RADIO • TELEVISION • ELECTRONIC

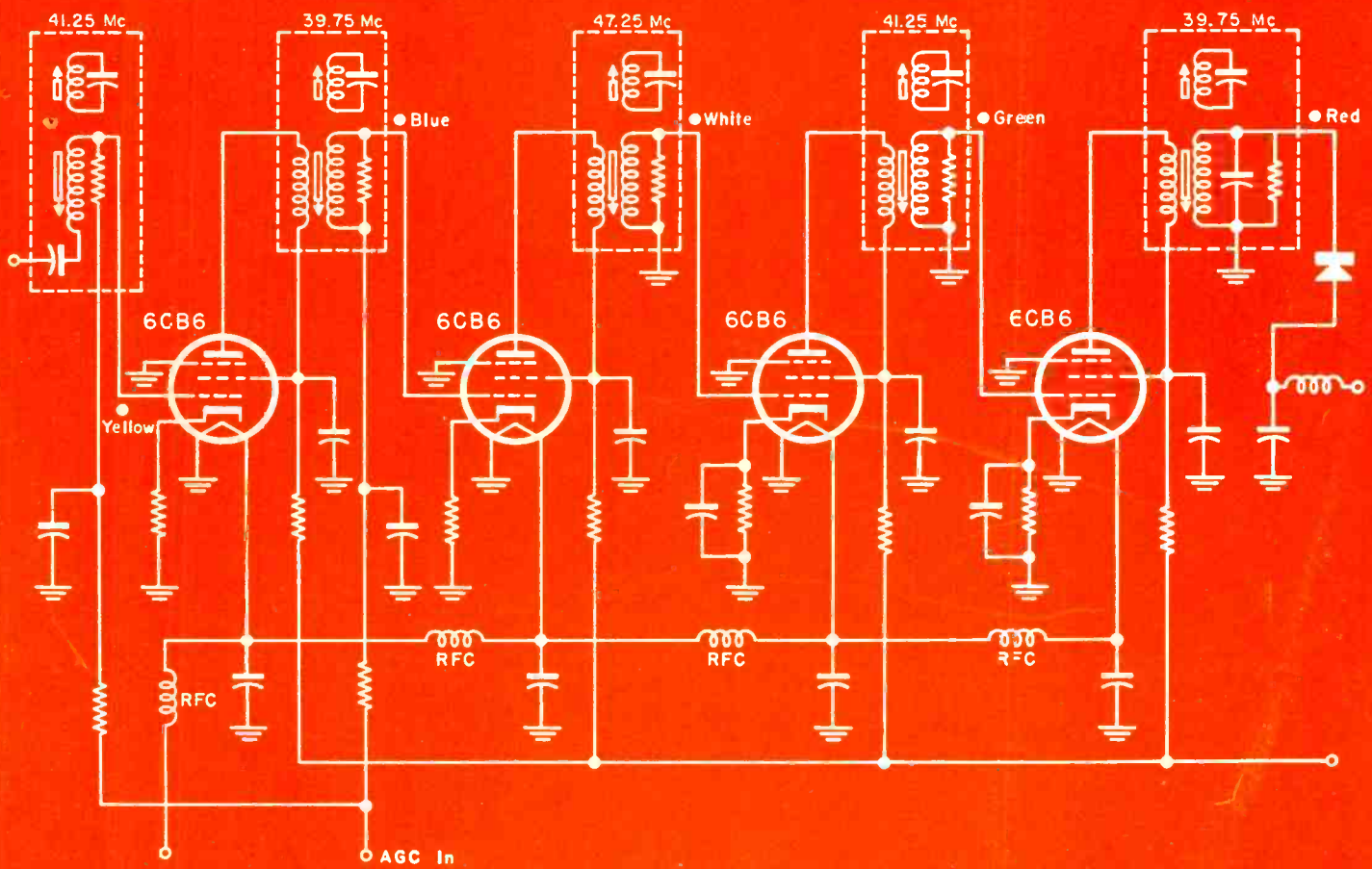
SERVICE

VOL. 24

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

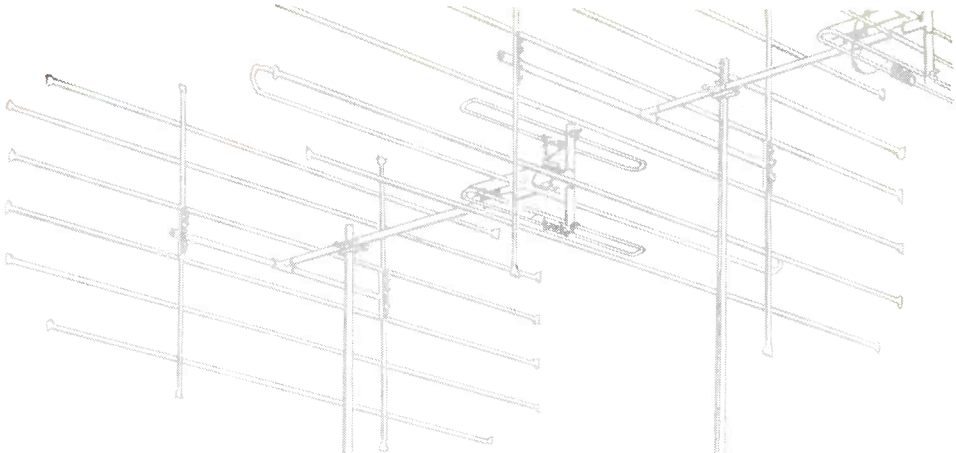
FEBRUARY 1955

In This Issue: AUDIO FORUM



Four-stage stagger-tuned printed circuit if section employed in completely sectionalized pc TV receiver.
[See circuit analysis, this issue]

