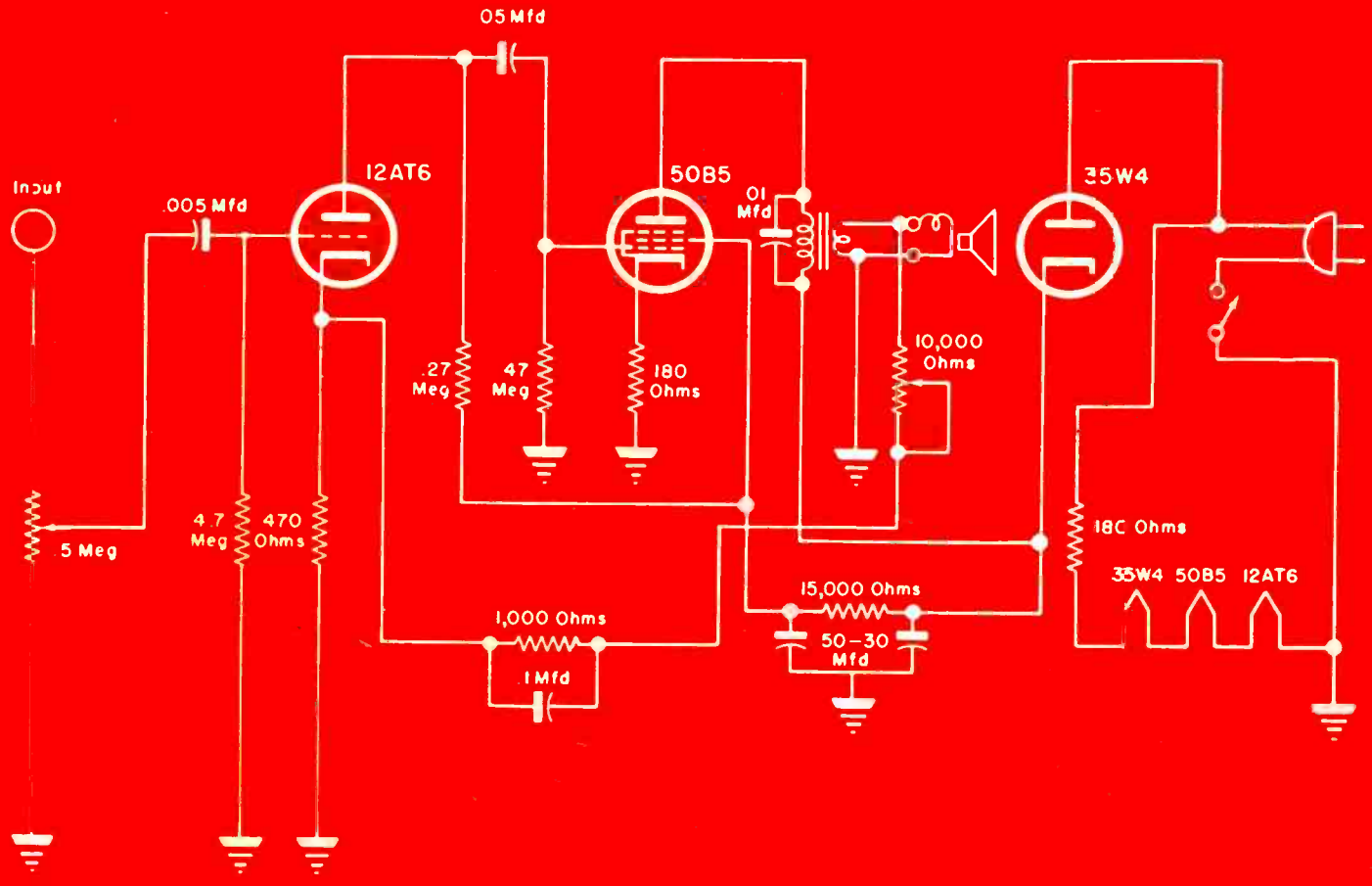
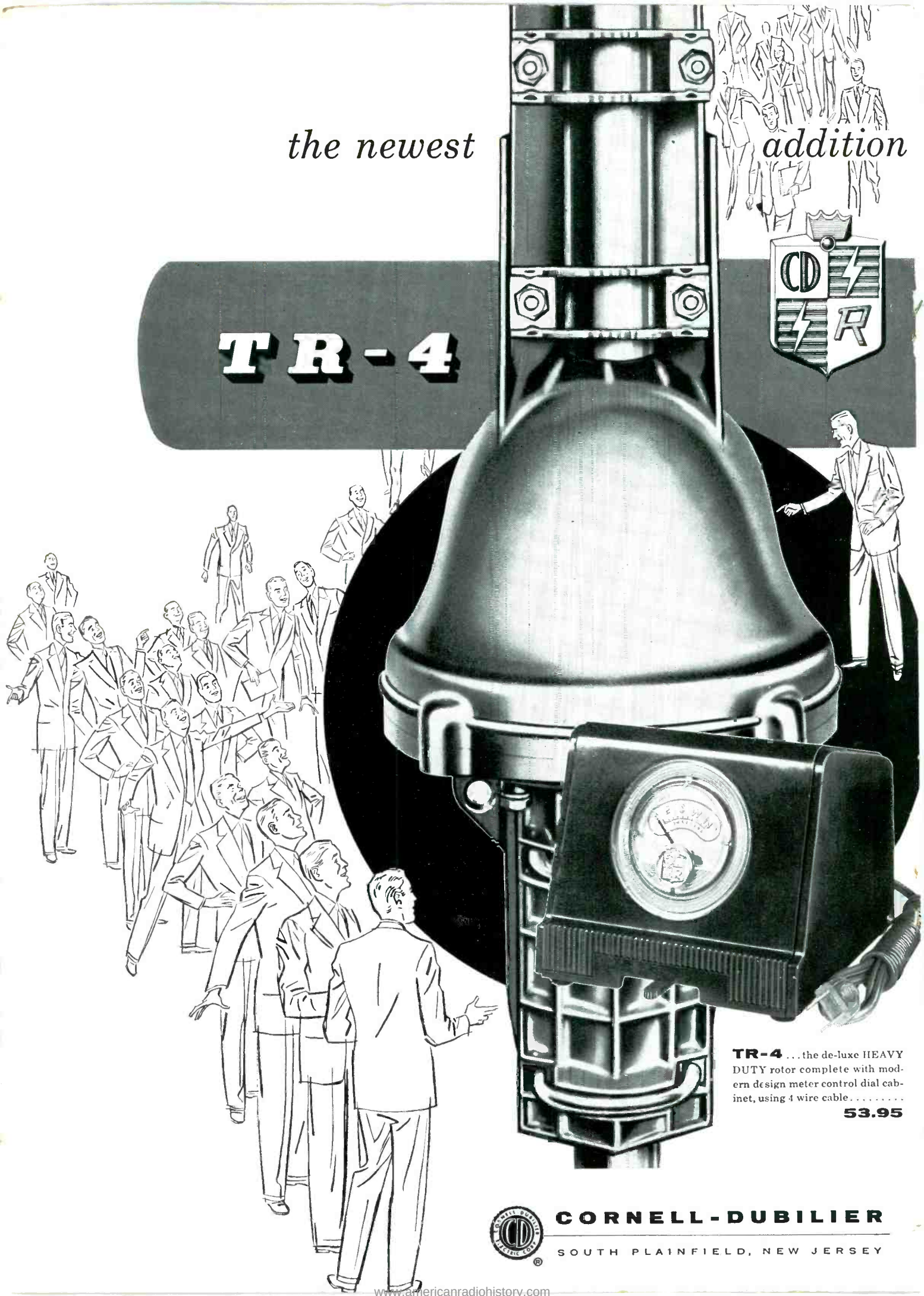
FEBRUARY 1954



Printed-circuit two-stage audio amplifier with feedback-type tone control.
[See circuit analysis, this issue]

the newest *addition*

TR-4



TR-4 . . . the de-luxe HEAVY DUTY rotor complete with modern design meter control dial cabinet, using 4 wire cable **53.95**

CORNELL-DUBILIER

SOUTH PLAINFIELD, NEW JERSEY

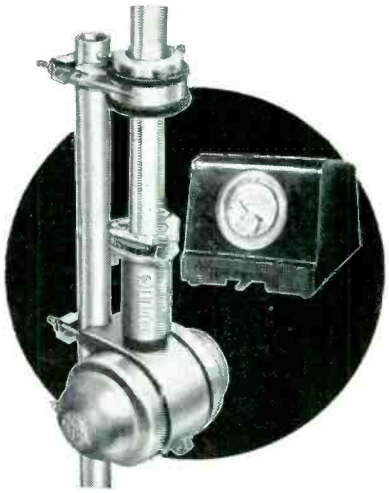
to the family of C·D·R Rotors

C·D·R ROTOR

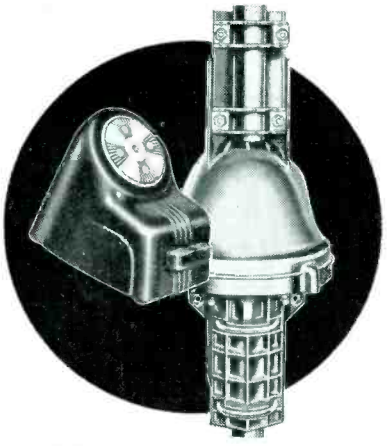
the ultimate in heavy duty Rotors

incorporating all the fine features
that have made the TR-2 outstanding
plus these fine features:

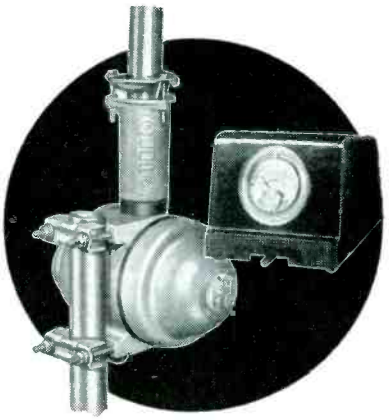
★ Handsome Meter Dial Cabinet **★ Uses 4 Wire Cable**



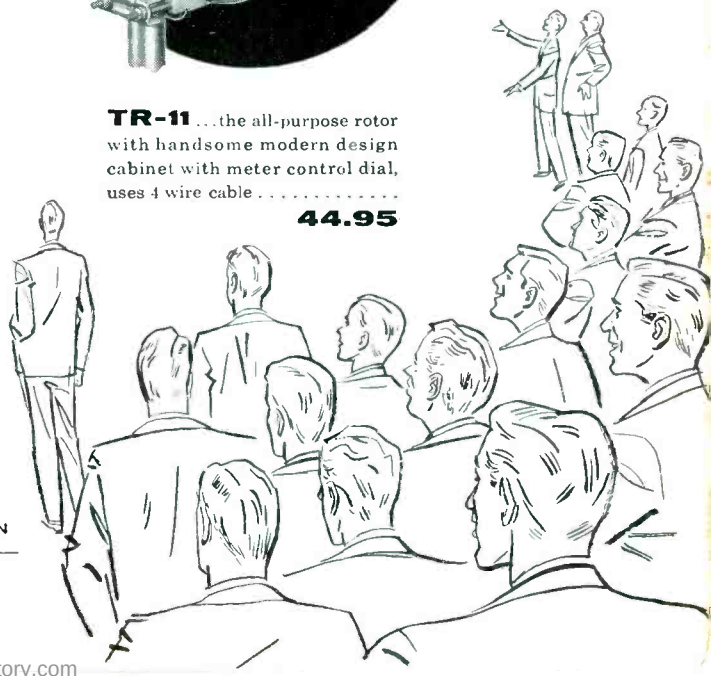
TR-12 . . . a special combination value consisting of complete rotor, including thrust bearing . . . handsome modern design cabinet with meter control dial, 4 wire cable
47.95



TR-2 . . . . the Heavy-Duty rotor, complete with "Compass Control" cabinet having illuminated "perfect pattern" dial . . .
49.95



TR-11 . . . the all-purpose rotor with handsome modern design cabinet with meter control dial, uses 4 wire cable . . . . . .
44.95



THE **RADIART** CORPORATION
CLEVELAND 13, OHIO

Vol. 23, No. 2

RADIO • TELEVISION • ELECTRONIC
SERVICE

February, 1954

LEWIS WINNER
Editor

B. BLOCK
F. WALEN
Assistant Editors

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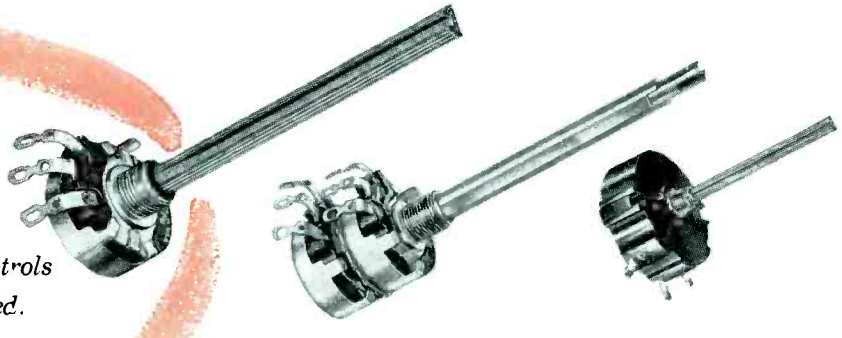
NO. 1 CHOICE

of service technicians for

TV CONTROLS*



Not Claims! Not Predictions! But Plain Facts! More Service Technicians prefer IRC TV Controls than the next 2 brands combined. Proved by unbiased, authoritative, independent surveys.

ASK FOR IRC TV CONTROLS... MOST SERVICE TECHNICIANS DO!

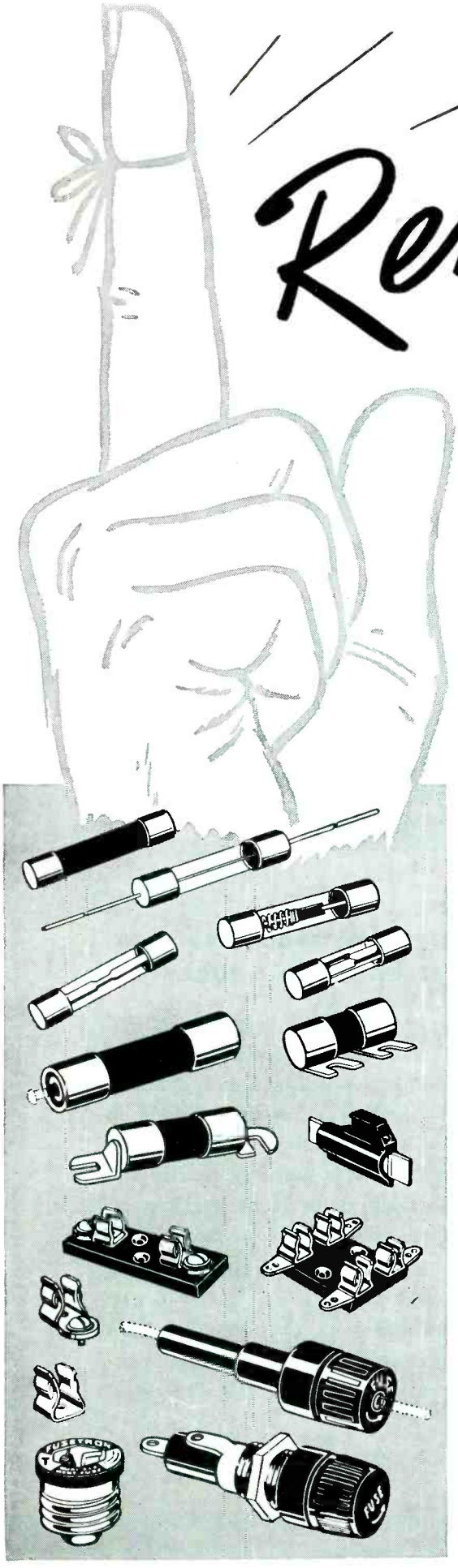
IRC

INTERNATIONAL RESISTANCE COMPANY

413A N. Broad Street, Philadelphia 8, Pa.

In Canada: International Resistance Co., Ltd., Toronto, Licensee

Wherever the Circuit Says



Remember!

For "Trouble-Free" Fuses Handle BUSS FUSES

There is a reason manufacturers and service organizations have learned to rely on BUSS fuses to operate properly under all service conditions. Every BUSS fuse normally used by the Electronic Industries is tested in a sensitive electronic device that rejects any fuse that is not correctly calibrated, properly constructed and right in all physical dimensions.

Once properly installed, a BUSS fuse will blow only to protect. If a BUSS fuse does blow, the service man knows there is trouble in the circuit. When he has corrected the trouble and installed a new BUSS fuse the job is finished. There won't be any costly and time-wasting "call-backs" due to the fuse failing to operate properly . . . because a BUSS fuse will carry its rated current and it is properly constructed to prevent poor contact heating causing needless blows.

And by standardizing on BUSS fuses, you can fill your exact fuse needs from one source. The line is complete-dual-element (slow-blowing), renewable and one time types . . . in sizes from 1/500 ampere up.

To your customers too, the BUSS trademark represents quality.

Millions and millions of fuses, used throughout the country for over 39 years, have firmly established BUSS as the *known* brand. When you furnish a BUSS fuse, there are no "kicks" or "comebacks" from the customer. It's just good business to handle only *genuine* BUSS fuses.

FUSETRON

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

For More Information *Mail this Coupon*

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me bulletin SFB containing facts on BUSS small dimension fuses and fuse holders.

*Name*_____

*Title*_____

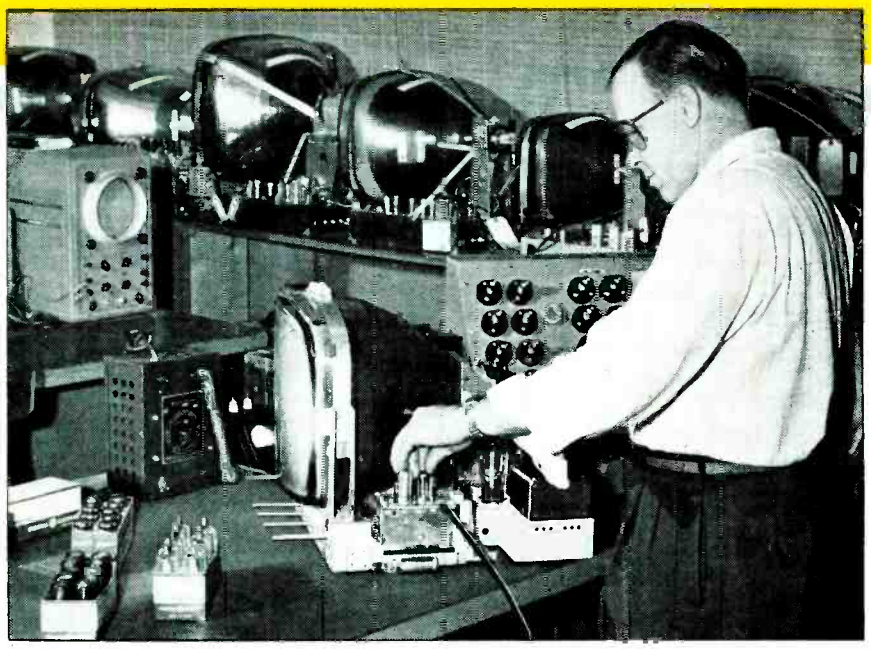
*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ S-254

Now G-E TUBES ARE SERVICE-TESTED

IN INDIANAPOLIS: Howard W. Sams & Co., Inc. regularly checks the performance of current-production G-E tubes in all popular TV chassis, at various line voltages.



A Howard Sams staff member tests General Electric tubes in one of a series of TV chassis of different makes. The preheating panel at right makes it possible to have up to 30 tubes ready at one time for substitution and test.

GE Electronic TUBES

Simplify your tube requirements, reduce service call-backs, with G-E interchangeable tubes!

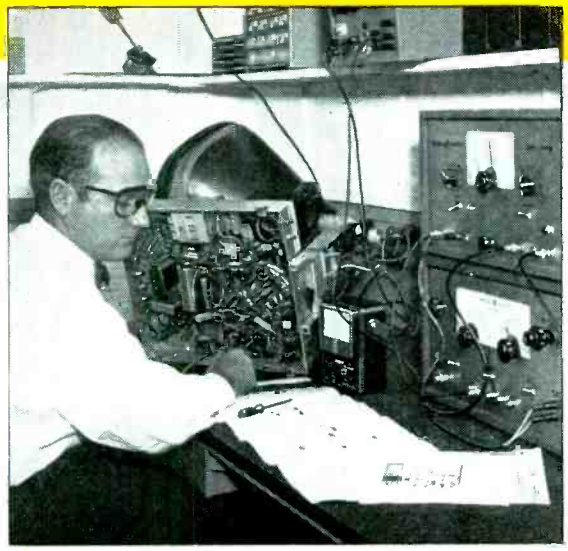
SINCE September, 1953, the nationally-known Howard Sams TV-radio technical organization has checked G-E receiving tubes for servicing interchangeability.

A number of tubes of each type are selected periodically for test. The tubes are fully representative of normal production—their performance ranges all the way between top and bottom limits of the permissible variation in tube characteristics. The tubes are all tested at various line voltages in TV chassis of different makes. Their performance is accurately checked by instruments. When a tube fails to operate satisfactorily in any chassis, that fact is noted in the detailed report sent by Howard Sams to General Electric.

Based on these reports, G.E.—as described at right—takes prompt corrective steps that help give you tubes you can install successfully in every make receiver!

FOR TV-SET INTERCHANGEABILITY!

AT GENERAL ELECTRIC: the Howard Sams reports are carefully studied for ways in which G-E tubes may be improved for wider usefulness in servicing.



A General Electric tube engineer—with a Howard Sams analysis before him—re-checks tube performance in the same make of chassis where difficulties were reported.

A General Electric executive micro-inspects a tube structure, to determine whether or not manufacturing or test requirements need to be changed.

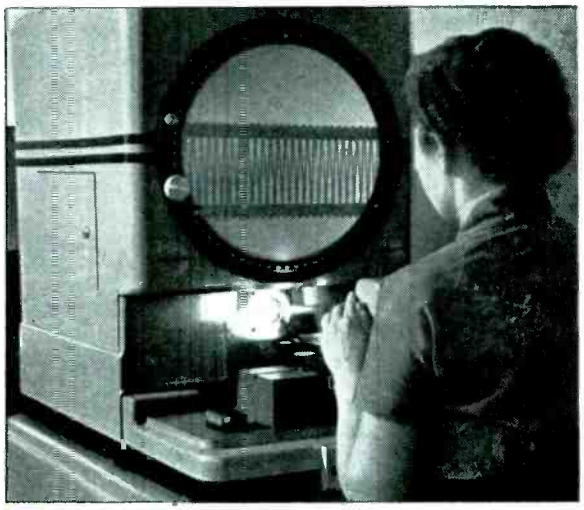
Ever-better quality is the aim of G-E tube manufacture and testing!

So that G-E tubes will give superior service in *all* receivers, G.E. exhaustively studies each case of unsatisfactory performance reported by Howard Sams.

First, a cross-section of General Electric tubes of that type is tested in the same make TV chassis where trouble was encountered. Afterwards, tubes other than G-E are substituted and checked.

By comparison and analysis, any G-E tube performance fault is established and isolated. The cause then is determined by laboratory investigation, and corrective steps follow immediately. These may take the form of an improvement in manufacture or inspection, or revised tube test specifications.

Result: you are always installing *better G-E tubes.* Your General Electric tube distributor is your source for a product that is constantly being improved in quality and interchangeability. *General Electric Co., Tube Department, Schenectady 5, New York.*



A General Electric plant employee checks a tube grid, using a comparator that greatly magnifies the component which is to receive special attention.

GENERAL ELECTRIC

161-1A1

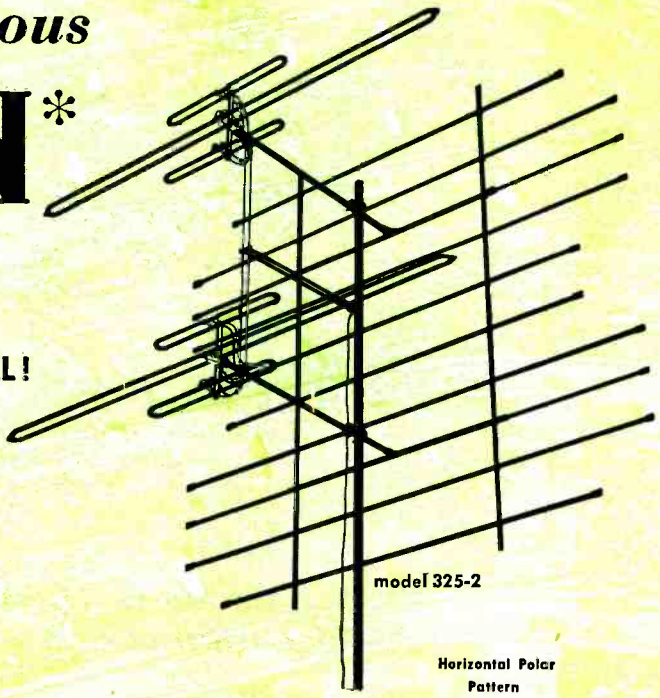
over 100,000 already installed!


model 325-4


model 325

CHANNEL MASTER'S *fabulous*

CHAMPION*


model 325-2

the world's most powerful all-channel VHF antenna —OUT-PERFORMS AND OUT-SELLS THEM ALL!

Never before in the history of television has an antenna received such an overwhelming reception. Channel Master's CHAMPION — in a few short months — has rocketed to the top as the nation's most-wanted, best-selling, best-performing VHF antenna!

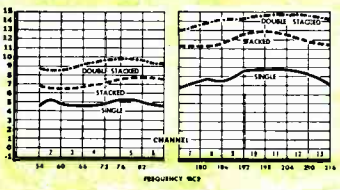
CHAMPIONSHIP Performance: Only the CHAMPION has the unique new "Tri-Pole", a *triple-powered dipole system* in which the Low Band dipole also functions as *three* dipoles tied together, in phase, on the High Band.

All-aluminum. Assembles faster than a 5-element Yagi! The CHAMPION is *another* great contribution of the Channel Master Antenna Development Laboratories.

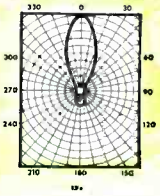
CHAMPIONSHIP Promotion: The CHAMPION is the antenna America knows best!

• Publicized in leading magazines! • Outstanding dealer Cooperative Advertising Program! • Free newspaper mats, window streamers and TV film commercials!

gain above tuned reference dipole



Horizontal Polar Pattern (Relative Voltage)



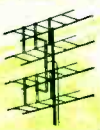
THE STACKED CHAMPION PROVIDES:

11-13 DB High Band gain

6½-7½ DB Low Band gain

THE STACKED CHAMPION OUT-PERFORMS

this . . .



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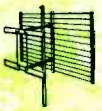


this . . .

or this

Model No.		List Price
325	Single Bay	$20.83
325-2	2-Bay	$42.36
325-4	4-Bay	$88.89
Separate Stacking Harness		
325-3	2-Bay Harness	$ 2.08
325-5	4-Bay Harness	$ 4.17

CHANNEL MASTER CORP.

ELLENVILLE, N. Y. WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

*pat. pending

TIE SEPARATE ANTENNAS TO ONLY ONE TRANSMISSION LINE

CHANNEL MASTER inter-action filters

Only *Channel Master* filters are permanently sealed in a block of moisture-proof, high melting-point electrical wax, locked in an attractive styrene case.

- Single lead
- No switching
- No signal loss
- No inter-action, effective isolation.

VHF only

New!

TENNA-TIE

model no. 9033-A

Use with leads of any length!

New, specially designed High and Low Pass filters entirely eliminate the need for critical lead lengths! This new, extremely effective circuit makes the TENNA-TIE the most effective filter of its type now available.

— *only* $3.50

VHF-UHF

ULTRA-TIE

model no. 9034

JOINS — separate VHF and UHF antennas for use with a single lead.

SEPARATES — VHF and UHF signals at the set or converter where separate terminals are provided.

"Free-space" terminals.

new low price — $3.75

VHF-UHF

TRIPLE-TIE

model no. 9035

Ties together all *three* TV reception bands:

1. *Low Band VHF*
2. *High Band VHF*
3. *All UHF*

High and Low Pass filters enable the Triple-Tie to adapt all Hi-Lo VHF installations to UHF — quickly and effectively. "Free-Space" terminals for perfect all-weather UHF reception.

new low price— $4.86

THE ANTENNA IN COLOR TELEVISION

by Harold Harris, *Vice President, Sales and Engineering*

Now that color telecasting is a reality, we will see an ever-increasing flow of color sets to the consumer. Although much is being said and written on the subject of color sets, many unanswered questions remain about the role of the television receiving antenna in color television.

Will present antennas work on color?

Will a special antenna be needed?

The results of thorough laboratory and field tests made by engineers of the Channel Master Antenna Development Laboratories show that practically all present TV antenna types will perform satisfactorily on color. Gain variations as high as 3 DB across one channel can be tolerated. When this figure is exceeded blurring or smearing of the picture may occur. Although there are certain antennas on the market which do have excessive gain variation, this is not the case of the vast majority of present installations.

There are also indications that fringe area color reception may be more critical. This may necessitate the use of fringe area antennas in areas closer to the TV station.

In the nation's most advanced television research laboratory, Channel Master antennas have always been designed for full band width and minimum variation in gain on any one channel.

For this reason, every Channel Master antenna which you have installed in the past, as well as the ones you install today, will provide reception of outstanding quality when color TV comes to your area.

Channel Master antennas were the antennas selected for the tests which led to the F.C.C.'s approval of the National Television Standards Committee color system.

TRIPLETT 630 Volt-Ohm-Mil-Ammeter "speaks" for itself in any company

TRIPLETT 630 Volt - Ohm - Mil - Ammeter has many significant advantages and features that make it stand distinctly apart from similar instruments in its price class. Actually in components, in engineering, in minutely accurate performance, Triplett 630 closely approaches laboratory standards.

Since the scales of any VOM comprise the means by which it makes its multiple services most valuable, the legibility and easy-read-ability are of prime importance. Triplett engineers have created in Triplett 630 the longest scales available in this size tester. (The upper arc by actual measurement is four and three-eighth inches.)