The Most Complete Line



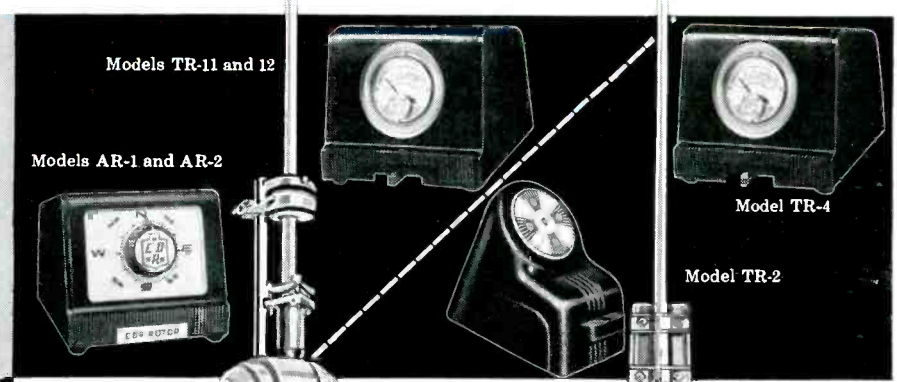
C·D·R ROTORS are BEST

Most Powerful—Most Dependable—Sharpest Tuning

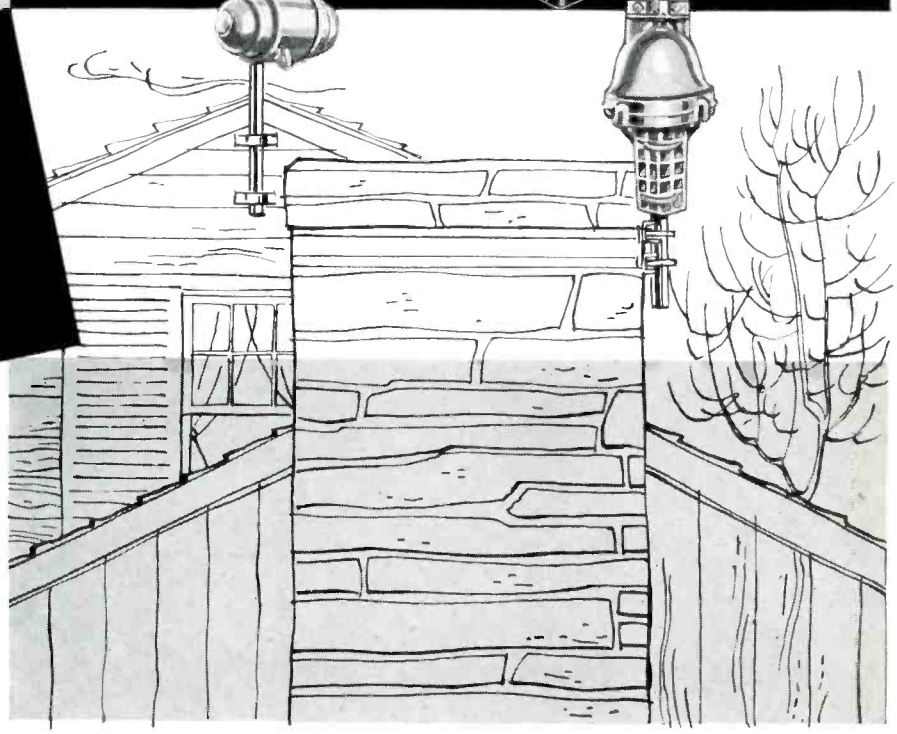
BEST...

from the bottom up...
inside out...

because



C·D·R ROTORS have AXS 679*



* The highest grade premium die cast aluminum . . . so rugged and durable that it is used for aircraft landing gear.

PRE-SOLD to MILLIONS
through spot announcements on television.

CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.

THE RADIART CORP.
CLEVELAND 13, OHIO

Vol. 24, No. 2 — February, 1955

RADIO • TELEVISION • ELECTRONIC
SERVICE

LEWIS WINNER
Editor

B. BLOCK
F. WALEN
Assistant Editors

Including SERVICE—*A Monthly Digest of Radio and Allied Maintenance*; RADIO MERCHANDISING and TELEVISION MERCHANDISING. Registered U. S. Patent Office.

CIRCUITS

COVER

Manufacturers

Published monthly by Bryan Davis Publishing Co., Inc.
52 Vanderbilt Avenue, New York 17, N. Y. **Telephone: MUrray Hill 4-0170**

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East-Central Rep.: James C. Munn, 2253 Delaware Dr., Cleveland 6, O. Tel.: ERieview 1-1726
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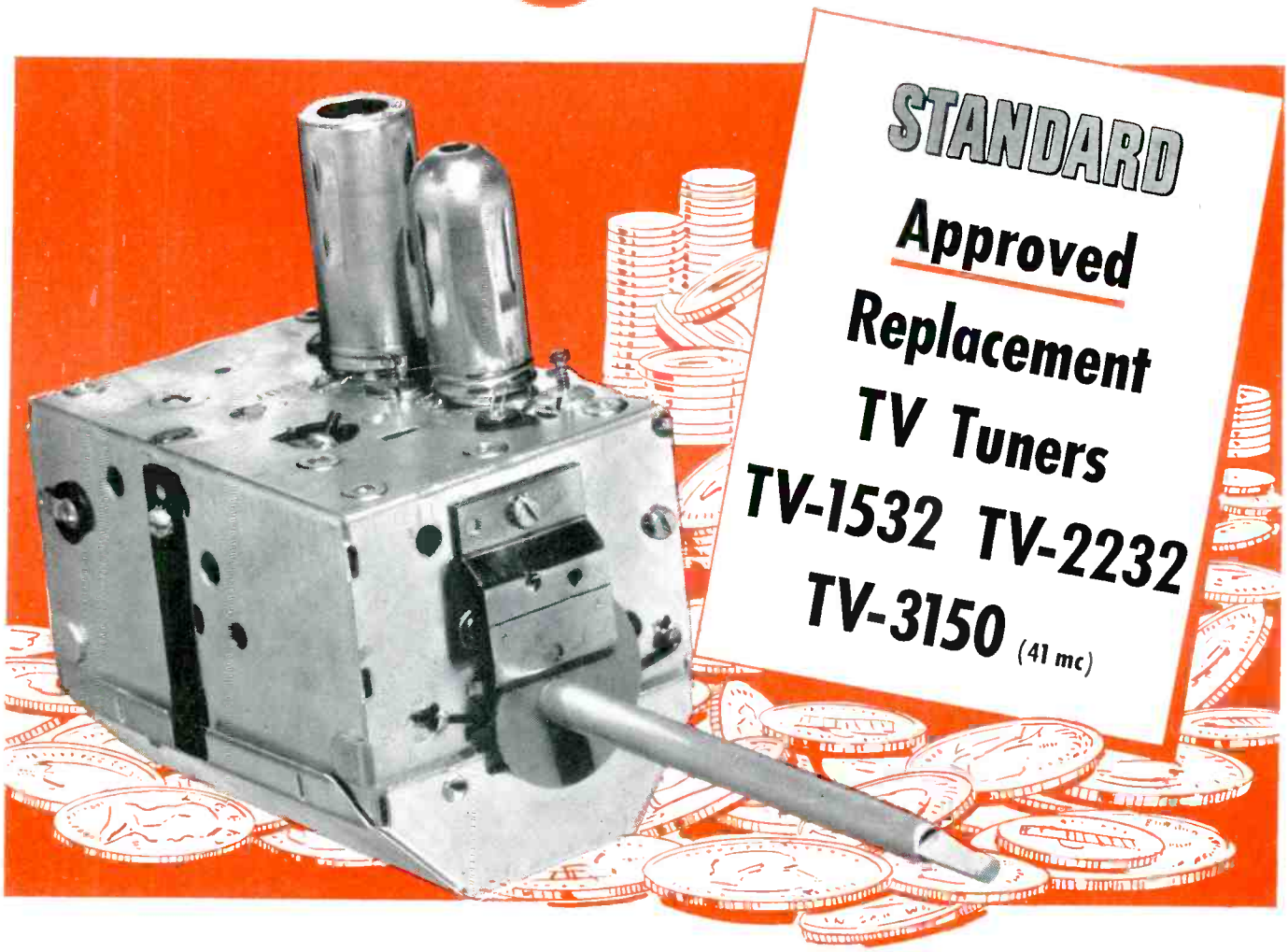
PROFIT 3 BIG WAYS!



1 Good profit when you install 2 Extra dollars later through simple conversion to UHF 3 More income-per-hour by eliminating costly callbacks

Standard Replacement Tuners sell easier, install faster and give far more customer satisfaction than any other tuner on the market. Designed, built and approved as tuner replacements—they're *BEST* for any job.

Standard
COIL PRODUCTS CO., INC.
CHICAGO • LOS ANGELES • BANGOR, MICH. • NO. DIGHTON, MASS.
Export Agent: Rocke International Corporation, 13 E. 40th Street, New York City

Order from your jobber today, or write Standard Coil Products Co., Inc., 2085 North Hawthorne Avenue, Melrose Park, Ill.

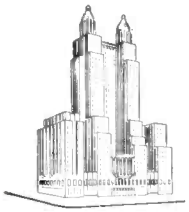
In TV it's Standard

March 21-24

The Radio-Electronic SPECTACULAR of 1955!

See! Hear!

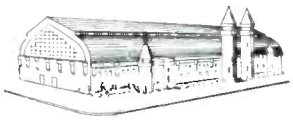
IRE National Convention



and

Radio Engineering Show

At both the Waldorf-Astoria (convention headquarters) and Kingsbridge Armory, you'll attend what actually amounts to 22 conventions fused into one. Hundreds of scientific and engineering papers will be presented during the many technical sessions, a large number of which are organized by I R E professional groups. You'll meet with the industry's leaders—enjoy the finest meeting and recreational facilities in New York.



At the Kingsbridge Armory and Kingsbridge Palace, you'll walk through a vast panorama of over 700 exhibits, displaying the latest and the newest in radio-electronics. You'll talk shop with the industry's top manufacturers—enjoy the conveniences provided for you in the world's finest exhibition halls, easily reached by subway and special bus service.

Admission by registration only. $1.00 for I R E members, $3.00 for non-members. Social events priced extra.

The Institute of Radio Engineers
1 East 79 Street, New York

7 out of 704* good reasons why you should attend the Radio Engineering Show

Hear...

vital research and engineering papers on computers, transistors, color TV, etc., subject-organized in 55 sessions.

Watch...

a computer balance a cane, making 20 corrective moves a second—at the IRE Show.

See...

the exhibits of 69 components vital to successful Automation. Or compare 21 different types of Transistors—and other subminiature components.

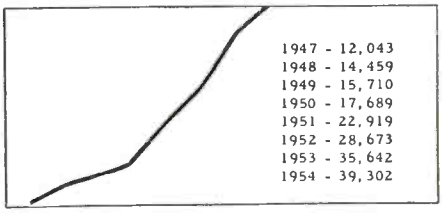
Check-up on...

"1955 Instrumentation" shown on Instruments Avenue. Exhibit grouping helps you see more on the Avenues named.

Audio • Broadcast • Radar
Transistor • Television
Radio • Components • Microwave
Airborne • Production
Circuits • Computer • Electronics

Meet...

all your friends. 39,302 attended IRE in 1954.



Enjoy...

The Convention's Social Events. It is good to mingle with your industry friends at IRE.

Get the facts...

faster and easier at exhibits and sessions than you could from weeks of your own "digging."

**Send for the 1954 Directory of 604 Exhibitors and list of 100 new exhibitors.*

PRODUCTION RATE TV PICTURE TUBES AS OF DEC. 1st = PLACES CBS-HYTRON IN "BIG THREE"

Another demonstration of confidence in CBS-Hytron advanced-engineering

CBS-HYTRON Main Office: Danvers, Massachusetts
A Division of Columbia Broadcasting System, Inc.

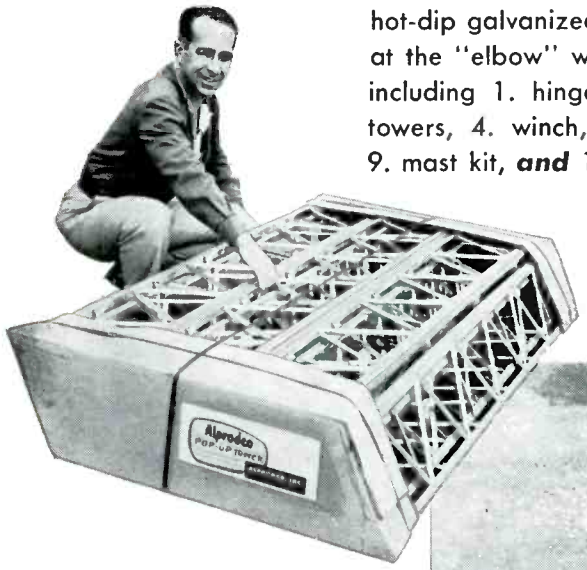
A member of the CBS family: CBS Radio • CBS Television • Columbia Records • CBS Laboratories • CBS-Columbia • CBS International • and CBS-Hytron

The Only TV Tower

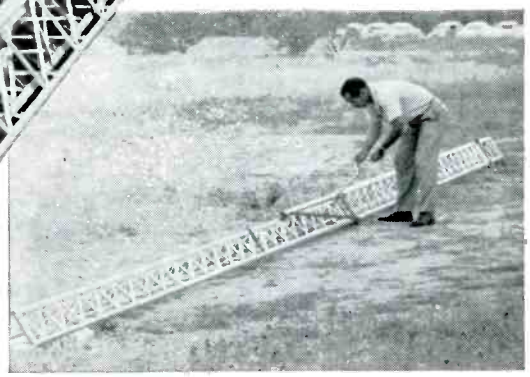
ALPRODCO'S POP-UP TOWERS

THE ANSWER! YOU BET! For the first time since **TV** started, we have a tower that solves all the problems! It comes in a package! It is pre-assembled! One man can erect it easily! Install antenna and rotator on the ground! Raise and lower it in seconds! It is guaranteed! And look at the low, low cost. Yes, **POP-UP** is the answer!

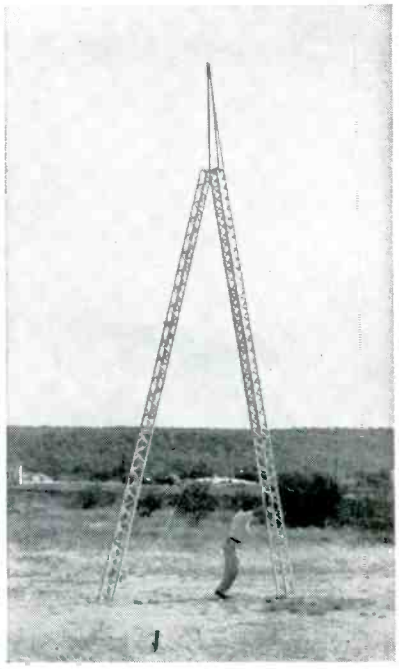
POP-UP's CONSTRUCTION: It is a beautiful combination of Alprodco's famous aluminum and steel towers. The lower section is Alprodco's triangular hot-dip galvanized steel and the top section is Aircraft Aluminum joined at the "elbow" with a strong A-frame. You get the whole "Ball-o-wax" including 1. hinged base, 2. ground anchors, 3. Aluminum and steel towers, 4. winch, 5. cable, 6. A-frame, 7. guy-brackets, 8. top-trim, 9. mast kit, ***and*** 10. a 9 foot telescoping aluminum mast.



1. POP-UP TOWER package—neat, compact and delivered without damage. Lay the tower out on location, bolt the sections together and it's ready to **POP-UP**.



2. ASSEMBLED: Use temporary guys at right angle to the raising position and **POP-UP** can be pushed up by one man. The top aluminum tower serves as a "reverse" boom.



3. PUSH POP-UP up. Pick the tower up at the "A"-frame "Elbow" and work back on the top half as the tower jack-knifes up. While the tower is in this position, secure the third guy and then plumb the lower tower.

WORLD'S LARGEST PRODUCER OF ALUMINUM TV, AM AND FM TOWERS

ALPRODCO, INC.
ELECTRONICS DIVISION

TOWERS • ANTENNAS

MINERAL WELLS, TEXAS

One Man Can Erect!

PRE-ASSEMBLED POP-UP TOWERS are delivered with all parts assembled. Bolt the sections together and it's ready to POP-UP.

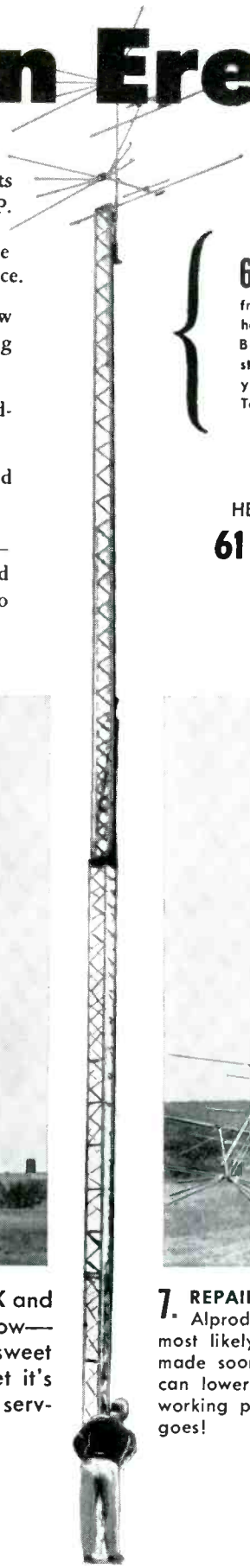
SAVES STORAGE SPACE. The aluminum tower is nested inside the lower steel tower and requires less than half the usual storage space.

COMPLETE INSTRUCTIONS with each tower. Simple, easy to follow instructions guide correct **ASSEMBLY, ERECTION,** guying, installing antenna, lead wire and any make rotator.