This long-scale factor accounts for the ease with which precise readings are easily made. Further legibility is gained by use of black and red scale markings. D.C. and D.B. are black and white. A.C. and Ohm markings are red on white. Ohms from one hundred million to one-tenth ohm mark the range of this amazing scale. On low ohms, center scale reading is 4.5 ohms.

The Single Switch

Further indication of the practical skill and engineering "know-how" behind Triplett 630 is the Single Switch. Its simplicity of operation assures no burn-outs thru momentary memory lapses. There is instant switching to desired circuit thru a single 2½" knob flush with the face panel. The molded switch itself embodies the most advanced engineering practices. Fully enclosed, the silvered contacts are kept permanently clean. Its rugged construction means stronger performance and longer life.

These two factors are but samples of the many ways in which on-the-job needs have been anticipated and provided for in a beautiful streamlined tester. It provides A.C.-D.C. Volts, D.C. Micro-amperes, Milliamperes, Amperes, Ohms, Megohms, Decibel and Out Put readings in a no-short design embodying interior construction with all direct connections; no harness cabling. Its fool-proof unit switch construction houses precision resistors in insulated recesses in direct connection with switch contacts.

Study the following Ranges and descriptions and compare them point by point with *any* similar instrument for conclusive proof that Triplett 630 "speaks" for itself in *any* company.

Ranges

D.C. Volts: 0-3-12-60-300-1200—at 20,000 Ohms/Volt (For Greater Accuracy on TV and other High Resistance Circuits.)
A.C. Volts: 0-3-12-60-300-1200-6000—at 5,000 Ohms/Volt (For Greater Accuracy in Audio and other High Impedance A.C. Circuits.)
Decibels: −30, +4, +16, +30, +44, +56, +70. (For Direct Reading of Output Levels.)
D.C. Microamperes: 0-60—at 250 Millivolts.
D.C. Milliamperes: 0-1.2-12-120—at 250 Millivolts.
D.C. Amperes: 0-12—at 250 Millivolts.
***Ohms:** 0-1,000-10,000—(4,4-44 at center scale).
***Megohms:** 0-1-100—(4,400-440,000 center scale).
Output: Condenser in series with A.C. Volt ranges.

**Resistance ranges are compensated for greatest accuracy over wide battery voltage variations. Series Ohmmeter circuits for all ranges to eliminate possibility of battery drain when leaving switch in Ohms position.*

Get a Triplett 630 into your own hands at your distributor.
U.S.A. Dealer Net $3950

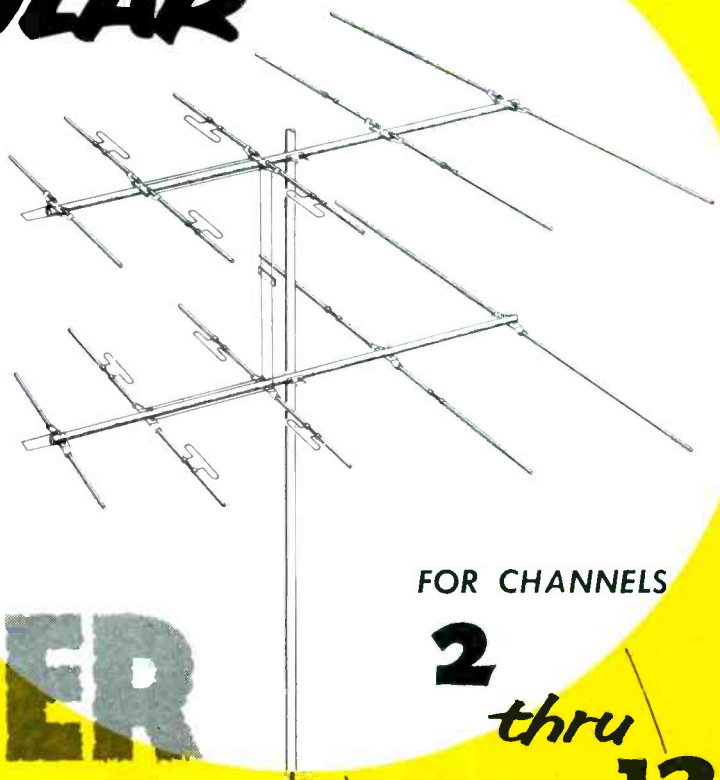
TRIPLETT ELECTRICAL INSTRUMENT COMPANY
BLUFFTON, OHIO

TRIPLETT

THE MOST

SPECTACULAR

ANTENNA DEVELOPMENT IN YEARS . . .

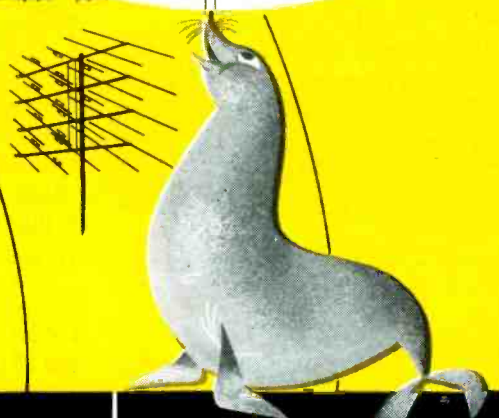


THE

TACO

TRAPPER

FOR CHANNELS **2** *thru* **13**



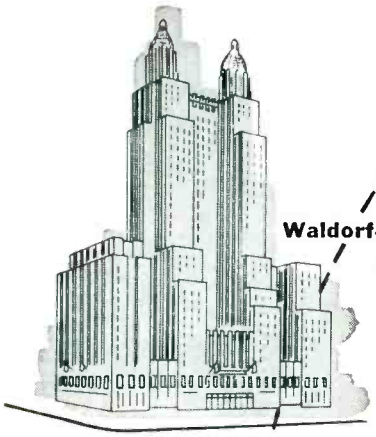
GAIN: Up to 10 DB single and 13 DB two bay stacked	**DIRECTIVITY:** Excellent pattern and high front-to back ratio for ghost-free performance	**SIZE:** No larger than a single channel five element low band Yagi	**DURABILITY:** High tensile strength aluminum and Fiberglas insulation assures stability
APPEARANCE: Streamlined and symmetrical. Provides neat installation	**COLOR TV:** Sharply directional, a color TV requirement	**PACKAGING:** No KING SIZE cartons —easily transported & stored	**PRICE:** Cat. No. 1880 Trapper. List: $19.75 ea. Cat. No. 1882 Stacking lines. List: $1.75 pr.

All around, your BEST antenna buy!

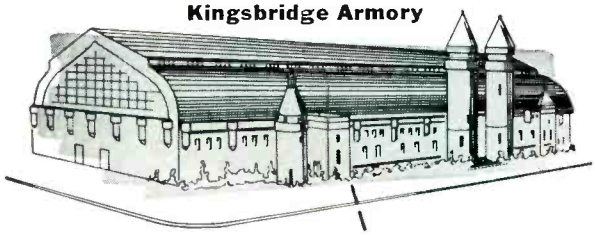
AT LAST, A SINGLE MODEL PACKAGED TWO PER CARTON, TO FILL EVERY VHF INSTALLATION NEED. REDUCES INVENTORY.

TECHNICAL APPLIANCE CORPORATION, SHERBURNE, N. Y. In Canada: Hackbusch Electronics, Ltd., Toronto 4, Ontario

The eye-opening event of the radio-electronic new year!



Waldorf-Astoria Hotel



Kingsbridge Armory

For the past 12 months the vast, fast-growing radio-electronic industry has been preparing for 4 great days — March 22-25. This is when the IRE National Convention and Radio Engineering Show — the biggest and best ever — will take place in New York City. Be sure to join the other radio-electronic men — nearly 40,000 are expected — who will come, see and appraise the show at which all that is new will be unveiled.

A practical summary of radio-electronic progress will be unfolded at 54 technical sessions during the four-day period. 243 scientific and engineering papers, grouped by related interests, will be presented during these sessions, more than half of which are organized by IRE professional groups. Actually, you will be attending 21 conventions fused into one. New York's finest meeting facilities are provided — the Waldorf-Astoria Hotel plus 3 huge halls in Kingsbridge Armory. Transportation between the two locations is quick, easy — by subway and bus service.

At the show you will find over 600 firms **"spotlighting the new"** in their high-interest product exhibits. These will extend over a mile and a half along avenues appropriately named for radio elements: "Instruments," "Components," "Airborne," "Radar," "Transistor," "Audio," "Microwave," etc. These exhibits, an education and revelation in themselves, fill the four-acre space of the great Kingsbridge Armory . . . and can be viewed throughout any one or all of the four days.

Admission is by registration only, and serves for the four-day period. For IRE members the cost is only $1.00. For non-members it is a low $3.00, covering sessions and exhibits. Social events have been carefully planned. These are priced separately.

March 22-25, 1954

is the date! New York is the city where the radio-electronic event of the year will take place. Come! See! Enjoy!

THE 1954
IRE NATIONAL CONVENTION
AND
RADIO ENGINEERING SHOW

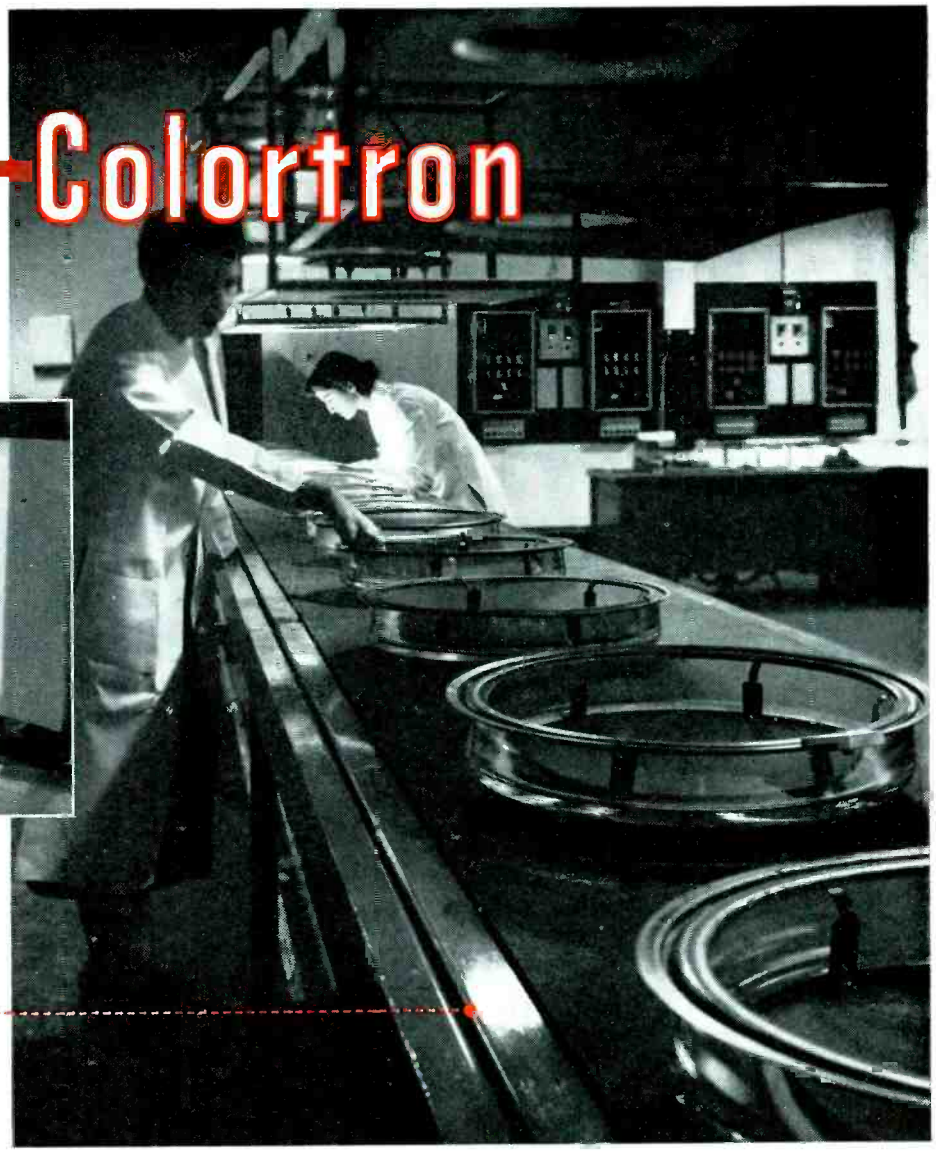
THE INSTITUTE
OF RADIO ENGINEERS

1 EAST 79th STREET, NEW YORK CITY

New CBS-Colortron

NOW IN MASS PRODUCTION

Unique photographic process, like photoengraving, uses aperture masks as negatives to print consecutively the red, green, and blue phosphor dots (250,000 of each) on CBS-Colortron screens.



After tri-color screens are printed, aperture masks are temporarily removed and face plates move on to critical inspection for screen imperfections.

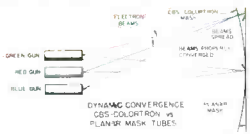
COLOR TV IS COMING . . . faster than you think. The revolutionary new CBS-Colortron . . . a practical color picture tube . . . hastens the day. Already it is in lower-cost, mass production . . . made possible by its simplified, advanced design.

As in black-and-white tubes, the CBS-Colortron's screen is deposited directly onto the inside of its face plate. A unique photographic technique makes this possible. Because each aperture mask serves as a negative to print its tri-color screen, perfect register of mask and screen is automatically achieved and maintained. The rugged, simple, light-weight mask sharply reduces assembly and exhaust problems. And the spherical design of mask and screen simplifies convergence circuitry and adjustment.

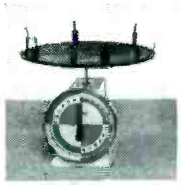
The CBS-Colortron is now a 15-inch, round tube. But, as soon as tooling is completed, it will be made in larger sizes. Watch for the new CBS-Colortrons. You'll see plenty of them soon. And you'll be sold on sight by their logical simplicity . . . their superior performance . . . their many advantages.

CBS-Colortron OFFERS MANY ADVANTAGES

Cross-section (face plate, aperture mask, funnel, tri-color electron gun) shows simplicity of CBS-Colortron and its adaptability to low-cost, mass production.



Spherical screen and aperture mask of CBS-Colortron simplify convergence and focus. Electron beams remain in focus over entire surface of screen.



Light-weight (6 oz.), rugged, simple aperture mask of CBS-Colortron minimizes problems of exhaust, handling, and assembly.

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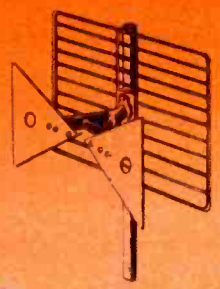

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For fringe areas up to 30 miles (depending on local conditions). Kit complete.

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No. 9039	(Series 3 accessories)	16.75
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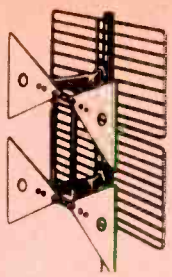
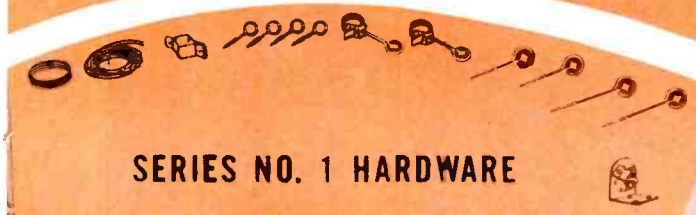
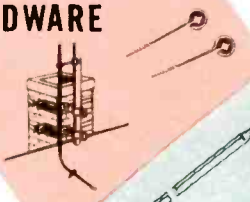




SERIES NO. 1 HARDWARE

SERIES NO. 2 HARDWARE



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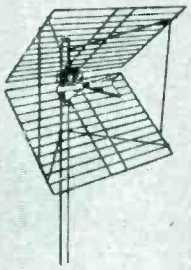
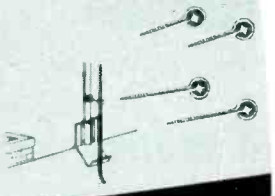
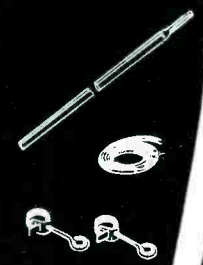
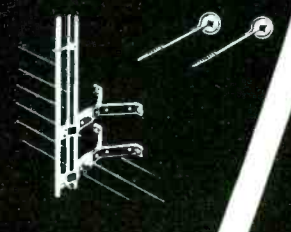


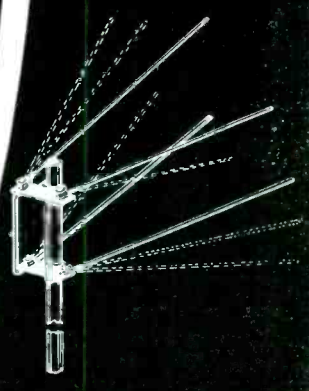
SERIES NO. 3 HARDWARE





SERIES NO. 4 HARDWARE





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50 ft. Guy Wire
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1—Guy Wire Clamp
4—Screw Eyes
2—Universal Mast Stand-Offs
2—3" Wood Screw Stand-Offs
2—7" Wood Screw Stand-Offs
1—Mast Base

SERIES 2 ACCESSORIES

Complete Antenna, as shown
1—6 ft. 1¼" Mast
50 ft. UHF Low Loss Line
2—Universal Mast Stand-Offs
2—3" Wood Screw Stand-Offs
2—7" Wood Screw Stand-Offs
1—Chimney Mount

SERIES 3 ACCESSORIES

Complete Antenna, as shown
1—5 ft. 1¼" Mast
50 ft. UHF Low Loss Line
2—Universal Mast Stand-Offs
2—3" Wood Screw Stand-Offs
2—7" Wood Screw Stand-Offs
1—All-Purpose Antenna Mast Bracket

SERIES 4 ACCESSORIES

Complete Antenna, as shown
1—5 ft. 1¼" Mast
50 ft. UHF Low Loss Line
2—Universal Mast Stand-Offs
2—3" Wood Screw Stand-Offs
2—7" Wood Screw Stand-Offs
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Ultrahighs Are Not A Passing Fancy

THOSE UPSTAIRS FREQUENCIES, bluntly viewed by scores of experts during the early channel-allocation-hearing days in Washington as impractical and a sheer waste of valuable spectrum, now have those skeptics blushing. For these higher bands have been found to be far from useless, but rather rich in their potential possibilities. Instead of complete frustration on these new channels, as forecast in the pre-freeze meetings before the Commission, many, many stations throughout the nation have found ultrahigh telecasting an excellent medium.

The records show that more than 126 *uhf* telecasters are now on the air, serving millions of viewers. In a recent survey made by a *uhf* operator in St. Louis, it was found that nearly a quarter-million set owners converted their standard-band chassis to permit *uhf* pickup and are pleased with the results. And this survey was made in only a twelve-mile area of the station during the early days of experimental operation. In a subsequent Belleville, Ill., study, it was found that over 145,000 receivers had been converted for *uhf*.

A few weeks ago, in a report filed with the Commission, it was noted that the public has spent nearly five-million dollars for ultrahigh equipment, installation and service. Another official uhf-area analysis has disclosed that in one community in Texas it is believed that nearly seven-million dollars will be spent for receivers, components and accessories, and installation and service time to provide *uhf* reception. And the books show too that at least one-hundred more high-band stations will begin operation during the year, not only in virgin areas, but in local and fringe centers where only reception from one or two *vhf* stations has been available, bringing hundreds of thousands of bright prospects for new antenna chains, low-loss leads, rotators, arresters, standoffs, and allied hardware, and the inevitable converter or booster, or both.

As noted on several occasions, requirements on the high bands are more acute than on the standard channels, because of propagation peculiarities at these frequencies. It is these problems that frightened many in the early days. There are, for instance, those shadow areas walled in by hills and heavy foliage which require careful antenna orientation at receiver and transmitter, and the use of increased power to provide adequate coverage. Then there are the humid zones and the salt-spray seacoast areas, buffeted by shifting winds, which again call for a particularly-careful antenna installation, and the use of leadin that will not be affected by moisture. Then, too, there are those locations where stations are widely separated, and antenna orientation is required for satisfactory reception. And, there are many installations where low-power and low-ceiling transmitting antennas make it necessary to hike the receiving antennas and pull up their gain by stacking and installing boosters.

These are the bulky problems for which solutions have now been found by determined researchers and design engineers, and alert Service Men, too. Tube and setmakers have jointly studied the problems carefully with effective results. The tube folks have developed tubes that not only have substantial gain, but excellent noise figures and good stability when used in oscillator circuits. And, many highly-efficient diodes have also been developed for use in *uhf* gear.

Service Men have found that it is wise to explore mounting locations carefully before installing an ultrahigh antenna. The broad practice of mounting an antenna atop a *vhf* antenna pole, because of immediate convenience, is being discarded, for it has been found that what might be a choice location for *vhf* pickup is not necessarily the ideal pickup point for an ultrahigh signal. Where, of course, conditions do not permit a dual-pole installation rotators have been found to provide an equivalent service. Many have already announced special bracket mounts to permit the addition of a rotator and pole above a *vhf* installation. This modified antenna setup has served to spotlight the hot spot in the *uhf* signal path, and assure a stronger input to the receiver.

Those in the Commission, also aware of these difficulties, have come up with plans that should soon prove to be a boon to broadcasters and viewers. To increase coverage, one FCC spokesman has noted that stations might be permitted hereafter to tilt and directionalize their antennas. In addition, authorizations may be granted to permit the construction of satellites or boosters, which feature the use of slave, unattended stations to reamplify and retransmit on the same or separate frequencies.

Strongly censuring those who call *uhf "small-town television,"* a Commissioner declared that ultrahigh channels have been requested or have been granted in over 230 cities, and in 125 of these cities, there'll only be *uhf*. Except for Boston, it was noted, Massachusetts will only have *uhf*. And except for Newark, New Jersey will also only have *uhf*. In New York State, 48 out of 60 channels will eventually be on the ultrahighs. And in Pennsylvania, at this writing, the greatest *uhf* ratio prevails, with 48 out of 58 assignments going to the ultrahighs.

Authorities in Washington declare that there will be a continued move to the ultrahighs, and that it will not be too long before channels 14 to 83 will be in use by the majority of TV broadcasters in the country.

The ultrahighs can no longer be called soporific, idling in a TV wasteland; rather they represent a lush habitable telehome, offering a robust future for telecasters, televiewers and the Service Man.—L. W.

SERVICE...The National Scene

FIRST COLOR SETS INSTALLED-SERVICED IN NEW YORK ON CONTRACT BASIS--In a surprise move, limited quantities of 15" three-gun color-TV chassis were shipped recently by an independent manufacturer to one of New York City's largest department stores. The receivers, it was said, are being installed and serviced on a contract basis, with one independent servicing group in charge of the entire operation; a $229 charge is being made for installation and service, while $200 covers service only. (Unlimited service is provided in either arrangement.) . . . Before the color set delivery deal was closed, store executives reported, members of the service company not only attended intensive technical meetings at the plant of the manufacturer, but participated in lengthy private sessions with the design engineers, and spent many hours too with the receivers to become fully familiar with all of their operational characteristics.

THE COLOR MODELS were built to facilitate servicing, it was disclosed, using a slide-out feature for the basic video-audio chassis. All controls for adjustments were placed up front, and provision was made for removal of the front panels for inspection and repair. . . . In reviewing the potential problems that will probably obtain in servicing color sets, it was noted that convergence will undoubtedly be one of the most important factors as long as three-gun tubes are used. It was also pointed out that the delay line, as now constructed, may also present some trouble. At present, these lines feature fine wires surrounding a polystyrene core and, if when soldering a contact to the line, too much heat is applied, the line can be ruined. Service Men will also have to be particularly careful in repairing the high-voltage section, since up to 20,000 volts flow through the hv lines of some of the color sets. Oscillator drift, due to crystal structure and socket mounts, was also revealed as a color-set headache.

SOME SET DESIGNERS have reported that monochrome receivers might not be capable of providing satisfactory b-w reception during a colorcast because of improper if alignment. This condition, it was said, has been found to be due to a lack of adequate checking in some plants. Thus, Service Men may be called on to realign if stages in b-w sets to guarantee best results when programs are sent out in color.

COLOR SETS are expected to require from 6-10 service calls a year, not only because of the chassis construction complexity, but because operating instructions will undoubtedly have to be repeated on several occasions to set owners, and a number of component difficulties will certainly arise in the first runs of chassis. To cover the extensive servicing (and installation) that might be required, some have estimated that the contract costs might go as high as $250, at least for the first year.

SOARING MARKET FOR REPLACEMENT TUBES AND PARTS FORECAST--The sales of receiving, TV-picture and special electronic tubes and components for replacement, which amounted to over $600-million in '53, are expected to jump to $850-million in '54, according to one of the country's leading market analysts. And the rise will continue, he reported. In the '57-'59 period, an annual average of about $1,400-million was seen, and in '60-'62 replacement parts sales are expected to exceed $2,200-million. . . . In a discussion of the potential of TV, it was pointed out that industries seldom exist on the basis of initial installation sales only, and it will become increasingly important to consider such factors as the obsolescence of sets, wear-out, the mounting number of new families and new homes, and the era of second-set TV homes, following the present trend in radio with from two to a half dozen sets in most homes.

AUTO RADIOS will continue to be a vital factor, too, on the scene, it was noted, with at least four-million sets, having a total value of over $120-million, scheduled for sale in '54. Auto sales in the '57-'59 and '60-'62 periods should average from 3,600,000 to 3,800,000 units a year, it was predicted.

SERVICE...The National Scene

TV ANTENNA INSURANCE PLAN UNDER STUDY IN NEW HAMPSHIRE--An unusual form of TV antenna insurance, providing partial reimbursement for wind and hailstorm damage, is now being probed by insurance experts in New Hampshire. The plan provides for $50 deductible coverage for wind and hail destruction, with a charge of eight cents per $100 for a year's policy. The proposed rates are being studied by the State Board of Fire Underwriters and the State Insurance Agents' Association.

GIMMICK ADVERTISING CONDEMNED BY BBB--In view of a continuing stream of complaints against those who advertise that they can fix sets at home at extremely low charges, and then fail to support these promises, the BBBs are up in arms. . . . In St. Louis, the Bureau has asked all newspapers and magazines to observe a set of regulations in accepting ads from service companies. In a letter to these publications, the BBB noted that advertisers who quote a price for service calls must state definitely the period of labor time included for the price advertised, and the rate per hour to be charged in excess of that price. References must also be made to the extra costs involved for necessary replacement parts. . . . The campaign, it was felt, will alert Service Men to the danger of misrepresentation, and help to establish equitable standards of practice.

COLOR AND HI-FI TO HIGHLIGHT IRE-ASSOCIATION CONCLAVES IN N. Y. AND PHILA.--At the Waldorf-Astoria and Shelton Hotels, and the Kingsbridge Armory, in New York City, on March 22-25, and at the Bellevue-Stratford, in Philadelphia, on April 2-3-4, color TV and high fidelity will be headlined in striking programs featuring operational exhibits and outstanding illustrated talks by the nation's foremost authorities.

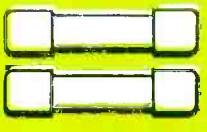
IN NEW YORK, where the IRE will hold its annual national convention, hi-fi will be surveyed by such experts as W. E. Kock, Col. R. H. Ranger, R. L. Hanson, J. E. Volkmann, and John V. L. Hogan. They will report on hi-fi loudspeakers, the use of large-area microphones for distant pickup, stereophonic sound, room acoustics and hi-fi mikes. . . . Color experts from leading manufacturers, including Frank Bingley, E. J. Clark, D. C. Livingston, H. Weiss, and S. K. Altes and A. P. Stern, will discuss single-gun picture tubes, color fidelity and color distortion, the significance of some receiver errors on flesh-color reproduction, and self-balancing phase detectors for reference oscillators. . . . The first complete report on the use of magnetic tape for the recording and reproducing of color and b-w signals, will also be presented at the IRE meeting by a team of experts headed by Dr. Harry F. Olson. This talk will be part of a six-paper session on color-TV broadcasting, during which film scanners, color film and keyed clamping circuits will be analyzed.

IN PHILADELPHIA, color and audio will sparkle at a National Servicing Convention, co-sponsored by the Eastern Conference and the Council of Radio and TV Service Associations; over 30 associations (national, state and local) will be represented. . . . For the first time, all of the latest color-TV gear, including components, instruments, picture tubes and special receiving tubes, and operating color receivers, will be on view in two large exhibit halls. Special color programs will be transmitted to permit set demonstration during the three-day affair. . . . Over a dozen sessions will be devoted to color talks, during which colorimetry, color transmission, parts for color sets and color tubes, instrumentation, and typical production-line models will be thoroughly described, and supplemented by operational displays. . . . Hi-fi experts will also report on amplifiers, loudspeakers, cartridges, enclosures, and other items in the wide-range audio chain. . . . Other topics scheduled for discussion are printed circuits, the ultrahighs, auto radios, intercom, tape recorders, and business practices.

AT THE NEW YORK AND PHILADELPHIA meetings, there'll be nominal registration fees, and at the Philadelphia gathering, a convention record, containing an overall report on the three-day session, will be prepared for distribution to those who register. . . . At the New York meeting, ye editor will serve as co-moderator of the broadcast-color symposium, and in Philadelphia, he will preside as moderator of the color conference which is being organized under his direction. . . . Incidentally, at the IRE Radio Engineering Show, in the Kingsbridge Armory, which is being held jointly with the national convention, SERVICE will be in booth 892. Hope that we'll have the pleasure of seeing you in New York and Philadelphia.--L. W.

THINGS ARE NOT AS THEY SEEM...

Things are not as they seem
These two fuses look alike . . .
Until you look inside.



LITTELFUSE
DES PLAINES, ILLINOIS

This is not a spiral. **It is a series of concentric circles that do not join.**

This fuse has a straight element—cannot be made more delicate than 1/16 amp. with normal blowing characteristics.

This fuse has a bridge construction (note short filament between electrodes). This type fuse may be rated as low as 1/500 amp. with precision blowing characteristics required for protection of extremely fine instruments. Without this construction pioneered by Littelfuse—the microscopically fine filament would break in shipment, in normal operating vibration or even from nearby footsteps.

Littelfuse leads all other fuse manufacturers in design patents on fuses.

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Compatible COLOR TV System Controls

by W. L. ROBERTS
Westinghouse Research Laboratories

Colorimeter and Color-Set Control: Relationship of Brightness or Luminance, Hue and Saturation

Color obtained from any light source or reflecting surface may be specified in terms of brightness, hue and saturation. This means that to define adequately a color we must know how much light the light source emits or the surface reflects (*brightness* or *luminance*), what color it is, such as green, blue green, blue, etc. (*hue*), and what purity it has (*saturation*). Whereas the meanings of brightness and hue are familiar, the concept of the saturation of a color is perhaps not too widely understood. To illustrate the meaning of saturation, let us imagine we have two slide projectors side by side as illustrated by Fig. 1. The light output of each projector is controlled by a *variac* and whereas one projector has a slide containing a filter of any color (such as blue) inserted into it, the other projector merely produces a beam of white light. Now, let us assume that initially only the projector with the blue slide is operating and a circle of blue light is thrown on the screen. The color on the screen can be described as a *deep* or *intense* blue and can be regarded as fully or 100% *saturated*. Now, suppose the white light projector is turned on and its beam is allowed to fall on the same area that the blue light is falling. As the intensity of the white light is increased and the intensity of the blue light is decreased at the same time to keep the brightness level constant, the blue color becomes *paler* or more and more *desaturated*.

A color may also be specified in terms of three primary colors such as red, blue and green, and the relative amounts of these colors which when added together give the same color. To illustrate the effect of mixing three primary colors, Fig. 2 depicts three projectors, each projector producing a beam of a primary color. Let us imagine that the areas of the screen illuminated by the projectors do not completely overlap as shown. Then where the red and blue areas overlap, purple is produced; where red is superimposed on the green area, yellow results and the combination of blue and green gives a blue-green color. Where all three primaries overlap, the area will be white.

To reproduce any given color, the three beams of the projectors can be superimposed and their relative intensities suitably adjusted. The ratio of the intensities of the primary colors will determine the hue and saturation of the color, and the sum of the three individual brightnesses will determine the composite brightness.

In Fig. 2, the colors other than the primaries are obtained by illuminating an area with two primary colors simultaneously. The same psychological effect could be obtained, however, if the projectors were pulsing

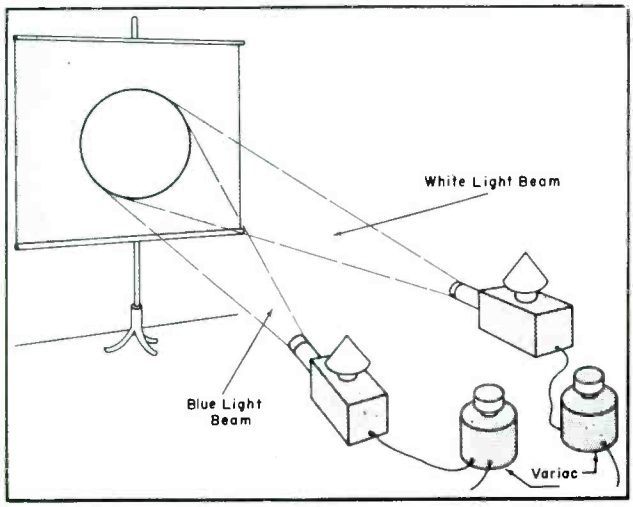


Fig. 1. Meaning of saturation can be demonstrated by positioning blue and white beams, and controlling intensity as shown.

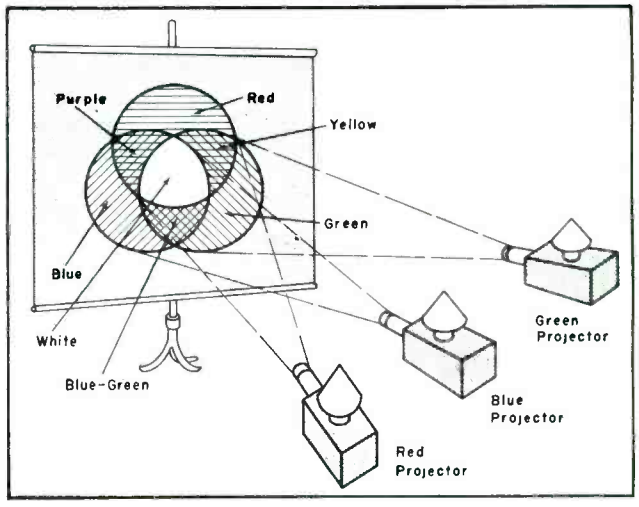


Fig. 2. Setup that illustrates results obtained when three primary colors are mixed.

on and off causing a given area to be alternately illuminated by first one primary color and then the other in a fairly rapid manner. This could be illustrated with a red and green projector, side by side, and a rapidly rotating sector wheel for obstructing the light beams alternately. The visual effect on the screen would be the same as if the sector wheel were removed, except that when the wheel is removed, more light energy would reach the screen and the screen is therefore brighter. However, the hue and saturation of the screen would be the same for both conditions.

It is not necessary for the primary colors to be superimposed either simultaneously or sequentially to produce a given color. Two small areas in close proximity to each other, each being illuminated by a different primary color will give the appearance of a single area illuminated by the mixture of the lights. Thus, small red areas beside small green areas will appear like a larger yellow area. This holds true whether the illuminated areas are continuously or impulsively illuminated.

Brightness of a Colored Image

It has already been shown that if three light sources of proper energy are added or mixed together they produce white light. However, owing to the normal characteristics of the eye the brightness of each primary does not appear to be the same. The green light looks the brightest and the blue light the dimmest. Of the total brightness associated with the white light, it has been found that 59% is contributed by the green light, 30% by the red light and 11% by the blue light.

For light of any color, we can express the primary colors as E_G, E_R, and E_B for the green, red and blue lights respectively, where

$E_G = K_1 \times$ (amount of green light)
$E_R = K_2 \times$ (amount of red light)
$E_B = K_3 \times$ (amount of blue light)

and where K_1, K_2, K_3 are constants. These constants are so arranged that for white light E_G, E_R and E_B are all equal to unity. Under these conditions the brightness value (E_Y) of any light source may be expressed by the equation

$$E_Y = 0.59\,E_G + 0.30\,E_R + 0.11\,E_B \quad (1)$$

In a color television system, there are three signals, E_G, E_R and E_B, developed which correspond to the amplitude of the three primary colors, green, red and blue respectively. When the camera is viewing a white or gray scene with no color information, the camera circuits are arranged so that these signals all have the same amplitude. Similarly in a receiver, when white or gray is to be presented on the face of the picture tube, these three signals developed in the receiver must be of the same amplitude.

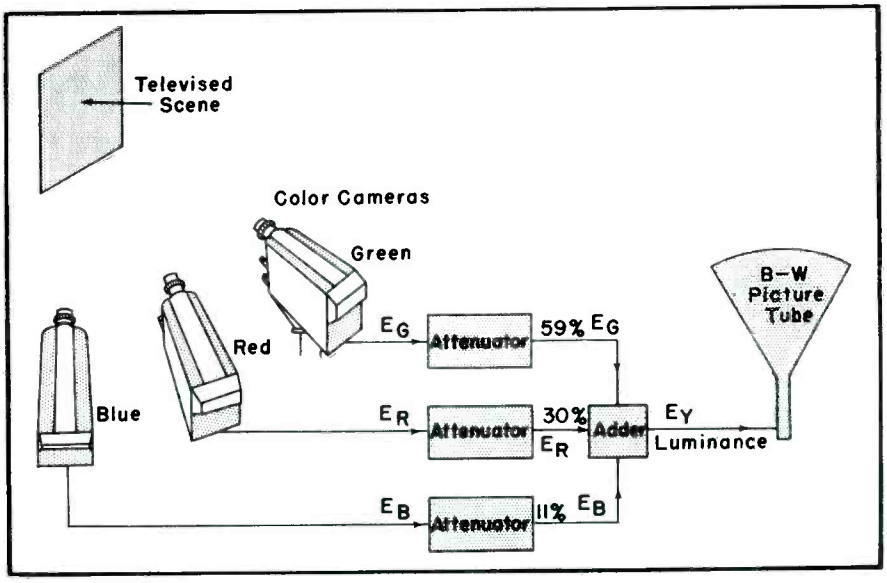


Fig. 3. Method of obtaining brightness signal from the three color signals.

However, it must be remembered that scenes recorded by color TV cameras must be presented on present day black-and-white receivers. Such receivers reproduce the television scene only in various shades of gray and for such sets to operate properly the transmitted signal must be an accurate brightness signal. It has already been shown that the three primary colors, when mixed in the correct relative amounts, do not contribute equally to the brightness but as shown in equation *1*. Thus, if a color TV system is to reproduce brightness signals correctly on black-and-white receivers, the *luminance* or *brightness* signal E_Y must be a mixture of the three primary color signals as expressed in equation *1*. This is perhaps more easily understood by studying Fig. 3, illustrating three TV cameras viewing a scene to be televised. (Initially the cameras have been adjusted so that when viewing a white scene, their three outputs (E_G, E_R and E_B), are all equal in amplitude.) The outputs of the three cameras are passed through respective attenuators and combined in an adding circuit to give a *luminance* signal E_Y. This is composed of 59% of the E_G signal, 30% of the E_R signal and 11% of the E_B signal. When this signal is applied to a black-and-white picture tube as shown, the presented picture exhibits correct brightness levels for all parts and all colors of the televised scene.

The Color Subcarrier

Color TV transmitters radiating compatible signals utilize a 6-mc bandwidth, like conventional back-and-white transmitters. In fact, the fre-

(*Continued on page* 65)

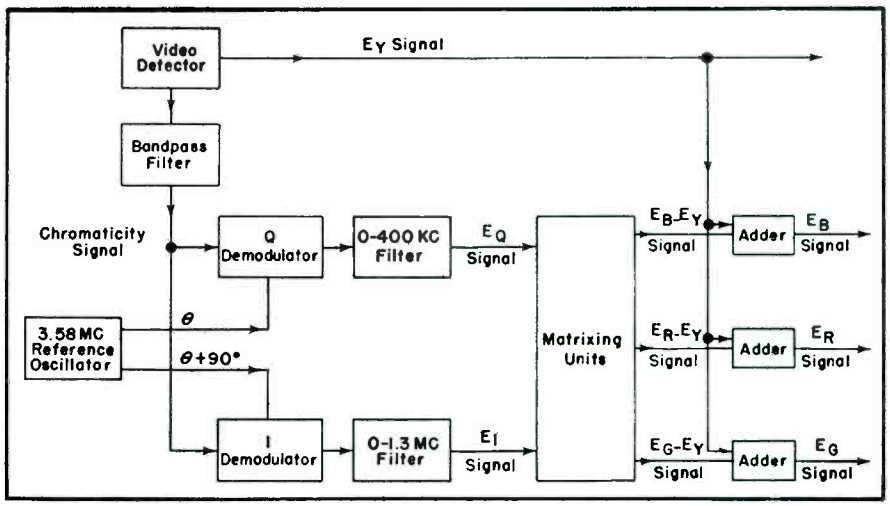


Fig. 4. Block diagram of typical color chassis video circuitry.

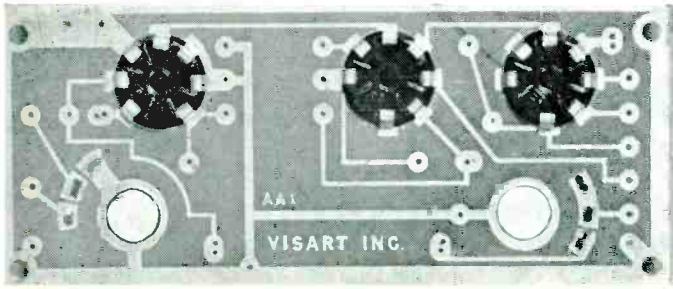


Fig. 1 (above and at right). Top and bottom of a pc three-tube ac-dc audio amplifier, whose circuit appears on the cover and on facing page, at the right.

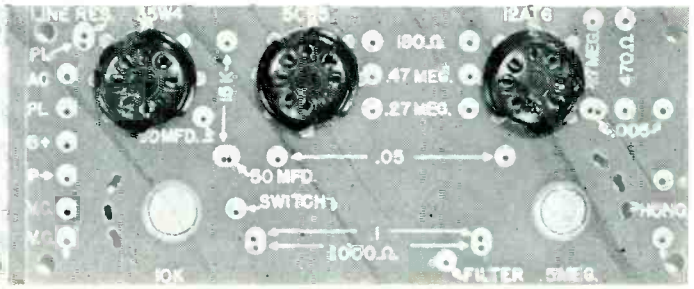
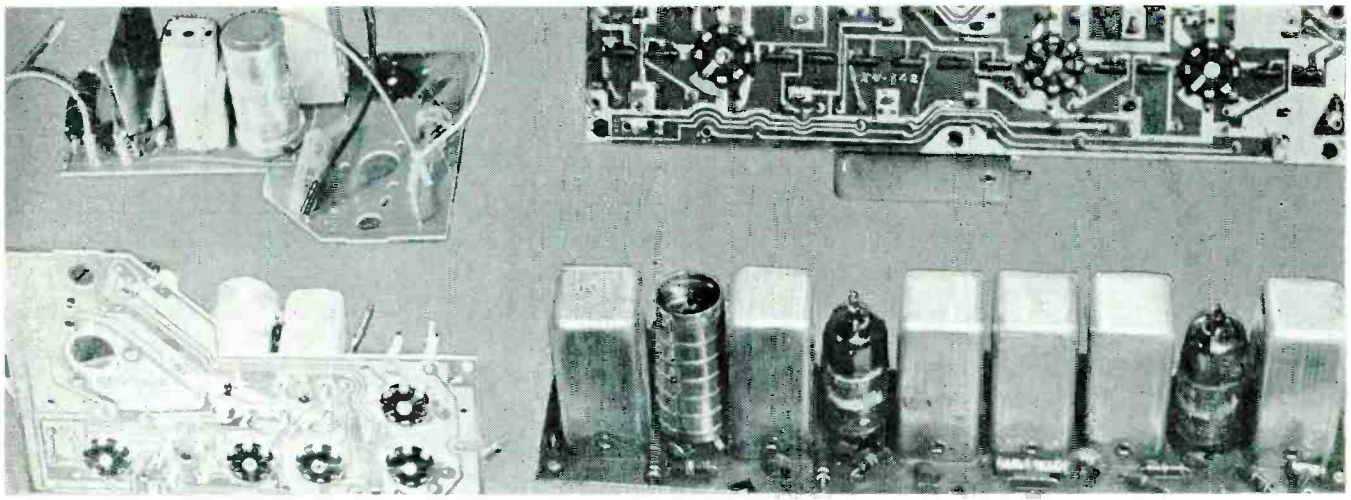


Fig. 2 (below). Two more examples of printed-circuit wiring: At left, a complete radio chassis, and at right, a tandem 40-mc if amplifier for TV. (Courtesy Hallicrafters, Methode and RCA.



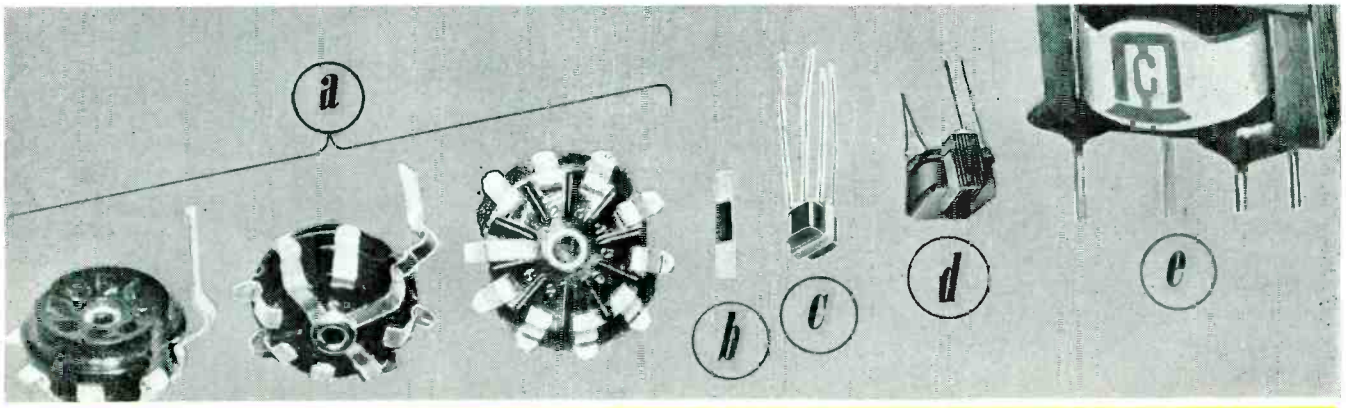
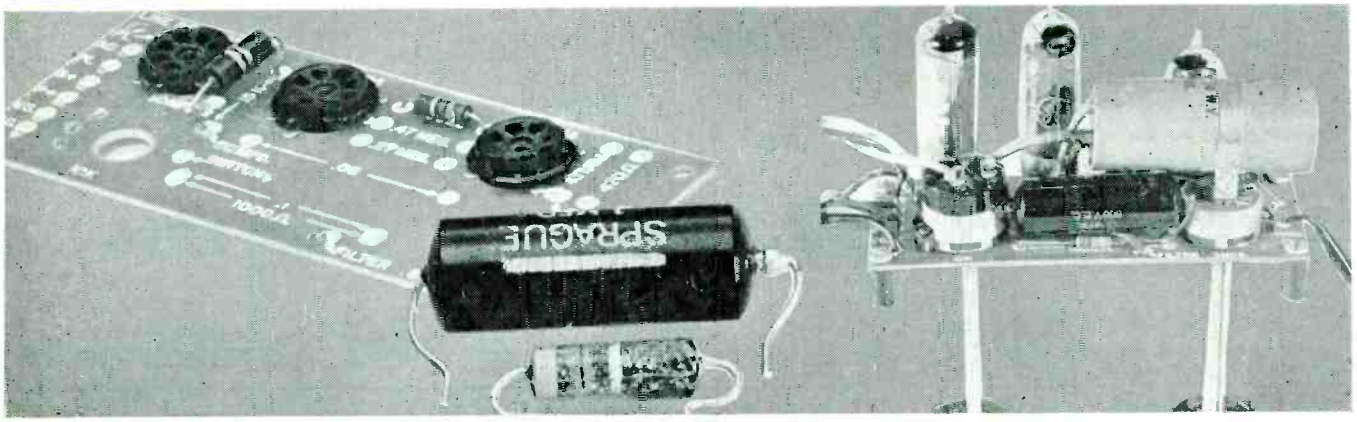


Fig. 3 (above). Components specially designed for application to pc chassis. Left to right: miniature sockets which snap into place on a pc panel; tape resistor available in cured ready-to-use models (½" long, ⅛" wide and 1/100" thick) in ranges from 100 ohms to 10 megohms; tiny transformer which can be adapted for hearing-aid and allied pc units (models made for interstage, input and output, and choke applications); miniature audio transformer for pc installations, which weighs less than 1/10 ounce, and is available for interstage, output or matching, and high impedance mike uses; and miniature transformers which range in power handling capacities from 8 milliwatts to 2 watts, designed with special soldering tabs for pc panels. (Photos—left to right—courtesy Methode Manufacturing Corp., Sanders Associates, Inc., Gramer Transformer Corp., Chicago Standard Transformer Corp., and Microtran Company, respectively.)

Fig. 4 (below). Lower right: resistor and capacitor prepared for mounting on pc panel; terminals cut short and bent as shown. Items also shown mounted (at left) on typical pc chassis.

Fig. 5 (below). A pc chassis on which standard type variable controls and capacitors, with the terminals properly cut and bent, have been mounted.



PRINTED-CIRCUIT Assemblies and Chassis for AF, Radio and TV

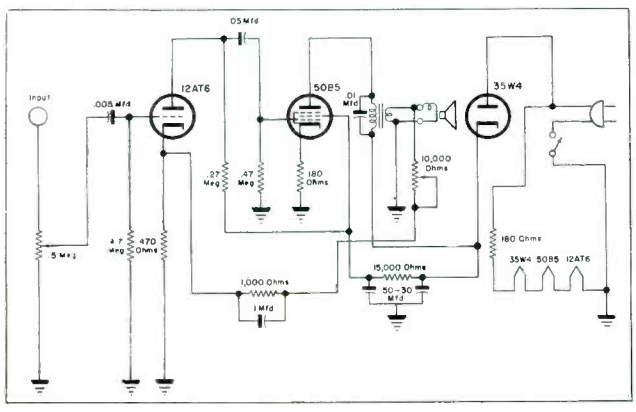
by M. A. SALIT
Visaft, Inc.

[*See Front Cover*]

PRINTED-WIRING for electronic units and components during the past year, has become a particularly important factor in design and construction. While the bulk of printed circuitry has gone into telephone equipment, guided missiles, and computers, the *pc*s have begun to appear in more and more home radios and TV receivers, too. Their low assembly cost, as well as their adaptability to mass production techniques, has attracted many in industry. Service Men will thus find it increasingly important to become not only thoroughly familiar with *pc* construction, but also to develop appropriate servicing procedures.

Several methods are presently being used in the preparation of printed circuits. The end result, in all cases, is a metal-foil-clad plastic of the desired configuration. The metal foil, in most instances, is a tinned copper sheet, about two to four-thousandths-inch thick, bonded to a sheet of plastic about one-sixteenth-inch thick. Metals other than copper can be used; specifically, gold, silver, cadmium, or nickel, depending on the end application. However, in the bulk of current construction copper is used. The unwanted metal can be etched away in an acid bath, or the metal can be deposited on the plastic.

Printed-wiring is used for both complete or portions of a chassis, and for components. In the printed-wiring circuits only the wiring itself is processed. Printed-component circuits are small assemblies normally comprising a network of resistors and capacitors in a single housing. While printed components may be used in conjunction with printed wiring to facilitate assembly, they represent an entirely different form of activity.



Circuit of three-tube ac-dc amplifier designed for a printed-circuit chassis. (See cover.)

A novel application of a printed-wiring circuit of the etched process type, is shown in Fig. 1. On the *cover* and below, the circuit for this unit appears. It is a three tube *ac-dc* amplifier employing a negative feedback type tone control. Another example of *pc* wiring appears in Fig. 2. Here we have a completely assembled radio, as well as a unitized *if* strip for a TV receiver.

With the use of *pc* wiring has come the development of special components peculiarly adapted to the assembly of these circuits. Some of these components are shown in Fig. 3. Printed circuit sockets, illustrated, snap into place in the printed circuit, and establish contact with the printed wiring by a spring action of the socket terminals. They are then soldered to the printed-wiring. Variable controls and switches are also available for *pc* wiring. Terminals on these components are bent back from the accustomed direction, to facilitate wiring and mounting. In addition, the switch leads are long flat metal strips, which may be rotated for connection to the wiring, by insertion into the plastic chassis. Resistors and capacitors can be prepared for assembly to *pc* chassis. The terminals are cut short, and bent as shown to introduce a slight spring action upon insertion, to prevent falling out. Otherwise, these components are standard. Printed circuits have also been used for *if* transformers. The only essential difference here is that the can screws are replaced with two lugs which are bent over after insertion to hold the can in place. The transformer terminals are also adapted to printed-circuit dip-wiring methods.

In production, after all components are mounted, the entire unit is dipped into a pot of low temperature solder, thus completing this operation in one step. After the dip, the unit is quickly removed, excess solder shaken off, and the unit is ready for use.

Some idea of the problems involved both in assembly and service can be obtained by reviewing the operations required to produce the unit shown in Fig. 1 at left. Here, the component values were imprinted in white ink on the top side of the chassis, to facilitate assembly. The component value imprint was found to be very helpful during servicing, expediting replacement of burnt-out resistors and simplifying checking of part values.

In actual service, Service Men may find it necessary to replace defective

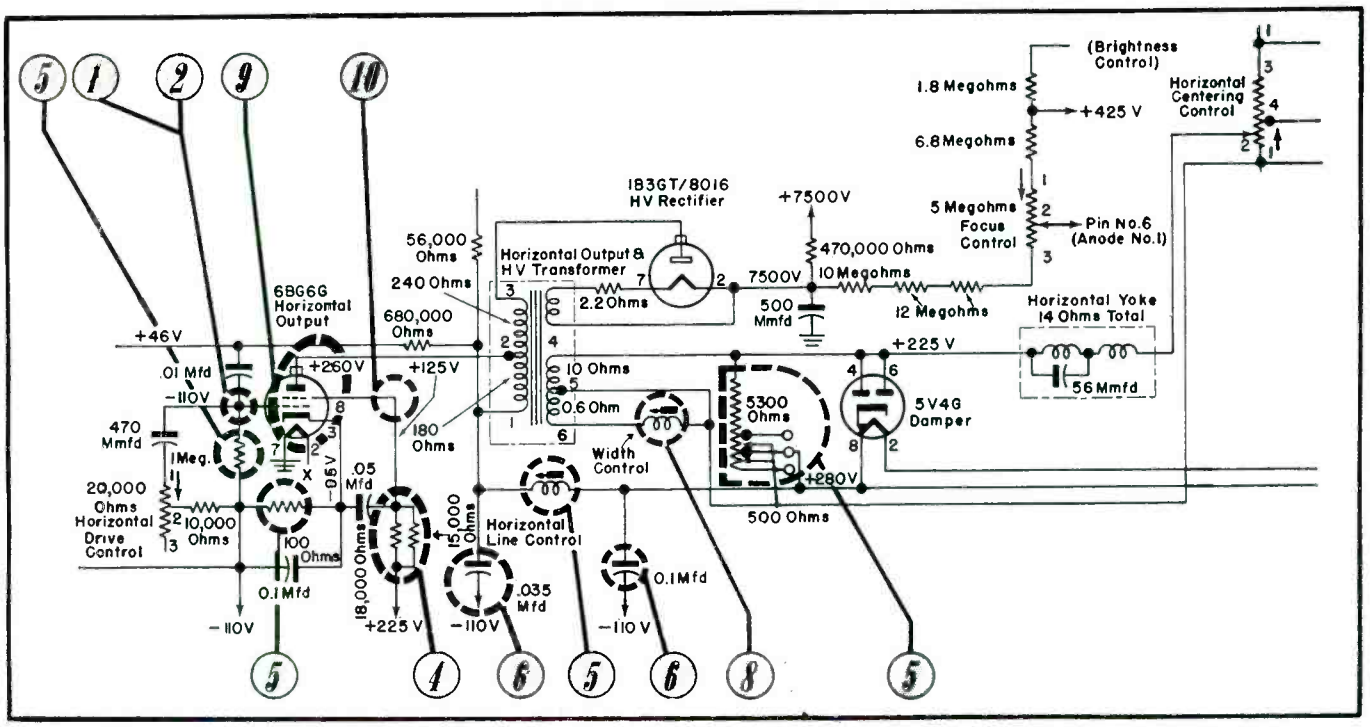
(*Continued on page 66*)

Checking SWEEP CIRCUITS

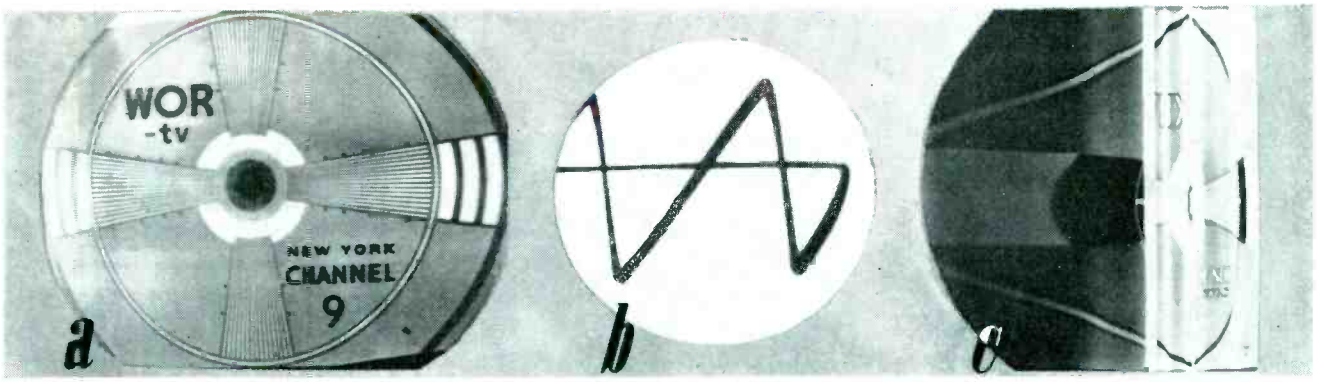
by DONALD PHILLIPS

Streamlined Trace-Remedy Guide for Poor Horizontal Linearity, Inadequate Picture, Picture Stretching, Barkhausen Oscillations . . .