Alprodco **PAYS COST OF SHIPPING** right to your door. No hidden costs when you get 5 or more **POP-UP** Towers.

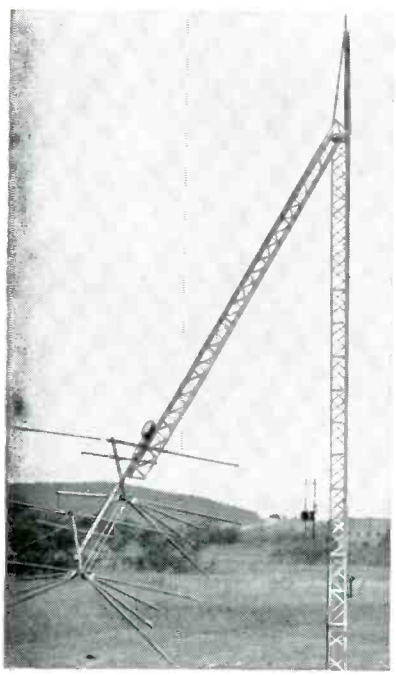
GUARANTEED to withstand up to 90 mile wind and storm load when guyed according to factory recommendations.

POP-UP'S DEALER PRICE: 49 ft.—$53.25; 61 ft.—$64.45; 73 ft.—$75.65. Full freight paid on 5 or more towers assorted. (The demand for this new tower has swamped our production department—so please allow as much lead time as possible on delivery.)

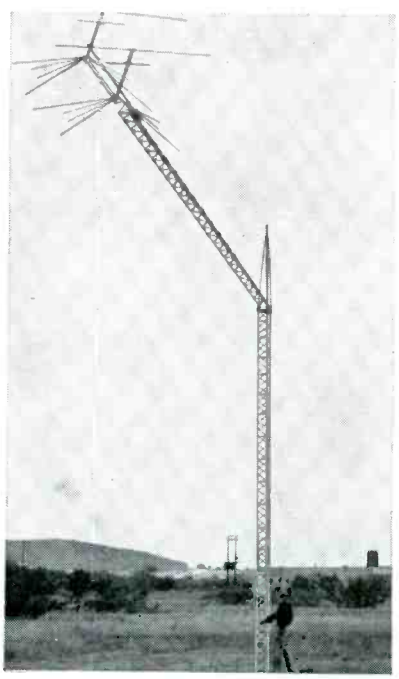


6. POP-UP is UP. Fasten the top guys and walk away from the easiest tower job you've had yet! And boy, isn't she a B-E-A-U-T-Y? Let winds and storm blow . . . no worries when you use Alprodco's POP-UP Tower.

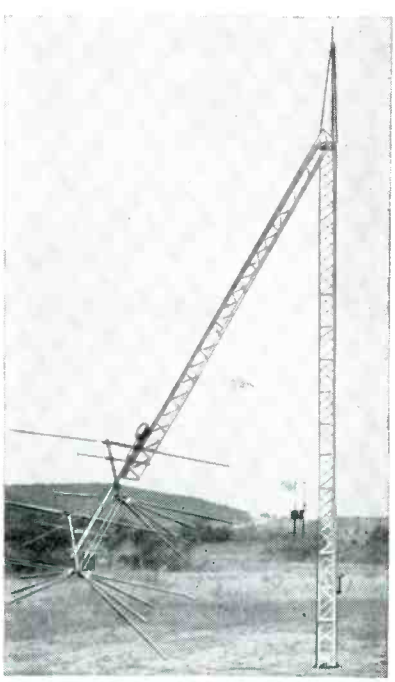
HEIGHT
61 feet



4. Attach an **ALPRODCO ROTATOR** if available, and an **ALPRODCO ANTENNA,** and it's all ready to go up. Pull the antenna away from the tower base to get winch leverage and crank.



5. JUST TURN THE CRANK and up she goes! Honest now—have you ever seen such a sweet deal! The Answer! You bet it's the answer! **POP-UP** is the service man's dream!



7. REPAIRS? If you haven't used an Alprodco Antenna and rotator, most likely there are repairs to be made soon. So—in 10 seconds you can lower the antenna to a handy working position. All done? Up she goes!

ROTATORS • SLIP-UP MASTS

KEMPTON, INDIANA • DUBLIN, GEORGIA

"TV SERVICE MONTH"

Sponsored by General Electric to

Electronic TUBES

HELPS IDENTIFY YOU AS A SOURCE FOR G-E TUBES. GIGANTIC CELEBRATION WILL FEATURE:

$25,000 in cash prizes for your customers.

Mammoth G-E ad in LOOK that builds recognition for your efforts. Your name and address can be listed.

Big kit of unique promotion items for your own TV Service Month.

DON'T DELAY! SEE YOUR G-E TUBE DISTRIBUTOR TODAY!

STARTS APRIL 19TH!

improve service business everywhere!

You too can display this colorful window emblem! Pinpoints your shop as Contest and TV Service Month headquarters.

YOU will get the full benefit of TV Service Month! For 30 days new customers will visit your shop to get their entry blanks for the big G-E $25,000 contest. $10,000 first prize . . . plus 816 other cash prizes!

And here's sensational news! *Your name and address* can appear in G. E.'s announcement in LOOK—in subscribers' hands and on the newsstands April 19. You can be part of the industry's greatest public-relations program to date. 20,000,000 people see LOOK. It's read in homes all through your neighborhood.

See your G-E tube distributor immediately so your name may be included! In order to spark sales still more, your G-E distributor has ready for you a big kit of unique promotion items—each new, different, a winner. Read about some of them at right . . . then see or phone your distributor today! *Tube Department, General Electric Company, Schenectady 5, New York.*

Large winacw streamer. Use it to announce a special attractive TV Service offer that will turn callers into buyers.

Footprints—plastic, self-stick—for sidewalk before your door. They invite customers in!

Talking postcard . . . brand-new, it's a record that actually plays on TV owners' phonographs! Also, regular advertising postcard. Both tell story of prize contest—help you promote TV Service Month profitably.

GENERAL ELECTRIC

161-1A1

the fabulous VHF-UHF antenna that actually *sells itself with performance!*

CHAMPION **RAINBOW***

What do America's servicemen think of Channel Master's RAINBOW antenna? Here are their very words†:

"The RAINBOW brings metropolitan reception to isolated areas."

"Gets more stations in this fringe area than any other antenna made."

"Just what our customers have been waiting for -- a powerful, sturdy, economical antenna."

†*Just a few of the many letters of praise we receive daily.*

LOOK at the RAINBOW'S unique design, so deceptively simple, yet so unbelievably efficient. ***LOOK*** at its advanced features: New *Spacing Formula*, new *Triple-Section* High Band elements, new full-efficiency *Intermix Design*, and the brilliant triple-power TRI-POLE! ***LOOK*** at its remarkable Yagi performance on every channel, its sharp single lobe. ***LOOK*** at its rugged, durable 100% aluminum construction, reinforced at all stress points. ***LOOK*** at its trigger-fast "Snap-Lock" Action, Channel Master's fabulous preassembly that snaps open, *locks* open, without hardware or tightening.

With every installation, Channel Master's RAINBOW again proves itself *the most powerful TV antenna yet developed by modern science*. Bay for bay, it out-performs every all-channel antenna on the market today!

Get In On This High-Powered Advertising Deal

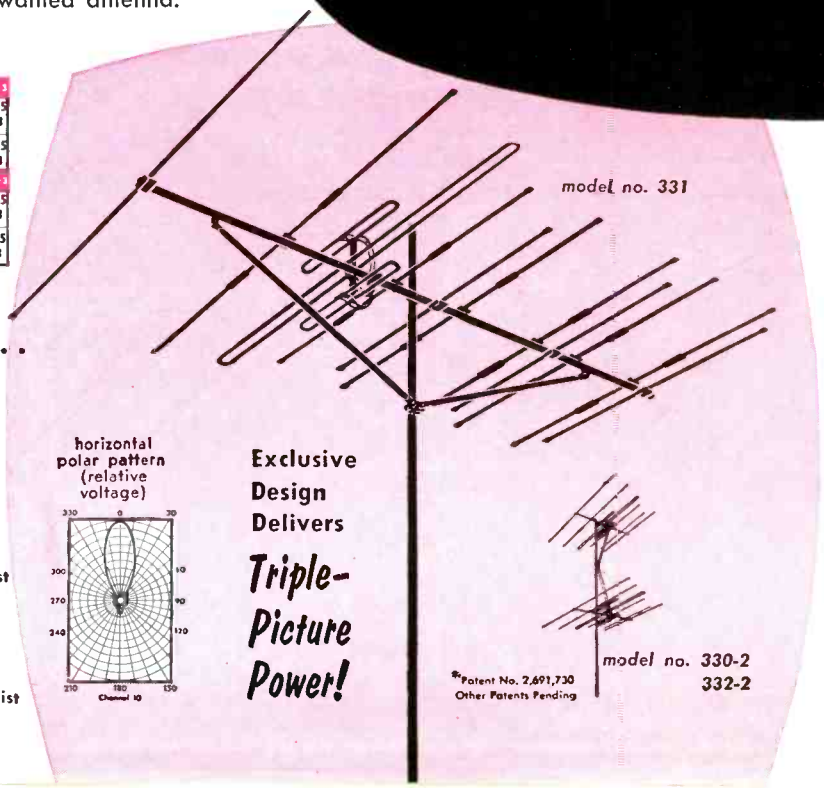
Your Channel Master distributor offers you a hard-hitting promotion program which includes TV spot films, newspaper mat ads, radio ads, full-color display material, and consumer literature. *Advertise* and *install* America's best known, most wanted antenna.

don't kid me!

NOTHING outperforms CHANNEL MASTER

Here's how the RAINBOW out-performs the famous Champion:

	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over 1-Bay Champion	1-Bay RAINBOW	0 DB	0 DB	0 DB	+1 DB	+2 DB	+3 DB	+2.5 DB	+1 DB	+.5 DB	+.5 DB	+1.5 DB	+2.5 DB
	1-Bay SUPER RAINBOW	+1 DB	+1 DB	+1.5 DB	+2.5 DB	+3.5 DB	+3.5 DB	+3 DB	+2 DB	+1.5 DB	+2 DB	+3.5 DB	+4.5 DB
	CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
Gain Over Stacked Champion	Stacked RAINBOW	+1.5 DB	+2 DB	+1.5 DB	+1.5 DB	+2 DB	+.5 DB	+.5 DB	+0 DB	+0 DB	+0 DB	+1 DB	+1.5 DB
	Stacked SUPER RAINBOW	+2 DB	+2.5 DB	+3 DB	+3 DB	+4 DB	+.5 DB	+1 DB	+1 DB	+2 DB	+2 DB	+2.5 DB	+3.5 DB



There's a RAINBOW model for every area . . . for every purse!

For fringe and super-fringe areas:

Super RAINBOW model no. 331, $37.50 list

stacked Super RAINBOW model no. 331-2, $75.70 list

For suburban and near-fringe areas:

Champion *RAINBOW model no. 330,* $23.60 list

stacked **Champion** *RAINBOW model no. 330-2,* $48.60 list

For economy installations:
(featuring butted tubing)

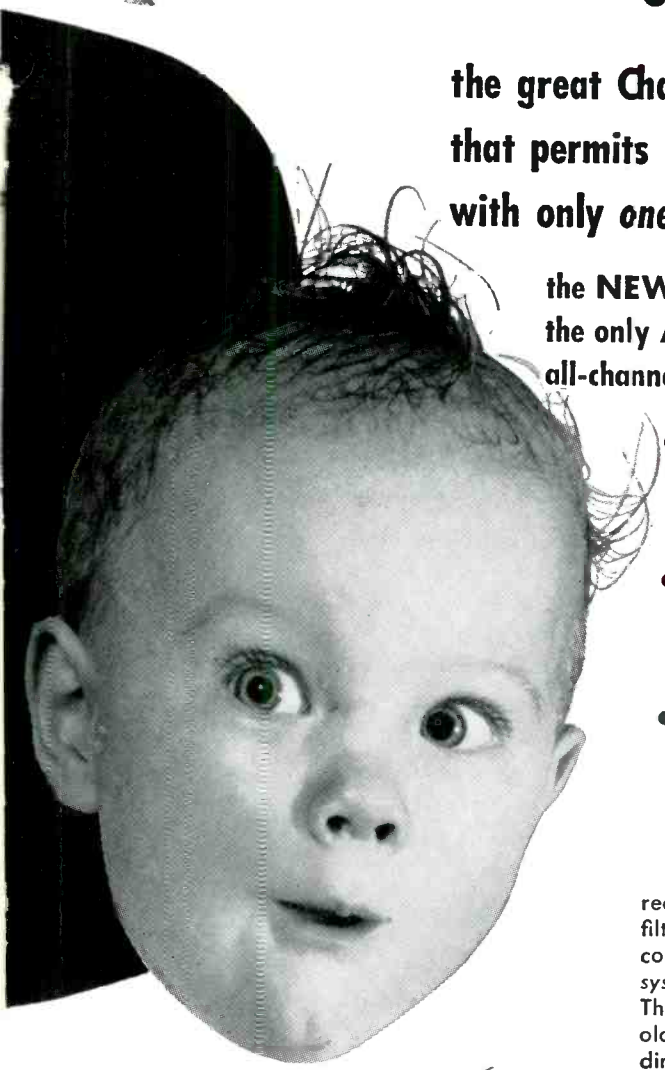
Challenger *RAINBOW model no. 332,* $18.06 list

stacked **Challenger** *RAINBOW model no. 332-2,* $37.50 list

a major step forward in installation procedures —

CHANNEL MASTER'S SELECTENNA coupling system

the great Channel Master development that permits *unlimited antenna combinations* with only *one* transmission line to the set!



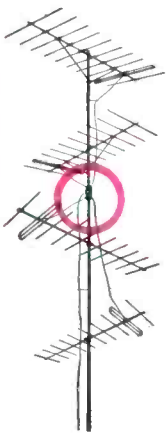
the NEW WAY, the BEST WAY, the only AUTOMATIC WAY to get all-channel, all-direction reception . . .

- ***Without rotators!***
  SelecTenna means: no extra control unit on the set; no moving parts to get out of order; antennas are always in perfect orientation.
- ***Without switches!***
  SelecTenna means: no manual switches to bother with; better performance because couplers have less insertion loss than switches.
- ***Without multiple lead-in wires!***
  SelecTenna means: neater, more professional installations, because no complicated wiring enters the home. Only one *lead* connects to the set.

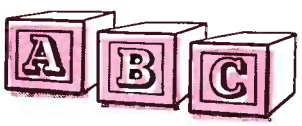
This modern way to obtain multi-directional reception — with its individual band-pass filter networks — offers the consumer great convenience advantages possible *in no other system*. There's never been anything like it! The SelecTenna System is rapidly replacing all older methods. Use it on your next "multi-direction" installation!

FREE TECHNICAL ADVISORY SERVICE

Our engineers will tell you the correct hook-up for your area. Merely list the channels you expect to receive, as well as the different antennas you would like to hook up. No charge or obligation.