Condition	Cause	Control Method
Poor horizontal linearity. *(1)*	Incorrect waveshape of driving voltage at grid of horizontal-output tube.	Waveshape of driving voltage should be checked with 'scope; if incorrect, waveforms must be traced back toward horizontal oscillator until faulty component is located: **See circuit and waveform at right; circle *1* and *A*.**
Inadequate picture width. *(2)*	Insufficient peak-to-peak driving voltage at grid of horizontal-output tube.	Peak-to-peak voltage at grid of horizontal-output tube should be checked with calibrated 'scope; if low, voltages should be checked back toward horizontal oscillator until faulty component is located: **See circuit at right; circle 2.**
Subnormal or inadequate peak-to-peak voltage at plate of horizontal oscillator tube. *(3)*	Can be caused by low line voltage.	Line-voltage booster transformer, or automatic line-voltage regulating transformer should be installed.
Inadequate picture width, after normal peak-to-peak voltages are restored in sweep circuit. *(4)*	Picture tube may be unsuitable for the sweep circuit, and require a small increase of sweep current.	The value of the screen resistor can be reduced somewhat, provided the plate and screen *dc* currents are not increased beyond the tube ratings: **See circuit and waveform at right; circle *4* and *B*.**
Right-hand side of picture is stretched. *(5)*	Incorrect tolerances on resistive and capacitive components.	Value of grid leak should be decreased somewhat; values of cathode and damper resistor might be increased, or inductance of horizontal-linearity coil increased: **See circuit at right; circle 5.**
Stretch can almost be taken out of right-hand side of picture when slug of linearity coil is completely inside winding. *(6)*	Marginal right-hand stretch may be caused by incorrect value of booster capacitors.	A capacitor-substitution box should be used to determine whether a slight change in booster capacitance will restore linearity: **See circuit at right; circle 6.**
Extreme stretch on left-hand side of picture, with foldover and ringing on right-hand side; picture narrowed. *(7)*	Can be caused by open input-booster capacitor.	Substitution test of input booster capacitor should be made and suspected capacitor removed from circuit when making test: **See waveform at right; C.**
Vertical white line appears in picture when values of screen components are varied. *(8)*	Crossover from damper to horizontal-output tube must take place at correct time.	Values of components in screen circuit must be restored and other methods used to obtain reqiured linearity and width; e.g., a small capacitor shunted across the width coil will increase picture width: **See circuit at right; circle *8*.**
Vertical black line(s) appear in picture on weak channels. *(9)*	Barkhausen oscillations develop in some sweep circuits, with some tubes.	Here, one should select tube which has best cutoff characteristic, and which accordingly develops the least Barkhausen: **See circuit and photo-diagram at right; circle *9* and *D*.**
Simplified types of horizontal-sweep circuits do not yield to usual Barkhausen control methods. *(10)*	Leakage reactance of transformer may be high, or shielding of sweep circuit may be insufficient.	The screen grid of the horizontal-output tube can be keyed with a negative pulse from the sweep circuit; this expedient cuts off the screen grid during the Barkhausen period. No evidence of the keying pulse is seen in the picture, because the first 30% of the forward trace is developed by the damper tube only: **See circuit and explanatory diagram at right; circle *10* and *E*.**



Typical high-quality horizontal-sweep circuit, capable of better than 90% linearity when properly adjusted.

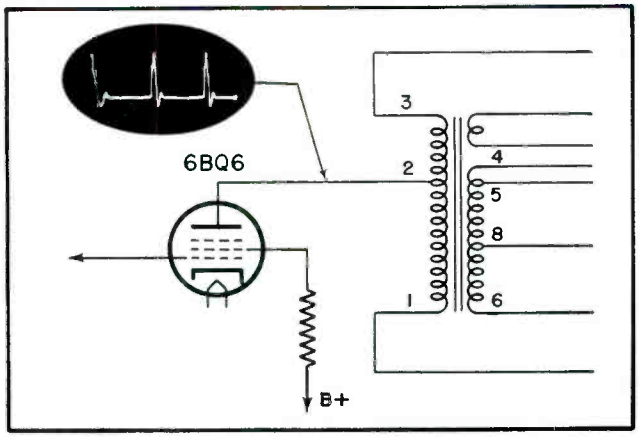


(A)
Horizontal non-linearity caused by poor waveshape of grid-drive voltage to horizontal-output tube.

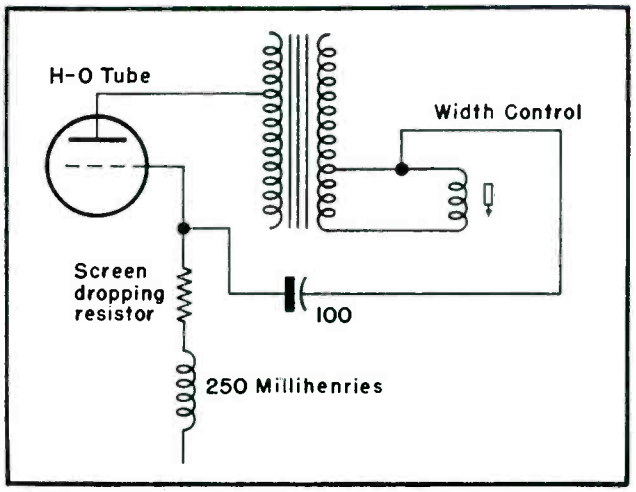
(B)
Typical peak-to-peak current, and normal pattern for deflection waveform delivered to yoke. A larger value of peak-to-peak current produces a wider picture.

(C)
Open input booster capacitor produces extreme right-hand stretch, and right-hand foldover, accompanied by ringing and reduced width, as illustrated.

(D)
Barkhausen cannot occur unless there is a negative undershoot of voltage following retrace. The presence of undershoot must be checked with a high-voltage capacitance-divider probe, as the 6 kv present at the plate of the horizontal-output tube will burn out the scope input circuit otherwise. (Negative undershoot and ringing of plate waveform is caused by leakage reactance in the horizontal-output transformer.)



(E)
Effective Barkhausen-elimination circuit which keys screen grid from sweep-voltage wave. A 100-mmfd capacitor and a 250-mh choke are utilized.



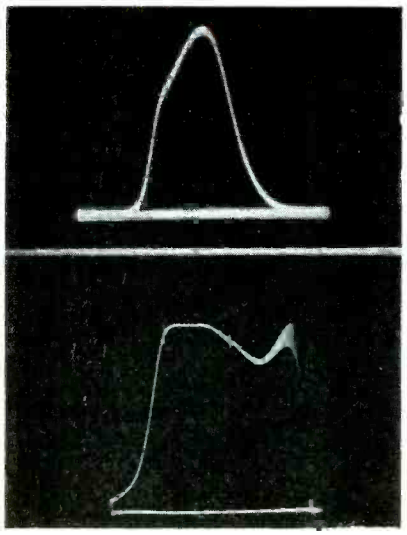
Answers to Puzzling Problems Encountered in TV Chassis Checking With 'Scopes and Square-Wave Generators

TV Instrument Clinic

by L. B. ARMIKAN

WHY DO RECEIVER manufacturers often use a combination of high-video peaking and low-video peaking in a video amplifier?

THIS IS DONE as a compensating measure, to offset the mid-band peaking commonly developed by simple *if* amplifiers. This relation is illustrated in Figs. *1* and *2 below.*



Figs. 1 and 2 (above). Fig. 1 shows a typical response of a simple if amplifier. The response is peaked at mid-band. Fig. 2 illustrates a typical video amplifier response with low- and high-video peaking, which partially compensates for the peaked if response shown.

IS SUCH compensation completely satisfactory?

FROM THE STANDPOINT of the average non-critical viewer, it can probably be asserted that the expedient is satisfactory, if not overdone. However, minor irregularities of circuit response always result, as shown in Figs. *3* and *4, below* and at *right.*

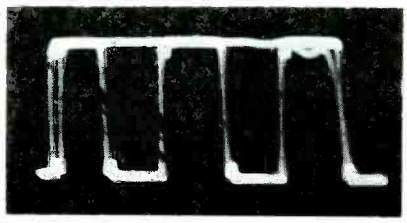
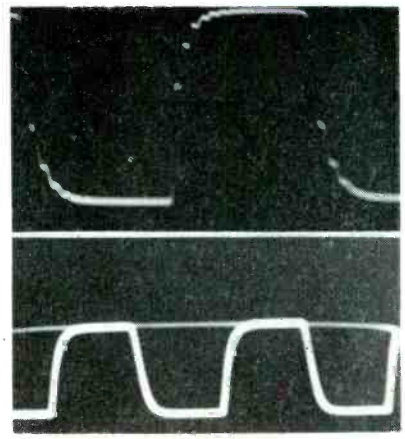


Fig. 3.

WHY MUST the rise time of the square-wave generator be faster than the rise time of the video amplifier under test?

THIS REQUIREMENT is illustrated in part in Figs. *5* and *6, below.* When the rise time of the square-wave generator is faster than the rise time of the video amplifier, *hf* characteristics, such as residual ringing, shown up in the pattern, as seen in Fig. *5.* However, when the rise time of generator is slower than the rise time of the video amplifier, the *hf* detail of the reproduced waveform is missing, as shown in Fig. 6.



Figs. 5 and 6 (above). Fig. 5 illustrates meaning of fast rise time; hf output from a square wave generator and the ability to reproduce hf characteristics of an amplifier, such as the residual ringing, shown here. The rise time of the generator is 0.05 microsecond. Fig. 6 shows a slow rise time which results in a reproduced square wave which reveals the lf characteristics of the video amplifier, but which fails to clearly show all the details of the hf characteristics.

Fig. 4.

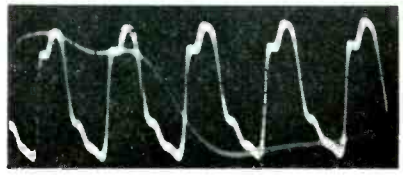
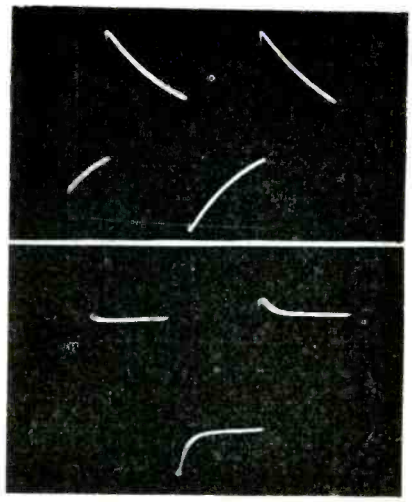


Fig. 3 (left). Waveform attained with a 100-kc square-wave test of video amplifier employing frequency compensation. An irregularity is seen at the corner; this is a stepped corner.

WHAT IS the difference between linear and non-linear distortion in square-wave tests?

THE DIFFERENCE is illustrated in Figs. *7* and *8 below.* In Fig. *7,* the positive and negative half cycles of the reproduced square wave are tilted and curved symmetrically; this indicates that the amplifier is operating in a linear manner with respect to amplitude, although low-frequency attenuation and leading low-frequency phase shift are present. However, in Fig. *8,* the overshoots of positive and negative half cycles are unsymmetrical, showing that the amplifier is operating in a non-linear manner with respect to amplitude.



Figs. 7 and 8 (above). Fig. 7 shows a reproduced square wave which reveals the presence of low-frequency attenuation and phase shift, but does not indicate appreciable amplitude distortion. In Fig. 8 is a square wave which indicates the presence of overshoot combined with amplitude distortion.

Fig. 4 (below). Another waveform obtained during a 500-kc square-wave test of the same frequency-compensated video amplifier used to obtain waveform shown in Fig. 3. This reproduced square wave exhibits high-frequency smear.

An Analysis of the Characteristics of Treble, Bass and Compensated Volume or Loudness Controls

Tone and Volume In HI-FI AUDIO

by MARK VINO

No matter how carefully an audio system is designed, or how precisely the fixed equalizers perform their functions, there is always need for variable tone controls. Placing aside questions of taste on the part of the listener, and assuming that only natural reproduction of the original music is being sought, there are many functions served by the tone controls. These include compensation for frequency response irregularities in associated equipment, especially the speaker; exact matching of the recording characteristics of different records; compensation for the effect of room acoustics; and compensation for the apparent loss of bass at low volume (the Fletcher-Munson effect).

The vast majority of tone controls consist of *rc* networks, including a potentiometer for control purposes. A single *rc* network can provide a progressive boost or cut of signal amplitude, above or below a selected transition frequency which approaches the maximum rate of change of 6-db/octave.

The Treble Control

The basic circuit of a treble cut network is illustrated in Fig. 1a. The lower arm of the voltage divider (the arm consisting of R_2 and C_2 in parallel) is a reactive element whose impedance becomes less as the frequency is raised.

The basic circuit of a treble boost network is illustrated in *b* of Fig. 1. This time the *upper* arm of the voltage divider is reactive, and the impedance of this upper arm becomes less as the frequency becomes higher, allowing more signal voltage to pass. Although such a circuit effectively performs the function of treble boost, as can be seen from its frequency response graph, the circuit is really nothing more than an old-fashioned voltage divider, which may be thought of as attenuating the entire band of signal frequencies uniformly, and then progressively letting the treble portion of the signal back in. It is obvious, then, that the final effective boost cannot be had without a price; the circuit must sacrifice overall gain.

The two circuits described may be combined into a single control, such that at mid-position the response is flat, while treble attenuation is introduced when the control is turned in one direction, and treble boost when it is turned in the other direction. One

(*Continued on page 70*)

Fig. 1. In a is basic treble cut equalizer, and frequency response curve. A basic treble boost equalizer, and frequency curve is shown in b, and in c appears a combination of the circuits of a and b into a treble tone control, with variable response as shown.

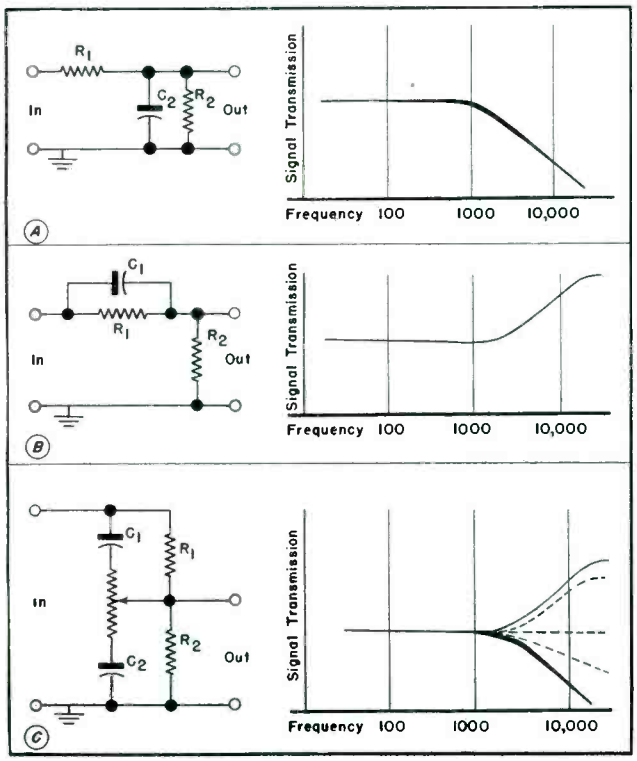
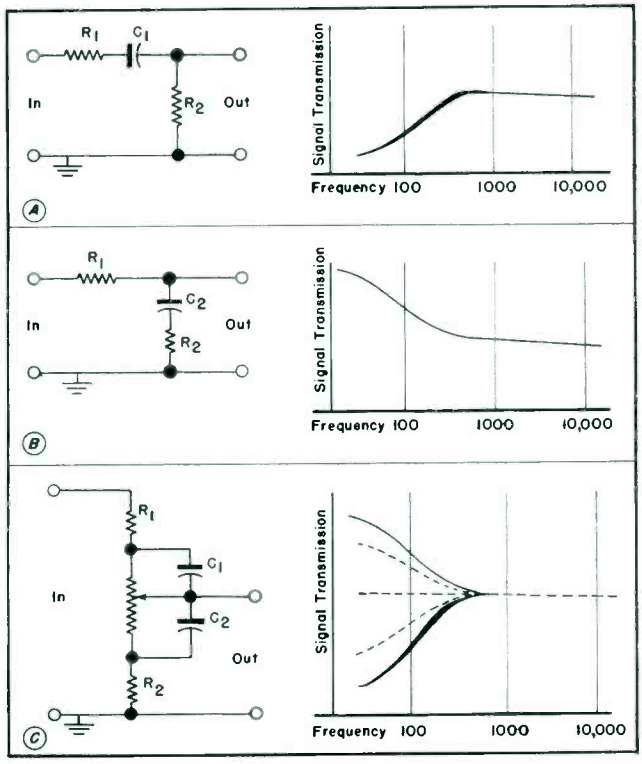
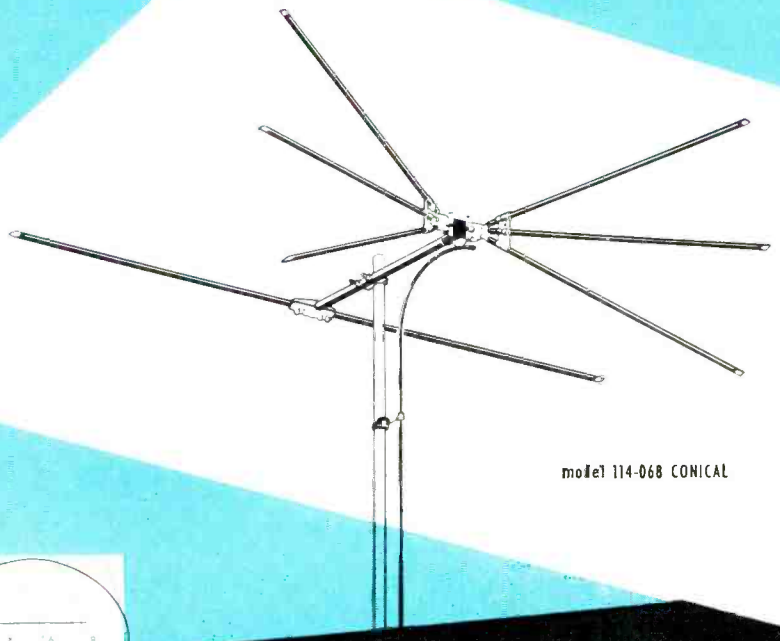


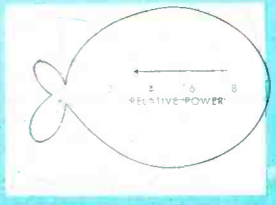
Fig. 2. Bass cut equalizer and frequency response curve is shown in a. In b is illustrated a bass boost equalizer, and its frequency response curve. A combination of the circuits of a and b into a bass tone control, with its variable response is shown in c.



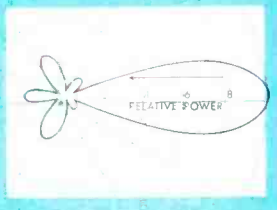
now!



model 114-068 CONICAL



69 mc—channel 4



195 mc—channel 10

Directivity patterns of the CONICAL are exceptionally clean. The strong major lobe indicates fine directivity.

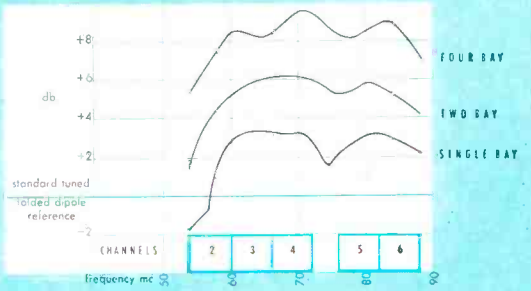
a VHF CONICAL antenna built to the Quality Standards of AMPHENOL

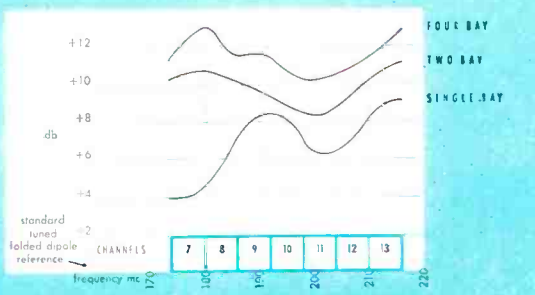
Now ready to join the fastest-growing and fastest-selling antenna line in the United States is a new AMPHENOL VHF antenna. Designed to supplement the fabulous INLINE* for VHF reception, the new CONICAL antenna will give true-picture reception in *every VHF signal area*: major, fringe and long-distance. Gain and directivity have been engineered to the high AMPHENOL standards that have set the quality goal for the entire industry; craftsmanship attention to the small but important details make the CONICAL another example of AMPHENOL's fine antenna work.

AMPHENOL CONICALs are available in single, two and four bay models. The stacked models use unique phasing harnesses for extra gain. The CONICAL may be obtained in packaging that contains all the necessary stacking equipment or else the individual antenna may be purchased one or two to a carton. In addition, the single bay CONICAL is available in a complete antenna installation kit.

All elements of the CONICAL are constructed of sturdy, long-lasting seamless aluminum tubing – assuring rust-free years of top performance.

*Reissue U. S. Patent 23,273





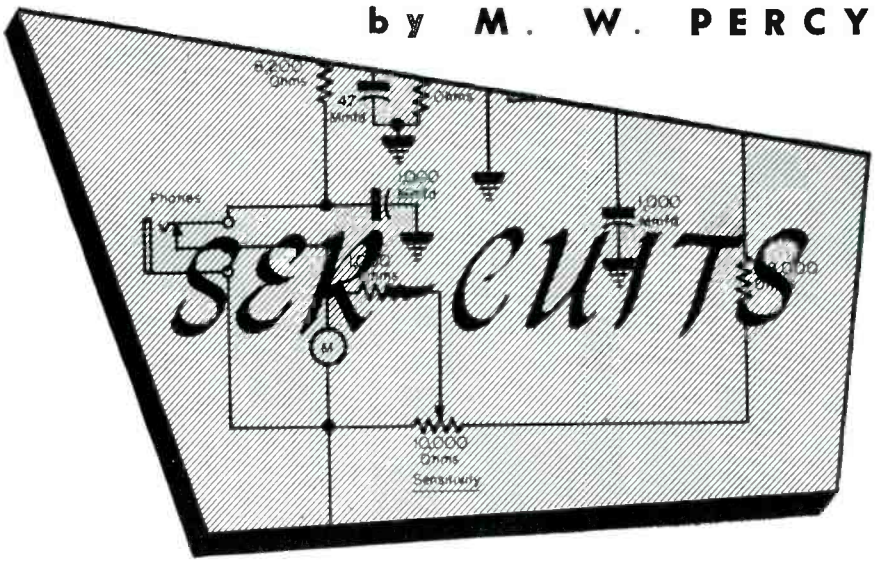
High gain of the CONICAL is illustrated in the gain charts for single, two bay and four bay models. Measured in accordance with proposed RETMA standards, the charts also show the desirable flatness of the gain.

AMPHENOL

AMERICAN PHENOLIC CORPORATION • *chicago 50, illinois*

Circuitry Report on 9 to 900-Mc Instrument Designed to Serve as Signal, Marker and Pattern Generator‡

by M. W. PERCY



ON THE SERVICE bench and in the field one is constantly concerned with the testing and alignment of tuners and *if* amplifiers, and the proper adjustment of linearity of horizontal and vertical deflection circuits, as well as checks on video and audio amplifiers.

For such work, one must normally employ signal, marker and pattern generators. Recently, one manufacturer developed a generator that, it is said, combines all three functions on one device.[1] The unit, basically an AM signal generator, is claimed to cover a range of from 9 to 900 mc.

Two 12AT7s, each a duo-triode, serve as audio and *rf* oscillators. The left-half triode of V_1 functions as a 360-*cps* oscillator, while the right-half produces a 141.75-*kc* signal.

S_2, a modulation switch, connects either plate or both to B+. As shown on the schematic (Fig. 1), neither plate reaches B+; in this position unmodulated *rf* is provided since the audio signal is non-existent. Rotating the switch clockwise, one position to a *horizontal* bar position connects pin *1* to B+. Rotating the switch one more position, clockwise, to a *vertical* bar position, connects pin *6* to B+, and disconnects the other plate. And one more clockwise rotation to a *cross-hatch* position, connects both plates to B+, and both the 360 *cps* and 141.75-*kc* oscillators function simultaneously.

Rf signals are produced by V_2, the *rf* oscillator. Signals are produced on five frequency ranges. The two lowest are developed by the left-half of V_2, while the three higher ranges are produced by the right-half of V_2.

Amplitude modulation takes place when the audio signals, from the plates of audio oscillator, V_1, are applied through .1 and .001-mfd capacitors, and 10,000-ohm resistors to the grids of the *rf* oscillators, V_2. The *rf* output is developed across a 91-ohm common cathode resistor, which it was found helps to reduce frequency drift.

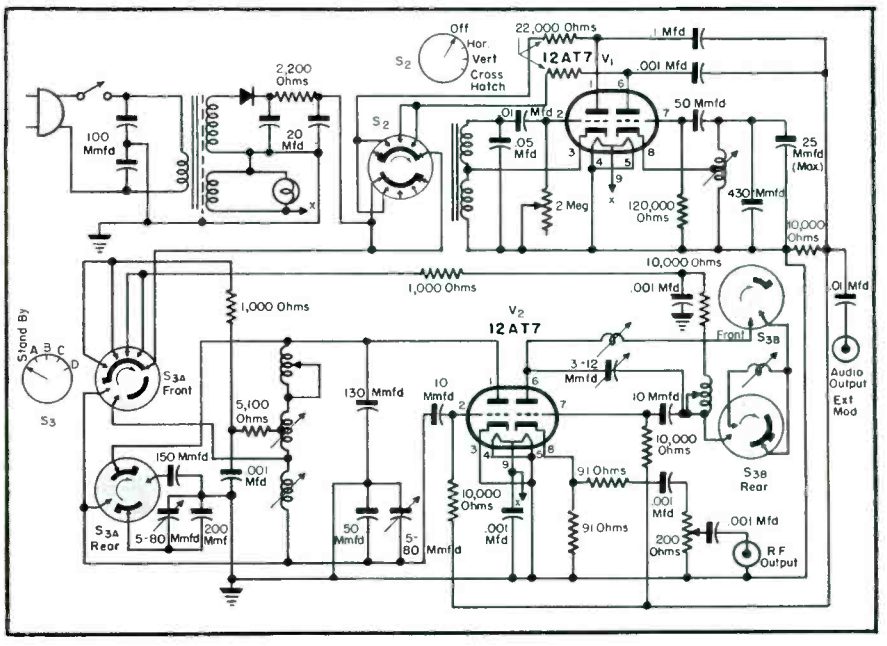
The 360-*cps* modulation frequency was selected because this frequency is six times that of the TV vertical scanning frequency of 60 *cps*. This relationship is illustrated in Fig. 2*a-b* (p. 74). During the time required for one vertical scan of the TV picture tube, the 360-*cps* signal alternately drives the grid (or cathode, in some receivers) of the tube positive and negative, six times. This results in a brightening and dimming of the electron beam on the picture tube face, as shown in *c* of Fig. 2. Since many horizontal lines are scanned during this one vertical scan, some of the horizontal lines are bright, while others are dark. Fig. 2*d* illustrates this. The light horizontal lines appear in the areas numbered *1* and *3*. Dark horizontal scannings appear in the areas *2* and *4*. With a 360-*cps* frequency from the signal generator reaching the picture tube of the receiver, six pairs of white and dark horizontal bars appear on the screen as shown in *d* of Fig. 2. The vertical fly-back or retrace occurs during only a portion of one of the 360-*cps* signals, so almost nothing is lost then.

The other modulating signal of the generator, 141.75 *kc*, is exactly nine times that of the TV horizontal scanning frequency of 15.75 *kc* or 15,750 *cps*.

During the time of one horizontal scan, the 141.75-*kc* signal drives the picture tube grid alternately positive and negative nine times. During each horizontal line, therefore, the electron beam is made brighter and

(*Continued on page 74*)

Fig. 1. Circuit of RCP signal generator; model 750.

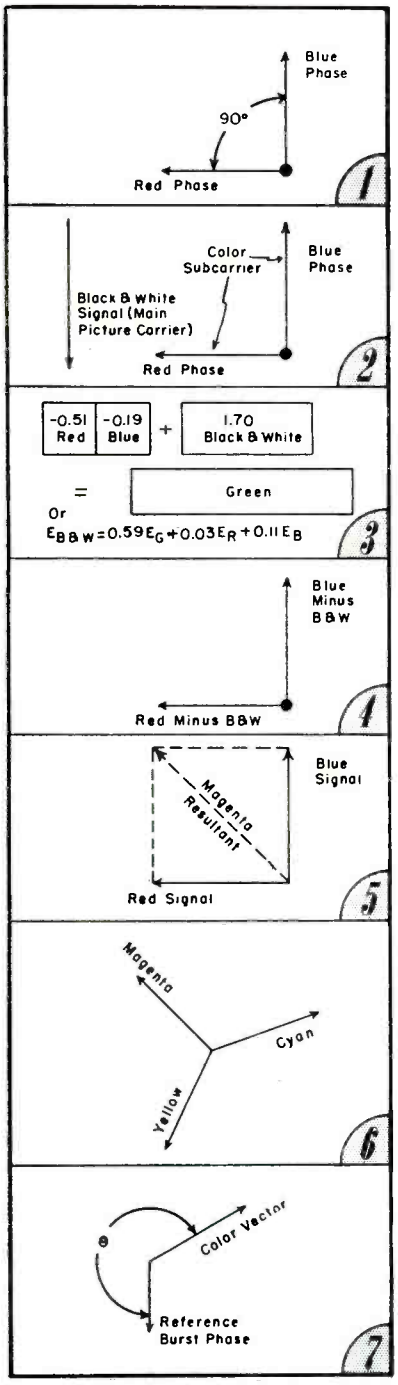


‡*From a report prepared for* SERVICE by ***Richard Blitzer.***

[1]RCP 750 *uhf/vhf* signal generator.

TELEVISION COLOR

Phase Angles and Color Signal Mixing[1]



by W. KAY BROWNES

(1)

THE COLOR SIGNAL is transmitted by a color subcarrier having a single frequency, but two phases. The two phases are 90° apart, as shown.

(2)

ONE PHASE OF the carrier corresponds to the red signal, while the other phase of the carrier corresponds to the blue signal. There is also a black-and-white signal transmitted by means of the main picture carrier. These three signals are illustrated.

(3)

IN THE COLOR sequence, a green signal is, of course,, required. The green signal is derived by suitable mixing of the red and the blue signal with the black-and-white signal. This is readily possible, because the black-and-white signal contains all hues or colors. The relations between red, blue, black-and-white, and green, are set forth in the diagram at left.

(4)

SINCE THE BLACK-AND-WHITE signal must be transmitted as a true, directly reproducible signal, for utilization by black-and-white receivers, the red signal and the blue signal are modified to the now-familiar color-difference components. A red-minus-brightness signal produces a red hue when it is added to the brightness (black-and-white) signal.

(5)

TO PRODUCE A MAGENTA color or (hue), some red signal must be transmitted, and some blue signal must be transmitted, as shown. The length of the red vector indicates the amount of red voltage which is required, and the length of the blue vector indicates the amount of blue voltage required.

(6)

THE MAGENTA VECTOR is the vector sum (or resultant) of the red vector plus the blue vector. The resultant has a different phase and a different voltage from either of the primary vectors, according to the familiar laws of vector addition. Other hues are similarly produced by combining the primary vectors in other proportions.

(7)

IT IS NOW APPARENT that each hue has a certain phase, and is described electrically by that phase. It is also apparent that each hue has a saturation value (intensity) which is determined by its voltage value (length of the vector). (Phase angle θ determines hue, and length of vector determines saturation.)

[1] *See p. 22 this issue for additional information on the subject of color mixing in transmission and reception.*

Corner and Rectangular Speaker Enclosure Construction ‡
. . . How to Apply Feedback Properly*

by KENNETH STEWART
and PAUL EDWARDS

To REALIZE the full benefits of loudspeakers with 40-15,000[1] and 50-13,000[2]-cps ranges, amplifier-systems should be capable of reproducing these frequencies with adequate power and low distortion. The power amplifier, for instance, should have a power output rating of approximately 10 watts with negligible distortion (less than 1% harmonic); a rating found to be adequate for high-level operation in a substantially large living room.

Loudspeaker Enclosures

The installation of the loudspeaker is perhaps the most critical and important part of a *hi-fi* fidelity system. Without a properly designed enclosure, no speaker can perform well.

In the average living room, the corner will generally be found to be the best acoustic location for the speaker. Built-in installations may also take advantage of the opportunity to place the loudspeaker at ear level or higher to obtain unobstructed radiation of sound throughout the room.

There are many types of enclosures available today, each designed on a slightly different principle and each offering some advantages and some disadvantages. In choosing an enclosure one must decide on its most important features, and engineer the design for the loudspeaker used, so that its advantages are utilized to the fullest and its disadvantages are minimized.

Recommended Enclosures

The recommended enclosure for one series of 12″ loudspeakers is a *distributed port* cabinet[3]. This has an enclosed volume of 6 cubic feet, designed to utilize loudspeaker back radiation at low frequencies and provide good cone loading.

Built-in Enclosures

For those who are installing a *built-in* high-fidelity system, *distributed port* enclosures can be constructed, following the designs illustrated in Figs. 1 to 4. Drilling plans for the *distributed port* model with an enclosed volume of 6 cubic feet appear in Fig. 3, and for 10 cubic feet in Fig. 4.

Some speakers[1] employ a protective front plate, making the use of a grille cloth unnecessary. To take full advantage of this feature, the speaker should be mounted on the front surface of the speaker mounting board. If a grille cloth is required for styling purposes, the material used must not impair the transmission of high frequencies. Suitable materials are woven plastic or fabric, having a light porous weave. The grille cloth should be mounted in a manner which will not allow vibration of the cloth against the cabinet. When grille cloth is used, the speaker is attached to the rear surface of the speaker mounting board.

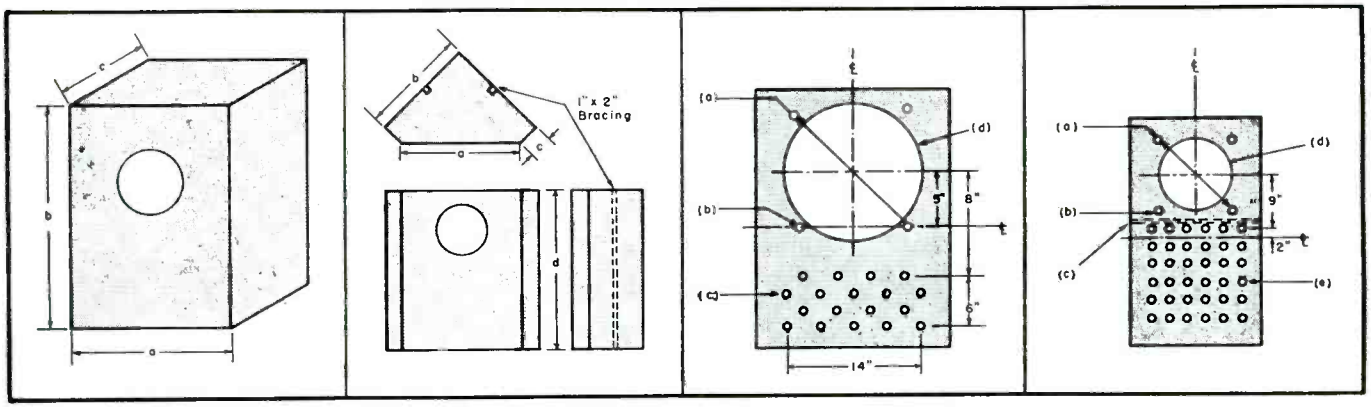
For the 6 cubic feet enclosures, plywood at least ½″ thick should be used. For the 10 cubic-foot cabinet, ⅝″ plywood should be used. The three inside surfaces (non-parallel) should be lined with 1″ fiber glass or similar

(*Continued on page 72; Pictorial new-product review appears on page 36*)

‡From installation notes prepared by the *hi-fi* section of the G.E. radio and TV department.

[1, 2]Such as the G.E. A1 400, or 1201A or 1203A models. [3]G.E. A1 406.

Figs. 1, 2, 3 and 4. Speaker enclosures with 6 and 10 cubic-foot volume. Fig 1 (extreme left) illustrates a rectangular housing; a=at least ½ b, and c=12″ minimum inside (approximately 16″ to 18″ preferred). Drilling plans, shown in Figs. 3 or 4, should be followed for 6 or 10 cubic foot volumes. A corner enclosure is diagrammed in Fig. 2. Here, for a 6 cubic-foot area, a=24″, b=25½″, c=8½″, and d=25½″. For a 10 cubic-foot model, a=24″, b=25½″, c=8½″ and d=40″. In Fig. 3 (for a 6′ enclosure), a = mounting bolt circle 11⅝″ diameter; b = 4 holes ¼″ diameter equally spaced; c = 18 holes ¾″ diameter, and d = speaker mounting hole 11″ diameter. In Fig. 4 (for a 10′ enclosure), a = 11⅝″ diameter mounting-bolt circle; b = 4 holes ¼″ diameter equally spaced; c = 1″ x 2″ bracing; d = 11″ diameter speaker mounting hole, and e = 36 holes ¾″ diameter on 3½″ centers.



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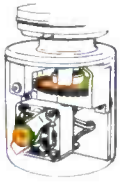

• **Double Lock Stop Prevents Drift & Coast**

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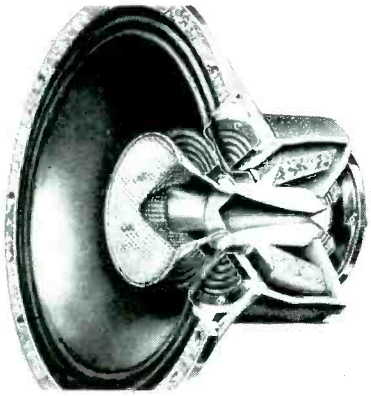
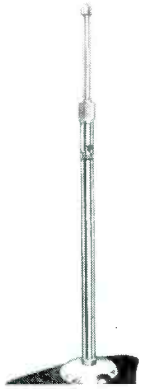
LEADING THE WAY TO BETTER PRODUCTS

Pictorial Review of New Components and Accessories for Audio

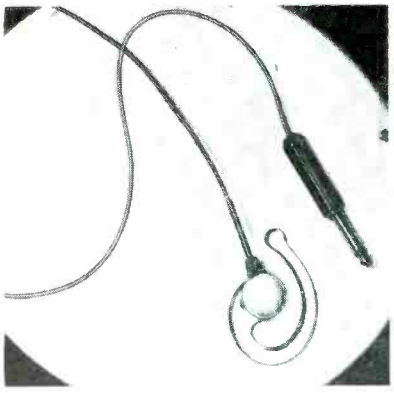


A 15" coax loudspeaker with a 10½-pound ring of Alnico V. Woofer cone is fabricated of a special fiber, and has a double-rolled edge, treated with Geon vinyl plastic. A 3" voice coil is mounted on an aluminum form, and a pressure-type high frequency tweeter mounted coaxially through the woofer pole piece, has a phasing plug said to improve hf response. A 10-element acoustic lens of non-resonant plastic is included to transmit high frequencies uniformly through a 90° angle of coverage in all planes. (Model RF-475; Stromberg-Carlson Co., Rochester 3, N. Y.)

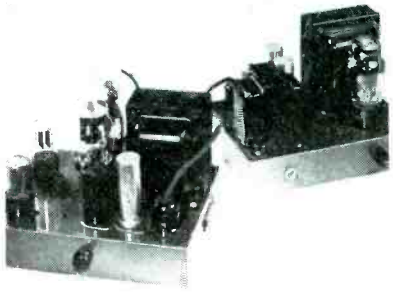
Battery of 20 two-foot hypex loudspeakers mounted atop Steinway Hall in New York, operating in conjunction with a Deagan electronic carillon to project bell music over upper mid-town Manhattan during Steinway Centennial now being commemorated. Ten amplifiers supply 600 watts of power to the driver units on speakers. Inspecting speakers are (left to right): Jack C. Deagan, vice president, J. C. Deagan, Inc., and William R. Steinway, vice president, Steinway & Sons. (Courtesy Jensen Manufacturing Co., 6601 South Laramie Ave., Chicago 38, Ill.)



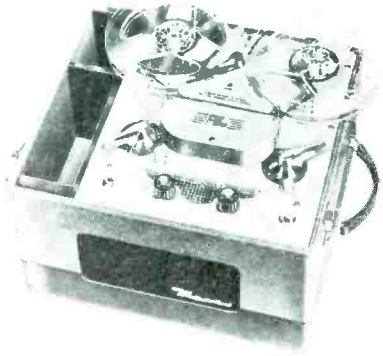
Microphone stand with telescoping section said to be cushioned on air; escapement of air permits slow, smooth and quiet collapse of the stand if full-grip clutch holding adjustment is insufficiently tightened or accidentally released. Has a height adjustment of 37" to 66", and base diameter of 17". Tube finish is full chrome; base finish is chrome and gray shrivel. Tube terminates in a 5/8"-27 machined thread. (Model MS-25; Atlas Sound Corp., 1451 39th St., Brooklyn 18, N. Y.)



Miniature earphone, with a 200 to 10,000-cps frequency response, said to provide comfortable listening at 50 microwatts. Available with plastic or metal frames which are reversible for either ear. Supplied with 5-foot cord or with volume control cord. (Models 4670 and 4680 (plastic) and 4695 and 4696 (metal) for 128 and 2000 ohms; Telex, Electro-Acoustic Div., St. Paul, Minn.)



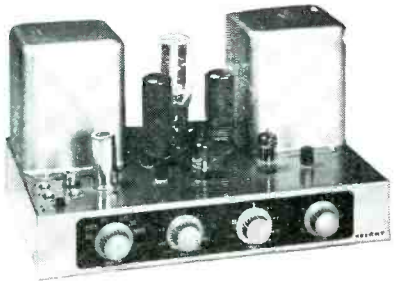
An ultra-linear hi-fi amplifier said to have intermodulation distortion of 3% at 28 watts equivalent sine wave power; total harmonic distortion, measured at 1000 cycles, claimed to be less than 1% at 25 watts. (Features use of ultra-linear output transformer A-8072. Available in kit described in bulletin 479; Chicago Standard Transformer Corp., Standard Division, Addison and Elston, Chicago 18, Ill.)



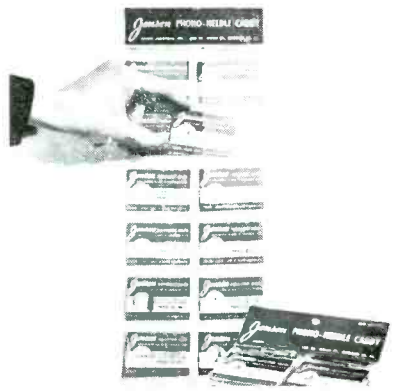
Tape recorder with dual speed, automatic amplifier equalization for each speed, two-motor drive and dual-track feature. Inputs are provided for microphone, radio or phono; outputs for external speaker, external amplifier or telephone line. Has press-to-record pushbutton. Frequency response is claimed to be 80 to 8500 cps ± 3 db at 7.5 inches per second; 80 to 5000 cps ± 3 db at 3.75 ips. (Series 53; Mark Simpson Mfg. Co., 32-28 49th St., L. I. C. 3, N. Y.)

Corner horn enclosure for 12" and 15" speakers, furnished in kit form. Utilizes principle of backloading to increase path length. Dual port arrangement provides for the use of two speakers. (K-12/K-15; G & H Wood Products Company, 75 N. 11th St., Brooklyn 11, N. Y.)

Amplifier, said to have frequency response, at 24 watts output, of from 20 to 40,000 cps, ± .75 db. Has four inputs: one for G.E., Pickering or Audak magnetic cartridges; two are for radio tuner, crystal cartridge, TV or tape recorder; another for a high-impedance microphone. Panel switch permits selection of any input. Also features a three-position record equalizer that provides flat playback or equalization for NARTB or AES recording curves. Golden Knight; Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.)



Phono needle kit, with 12 needles, which can be used as a hanging wall display card, or when folded can be taken out on service calls. (No. 300; Jensen Industries, Inc.)



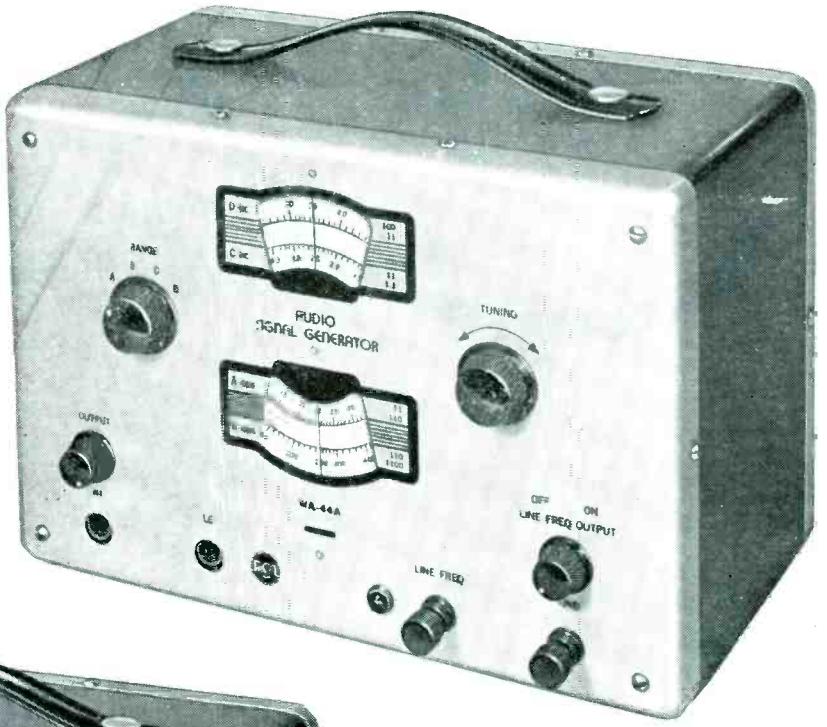
11 CPS to 30 Mc

. . . covered by two *new* RCA Companion Signal Generators for testing and trouble-shooting audio, AM, FM and TV equipment

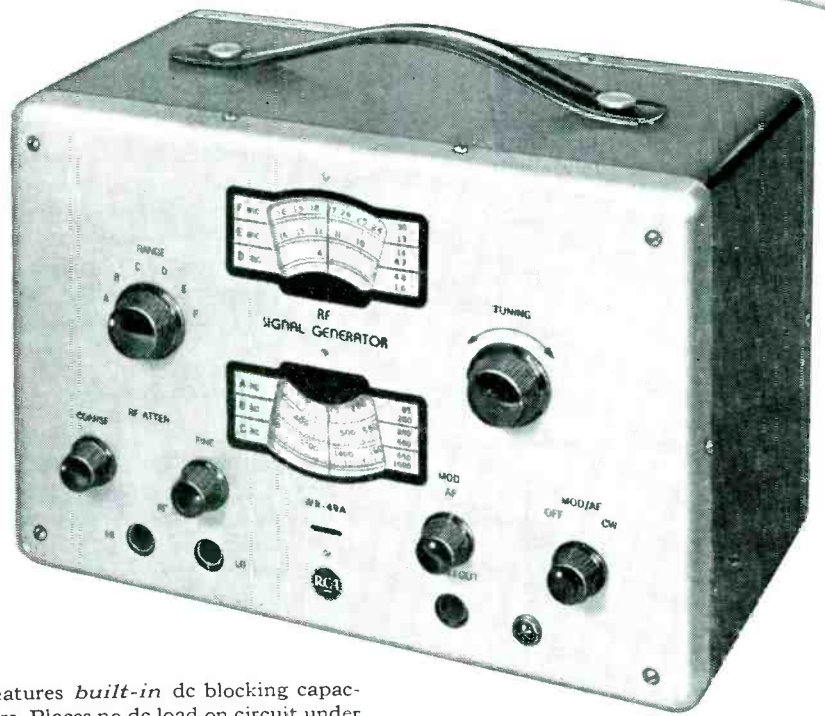
RCA WA-44A
Audio Signal Generator

Continuous sine-wave coverage from 11 cps to 100 kc

ONLY $87.50 Suggested User Price



Features new RCA-type oscillator having wide frequency range, and frequency stability of ± 3% or better. Regulated power supply. Amplified agc circuit insures an output uniform within ± 1 db over entire frequency range. Total harmonic distortion, 2% or less. Has direct-reading scales. Can be used with high- or low-impedance circuits. Useful for all response measurements. Has separate line-frequency output for inter-modulation distortion measurements. Compact, weighs only 10 lbs. Ac-operated.



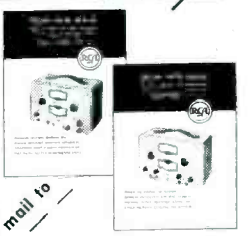
Features *built-in* dc blocking capacitors. Places no dc load on circuit under test . . . protects instruments when connected to B-plus circuits. Cathode-follower output stage isolates oscillator from effects of load reactance and resistance, thereby maintaining good output waveform, voltage regulation, and frequency stability of the oscillator.

Built-in 400-cycle oscillator for internal modulation. Modulation percentage continuously variable. Dial calibrations accurate to ±1% on all six bands. Complete shielding of copper-plated cabinet and of cables for minimum leakage. Compact, weighs only 8 lbs. Ac-operated.

RCA WR-49A
RF Signal Generator

Continuous coverage on fundamentals from 85 Kc to 30 Mc

ONLY $59.50 Suggested User Price



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Servicing Helps

by T. L. GILFORD

Tracing TVI With A Wavetrap Meter . . . '53 Auto-Radio Power Supply Notes . . . Low-Pass Filter Designs . . . Horizontal Drive Line Cures . . . Snivets . . . Increasing Brightness Range

INTERFERENCE has always been an irritating problem, particularly in TV, often involving experimentation with an assortment of traps before a solution is found.

Recently, it was found that the search and remedy for interference problems might be solved with a single test unit,[1] that would determine the type of trap or traps that would be necessary.

Pi-Filters Used

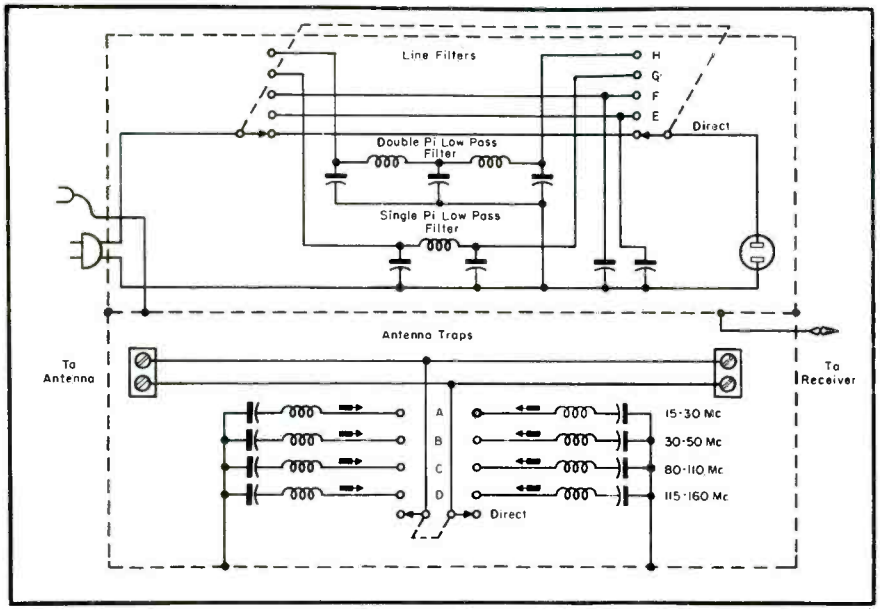
The instrument features a series of single and double pi low-pass filters serving as line filters, and iron-core coils capacitively coupled as antenna traps for 15 to 160-mc ranges.

In a typical installation of the unit, the antenna lead is removed from the TV chassis connected to terminal marked *to antenna*. A short piece of 300-ohm wire is then connected to the TV set antenna posts and to terminals marked *to receiver* on the test device. The *ac* cord of the receiver is then plugged into the receptacle on the test unit and lug grounded on the outlet box on the wall. Both switches are set at the *direct* position. This position is a direct feed-thru, with none of the traps connected in the circuit. The receiver is then turned on to the offending channel. Starting with position *a* on the *ant filter* switch, trimmers are adjusted until the interfering pattern is either completely eliminated or substantially reduced. If there is no reaction when the adjustments are made, then the switch is turned to position *b* and the same procedure is repeated. When a position is found where the maximum reduction of interference is accomplished, that position can be checked against a chart with characteristics of commercial traps that can be used to eliminate or reduce interference.

Where interference is suspected of entering the set through the *ac* line, various filters on the test unit can be switched in, and then a commercial line filter substituted as recommended.

[1] Fil-Test Wave Trap; Vidaire Electronics.

Fig. 1. Schematic of Vidaire wavetrap meter, FT-100, designed to identify assorted types of TV interference.



1953 Auto-Radio Power Supply Requirements*

ONE VERY important piece of equipment for auto radio service often overlooked is the power supply. Although a power supply is primarily a source of input voltage, certain of its features make possible a more thorough job of servicing and result in a speedier service operation.

12-V System Problems

A number of the '53 car models have 12-volt ignition systems. To take care of both 6 and 12 volt models, it is desirable to use a supply which can accommodate either type of set. For convenience, the supply should have features which enable the operator to set and control either voltage from the front panel; either a continuously variable control or a step switch. It is important to check always the voltage range setting before connecting the radio to prevent putting 12 volts into a 6 volt set.

To conserve copper for defense projects an aluminum wire solenoid was used on both the 6 and 12 *v* signal seeker radios made by GM. Due to

(*Continued on page 67*)

**From* TESTING TIPS, *prepared by the* DELCO RADIO DIVISION, *and submitted by* S. W. ARCHER, *Delco Radio Service manager.*

join the Jensen one-a-day club

MAKE EXTRA PROFIT OF $240.00 AND UP ON JENSEN PHONOGRAPH NEEDLE SALES IN 1954!

There's a golden opportunity to earn fast, extra profit every time you make a radio or TV Service Call. Here's how:

1. Simply say, "As long as I'm here, may I check your phonograph needle? If it hasn't been changed for the last 60 hours of play, it will absolutely *ruin* your records—*every time it plays.*"

2. Tell your customer you recommend a new Jensen and take the proper needle out of your Jensen kit and install it in just 2 or 3 minutes. *Pocket the profit at not one cent of extra sales cost to you* because you're there in the customer's house anyway!

A service dealer in California just reported selling 50 needles per week by this method. Previously he sold only 1 or 2 needles a week!

important!

93% of your customers are using worn needles. It stands to reason that you can easily sell at least 1-needle-a-day out of the 8 or 10 calls you make. Selling just 1 out of 8 customers a new Jensen will average $240.00 extra profit in a single year. And to net an extra $1000 profit a year from your regular service call business, you only need to sell every *other* customer.

GET READY TODAY for those extra profits tomorrow. See your distributor for the Jensen Phono-Needle Caddy No. 300 and One-A-Day folders for your service men and join the money-making Jensen "One-A-Day" Club now!

the Jensen **PHONO NEEDLE CADDY NO. 300**

. . . THE SALES TOOL THAT MAKES FAST, EASY NEEDLE PROFITS FOR YOU . . . THE JENSEN PHONO-NEEDLE CADDY!

This sensational Jensen Phono-Needle Caddy holds 12 replacement needles—the right needles to meet record player requirements in over 50% of your service calls. The novel accordian type plastic case folds down to only 5" by 2" and is only 1" thick. Slip it into your coat pocket or kit—takes hardly any space!

ONLY $9.75 TO DEALERS (complete installation tools included at no additional cost) RESALE VALUE OF NEEDLES $19.50.

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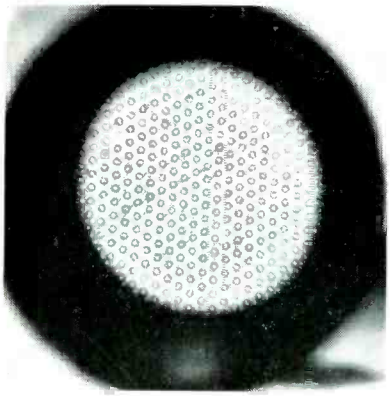
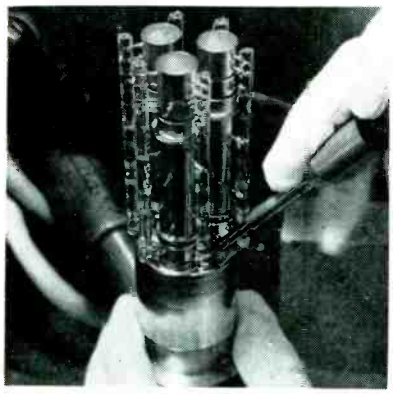
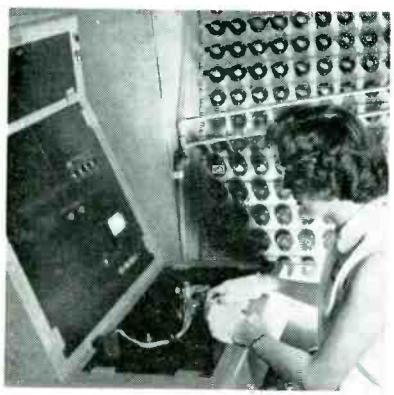


(Above)
Color-dot pattern of tricolor picture tube as seen through a magnifying lens. Approximately 600,000 dots of phosphor material on the tube's screen are aranged in precise triangular groups, each group containing a red, a green, and a blue phosphor dot. (RCA.)

(Below)
Tricolor picture tube's three electron guns, arranged in circle 120° apart. Guns are welded together. Then, cathodes, stem, and heater are added to complete gun assembly. Each gun emits electron beams to excite one of the three primary phosphor colors (red, blue, green) on the picture screen. (G. E.)



(Below)
A semi-automatic test set, said to be capable of handling up to 1,000 receiving tubes per hour. As tubes come off a sealing machine, an operator plugs them into the aging conveyor (shown behind the test set operator). Operator removes them from aging conveyor and plugs them into test socket. Test cycle is initiated automatically when the tube is inserted into test socket. Test cycle proceeds automatically, and if a reject should occur, the cycle is stopped at the reject test, and a red light indicates that the tube is not acceptable. (Sylvania)



by E. A. TEVERSON

TUBE News

Operational Properties of Tubes and Crystal Diodes Recently Developed for TV

To INCREASE efficiency of wide-angle picture tubes, and improve TV circuitry gain and stability, an assortment of new tubes have been developed.

For picture tubes with 90° deflection, a 6AU4GT[1] glass-octal rectifier intended for use as a damper diode has been designed.

Rated to withstand a maximum peak inverse plate voltage of 4500, the tube can supply a maximum peak plate current of 1050 milliamperes and a maximum *dc* plate current of 175 milliamperes. Furthermore, it is said, negative peak pulses between heater and cathode of as much as 4500 *v* with a *dc* component of 900 *v* can be used when the heater is operated negative with respect to cathode.

The *base pins* of the 6AU4GT fit the standard octal socket. Socket terminals for pins *1, 2, 4,* and *6* must not be used for tie points. It is also recommended that socket clips for these pins be removed to reduce the possibility of arc-over and to minimize leakage.

For final video *if* amp application, a new tube, 6AM8, a diode-pentode[2] has been developed. The tube is similar to a 6CB6 plus one-half a 6AL5 in 9-pin construction.

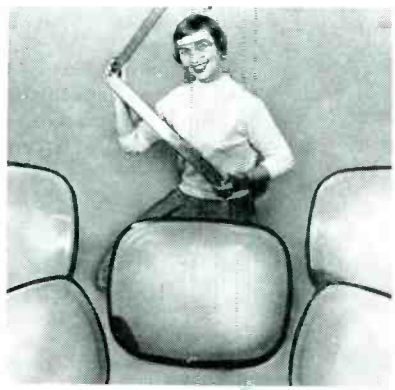
The pentode section of the tube has a transconductance of 5800 in typical operation. The addition of the diode is said to allow the tube to serve as a combined *if* amplifier and video detector.

Crystal diodes, of the germanium point-contact type, especially designed

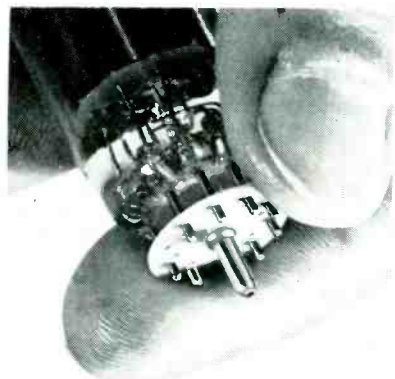
(*Continued on page 76*)

[1]RCA.
[2]Sylvania.

All-glass 21-inch 90° rectangular picture tubes, types 21ACP4 and 21ACP4A (aluminized), which are 20" in overall length. (G. E.)



Socket locator. In using, first, tube pins are straightened. Then tube is inserted into socket locator (the locator contains two pin circles . . . for seven-pin and nine-pin miniatures). Then, with key of locator, one finds hole in center rivet of socket, and tube is rotated until pins drop into socket. Tube is pressed gently, letting locator slide up pins, until tube seats firmly in socket. (CBS-Hytron.)