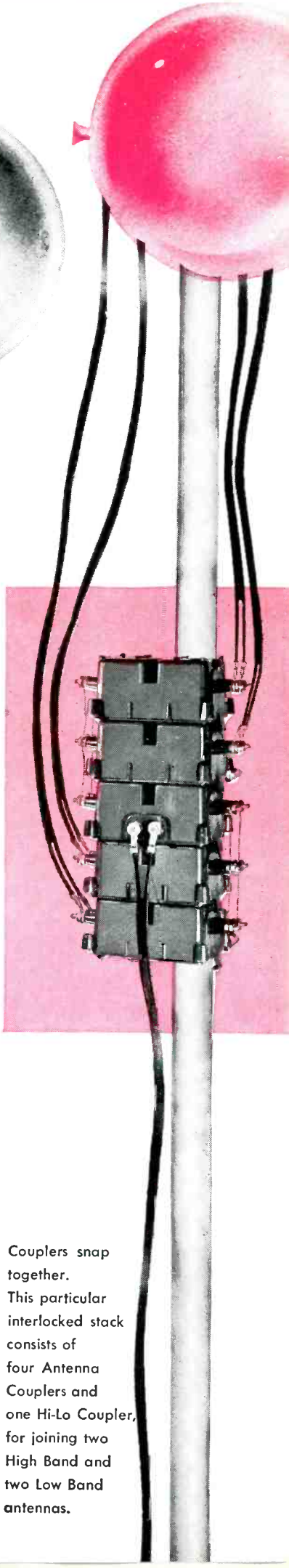
Simple as:



Simply select your channel on the set--- the right signal is always there!

list price: $5.42 each

including mounting hardware and connecting wire.

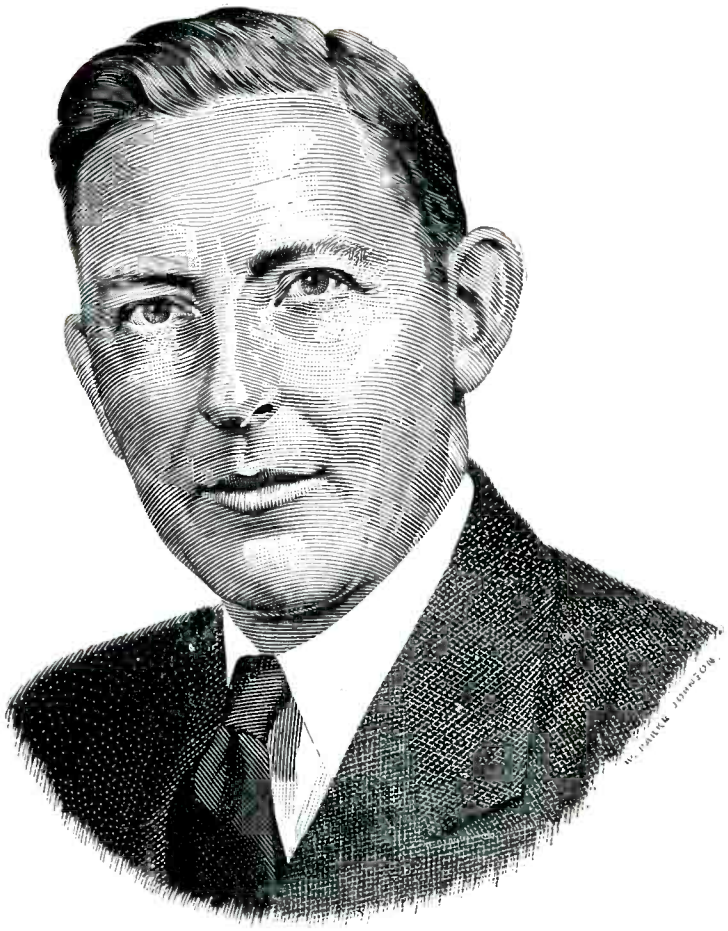


Couplers snap together. This particular interlocked stack consists of four Antenna Couplers and one Hi-Lo Coupler, for joining two High Band and two Low Band antennas.

CHANNEL MASTER CORP. ELLENVILLE, N. Y.

The World's Largest Manufacturer of Television Antennas and Accessories.

"...through a person-to-person canvass..."



ROBERT S. MACFARLANE
President
Northern Pacific Railway Company

"Combine a good product with enthusiastic salesmanship, capably directed, and favorable results are reasonably certain. This winning combination through a person-to-person canvass recently added more than 8,000 employees of the Northern Pacific Railway to the Payroll Savings Plan for purchase of U. S. Savings Bonds. It is gratifying to me that the organized efforts of Northern Pacific personnel not only have resulted in substantially increased systematic saving and a greater investment in America's future by our employees, but that the Treasury Department is using our campaign as an example throughout the railroad industry in its efforts to step up regular purchases through payroll deductions."

The U. S. Savings Bond *is* a good product . . . Payroll Savers *are* enthusiastic Bond Salesmen . . . company spirit *was* good because everybody on the Road knew that Mr. Macfarlane was 100% behind the effort to increase employee participation in Northern Pacific's Payroll Savings Plan.

But, there was still another, and very important, factor in the success of Northern Pacific's campaign that added more than 8,000 new Payroll Savers — a Person-to-Person Canvass.

A good Person-to-Person Canvass is an organized employee effort that puts a Payroll Savings Application Blank in the hands of every man and woman in the company. There is no pressure, no drive to "sign up." Every employee is free to make his own decision. That's all there is to a Person-to-Person Canvass, but in literally thousands of companies, as on the Northern Pacific, a high percentage of employees *want* to build their personal security and are quick to join the Payroll Savings Plan when its availability and many advantages are brought to their personal attention.

Upwards of 8,000,000 employed men and women are enrolled in the Payroll Savings Plan, most of them as a result of Person-to-Person Canvasses. Each month these Payroll Savers invest more than $160,000,000. The 1954 goal is 9,000,000 Payroll Savers. It can be reached if you and other executives will take a personal interest in the Plan and what it means to your employees, your company and your country.

If your company has the Payroll Savings Plan your State Director will be glad to help you organize a Person-to-Person Canvass that should increase employee participation to 50%, 60% or more. If you do not have a plan he will show you how easy it is to install one. Write to Savings Bond Division, U. S. Treasury Department, Washington, D. C.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

SERVICE

COLD FACTS – on a HOT UHF CONVERTER...

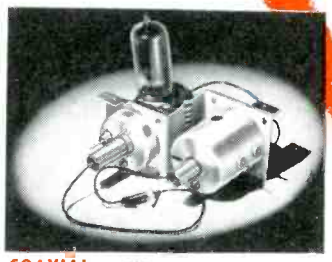
THE GRANCO CONVERTER HAS EVERYTHING!

Model LCU-A
$29.95 List

PRESELECTION

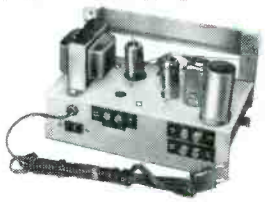
Only the **desired** signal is tuned in and amplified. A "must" in areas having two or more channels, UHF or VHF. Results are clearer, better pictures with less interference. Higher signal-to-noise ratio is obtained.

All these add up to the BEST BUY in UHF CONVERTERS



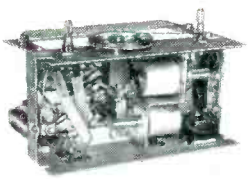
COAXIAL TUNED

No wiper contacts—no switch contacts—nothing to cause noise. Coaxial tuning is the most efficient UHF tuning known. **Not the cheapest—but the best!**



AMPLIFICATION

True high-gain amplification combined with inherent low-loss circuitry, provides any TV receiver with strongest, clearest picture in UHF.