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SERVICE

Transit (Bus) FM Chassis Design . . . Receiver Control Through Supersonic Signals . . . Audio and Antenna Systems for FM Auto Models‡

Service Engineering — field and shop notes

by THOMAS K. BEAMER

IF YOU HAVE ever ridden a public bus in Cincinnati, Washington, St. Louis, Wilkes-Barre, or a score of other cities, you were greeted by soft, background music and occasional break-ins for weather, news, and short commercial announcements. And regardless of one's personal reactions at that particular time of day, exhaustive questionnaires have indicated repeatedly that over 90% of the riders like this form of reception via the *transit-bus* system.

Developing *transit* broadcasting to a practical point introduced a number of problems, and considerable field engineering on receivers, antennas, shock-mounts, power supplies, etc., was required. In addition, a fool-proof system for controlling both the level and on-off times of the receivers *from the transmitter* was necessary.

Receiver Development

Preliminary field work on the transit-bus scheme was started early in '49 when three members from WKRC (*John Ledbetter, Al Piepmeyer,* now of CBS, Hollywood, and *Max Kimbrel*) were assigned to the project of installing and field-testing FM receivers in five Cincinnati street railway trolley buses. The original receivers were shock-mounted in the rear window of each bus, with a ventilated steel cover protecting the receiver. Originally, eight *pm* speakers (four on each side) were installed in the buses, and speaker wiring run through the transom ducts. This presented a problem in certain types of buses because wiring had to be run through several solid bulkheads or rerouted. (Subsequent tests indicated that sufficient coverage could be obtained with six *pm* speakers instead of the original eight). For the final installation, each speaker was enclosed in a specially-made 6" plastic baffle mounted on the transom duct of the bus.

The receiver itself was a straight FM model with cascade limiters and a crystal oscillator stage for eliminating frequency drift. A major difference from ordinary FM receivers was the addition of a frequency-sensitive selector circuit to turn the receiver off and on, and increase the audio output by approximately 3 db when commercial announcements, news reports, etc., were made. (This increase was found to be necessary to give the same apparent level for both voice and music.) Tests proved that the same level which sounded *just right* for voice would almost cause passengers to leap headlong through the windows when music came on. The foregoing conditions were corrected by installing automatic level control. The *off-on* provision actually served to disable the audio system by grounding the grid of the first audio stage. The receiver, generator-powered, was designed to operate efficiently, until the bus is taken off the run.

Antenna Problems

Even with Cincinnati's hills, *dead* spots were surprisingly few. The main problem was the type of antenna which could be adapted to bus use. Originally a *V* type was used; it provided a signal but was impractical because automatic washing systems used for the buses damaged the antenna or transmission line each time buses were run through. The final model, acceptable in every way, was a folded dipole or *curtain-rod* type. Partly because of its configuration, and largely due to good limiting and *avc* in the receiver, reception was found to be excellent with practically constant level maintained over all bus runs.

Receiver Control Problems

Since WKRC-FM (the Transit FM station in Cincinnati) also broadcasts programs for home FM, it was neces-

(*Continued on page 77*)

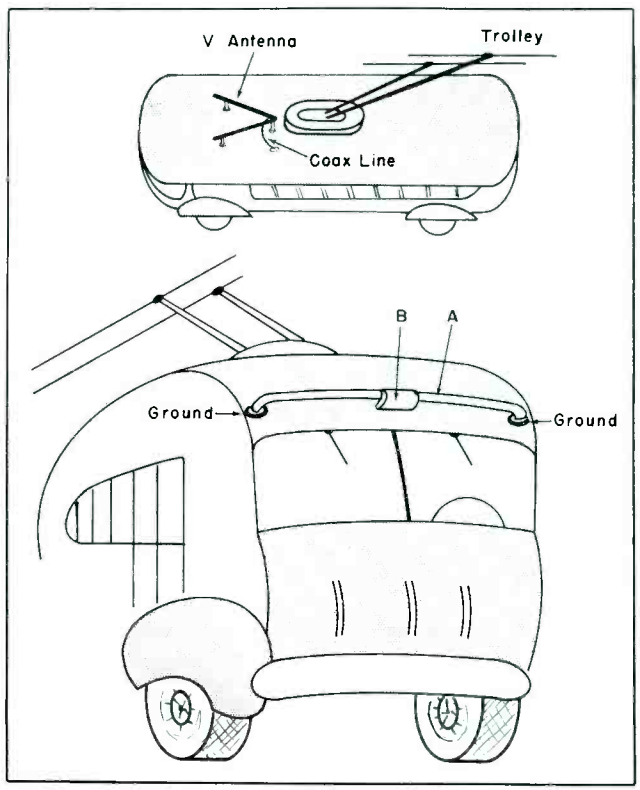

Fig. 1. At top is illustrated view of roof of bus with original V type of antenna used to pick up FM; antenna was found to be impractical because automatic car-washers damaged rods. In its place curtain-rod folded dipole, shown below at A, was adopted, with insulator and leadin connection installed, as shown at B.

‡*Based on information supplied by* ***John B. Ledbetter****, engineering writer, Convair.*

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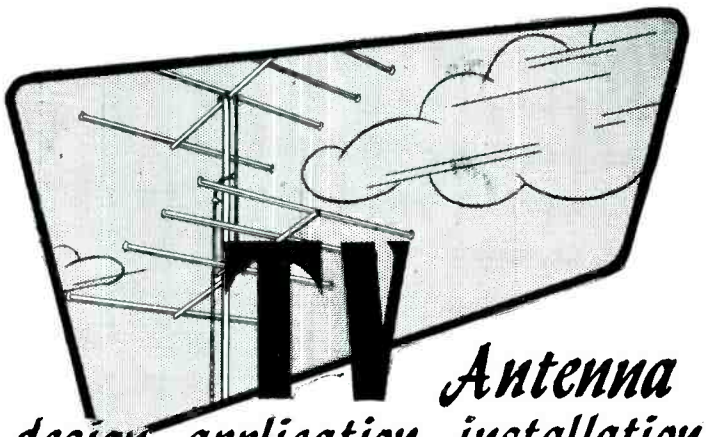


TV Antenna Digest
design..application..installation..service

by **RALPH G. PETERS**

Evolution of a Broad-Band VHF Antenna‡ . . . Highlights of New Antennas and Accessories for UHF and VHF

WITH THE LIFTING of the TV freeze, bringing expanded *vhf* coverage through new station operation, increased power and channel shifts, multi-channel pickup has become increasingly important. This need has prompted the development of 12-channel antennas.

In the evolution of one model for broad-band use, one group began their probe by considering first the ideal solution. Reviewing the horizontal polar diagram of a half-wave dipole and its current distribution, it was noted that since the voltage that a dipole picks up is proportional to its length, a high band dipole will pick up only one-third the energy of a low band dipole. The low band dipole can be considered to be three half-wave high-band dipoles tied together. The lobe-splitting is due to the fact that the two outside dipoles are in-phase and the center dipole is 180° out-of-phase. Therefore, cancellation occurs.

The desirable goal would be to have three dipoles in phase. Theoretically, the gain of three half-wave dipoles side by side in phase is about 3.2 db. It must always be remembered that the same three half-wave high-band dipoles must also function as a one half-wave low-band dipole.

One of the early attempts to achieve an all-band *vhf* dipole was the system which used a *bat wing*. This method was found to provide both high and low band operation; the dipole structure acted as a half-wave dipole on the low band, but on the high band, the *bat wings* formed electrical discontinuities in the dipole and effectively isolated the outer third of the dipole on each side. Thus from apex to apex of the *bat wings* on the dipole, there was one half-wave on the high band and, therefore, this dipole acted as an ordinary half-wave dipole. However, its full length was not utilized on the high band; consequently no significant gain was achieved in the high band dipole alone.

Probably the most familiar types of broad-band antennas are the conical or fan types. The total length of the elements equal one half-wave on the low band and three half-waves on the high band. The current distribution on the high band is the same as an ordinary low-band dipole, with the outer two sections being out-of-phase with the center section. The normal split-lobe pattern is overcome by tilting the dipole forward from the apex.

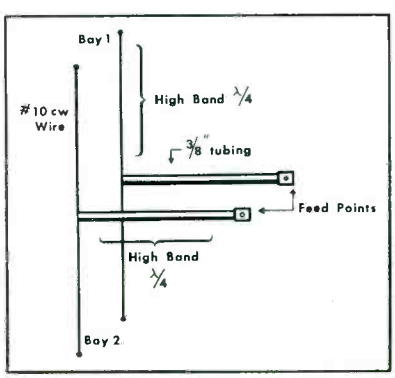
After reviewing the foregoing, it was decided to reverse the phase of the center dipole during high-band operation. The resulting configuration revealed another high band half-wave dipole immediately adjacent to the out-of-phase section in the low band dipole, when operating on the third harmonic.

It was noticed though that since two of dipoles occupied approximately the same point in space, they cancelled one another, so that high band operation was achieved through the use of a pair of extended dipoles. However, this approach produced only *two* half-wave dipoles on the high band. Low band operation remained unimpaired. The next step, then, was to tie another high-band half-wave dipole to these same feed points.

This system did achieve in-phase operation of the three sections on the high band, and also functioned as a half-wave dipole on the low band. However, due to low impedance characteristics, it had limited bandwidth.

Throughout these experiments, it was borne in mind that some reflector system would be required and that this would reduce the impedance of the antenna even further. Higher impedance was necessary and was obtained by using a folded dipole for the low band dipole, and straight conductors in the phase-reversing dipoles. This design still lacked the high-band characteristics necessary for flat response on channels *7* through *13*. And so, in

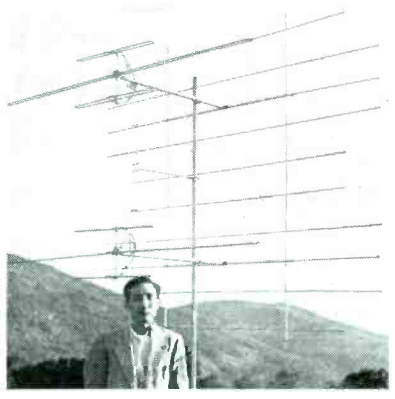
(*Continued on page 47*)



‡*From notes prepared by* ***Harold Harris****, in charge of engineering, Channel Master.*

(Left)

Fig. 1. Transformer arrangement used with broad-band dipole which serves to increase the impedance of the high-band frequencies more than the impedance of the low-band frequencies.



(Right)

Dr. Yuen T. Lo and broad-band vhf antenna designed for Channel Master.

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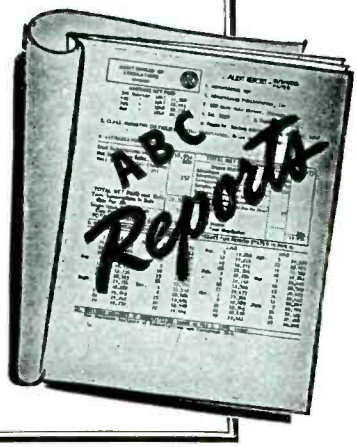

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TV Antennas

(*Continued from page 45*)

a final arrangement, folded dipoles were used throughout the entire structure.

The impedance of each of the two small phase-reversing dipoles was found to be below 300 ohms, due to mutual impedance and coupling. Special quarter-wave transformer lines had to be designed to transform these low impedances to sufficiently high values so that the total impedance of the three dipoles in parallel stayed in the vicinity of 300 ohms. In this final version, the high-band impedance was found to be slightly lower than 300 ohms, and the low-band impedance slightly higher.

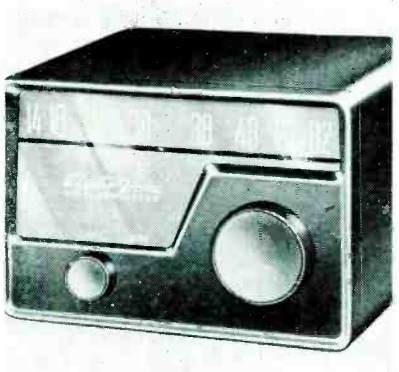
With the development of a dipole system which fulfilled the requirement of half-wave operation on the low band, and three half-wave in-phase operation on the high band, it was necessary to add a reflector system. A straight bar parasitic reflector was ruled out for several reasons.

The maximum potential gain of a straight bar reflector was found to be somewhat over 3 db and possible only at one frequency. However, it was found that a screen-type reflector has an optimum gain of approximately 7 db and is non-resonant. Thus the reflector itself is not frequency sensitive.

Accordingly it was decided to design a screen reflector large enough to provide efficient reflection at the low band. The dipole was spaced a quarter-wave from this reflector at low band operation and three quarter-waves on the high band. An interesting mechanical arrangement was developed for this screen reflector so that the entire reflector could be preassembled.

The widest application of this particular antenna system is in a two-bay array. A stacking harness introduced other problems. Since the transformation of impedances tends to multiply

(*Continued on page 77*)



(Right)
Guy wire in a flat handi-pack. A 7" circle on the top of box is perforated for lifting. Wire is unwound from the center of box. (Tuf-Guy Ten Spot; Fenton Co.)

(Left)
Uhf converter, available for local and fringe use. Features non-slip micrometer type tuning mechanism for continuous tuning of all uhf channels. Fringe model uses 6AF4 and 6BC5. High signal area model has tuned pre-selector stage in antenna circuit to discriminate against the local oscillator's back radiation. Output signal is also taken from tuned transformer. (Suburban (3300) and Urban (3400); designed by E-V and made by Harvey-Wells Electronics, Inc., Southbridge, Mass.)

Home Service-Call Procedures . . . Differences Between Radio and TV Servicing Techniques . . . Planning for Color TV Servicing

Systematic Servicing

by J. C. GEIST

IN PLANNING a systematic service program, it is important to include a routine procedure schedule for home service calls.

The following is suggested as a basis from which to develop such a plan:

(1) *Inspect antenna installation.*

A careful check of the entire antenna and transmission-line installation can be a real service in preventive maintenance. (If a second man is there he might just as well use his time to advantage. Also the fact that an antenna check is made on every service call would make good advertising copy.)

(2) *Measure receiver line voltage.*

Confusion can be eliminated by insuring that the line voltage is correct before attempting any servicing. For this, it is suggested that a *variac,* voltmeter and power outlet be mounted in a box, from which a line cord can be plugged into the wall outlet, and into which the receiver line cord can be plugged. With this device it will be possible to adjust the line voltage to the correct value and also to check receiver performance over a range of primary voltages.

(3) *Check rectifier tubes.*

Actual voltage measurements should be made instead of attempting to judge rectifier condition by picture characteristics. To allow rectifier output voltage to be measured from the top of the chassis a simple adapter could be provided for each standard type rectifier and from which a connector to the heater or cathode would be available for connection to the voltmeter.

A new tube should be substituted for each rectifier and should be left in as a replacement if it provided over about 15% increase in output voltage. An alternative procedure would be to test the rectifier tubes in a portable tube tester and replace the weak ones.

(4) *Measure picture tube second-anode voltage with brightness control at both extremes of range.*

If below normal, the high-voltage rectifier and other tubes in the horizontal deflection circuits should be replaced to bring this voltage up to normal. It will be impossible to get at the second anode terminal on some compact receivers without removing the chassis from the cabinet. A convenient way to make this measurement in most receivers is through the use of a high-voltage probe with a needle point which will pierce the rubber insulation. Such probes are now commercially available.

(5) *Correct specific faults by tube replacement.*

(6) *Make picture adjustments (height, width, drive, centering, etc.)*

(7) *Adjust tuner local-oscillator frequencies on all channels.*

To combine home calls and shop work properly into a single integrated professional service, *home-call teams* should become familiar with the past service history of each receiver on the day's schedule before leaving the shop. If it is not standard practice to take schematics on home service calls, a quick review of the applicable ones should also be made so as to recognize unusual tube compliments or other special features to be encountered. The team should also record the work done at each call so that it can be added to the shop service records.

Routing Home-Call Teams

Another area in which there is opportunity for improvement is in the scheduling and dispatching of the *home-call teams.* Some of the know-how from a progressive taxicab company could be advantageously applied to this phase of the operation. In larger service operations mobile radio dispatching is undoubtedly profitable. Whether or not it would be profitable in the smaller one-to-three truck operations is worthy of study. In any case, operating efficiency can certainly be improved by scheduling home calls in such a manner as to reduce the amount of traveling to a minimum. Some means of continuous control of the service teams should also be provided. A suggested method is to have the *home-call teams* telephone the shop at the completion of each call. In this way changes in schedule can be made for more efficient operation, last minute calls on the scheduled route can be included, and customers can be given accurate information as to when to expect service.

Summary

In the initial installment[1] of this report it was noted that spot repairing had been carried over from radio servicing. While it is natural for a radio service business to expand into the field of TV service, it is felt that failure to recognize the basic differences in the two operations has been a handicap in establishing generally profitable TV service activities with good customer acceptance. Home radio receivers are small, easy to handle and relatively simple in operation. Radio broadcasting is based on high signal level, groundwave transmission so that normally no antenna installation is required. The radio set is essentially a single-purpose device in that it must provide only a sound program. The signal received is such that considerable degradation in receiver performance can be compensated for by advancing the volume control. As a result the bulk of radio repairs have been successfully based on the repair of gross faults, replacement of weak tubes, a good knowledge of the trick circuits used to cut costs, and the ability to locate intermittents quickly.

On the other hand television receivers are large, difficult to handle (particularly in the modern larger screen sizes), and complex in operation. Television broadcasting is based on lower level line of sight transmission

(*Continued on page* 51)

[1] SERVICE: November, 1953.

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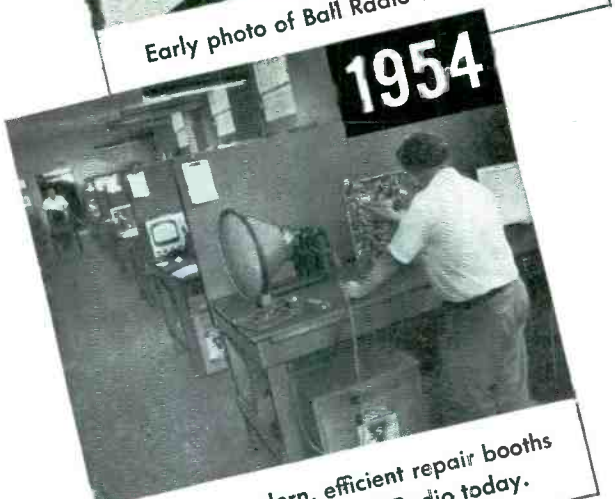
The steady and substantial growth of the Ball Television and Radio Service, from basement shop to the large handsome brick building, shown below, is a tribute to the fair practices and alert policies of the owner, Mr. Ted Ball.

Early photo of Ball Radio Service Shop.



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Rep Talk

BERT GILBERG, formerly office manager, is now a sales engineer for D. R. Bittan Co., 53 Park Place, New York 7, N. Y. Gilberg recently returned from Germany after serving two years in the armed forces. . . . *George G. Scarborough* has been elected president of the Mid-Atlantic chapter of the Reps. Others elected include: *John J. Mahoney*, vice president; *David G. Quinlan*, secretary, and *Kenneth Randall*, treasurer. Committee appointments were: *Wilfrid Graham*, publicity and information; *Samuel A. Jeffries*, industry relations; *J. R. Benge*, membership; *C. H. Newson, Jr.*, new industry; *Charles W. Lienau*, entertainment, and *Robert L. Wilkinson*, board of governors. . . . *Jerry Greenberg* has been named vice president of Adolph L. Gross Associates, Inc., 23 Park Pl., New York City. . . . *Frank A. Emmet Co.*, Los Angeles, Calif., is revamping its two story building at 2837 W. Pico Blvd., with the addition of mezzanine warehouse facilities, plus new shipping-receiving docks in the rear. . . . *Conrad R. Strassner Co.*, Los Angeles, Calif., has installed a teletype machine for use in communication with eastern factories. . . . *A. T. R. Armstrong Co.*, 50 St. Clair Ave. W., Toronto, Canada, has been appointed rep for Mark Simpson Manufacturing Co., Inc., in eastern Canada. . . . *Sam Karns Co.*, 36 Oak Ave., Tuckahoe, N. Y., is now rep for the Champion Bronze Powder and Paint Co. (aerosol products) in metropolitan New York, Westchester and New Jersey, south to and including Trenton. . . . *Edward S. Rivers* has been added to the jobber sales staff of Marshank Sales Co., 672 S. Lafayette Park Pl., Los Angeles, Calif. . . . *Barron-Jur Co.*, P.O. Box 653, Encino, Calif., has been appointed rep for Ward Products Corp., in southern California. . . . *S. A. Shaw Co.*, 92 S. Central Ave., Hartsdale, N. Y., has been named rep for the Radell Corp., in New York City, Long Island and Westchester, and portions of New Jersey. . . . *Ronald G. Bowen Co.*, 446 Broadway, Denver, Colo., has been appointed rep for the Raytheon receiving tube division's replacement tube department, in Colorado, Montana, New Mexico, Utah and Wyoming. . . . *K. C. Burcaw and Co.*, 22128 Grand River Ave., Detroit, Mich., will cover Michigan for Raytheon's receiving, picture and industrial tube lines.

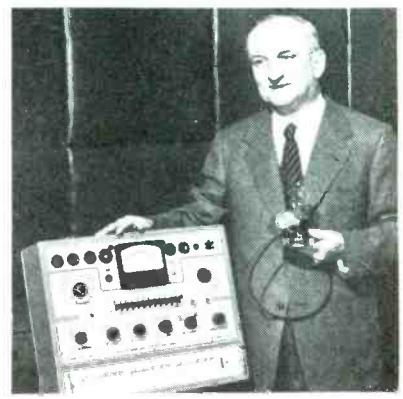
* * *

NEW ANTENNA PLANT

(Left)
TV antenna plant, said to represent investment of $1,500,000, and capable of a production potential of over four times its present factory, opened recently by Channel Master Corporation, Ellenville, N. Y. In addition to new factory, Channel Master's older plant, half mile away, will remain in operation. Plant has 115,000 square feet of floor space, and has six separate assembly lines. Feature of the factory is a complete aluminum extrusion and tube mill.

(Right)
R. L. Triplett, president of Triplett Electrical Instrument Co., holding tube tester he developed and designed in '35, comparing it with recently developed tube tester (model 3423). Company is now celebrating it's 50th year in the instrument business.

OLD AND NEW



Systematic Servicing

(*Continued from page 48*)

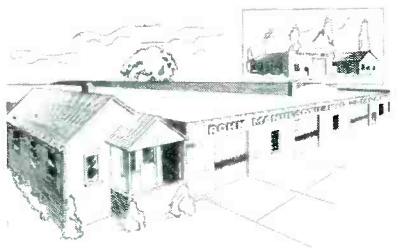
so that normally a separate antenna installation is required, and the nature of the signal is such that the antenna must be carefully installed and properly oriented. The TV receiver is a multi-purpose device in that it must provide not only a sound and picture signal, but it must also generate vertical and horizontal scanning signals and must sync these signals with components of the broadcast television signal. Furthermore, general degradation in performance cannot be compensated for by a single gain adjustment. To consider the television receiver as merely an overgrown radio is an over-simplification of the situation.

A service operation designed to meet the particular needs of television will result in an entirely different type of business, than one stemming from the simple extension of radio service techniques. Suggestions have been offered as a challenge in the hope that they may help to raise the general professional level of TV service. It has been implied throughout that equipment complexity is an important factor in the determination of appropriate service methods.

Color TV is in the offing and color receivers will be considerably more complex than the present black-and-white sets. Certainly service techniques embodying the concepts presented will be necessary to provide satisfactory solutions to the problems to be encountered in servicing color receivers. It will be necessary to develop more efficient methods to keep service costs within reason and to maintain a satisfactory level of receiver performance, and it will be necessary to make this more efficient service available to make color television broadcasting successful.

•

TOWER PLANT EXPANSION



Sketch of enlarged Rohn Manufacturing Company's plant, in Peoria, Illinois; 5,000 square feet addition has been completed at the main plant, the third addition to the original plant.

PERSONNEL

VERNE ROBERTS has been named distributor sales manager for I.D.E.A., Regency division, Indianapolis, Ind. Roberts, who formerly operated the National Sales Co., succeeds EARL H. KIRK, who takes over a newly created post of sales coordinator at I.D.E.A.


Verne Roberts


Roy A. Lake

ROY A. LAKE has been appointed vice president and general manager of the Jontz Manufacturing Co., Mishawaka, Ind. Lake was formerly assistant sales manager of the Conrad Hilton Hotel.

* * *

W. WALTER JABLON has been named sales manager, Home Instruments division, of the Freed Electronics and Controls Corp., 200 Hudson St., New York 13, N. Y.


W. W. Jablon


J. C. Lane, Jr.

JOE CHAPMAN LANE, JR. has been appointed manager of advertising and sales promotion for the Westinghouse Electronic Tube Division.

* * *

RUDOLPH FELDT, formerly manager of the instrument division plant of Allen B. DuMont Labs, has been appointed manager of the instrument division of Federal Telecommunications Labs, Nutley, N. J.

* * *

CHARLES M. ODORIZZI has been appointed executive vice president in charge of a newly consolidated corporate staff serving all unit and subsidiaries of the Radio Corp. of America. . . . DR. ELMER W. ENGSTROM is now executive vice president in charge of the RCA Laboratories division. . . . W. WALTER WATTS has been promoted to executive vice president in charge of electronic products division. . . . JOSEPH B. ELLIOTT has been named executive vice president in charge of consumer products division. . . . Elliott, Watts and Odorizzi will headquarter in the RCA Building, New York City; Engstrom will continue at the David Sarnoff Research Center in Princeton, N. J.

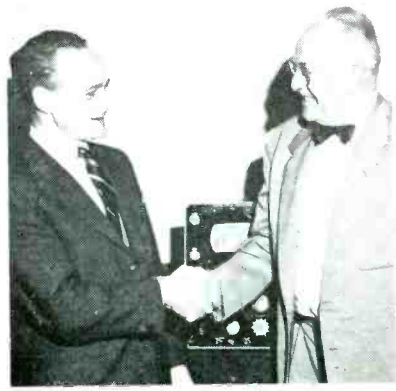
DR. GLENN BROWNING is now chairman of the board and GARDINER G. GREENE has become president and principal stockholder of Browning Laboratories, Inc., Winchester, Mass.

* * *

C. L. WALKER has been named manager of the Chicago sales office of General Instrument Corp. and its F. W. Sickles division. . . . RALPH R. STUBBE has become G.I.C. chief engineer.

* * *

MARTIN SHERIDAN, formerly with Steve Hannegan Associates, has been appointed director of public relations of the Admiral Corp., 3800 Cortland St., Chicago, Ill.


G. G. Greene G. H. Browning

Dr. M. Yung-Miao Dr. W. Osborn

DR. WILLIAM OSBORN and DR. MIAO YUNG-MIAO have been added to the engineering staffs of the Channel Master Corp., Ellenville, N. Y. Dr. Osborn was named project engineer in the development of *vhf* and *uhf* antennas, and Dr. Yung-Miao project engineer for mechanical test equipment for antennas.

* * *

DANIEL J. WEBSTER has been appointed marketing manager of Raytheon Manufacturing Co.'s equipment division

* * *

JEROME V. DEEVY is now director of industrial relations for National Union Radio Corp., Hatboro, Pa.

* * *

JOSEPH H. QUICK has been elected president of the National Co., Inc., Malden and Melrose, Mass., succeeding Charles C. Hornbostel who has resigned.

Joseph H. Quick

Charles F. Stromeyer

CHARLES F. STROMEYER has been named president of CBS-Hytron, Danvers, Mass. He succeeds Bruce A. Coffin who will retain his membership on the board of directors of CBS, Inc.

* * *

ROBERT A. SEIDEL has been appointed vice president of the sales and service subsidiaries of RCA. Headquartering at Radio City in New York, Seidel will be responsible for the activities of RCA Institutes, Inc., RCA Service Co., Inc., and RCA Victor Distributing Corp.

* * *

MORGAN GREENWOOD has been named general advertising manager of Philco Corp., Philadelphia, Pa. Greenwood was advertising manager of the TV and radio division.

* * *

CLIFFORD SHEARER has been named advertising manager of Radio Merchandise Sales, Inc.

Clifford Shearer

Tools . . . Instruments Parts . . .

ELECTRO DC POWER SUPPLY

A *dc* power-supply unit, *D-612,* for servicing and testing 6- or 12-*v* auto radios, or for battery charging, electroplating, etc., has been introduced by Electro Products Laboratories, 4501 Ravenswood Ave., Chicago 40, Ill.

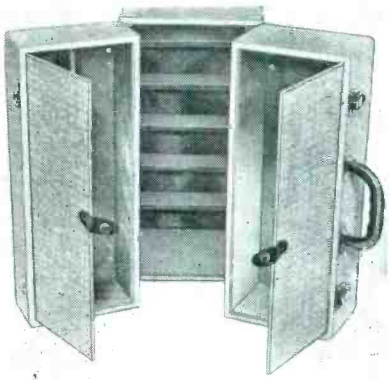
Features a continuously variable output 0-8 *v* and 0-16 *v dc*; maximum continuous current rating of 10 amperes for all voltages up to 12 *v* with intermittent current rating of 20 *a*; low ripple (less than 5% overall rated ranges is claimed); and choke input-type filter.

SERVICE
Will Be in Booth 892
1954 IRE Radio Engineering Show
March 22-25
Kingsbridge Armory, N. Y. C.

WINDSOR TUBE CADDY

A TV and radio tube caddy, *Carry-All*, capable of holding tubes, meters and tools for on-the-spot servicing, has been announced by the Windsor Electronic Tube Co., 1515 Sheepshead Bay Rd., Brooklyn 35, N. Y.

Available by purchasing a specified number of Windsor tubes over a period of time, or may be bought outright.



Windsor Tube Caddy

* * *

CLAROSTAT SMALL WIRE-WOUND AND TWISTED TAB CONTROLS

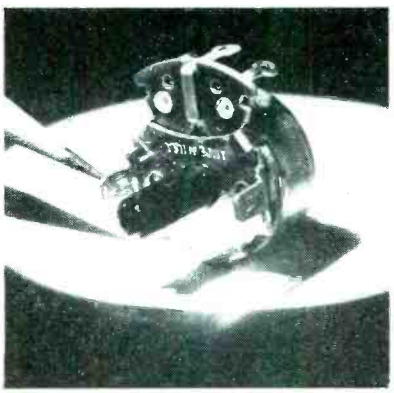
An improved version of the 1⅛" diameter (*series 43*) wire-wound pots, *series 43c*, available from 1 ohm to 10,000 ohms (2-watt rating), has been announced by Clarostat Mfg. Co., Inc., Dover, N. H.