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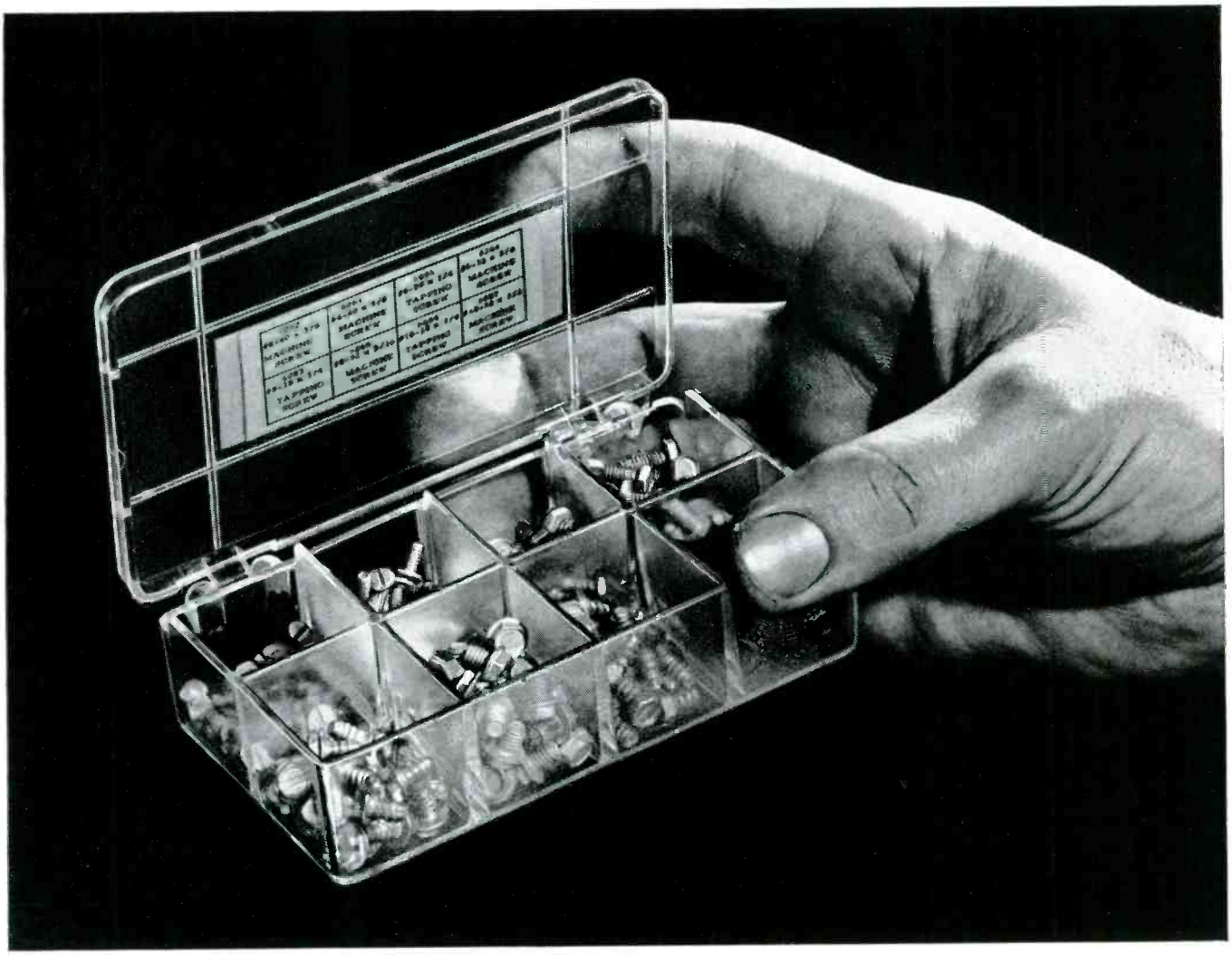

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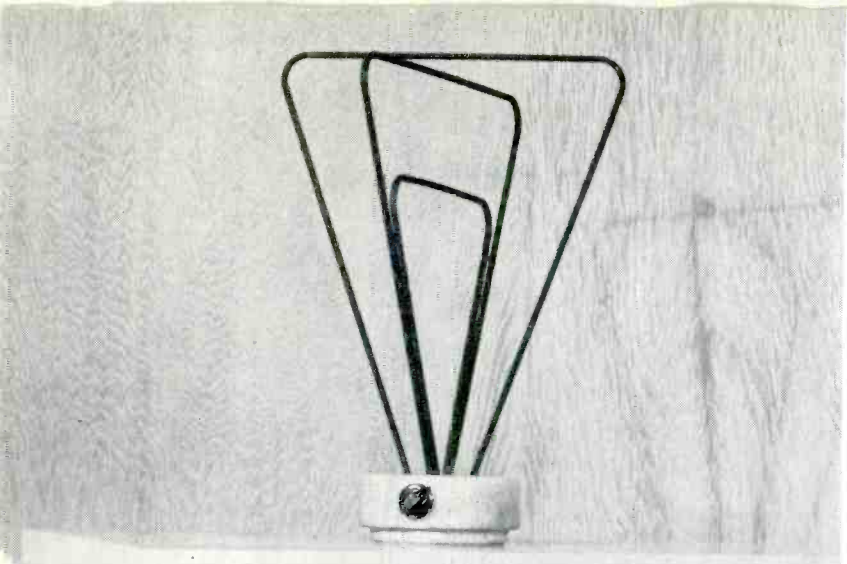


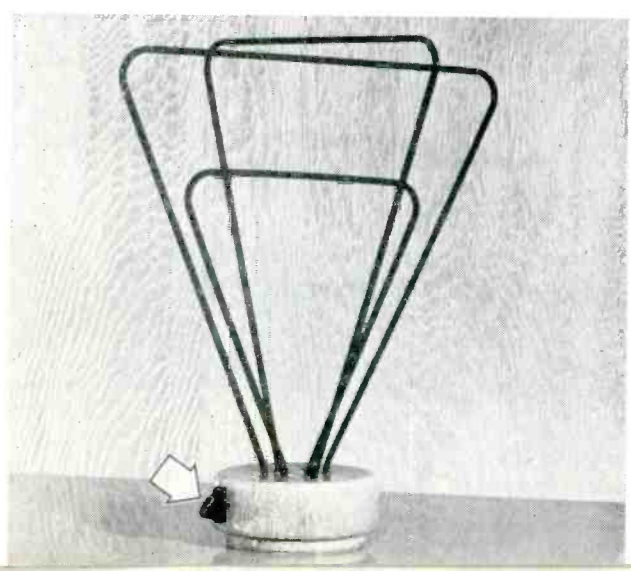
SPECIAL REPORT

Introducing the WALSCO Star...*

FIRST INDOOR ANTENNA TO BE COMPARED WITH OUTDOOR INSTALLATIONS

Attractive, compact in design...the new Walsco *Star* doesn't stick out like a sore thumb. Smart styling and distinctive colors (chartreuse, sand, green) are being recommended by interior decorators. No ugly rods to manipulate. Proven comparable in performance to a good *outdoor* antenna in most metropolitan and suburban areas.

Electronic tuner selects right combination of elements automatically for crystal-clear picture reception. Receives VHF and UHF stations in opposite directions or on widely separated channels. The Walsco *Star* is the most advanced indoor antenna ever built.



Los Angeles...A new standard in the design and performance of indoor antennas can be found in two new models recently introduced by Walsco. This is the first indoor antenna with a built-in, electronic rotating and tuning control that changes its directivity. Without moving, twisting or pulling, the new Walsco *Star* can be positioned perfectly by a simple turn of the control. Ghosts and interference are reduced or eliminated completely...and the correct combination of elements provides perfect reception on each channel.

The sharp, clear performance of the Walsco *Star* has made it the only indoor antenna that can, in most cases, be compared with a good *outdoor* installation. It was designed specifically for outstanding VHF and UHF reception in metropolitan and suburban areas. List price is $12.95. The Walsco *Starlet* (without tuning control), for use in strong signal areas, lists for $10.95. Available at jobbers everywhere in 3 smart, decorator colors.

Walsco Electronics Corporation, 3602 Crenshaw Blvd., Los Angeles 16, California.

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*Based on a recent survey

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FOR OVER THREE DECADES, our industry has driven hard and etched an inspiring record of accomplishments. In the lab, on the production line, in the front office and in the field, an army of skilled, alert and faithful men and women have striven to deliver the best possible products to win your favor.

Today, even though technological problems have mounted, the zeal and eagerness haven't diminished. The goal is the same; to compete for your acceptance with uniformly high quality and constantly-improved products, and thus give you more for your money. This has been and is the credo of the Service Man's loyal ally, the standard-brand manufacturer.