Units feature an improved wiper arm contact and end termination. Contact is claimed to allow higher resolution, more intricate tapers and tighter tolerances in overall resistance and linearity. Terminals are directly fastened to winding for low contact resistance. Collector and terminal are in one piece, eliminating rivets as mechanical fasteners and current conductors. Stop is integral with base instead of in the cover.

Taps and various tapers available. With or without switch. Single, dual and triple assemblies. Choice of shafts.

Twisted tab mounted controls, series *47* (shown below), that are said to eliminate the usual bushing, lockwasher and nut, are also available.

Unit is mounted by inserting the tabs through slots in panel or chassis, and twisting them to secure the control in place. Control is 15/16" in diameter; available with or without switch, in resistance values from 500 ohms to 5 megohms; .5 watt rating; choice of tapers and taps; all types of metal or plastic shafts, including, if desired, a rear protruding slotted shaft.



ASSOCIATIONS

Howard W. Sams (center) showing the NATESA Friend of Service Management plaque, which he received at a special luncheon in Indianapolis, to Fred Colton, NATESA eastern central vice prexy, as Frank Moch, NATESA prexy, looks on. Colton was the recipient of the first annual award of the President's Cup of NATESA. The Cup, to be awarded annually hereafter at the Alliance's conventions, was presented to Colton . . . "because of his zealous work on behalf of NATESA."

RTA, Springfield, O.

RUSSELL L. DOVEL is now president of the Radio and Television Association of Springfield, Ohio and vicinity. He succeeds *Jack Carpenter*. *Anthony Petrausky* will serve as vice prexy, while *Walt Kugler*, and *Paul Boller* were both reelected to their posts as treasurer and secretary respectively, for another term.

NATESA

HOWARD W. SAMS received the *Friend of Service Management* award of the *National Alliance of Television-Electronics Service Associations* from Frank Moch, NATESA prexy, recently during a special luncheon at the Indianapolis Athletic Club.

Among those at the award ceremonies were *Mayor Alex Clark; Brig. Gen. E. J. Bean*, Ft. Benjamin Harrison; *Edward Beaman*, executive director of the Indiana Department of Commerce; *Herman Shibler*, superintendent of Indianapolis public schools; *Capt. Mal Peterson, USN*, of the Naval Ordnance Plant; *J. A. Milling*, executive vice president of Howard W. Sams & Co., Inc., and *William Book*, executive secretary of the Indianapolis Chamber of Commerce who served as master of ceremonies.

Also at the luncheon were *Vincent Lutz*, NATESA West Central vice prexy and prexy of the Association of TV Service Companies of Greater St. Louis; *Fred Colton*, NATESA East Central vice prexy and chairman of the board of the Associated Radio and TV Service Dealers of Columbus, Ohio; *A. L. Mirus*, vice prexy of the Association of TV Service Companies of Cincinnati and *Fred Levine* and *Larry Corlew* of the Television Installation Service Association, Chicago.

FRSAP, PA.

MILAN KRUPA, Wilkes-Barre has been reelected prexy of the Federation of Radio Service Men's Associations of Pennsylvania.

Bert Bregenzer, Pittsburgh, was renamed vice prexy; *Leon J. Helk*, Carbondale, secretary; and *Fred Schmidt*, Steelton, treasurer.

TEN YEARS AGO

THE RELATIONSHIP OF CHASSIS design to servicing requirements, covered by *Irwin W. Stanton* of the RCA Service Co. in an IRE Winter technical session report, revealed design engineers have begun to consider repair and maintenance problems now when they prepare receivers for the production line. . . . *Arthur Stringer* of NAB, in another IRE paper, emphasized the need for thorough studies of circuit fundamentals. Such knowledge, he explained, couldn't help but facilitate servicing and provide improved receiver results. . . . Advantages of signal tracing with multivibrators were reviewed. . . . Front cover featured circuit of variable mu *if* pentode, double-diode detector-*avc*, power pentode and rectifier portion of British 4-tube, 2-band *ac* receiver. . . . Twenty-eight employees of *Ken-Rad Tube and Lamp Corp.*, Owensboro, Ky., received cash awards for production-efficiency suggestions. . . . *Dr. Allen B. DuMont*, Allen B. DuMont Labs., was named president of the newly-formed Television Broadcasters Association. *Lewis Allen Weiss*, Don Lee Network, was named vice president. Also appointed were the following committees: postwar planning—*Paul Raibourn*, chairman; program—*Worthington Miner*, chairman; engineering—*E. J. Bingley*, chairman; membership—*Jack Poppele*, chairman; and publicity and promotion—*Robert L. Gibson* and *Paul Rairbourn*, co-chairmen. . . . *George C. Connor* was appointed manager of the California division of Sylvania's equipment tube sales. . . . *Henry Burwell*, formerly southern rep for Solar Manufacturing, was promoted to Major in the Army Signal Corps. . . . *I. Allen Mitchell*, president of United Transformer Corp., received a plaque from his employees in appreciation of his fine and cooperative spirit. . . . *A. R. Oliver*, field sales manager of renewal tube sales for Sylvania, began operation of the Pilgrim Distributing Co. at 600 W. Jackson Blvd., Chicago. . . . *Henry C. L. Johnson*, former advertising manager of the radio division of Sylvania, was promoted to a full lieutenant in the U. S. Navy. . . . *H. L. Dalis, Inc.*, New York City radio parts distributor, celebrated 20th year in business. . . . *Dr. Lee deForest*, inventor of the audion, predicted that TV receivers would flood the market within a year after the war. . . . *Lt. Colonel Bruce Burlingame*, former manufacturers' rep, reported as being somewhere in India. . . . *Tung-Sol* acquired a new factory in Brooklyn (near Ebbetts Field).

Catalogs and Bulletins

Westinghouse Electronic Tube Division, Dept. T-567, Box 284, Elmira, N. Y., has published a 34-page booklet, *EB*-108, detailing solutions to *uhf* reception problems. Featured are analyses of *uhf* and *uhf/vhf* antennas, transmission lines, and lightning arresters, and use of crossover networks, supplemented by charts, curves and tables. Also contains *uhf* conversion data for chassis made by Westinghouse and 25 other manufacturers. Priced at $1.00 from Westinghouse; free with purchase of 25 tubes.

* * *

Sarkes Tarzian, Inc., Rectifier Division, 415 N. College Ave., Bloomington, Ind., has released a 4-page brochure on *Selenium Rectifier Power Supplies for Color-TV Receivers.* Seven models are described, including one plug-in type, which are said to deliver from approximately 250 *vdc* at 500 ma to 450 *vdc* at 750 ma.

* * *

P. R. Mallory and Co., P.O. Box 1558, Indianapolis, Ind., has issued an 11-page manual, *Auto Radio Replacement Control Manual,* with nearly 600 model listings of 39 makes of chassis manufactured since '46. Information is grouped as follows: Manufacturers' names and radio models; control uses; parts numbers; replacement parts; special bushings or shaft parts, and replacement switch part numbers.

* * *

Simpson Electric Co. has published the first issue of *The Technician's Timesaver,* a bulletin written by *Bob Middleton,* which details shortcuts to TV servicing and practical applications for electronic test equipment. First issue includes an article on *How to Adjust a Video Amplifier,* and notes on servicing color TV. Available from Simpson, c/o Service Dept., Howard W. Sams and Co., Inc., 2201 E. 46th St., Indianapolis 5, Ind. . . . A 4-page brochure, describing five volt-ohm-milliammeters and volt-ohm-microammeters, is also available from Simpson. 5200 W. Kinzie St., Chicago 44, Ill.

* * *

Burgess Battery Co., Freeport, Ill., has prepared a 4-page folder, covering its developments in transistor batteries. Describes requirements for batteries used in transistor circuit operation.

* * *

Allen D. Cardwell Manufacturing Corp., 96 Whiting St., Plainville, Conn., has released a consumer folder describing increased virtues of TV chassis equipped with all-channel *uhf*-TV converters. Explains basic reasons for *uhf* broadcasting in easy-to-understand language.

* * *

Radio Merchandising Sales, 2016 Bronxdale Ave., New York 62, N. Y., has published a 32-page catalog, *55,* describing their line of TV antennas and accessories.

* * *

Carter Motor Co., Dept. 17, 2644 N. Maplewood Ave., Chicago 47, Ill., has published a 28-page catalog, *753,* providing electrical and mechanical specifications on their dynamotors, including performance on 'scope charts. Featured are change-a volt *dynamotors* and a heavy-duty generator.

* * *

Gee-Lar Manufacturing Co., 1330 10th Ave., Rockford, Ill., has a 16-page catalog, *56,* featuring list prices as well as complete product description, of molded plastic knobs for radio, TV instrument and experimental work.

On Book Row

DIAL CORD STRINGING GUIDE. . . . DC-3 AND DC-4: Two useful books with dial cord stringing diagrams for radios from '50 through part of '51, TV receivers from '46 through part of '51 (DC-3), and radio and TV receivers from '51 to '53 (DC-4). Combined index in books cover models previously listed in the series.—*Each book 96 pages, 5½" x 8½" paper bound, priced at* $1.00 *each; Howard W. Sams and Co., Inc., 2201 E. 46th St., Indianapolis, Ind.*

* * *

GUIDE TO AUDIO REPRODUCTION. . . . BY DAVID FIDELMAN: Covers all phases of audio reproduction beginning at input circuit and carrying right through to loudspeaker. Special emphasis has been placed on requirements of sound systems, principles and practical applications of phono and mike pickup units, loudspeakers, enclosures and magnetic recording. One section is devoted to the servicing of audio amplifiers and hi-fi systems. Concluding chapter describes the techniques used for the measurement of audio quality from audio amplifying systems.—232 *pages,* 5½" *x* 8½", *paper bound, priced at* $3.50; *John F. Rider, Publisher, Inc.,* 480 *Canal St., New York* 13, *N. Y.*

* * *

ELEMENTS OF ELECTRICAL ENGINEERING—6TH ED. . . . BY COOK AND CARR: In this edition basic essentials are still emphasized, but space devoted to electronics has been increased. New problems have been formulated to illustrate principles of electric and magnetic circuits, electrical machines, *dc* machinery, *ac* circuits, *ac* machinery and instruments, electronics and special applications.—682 *pages, priced at* $6.75; *John Wiley and Sons, Inc.,* 440 *Fourth Ave., New York* 16, *N. Y.*

* * *

INDUSTRIAL ELECTRONICS. . . . By DR. R. KRETZMANN: This text is devoted to a detailed study of the applications of electronic tubes in industry, and examples of arrangements used for industrial operations, from component inspection and counting to welding and motor-control.—250 *pages, 6" x 9", priced at* $5.50; *Elsevier Press, Inc.,* 155 *E. 82nd St., New York* 28, *N. Y. (Distributors for Philips' Technical Library).*

* * *

UHF TELEVISION ANTENNAS AND CONVERTERS. . . . BY ALLAN LYTEL: Book features an explanation of *uhf* antenna properties and behavior, with emphasis on the principles and practices of transmission lines. One section is devoted to circuit diagrams and explanations of different types of *uhf* converters manufactured. Also contains a tabulation of *uhf* test equipment with specifications.—118 *pages,* 5½" *x* 8½", *paper bound, priced at* $1.80; *John F. Rider, Publisher, Inc.*

* * *

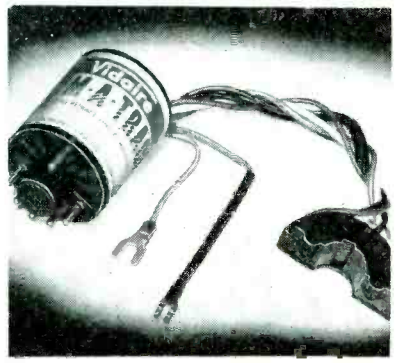
LOW-FREQUENCY AMPLIFICATION. . . . BY N. A. J. VOORHOEVE: A comprehensive volume on the audio-frequency art. Chapters detail basic principles, *af* tubes, preamps, output amplification, feedback, matching, control and limiting, components, rectifier systems using tubes and metallic cells, power units, acoustic principles, input sources, instrumentation, enclosures, and terms and symbols.—550 *pages, 6" x 9", priced at* $9.00; *Philips' Technical Library, distributed by Elsevier Press, Inc.,* 402 *Lovett Boulevard, Houston* 6, *Texas, and* 155 *E. 82nd St., N. Y.* 28, *N. Y.*

TV Parts... Accessories

VIDAIRE RETRACE-LINE ELIMINATOR

A vertical retrace line eliminator, *Elim-A-Trace*, that is claimed to eliminate vertical retrace lines usually visible when brightness-control is turned up, has been introduced by Vidaire Electronics Corp., Lynbrook, N. Y.

No cutting or splicing of leads is said to be necessary; installation can be made without removing chassis or picture tube from the cabinet.



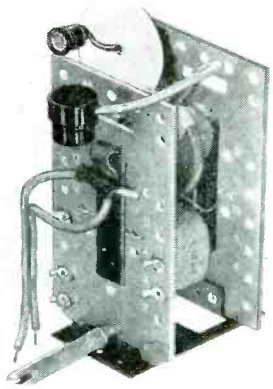
Vidaire Elim-A-Trace

* * *

HALLDORSON FLYBACK REPLACEMENTS

A flyback transformer, *FB412*, that is an exact replacement for part C-201-21025-1 used in *Airline*, *Raytheon*, and *Tructone* TV sets, is now available from the Halldorson Transformer Co., 4500 Ravenswood Ave., Chicago 40, Ill.

Unit features a variable-gap width control, tapped *age* winding, and special mounting base. Services 84 types of the TV makes mentioned; bulletin *116* lists models and chassis.



Halldorson Replacement Flyback

* * *

RCP HV MULTIPLIER PROBE

A high-voltage multiplier probe, *HVMP 2*, for extending the *dc* voltage ranges of model 655 peak-to-peak *vtvm*, has been announced by Radio City Products Co., Inc., 152 W. 25th St., N. Y. C.

Probe multiplies the scale used by 100. Available with multiplier resistor and terminations.

ARC LOW-VOLTAGE BOOSTER

A low-voltage booster, *PIX Expander,* that is plugged directly into a 5U4 socket, has been introduced by Arc Equipment Co., 85 Fifth Ave., Paterson 4, N. J.

Unit is said to add width and height to undersized pictures.

* * *

SECO GRID CIRCUIT TESTER

A grid-circuit tester, *GCT-1-2,* that employs an electronic eye which it is claimed will reveal *agc* circuit faults such as control-grid emission, high resistance cathode-grid or cathode-to-heater shorts, has been developed by the Seco Manufacturing Co., 5015 Penn Ave., S., Minneapolis 19, Minn. Tester also can check tubes in audio, *if* and sync circuits.

Tester is transformer operated using a selenium half-wave rectifier, and employs a *dc* amplifier with the eye indicator. Available in kit or wired form.

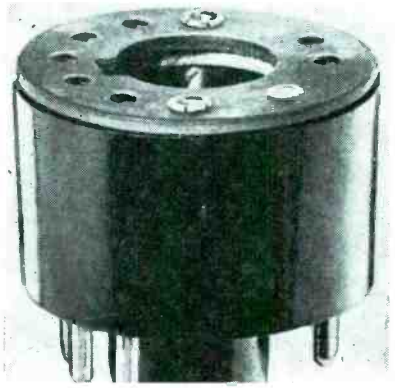
Seco Grid Circuit Tester

* * *

PERMA-POWER HORIZONTAL BAR GENERATOR

A horizontal bar generator, that is said to provide precise setting of yoke, positioning of focus coil or magnet and adjustment of vertical linearity, height and centering, has been introduced by the Perma-Power Co., 4727 N. Damen Ave., Chicago 25, Ill.

Features a neon-tube relaxation oscillator that provides a series of equally spaced horizontal lines to indicate picture linearity.



Perma-Power Horizontal Bar Generator

* * *

IMPERIAL GROUND ROD

A ⅜" steel ground rod has been produced by Imperial Radar and Wire Corp., 820 E. 233rd St., Bronx 66, N. Y.

Finished with oil coating. Rod is available in 4' and 6' lengths, with a turned down point that is said to make it easy to drive into any type of soil.

EICO PICTURE-TUBE CHECKER KIT

A picture-tube checker kit, *630,* for testing all sizes of electrostatic or electromagnetic types, either in the set or carton, is now available from the Electronic Instruments Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

Model features use of a neon lamp to indicate shorted or open elements, as well as bridge measurement of peak beam current. Test sockets and cables are provided for picture tubes with either duodecal or diheptal sockets. Octal socket is provided on panel so adapters can be plugged in for tubes with other bases. Unit is also available in wired form, *630-K.*

Right: Elco Picture-Tube Checker

VIDEO INSTRUMENT UHF BOOSTER

A uhf booster, *Vico*, that is said to have a 14-db gain and 6-db noise figure, has been announced by Video Instrument Co., 5458 W. Washington Blvd., Los Angeles 16, Calif.

Features a disk seal triode which is claimed to eliminate lead inductance, and provide input-output isolation in grounded-grid operation. Booster employs a tuned input line. Also incorporates a tuned quarter-wave line output tank circuit.

Video Instrument UHF Booster

* * *

HICKOK TV MARKER GENERATOR

A *u/v* marker generator, *690*, that is claimed to cover frequencies from 4.25 to over 225 mc on fundamentals with a .25-*v rf* output and provide dual markers with any TV sweep generator, has been introduced by the Hickok Electrical Instrument Co., 10521 Dupont Ave., Cleveland 8, O.

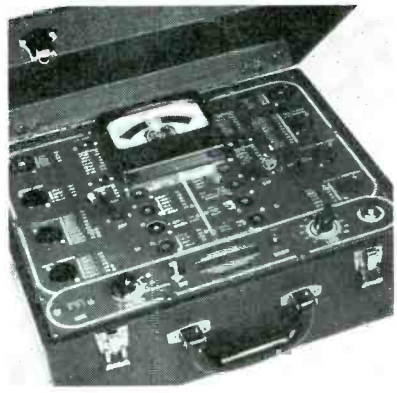
Unit is said to have an accuracy of .05% of marker setting. Features crystal control; fundamental ranges of 4.25-11, 19-50, 54-108, and 155-225 mc; harmonic output on *uhf* channels, 14-47 third harmonic and 48-83 fourth harmonic. Marker can be modulated by a self-contained 400 cycle signal, and has a position for adding two other crystals in addition to the 2.5-mc crystal included.

* * *

AMERICAN SCIENTIFIC TV TUBE TESTER

A TV tube tester, *TV-20*, with 20 connected sockets, is now available from the American Scientific Development Co., P.O. Box 104, Fort Atkinson, Wis.

Features dynamic conductance test, and includes automatic line compensation and gas detection circuit.



NEWS

TACO SPONSORS TECHNICAL FORUMS

Technical forums for Service Men are now being conducted by Technical Appliance Corp., under the auspices of Taco distributors.

Forums are being held in conjunction with field meetings. In sessions held recently in the Iowa and Florida areas with meetings in Des Moines, Tampa, Orlando, and Jacksonville, Taco was represented by *Tore Lundahl,* vice president, while the Florida meetings were conducted by *Ken Lippitt,* chief engineer. UHF installations were the topics discussed in these forums; meetings were supplemented by a *q* and *a* period.

* * *

DAVIS ELECTRONICS EXPANDS

Two additional plants, located in regional markets, are now in production on all-channel antennas, it has been announced by Davis Electronics, 4002 West Burbank Blvd., Burbank, Calif.

One plant at 8933 Brookville Rd., Silver Spring, Md., will supply the Eastern seaboard; unit is under the supervision of the *Morris F. Taylor Co.,* factory reps. Other plant will serve the Midwest, and is situated at 5725 N. Central Ave., Chicago, Ill.

* * *

GRANCO ADDS NEW PLANT

Ground has been broken for a new addition to the plant of Granco Products, Inc., 36-17 20th Ave., Long Island City 5, N. Y. Building will, it is said, more than double present quarters of the company. Much of the area in the present building will be devoted to engineering and lab facilities.

* * *

CINEMA CONVERSION CHART

An audio power conversion chart, that is printed in card form for hanging on wall or placing under glass tops of desks, is now available from the Cinema Engineering Co. Division Aerovox Corp., 1100 Chestnut St., Burbank, Calif.

Chart offers power level information; data may be used in converting from db system (zero equals .006 watt) to *dbm* and for voltages across impedances other than 600 ohms.

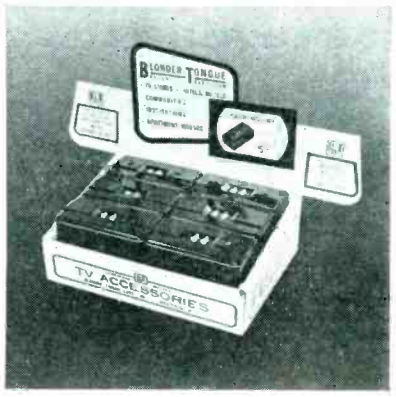
* * *

RCP COUNTER-MERCHANDISER

Left: A counter-merchandiser display, that features test leads, introduced by Radio City Products Co., Inc., 152 W. 25th St., New York 1, N. Y. Merchandiser, 18" x 13½" x 4½", has a storage compartment in the rear for stock. Test leads featured are 921 solderless test prod type; 930 retracto-lead model, and 910 hv test lead.

ANTENNA ACCESSORY DISPLAY CARTON

Display cartons designed to promote outlet boxes (packaged in weatherproof polyethylene bags), line splitters, matching transformers, attenuators, and line loss equalizers. (Blonder-Tongue Laboratories, Inc.)



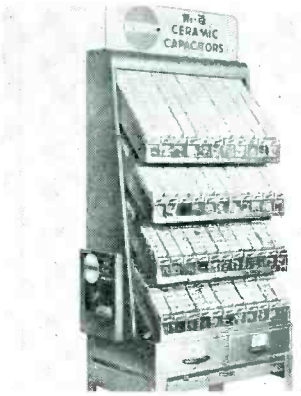
AT SERVICE CLINIC

Carroll W. Hoshour, director of sales engineering of Raytheon TV & Radio Division and F. E. Anderson, general sales manager of Raytheon's receiving tube division in Chicago, at recent service meeting in N. Y. City, which featured talks on the Raytheon Service-Saver system by William Ashby, Raytheon service engineer and John F. Rider.

TV ANTENNA TRUCK FLEET

Trucks now in use by Snyder to expedite delivery to nearby distributors, to docks and other points of shipment. Trucks will also be used for short hauls along the Eastern seaboard to distributors outside the Philadelphia area.

CERAMIC CAPACITOR DISPENSER



Ceramic Center dispenser which displays some 700 window cartons, each containing five pieces of given type and value. Cartons are on inclined channeled shelves to accommodate either the individual cartons or the ten carton display sleeve. Dispenser also has drawers for slug type or cartwheel capacitors, and again for plate assemblies. At cabinet sides are literature racks dispensing the latest catalogs and other data. (Aerovox.)

Color TV Controls

(*Continued from page 23*)

quency spectrum of a color transmitter is essentially the same as for monochrome transmission with the exception of the color subcarrier. In the spectrum of present day vestigial sideband TV transmission in the allotted 6-mc band, the video carrier has a frequency 1.25-mc higher than the lower frequency end of the 6-mc band. The video spectrum extends almost 1.25 mc downward and 4-mc upwards in frequency from the carrier, whereas the sound carrier is .25 mc below the upper frequency end of the band.

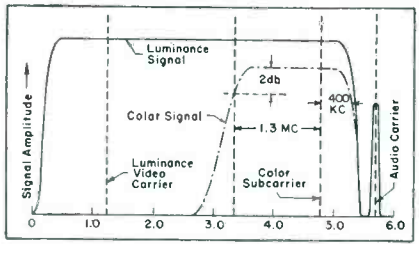
Color TV Spectrum

The channel for the transmission of color TV signals has a spectrum as shown in Fig. 5. Comparison with the b-w spectrum shows that another carrier has been added to the transmission, namely, the color subcarrier with a frequency of approximately 3.58 mc (actually 3.579545 mc) higher than the video carrier.

In the present day TV broadcasts the whole transmitted video spectrum carries the black-and-white, brightness or the luminance information (E_Y). Similarly, in color transmission all of the video spectrum, with the exception of the color subcarrier, carries this same luminance signal, E_Y. The color information is transmitted on the 3.58-mc color subcarrier.

The subcarrier is modulated in two ways; in amplitude and in phase. The amplitude of the signal corresponds to the saturation of the color, whereas the phase corresponds to the hue. In order that the phase of this color subcarrier may be measured, a *burst* signal is transmitted on the *back porch* of the blanking signal immediately after the horizontal synchronizing pulse. This burst signal consists of 8 or 9 cycles of a sine wave with a frequency of 3.58 mc and it is of sufficient duration and energy either to shock excite a resonant crystal circuit or control the frequency and phase of an oscillator operating at this frequency.

Fig. 5. Spectrum of NTSC compatible color TV transmission.



SERVICE MEN CASH PRIZE CONTEST

Announcements, now being distributed, detailing contest for Service Men that offers $5,600 in cash prizes. First prize in contest, sponsored by Pyramid Electric, will be $2,000; second and third prizes will be $500 and $100, respectively. In addition, there will be 500 other cash awards. Contest entails completing the sentence: "I like Pyramid capacitors because . . . " in 25 words or less. Entry blanks for the contest will be available through jobbers, who will countersign each one submitted. Each entry will have to be accompanied by the top of a box from a Pyramid dry electrolytic.

Printed Circuit Chassis

(*Continued from page 25*)

material with standard components. For example, *pc* controls can be replaced with standard types by bending back the terminals of the latter. If the terminals are too wide to fit the chassis holes, they may be trimmed with a pair of cutters to conform to the desired width. Some disagreement exists as to whether these parts should be mounted close to the chassis or away from it. When components are mounted close to the chassis, the leads require bending on the wiring side to prevent dropout. If a slight spring action is introduced to the component terminals, the parts can be mounted from the top side without this additional step, thereby saving time. Some resistors, particularly those used in voltage-divider networks, filters and bleeder circuits, can develop sufficient heat to affect the plastic. In addition, a resistor burnout or a shorted capacitor may destroy part of the plastic chassis. For these reasons, it is advisable to raise these components slightly above the chassis. Another method involves the use of small glass or ceramic beads slipped over the terminals to raise the component.

Soldering Precautions

When removing defective components, great care must be used, since the application of too much heat may destroy the bond between the plastic and the metal foil. When soldering or unsoldering, one should use a light pencil iron, applying it only long enough to cause the solder to flow. It is advisable to clip the leads of the defective part as close to the upper side of the chassis as possible, and then unsolder and remove the clipped leads from the printed wiring side. A thin pointed steel awl can be used to clear the hole of solder to facilitate the insertion of the new component.

If a defective socket is to be removed, the following procedure is recommended. Each socket terminal should be broken with either a sharp knife or a pair of cutters, being careful not to disturb or injure the printed wiring. The bakelite portion can then be snapped out, and the clipped terminals unsoldered from the wiring. The new socket can then be snapped into place and resoldered. In soldering in new sockets, the heat should be applied to the terminal and the solder allowed to flow off it onto the wiring. A similar method should be used for components. The heat should be applied to the component terminal, and the solder allowed to flow onto the wiring. While this method is not generally recommended for components,

particulary resistors, it will prevent lifting of the foil.

In servicing a receiver or other unit, it is often necessary to remove a resistor or capacitor from the associated circuitry to test it. In *pc* work, this will present a problem because of the danger of destroying the printed wiring. In some cases, it may be advisable to cut across the wiring with a sharp knife to kill the continuity. The subsequent repair can then be made in either of two ways. A drop of solder can be applied across the break. If this is not possible, then a short piece of No. 20 or 22 bare-tinned wire should be placed across the break, and soldered into place. A long piece of wire dipped in solder flux, with a short right angle bend in it, should be used to facilitate holding it in place while soldering. Incidentally, the same method is used for repairing wiring breaks.

PC Chassis Revisions

Circuit changes can easily be made on printed circuits. The plastic is drilled with an ordinary hand drill, and the component inserted in place and soldered. A No. 60 drill should be used for most leads; a No. 58 drill for the heavier leads such as filter capacitors; and a No. 52 drill for heavy wires and shielding.

While some holes may be drilled directly into the metal foil, it may not always be possible to do so, particularly if the foil width is too narrow. For this condition, the hole should be drilled alongside the wiring, and the component lead folded across the wiring to solder.

Bending a plastic chassis may cause minute breaks to appear in the wiring. This is a hazard not encountered in conventional wiring. It is therefore necessary, when checking *pcs* to test the wiring as well as the components. When testing with pin type probes, one must not stick the probe pins into the wiring. Testing should be done at terminal points, since it is very easy to destroy the wiring continuity, especially if the probe point should slip. Also, it is well to remember that all wiring is exposed, and any metallic objects can short out the wiring. If *vhf rf* circuits are not involved, it would be well to spray the wiring with a light plastic spray to reduce this hazard.

Undoubtedly, improvements in both plastic bases and metal bonding will eventually remove some of the less desirable characteristics of printed circuits. However, the natural servicing advantages of *pcs* will certainly be a boon to Service Men.

Servicing Helps

(*Continued from page* 38)

the characteristics of aluminum wire, greater current drain is required than for the equivalent copper wire size. The average current drain, after warmup, for the GM 6-volt models is 7.3 amperes with 6 volts input, and with the aluminum wire solenoid energized the current drain is 22 amperes. The average 12-volt radio model will draw 3.8 amperes after warmup with 12 volts input, and with the aluminum wire solenoid energized will draw 11 amperes. This high current drain will not blow the specified fuse in the *A* load under normal operating conditions because the overload only lasts 1/10 of a second. However, it will blow the fuse if the solenoid is kept energized.

To energize the 12-volt solenoid, at least 11 volts input to the 12-volt radio is required. If a solenoid appears to be defective, the input voltage should be measured at the spark plate of the radio. If this voltage is less than 11, the voltage range setting of the power supply should be advanced until there is 11 volts or more at the spark plate. The solenoid will be found defective if

(*Continued on page* 68)

Servicing Helps

(*Continued from page 67*)

it will not operate with 11 volts or more across it. A tuner mechanical bind or improper adjustment of the solenoid pole piece could also prevent the solenoid from operating. To check a 6-volt solenoid the voltage measured at the spark plate of the 6-volt radio should be 5.5 volts or greater.

If the power supply does not have good regulation, a battery of the required voltage rating can be floated across the terminals to hold the voltage constant as more current is drawn from the power supply. The battery, having excellent regulation, will hold the power supply voltage at 12 volts (or 6 volts as the case may be).

When the supply is turned on without a radio connected, the supply will act as a battery charger to supply a trickle charge to the battery; leaving the connections as they are, or positive to positive, negative to negative. When the supply is turned off, the battery will not discharge because there is no return path for the current.

Regulation is important also in that the no-load voltage must not be excessive. If 14.2 volts or more is applied directly to a 12-volt vibrator at the instant that it starts to operate, the air between the vibrator contacts may ionize and arcing could occur; this causes burning and welding together of the vibrator contacts. This condition is called *flare*. To avoid *flare* the vibrator circuit in the GM 12 *v* radios provides protection for the vibrator up to 17 volts. One must be sure that the 12-volt supply is always set to deliver less than 18 volts before turning on the radio, to avoid damaging the vibrator. If the power supply delivers more than 18 volts without any connected load, a battery floated across the power supply terminals will hold the output at 12 volts. (Note: If a battery is floated across the supply to improve regulation, it must be disconnected to vary the voltage output of the supply.)

Another method of controlling the no-load voltage is to connect a bleeder resistor across the output terminals of the power supply. A trial and error method will determine the value of resistance which will draw 1 ampere or less with no other load connected. To determine this for a 12-volt supply, the voltage range control should be set at maximum and resistors between 10 and 25 ohms (20 watts or more) connected until the correct value is determined to give approximately 1 ampere

of current and drop the no-load voltage to 18 volts or less.

Low-Pass Filter Design

THE LOW-PASS FILTERS referred to in the *Intermittent Fault Location* report, which appeared in the October issue of SERVICE, are intended to attenuate the signal generator frequency while passing the band of noise frequencies generated, when intermittent components are mechanically jarred or tapped.

In the case of the *rf* or *if* signal, the low-pass filter can consist of a .001 or .006-mfd capacitor shunting the output of the diode detector.

For testing audio circuits with a 10 to 15-kc signal, the filter can consist of a .25-mfd capacitor shunting the output of the diode detector. No resistors or chokes are necessary.

The diodes may be any of the vacuum tube variety, such as 6H6, 6AL5, etc., or germanium crystal type, such as 1N34.

Horizontal Drive Line Cures*

FIELD REPORTS indicate some have experienced difficulty in eliminating horizontal drive line on the CBS Columbia 1021 chassis; Masterline series.

This horizontal drive line is identified as a narrow white vertical line appearing either in the center of the picture tube or slightly to the left of center and runs from top to bottom.

Normal procedure to eliminate this drive line is to turn the horizontal drive control, located at the rear of the receiver, in a clockwise position.

If the drive line still persists it can be reduced by changing R_{412}, a 330,000-ohm resistor to a 180,000-ohm ½-watt resistor; R_{412} is connected from the horizontal drive control to ground.

Snivets**

SNIVETS, black lines or blotches appearing on the right-hand side of the raster in a TV picture tube, are quite prevalent in the *uhf* band in most manufacturer's receivers; they can be ignored unless they occur on a channel where the signal is not strong enough to override them. In such severe cases they can be eliminated or moved to a different part of the spectrum by changing the horizontal output tube; 6BQ6 or 6CD6.

Increasing Brightness Range‡

DEPENDING ON SUCH variable factors as line voltage, picture tubes, high voltage transformers, etc., it may sometimes be desirable to increase the amount of reserve brightness on Emerson 120196-B, 120197-B, 120197-D, and 120206-D chassis; models 781A, 781B, 784E, 748K, 784G, 792D and 781E.

This can be accomplished in the field by removing the capacitor (.0033 or .0068 mfd) mounted on the horizontal output transformer between lugs *1* and *5*. This capacitor is electrically connected across the horizontal width coil.

On some chassis a 100-mmfd 4,000-volt capacitor is used in place of the .0033 or .0068, but is connected between lugs *5* and *7* of the horizontal output transformer. This capacitor should be removed from those chassis which incorporate it.

In lowline voltage areas the removal of these capacitors may result in insufficient width even after readjustment of the horizontal width coil. If this is the case, the 6BQ6 horizontal output tube should be replaced. Several of these tubes may have to be tried for best results. Those 6BQ6s that do not afford maximum width, however, should not be considered defective.

‡Based on Emerson TV chassis service notes.

*From CBS-Columbia service notes.
**From Magnavox service department data.

Hi-Fi Audio

(*Continued from page 29*)

common control circuit performing in this way is illustrated in *c* of Fig. 1. An analysis of this circuit reveals that it consists of the simple equalizer circuits shown in *a* and *b*, both linked to the same potentiometer.

If C_1 of Fig 1*c* should open up, the amplifier would work normally except for the absence of treble boost when the control was turned to the right. Similarly, if C_2 should open up, the amplifier would work normally except for the absence of treble cut facilities.

If C_1 should short out, the overall gain of the amplifier would be greatly increased, the potentiometer would act like a volume control, and there would be a loss of treble boost facilities. If C_2 should short out, operation would be normal with the treble control at boost or mid-position, but towards the treble cut position the tone control would act as a volume control, grounding out the signal entirely at extreme treble cut.

The potentiometer has an audio or logarithmic taper, and should never be replaced with a linear taper unit. The value of the capacitors determines the operational characteristics of the control, and of course must not be changed if the control is to work according to its original design. There is one modification, however, which has often been found to improve the overall performance of the system.

An increasing tendency has been noted on the part of modern amplifier designers to raise the effective transition frequency of the treble boost control. Where the 800-1000 cycle region has been in common use, a 3000-cycle transition frequency is found in some of the more recent circuits. One reason for this change is the fact that treble boost in the first few thousand cycles often combines with boost at the lower treble frequencies produced by loudspeaker cone breakup, to create an over-strident tone. If, in the performance of the complete reproducing system, it is found that the treble boost control cannot be used without unnaturally shrill tone resulting, raising the transition frequency may well be advantageous. (Cutting the value of C_1 in half, with no other changes, will double the boost transition frequency, or raise it by one octave.) It may then be possible to introduce needed treble boost at the extreme highs, without having to accept the shrill quality produced by unwanted boost in the lower treble.

The analysis used for the treble control may also be applied for the bass tone control. Figs. 2*a* and 2*b* (p. 29)

illustrate basic circuits of bass cut and bass boost equalizers, respectively. These are fundamentally the same circuits as the treble boost and treble cut circuits discussed previously, but the component values are so selected that the sloped section of the response curve falls on the bass portion of the frequency spectrum.

In *c* of Fig. 2 we have an illustration of the combination of the basic equalizer circuits into a single bass cut-bass boost control of typical design. As in the case of the treble control, improper operation is commonly traced to shorted or open capacitors in the cut or boost sections. C_1 is the bass cut capacitor, and C_2 is the bass boost capacitor.

If it is found that bass boost cannot be used without creating an unpleasant, boomy tone, it may be advantageous to lower the bass transition frequency so that only the extreme low frequencies are affected. Doubling the capacitance of C_2 lowers the bass-boost transition frequency by one octave.

It might be pointed out that, after all, the original amplifier designer must have known what he was about, and his design should not be altered. But the amplifier designer could not consider the individual characteristics

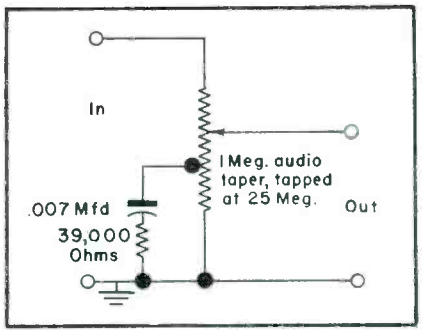


Fig. 3. Tone-compensated volume control (loudness control).

of the various speaker systems with which his unit would be used, while the Service Man can. In addition to the foregoing, the trend in modern amplifier design is to lower the bass-boost transition frequency from the value formerly in common use, by about an octave.

The compensated volume control, illustrated in Fig. 3, has been used for years, but recently more complicated circuits of this type have been incorporated into amplifiers. Such a volume control is called a *loudness control,* because its aim is to enable the operator to change the overall volume of the program material without changing the relative *apparent* volume, or loudness, at different frequencies.

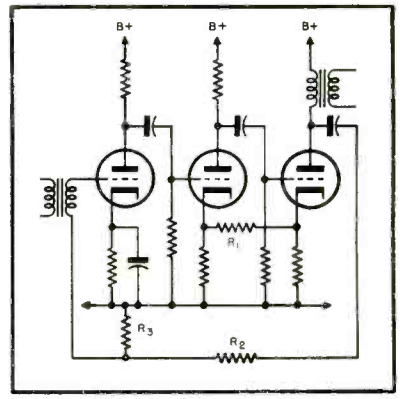


Fig. 5. In this circuit both the positive current feedback through R_1 and the negative voltage feedback through R_2, R_3, contribute to reduce effective ac resistance.

Audio

(*Continued from page 34*)

soft acoustic material. All joints should be glued. The front or back should be made removable, if the speaker is to be mounted on the inside surface of the mounting board.

The use of a 10 cubic foot enclosure will be found to extend the low frequency response to about 34 cycles and improve the power handling ability at low frequencies. The shape and proportions of the enclosure are not extremely critical, but the inside depth should be at least 12". Ratio of length to width should not exceed 2 to 1. The long dimension may be either vertical or horizontal.

*What Feedback Offers**

There are many who apply feedback with the vague idea that it's a good thing to do to make an amplifier better in some way, without quite knowing why in a specific instance.

Some have found by various experiences that negative feedback does not always work as a panacea. It has been known to aggravate the troubles it was hoped to remedy. Some have used it in a hope that it will reduce hum and tube hiss, by applying feedback over the input stages, at the same time reducing feedback over a later stage to retrieve the gain. But often hiss level will come up. Hum will be down on hiss anyway, so the effect on it will not be so evident.

Anyone who has tried negative feedback knows that gain is sacrificed, and more has to be found to compensate for the loss. Most of feedback's effects are directly related to the gain expended to achieve them. For example, to reduce harmonic content by a ratio of 10:1, the amount of feedback necessary will cut gain by 10:1, or 20 db. There are limits to this; for instance, no amount of feedback will boost the ouput from a 10-watt amplifier up to, say, 50 watts. Some have apparently argued that since the 5% distortion in a 10-watt amplifier can be cut to 1% by 14-db feedback, the same amplifier should then give 50 watts with 5% distortion. If this were the case, given enough feedback, amplifiers would supercede power generating stations.

This is obviously not true, when carried to such extremes, but perhaps one may still find it difficult to see the fallacy in the logic that found it possible to get 50 watts from a 10 watt amplifier with 14-db feedback. Let us analyze this point by reviewing the distortion characteristic of the 10-watt amplifier; it is probably 10% at 11 watts; 20% at 11.5 watts, and so on. Nothing will induce it to reach 15 watts with any amount of distortion. Now let us apply the 14-db feedback; the figures will become 1% at 10 watts, 2% at 11 watts, 4% at 11.5 watts, and still nothing will induce it to give 15 watts. Comparing

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

figures, it will be seen that the 14-db feedback can push up the output with 5% distortion to nearly 12 watts. But even this is not the whole story. For the 5% distortion with the 14-db feedback will be of the same composition as the 25% distortion point with no feedback, which probably contains more objectionable components than the 5% at 10 watts, which are likely all low-order harmonics.

The broad deduction from the foregoing is that feedback can clean up quality at lower levels, *but cannot materially increase undistorted output.*

Another use of feedback is to reduce damping, by cutting down the source impedance at the output. Any form of straight feedback modifies the output source impedance by the same ratio as it reduces the gain. So 14-db of feedback, for example, will multiply or divide the output source impedance by the factor 5.

Whether source impedance is multiplied or divided by the feedback change-of-gain factor depends on how the feedback is applied: negative voltage feedback, or positive current feedback, reduces the source impedance; negative current feedback, or positive voltage feedback, increases source impedance. Some believe that the omission of the cathode bypass capacitor reduces effective plate resistance. This is not true, because a voltage developed in the cathode circuit, when the output is taken from the plate, constitutes current feedback; thus the effective plate resistance is increased, not reduced. However, if the feedback taken from the cathode resistor is positive, it can reduce effective plate resistance. Fig. 5 shows a circuit employing both positive and negative feedback, both of which reduce the plate resistance. The coupling between cathodes boosts the gain, to offset the effect of negative feedback, and at the same time reduces plate resistance; then the overall negative feedback from the plate further reduces effective plate resistance.

Ser-Cuits

(*Continued from page* 31)

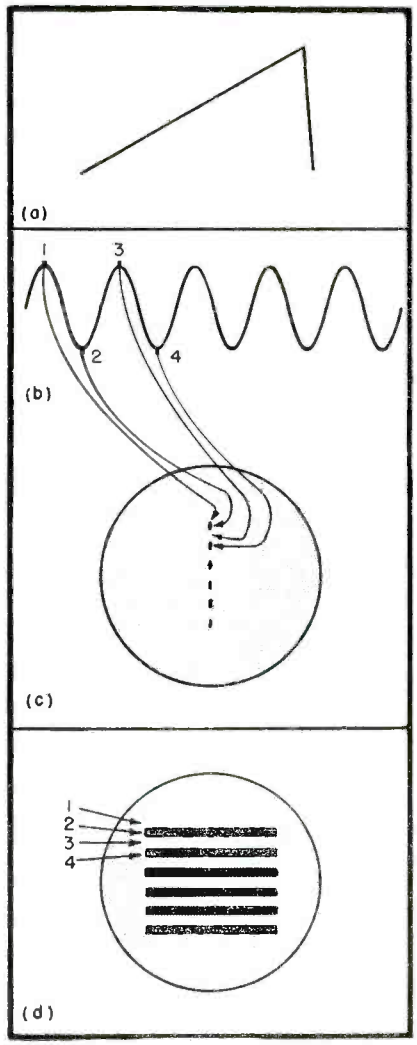
dimmer nine times. The horizontal fly-back or retrace occurs during about one of the nine 141.75-*kc* signals. This leaves eight cycles occurring during the sweep portion, resulting in eight pairs of light and dark areas for each horizontal line on the screen, as shown in Fig. 3.

Whenever either modulating signal, 360 *cps* or 141.75 *kc*, reaches the picture tube, black and white bars become visible on the screen.

Modulating signal alone, either the 360 *cps* (for six horizontal bars) or the 141.75 *kc* (for eight vertical bars), can be applied to any video amplifier or the input to the picture tube itself. Trouble at any of these points will prevent the black and white bars from being seen on the screen.

If the picture tube has been disconnected from the rest of the receiver,

Fig. 2. Waveforms illustrating operation of 360-cps modulation frequency in generator. At a appears a 60-cps vertical scanning pattern. The 360-cps modulating signal is shown at b, while in c we have the face of a picture tube showing vertical scan only. Face of a picture tube showing vertical and horizontal scan is shown in d.



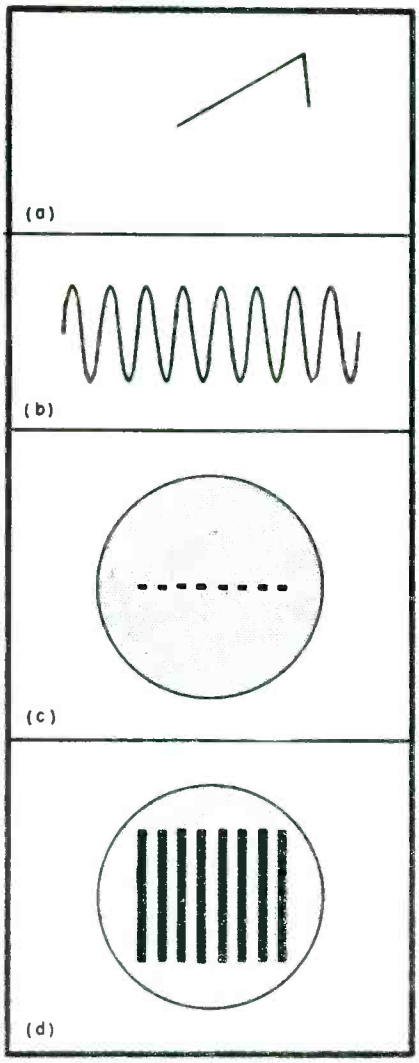
an *ac* voltmeter or a 'scope could show the presence of the signal at the input lead of the picture tube female plug.

Linearity, size and position of the picture can be checked and adjusted without an actual station transmission. Either modulating signal alone can be applied to a video amplifier, or an amplitude-modulated *rf* signal can be applied to set's antenna input.

In either case bars will be seen on the screen. Non-linearity of scan is indicated when the bars are of uneven widths, usually getting progressively narrower. The linearity and size controls can then be adjusted for most uniform bar size.

Cross hatch is a combination of both the six horizontal bars and the eight vertical bars simultaneously, producing a checkboard pattern on the picture tube. With the cross-hatch picture, horizontal and vertical size, and linearity can be checked simultaneously.

Fig. 3. Operation of the 141.75-kc modulating signal is reviewed in this illustration. At a is a 15,750-cps horizontal scanning pattern, and in b we have a 141.75-kc modulating signal. The face of a picture tube depicting a horizontal scan only is shown in c. Horizontal and vertical scan is represented in d.



Tube News

(*Continued from page* 40)

for TV, have also been announced.[1]

One type, 1N54A, a high-back-resistance model, is available for use in clipping circuits, high-impedance high-voltage probes, *dc* restorer circuits, and high-impedance detector circuits.

Another, 1N55A, is a large-signal type, having a high peak inverse voltage rating. This diode can be used in clamping circuits, *dc* restorer circuits, and in high-voltage probes.

The flexible leads of these diodes are usually soldered to the circuit elements. It is preferable to provide some slack or an expansion elbow in the leads before the soldering operation to prevent excessive tension on the studs. These crystal diodes can also be mounted in a holder of the fuse-clip type.

When these crystal diodes are to be soldered to circuit elements, one must avoid excessive heat during the soldering operation to prevent changes in the diode characteristics and possible damage to the diodes. To absorb some of the heat during the soldering operation, the flexible lead of the diode should be gripped between the stud and the soldering point with a pair of pliers.

A pentagrid amplifier (6BY6)[1] of the 7-pin miniature type intended especially for use as a gated amplifier in TV chassis has also been developed. It can be used as a combined sync separator and clipper.

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CORRECTION

In the W. L. Roberts report on Color TV Picture Tubes, which appeared in the January issue of SERVICE, the title subhead should have referred to the shadow-mask color tube as a *three-gun tube,* and the deflection mask type as a *single-gun tube.*

Service Engineering

(*Continued from page* 43)

sary to silence and activate all bus receivers at the proper times to avoid home-planned and commercial programs being carried on the buses. This was accomplished at the transmitter through transmission of supersonic signals, which silence or activate the receiver sound and increase receiver level for speech. (This increase in level is automatic when the announcer's microphone key is operated, or it can be controlled manually when a transcription or recording of voice is used.)

Tape Recorder for Audio

The problem of music presentation was solved by installing two tape recorders in an audio rack and using taped music throughout the day. Each 30-minute reel was supplied with selections (neutral or popular background) which run anywhere from slightly over 2 minutes to 8 or 9 (and sometimes longer) for a medley or occasional light opera selection. In recording these selections onto tape, a *dead* space of 5 seconds was left between selections for cutting out for news, commercials, etc. It was found that approximately 100 30-minute reels could provide quite a flexible library, with no storage problems.

Service and Maintenance Problems

The excessive vibration and pounding received by these receivers was found to place a strain that eventually takes its toll in defective tubes, loose can shields, etc. Through a regular routine maintenance program, it was found possible to prevent most failures and keep the system operation unusually high.

From the solution of these problems has come a successful FM broadcasting plan not only for bus receivers (over 450 in Cincinnati and nearby Covington, Ky.), but storecasting in a number of cities.[1]

[1]Currently, the FCC is considering the issuance of special licenses to FM broadcasters authorizing them to participate in, on a wide scale, buscasting, storecasting and other commercial applications of FM.

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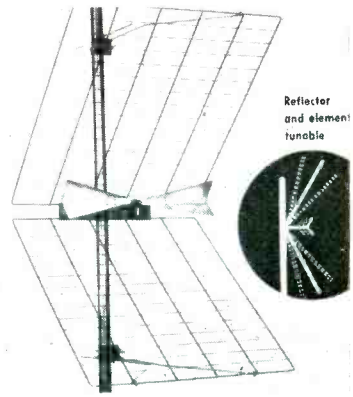
TV Antennas

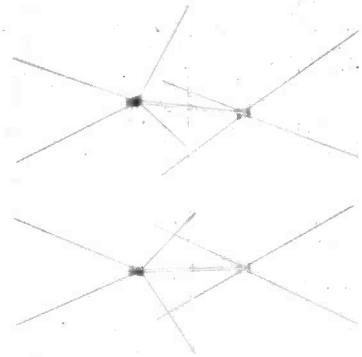
(*Continued from page* 47)

differences, considerations had to be made for the fact that this antenna had slightly different impedances on the high and low bands. To insure optimum performance on both bands, the high-band impedance was transformed in two stages, while the low-band impedance was transformed in one. This is illustrated in Fig. 1 (p. 45) showing how a stacking harness provides a match in the stacked antenna for both the high band and low band.

[See p. 78 for additional TV antenna news]

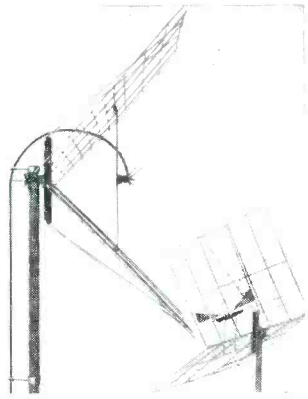


Tunable corner reflector for uhf. Antenna has a tunable reflector and element. Antenna is said to be adjustable for optimum lobe pattern in vertical and horizontal planes, and is also adjustable for optimum impedance match to any type of transmission line. (Model 715 Tuner Tenna; Tele-Matic Industries, Inc.)



Conical which features all aluminum construction. Element head design is said to permit interchanging of elements to suit requirements. Solid rod elements used. Stacking bars are included as required. Designed for all channel coverage. (Fretco.)

Corner reflector for uhf fringe reception. Reflector is said to be braced 4 ways for elimination of vibration: Dual brackets from the extreme end of each reflector grid to a channel-type anchor bracket to stabilize the end areas of the grids; anchoring at juncture of the grids by clamp; and four wire brackets in the center lock at two places on each grid. Dipole bracket (butyrate) is joined to all four center wire brackets. Has bronzidite anti-corrosion plating. (Model UHF 415 Golden Rig; JFD.)



JOTS AND FLASHES

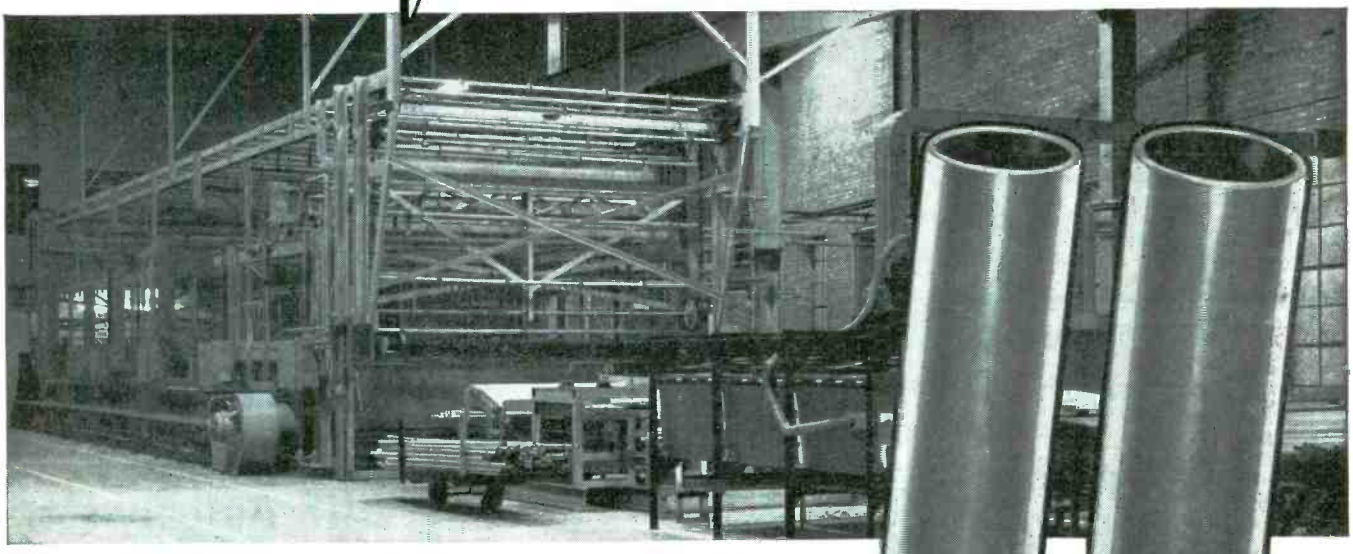
COLORED RECORDING TAPES, in green and blue, wound on colored plastic reels (supplied in five colors), that it is said will simplify editing and provide added protection against accidental erasure and labeling errors, are now being made, according to *W. C. Speed* of Audio Devices. . . . The total volume of TV antenna sales in '54, in units and in dollars, will be larger than ever before, Channel Master's vice prexy *Harold Harris* declared recently during a distributor's meeting. He predicted that eventually the industry will see a replacement market of at least 5,000,000 antennas annually. . . . More than ten-million color TV receivers will probably be in use five years from now, *Joseph B. Elliott,* RCA's executive vice prexy reported recently. . . . As an anniversary gift, desk name plates featuring engraved lucite plates on walnut, have been given by *Javex,* through their local manufacturer's reps, to the principles of their jobbers. . . . The *Entron Co.,* designers and manufacturers of community and master TV systems equipment, has moved into a new plant at 4902 Lawrence St., Bladensburg, Md. *H. M. Diambra* is prexy of Entron, and *George G. Edlen,* vice prexy. . . . A second study course for qualified TV Service Men will start early next month at the New York Trade School, RETMA has announced. Sixty, with at least one year of full-time TV service experience, will be selected from the New York area to participate in this course. . . . *Edwin Cornfield* is now sales manager of *Pilot Radio Corp.* . . . A new warehouse and general office building has been completed by the *Thorens Co.,* at New Hyde Park, L. I., New York. A lab and sound room for demonstration of record changers, players and transcription turntables will be maintained at the new location. . . . *Burton Browne Advertising* of Chicago is now handling the advertising and publicity of Triplett. . . . *Orradio Industries,* Inc., Opelika, Alabama, have opened an office at 458 Broadway, N. Y. C. *James F. Kenney* will be in charge. . . . *Dr. W. R. G. Baker,* vice president and general manager of G.E.'s electronics division, Syracuse, N. Y., was honored recently by the Eta Kappa Nu Association, honor society for the electrical engineering profession, and initiated into *eminent membership.* . . . Royalty-free licenses for wooden cabinets, under patent 2,338,262 which covers the hyperbolic exponential flare, will be issued by the Jensen Manufacturing Co., 6601 South Laramie Ave., Chicago 38, Ill. Examples of cabinets which employ this principle are described in Jensen technical bulletins *1* and *3.* . . . Hi-fi components, including AM-FM tuners, preamps and control units, amplifiers and AM-FM chassis, will be marketed under the *Freed-Eisemann* trademark by Freed Electronics and Controls Corp., 200 Hudson St., New York 13, N. Y. Design features of these units will be available soon.

ADVERTISERS IN SERVICE, FEBRUARY, 1954

5 ft. and 10 ft. self-coupling

prompt delivery from your Admiral distributor

Television MASTS



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	20 gauge	*18 gauge*	*16 gauge*
5 ft. plain end	M 40		
5 ft. flared end	M 40A		
10 ft. plain end	M 41	M 42	M 43
10 ft. flared end	M 41A	M 42A	M 43A

Ask your *Admiral* Distributor for

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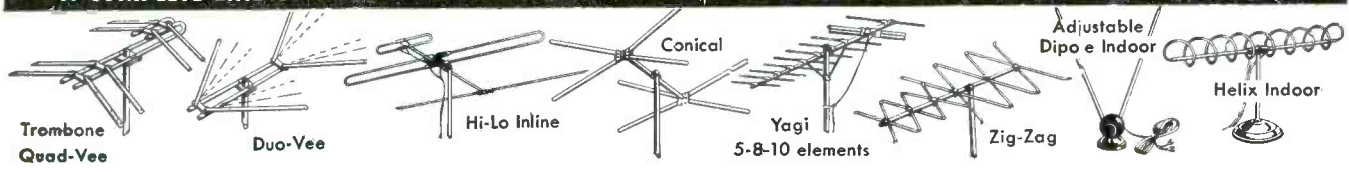

None... in a Million

A well-known TV and radio set manufacturer reports not one field reject during a 12-month period in which he used over 1,000,000 Mallory FP Capacitors. Yes, it's hard to believe but it happened. And it's

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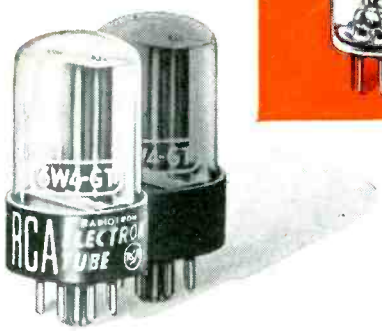
...but what a difference!



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RCA receiving tubes provide the superior performance and reliability usually associated with higher priced specialty designed types. That's because RCA receiving tubes are constantly being improved to meet the changing requirements of radio and television applications.

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Or take the RCA-6W4-GT. This type now uses a new RCA-developed carbonized plate-coating material which has improved heat-dissipating properties, thus contributing to longer tube life and increased reliability.

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