It's not a simple task to meet the stringent standards cited. The transition from a scientific discovery to a practical application is often extremely arduous.[1] The handling of new product ideas must be carefully systematized; the ideas must be considered at levels of increasing penetration, in terms of technical feasibility, processing economics, competition and consumer receptiveness. Mortality can be extremely high. Many have found that to obtain one successful new product, one must consider an average of several hundred ideas at the research level, perhaps twenty per cent of all of these ideas at the laboratory stage, and but two per cent when the semi-works stage is reached.

In the selection of a project that will lead to a successful new product, it becomes necessary to consider a number of production factors in detail; availability of raw materials, plant and processing costs, suitability for the market anticipated, patentability and ease of handling. Equally important, too, is the subject of merchandising. Management must ponder pricing, packaging, labelling, shipping and specialized techniques of retailing that are unique to the trade.

Industry's almost fantastic growth has underscored the soundness of the standard-brand philosophy. The records show that fifteen years ago, the radio-electronics industry produced about $500-million in gross product, but in '54, the total output was approximately $8-billion 8-hundred-million, or eighteen times the 1940 volume, and twice the volume achieved only two years ago.

Comparing the value of electronic products manufactured, with other major industries, we find that the volume in our industry is close to the $11-billion of the car industry, even closer to the $10-billion of steel output and well ahead of electric utility, crude oil and telephone revenues. It has been forecast, that by 1970, industry volume will total the bulging sum of around $20-billion.

The thoroughness, astute planning and processing that obtain in manufacturing today is graphically illustrated in the picture-tube industry, where millions of dollars have been spent and are still being poured out on research, design and new machinery to produce a better tube. Roaming through a modern plant, one will find blocks of automatic conveyors, which carry tubes through automatic washing, screen settling, baking ovens, exhaust tunnels and aging. And one will also see highly-trained personnel engaged in such deft manual operations as electron-gun assembly, graphite coating, detailed inspection and testing.

The receiving tube represents another lively exhibit of the painstaking care which prevails in the lab and on the assembly line. The standard-brand tube, in its modern dress, is truly a miracle of design and construction. For instance, since even infinitesimal contamination can destroy the usefulness of a tube, means must be provided to assure the utmost in cleanliness. Hydrogen furnaces have been designed for this job, and millions of tiny parts are cleansed this way. Even human error has been eliminated by such unique machines as the cathode-coater, where automatic controls serve to insure application of the correct weight and density of emissive coating to both sides of a cathode, during repeated cycling, through spraying and infrared baking.

Tube exhausting and sealing, as practiced today, is an art. In use are *rf* bombarder coils, which heat the tube's metal parts red hot, as pumps continue to evacuate released gasses, and at the same time, the cathode is conditioned by passing a current through its heater. There's also a rapidly-heated barium getter, which vaporizes and condenses on the cool top of the envelope in the form of a metallic film; this film serves to absorb any residual gasses.

All standard-brand tubes are aged and tested with scrupulous care. They are checked for glass defects, as they come off the belt from exhaust machines, and then fed onto an aging conveyor. Then a series of higher-than normal currents stabilize the electrical characteristics of the tube.

Only the perfect tubes can pass the tough tests established by the modern tube plant; they are the only ones that earn the blue-ribbon stamp of approval.

In the creation and production of standard-brand components, accessories, assorted equipment and test gear for the radio, TV, audio, communications and electronics fields, we find the tube pattern rigidly followed. The same hypercritical attention is given to every detail, so that Service Men can buy and install with complete confidence.

The manufacturers of quality standard-brand products know that their survival depends on you; they respect your judgment and appraisal of their merchandise and work hard to earn your firm approval. They are your staunch friends, ever on the job to give you a product that you can sell with pride and at an equitable profit, too. They merit your continuous support.—L. W.

[1] With apologies to the consulting staff of Arthur D. Little, Inc.

Color Bands, Codes and Components:

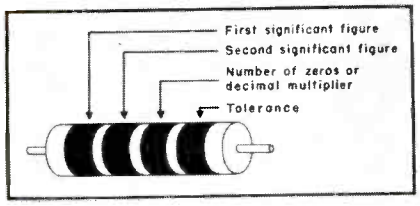


Fig. 1. Molded composition resistor code.

Fig. 2. Molded rf choke code.

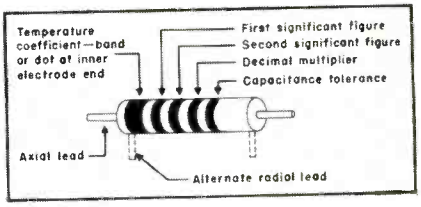


Fig. 3. Molded composition capacitor code.

THERE IS a dread disease, *compontitis*, born from a virus found in many manufacturers' engineering and research laboratories, that the unsuspecting Service Man is exposed to every time he opens up a modern radio or TV set for servicing. In the *good old days* of early radio a molded composition resistor stood alone in appearance and was not confused with other components. Then came along the molded wire-wound resistor, exactly the same size and shape as the molded-composition resistor. The method then adopted for distinction was the use of a different color for the body of the resistor. This was not satisfactory as high temperature and age made the two colors look alike. It was then decided to use a double band width for the first significant figure of the color code for molded wire-wound resistors.

With the addition of molded capacitors and *rf* chokes, *compontitis* became much more acute. Here again body colors were used to differentiate between the different components. The many colors or mixtures of colors of molding powders presented such a stocking problem that it was decided to use a color-code system.

The present standard color code systems for fixed molded composition and wire-wound resistors, molded *rf* chokes and capacitors, are illustrated in the drawings and charts shown in Figs. 1 to 4.

Molded Resistor Color Code

The color code for molded fixed composition resistors is shown in Fig. 1. For molded wire-wound resistors, a double width band is used for the first significant figure. Otherwise the code is the same as for composition resistors.

To clarify the use of the color bands and the product which they serve to identify, a number of typical examples have been prepared.

To illustrate, a tubular molded component with four color bands (red, red, orange, silver) all of equal width, represents a fixed composition resistor of 22,000 ohms, ±5%. However, a tubular molded component with the following color bands—yellow (double width), violet, brown and silver—is a fixed *wire-wound* resistor of 470 ohms, ±10%.

Molded RF Chokes

For the molded *rf* choke, a three-band system is used; this alone differentiates this component from the others. (Incidentally, in the color code for resistors, colors are used for numerals and tolerances.) Often a body of mixed colors, giving a marbled effect, is used. Some radio and TV manufacturers mark their chokes with a single band or dot only; this is especially true of older model auto receivers.

The Capacitor Color Code or 5-band or Dot System

The color-coding pattern adopted for fixed molded capacitors is indicated in Fig. 3 and table 1. Incidentally, this code indicates the temperature coefficient of capacitance, in addition to the capacitance value and tolerance.

To illustrate the application of the data in table 1, let us analyze a molded

(Above, left and center)

Fig. 1 (above, left). Color code for fixed molded composition resistors. Molded wire wound resistors have double band width for the first significant figure. Colors, significant figures and multiplying values are shown below:

Color	*Significant Figure*	*Multiplying Value*
Black	0	1
Brown	1	10
Red	2	100
Orange	3	1,000
Yellow	4	10,000
Green	5	100,000
Blue	6	1,000,000
Violet	7	10,000,000
Gray	8	100,000,000
White	9	1,000,000,000
Gold	± 5% tolerance	0.1
Silver	± 10% tolerance	0.01
No Color	± 20% tolerance	

Fig. 2 (above, center). Molded rf choke color code. Standard color bands (Fig. 1) are used for numerals and tolerances. Units are in μh (microhenries) inductance. In this code, a = a single band width, representing tolerance limits; b = single band width for values under 1 and double band width for values of 1 and over; c = single band width for values under 10 and double band width for values of 10 and over. Example: 0 = .91 two single bands; 1 = 9.1 double-single; 10 = 91 double-double.

Color	*Significant Figure*	*Decimal Multiplier*	*Capacitance Tolerance Per cent (C > 10 mmfd)*	*Capacitance Tolerance Mmfd (C ≤ 10 mmfd)*	*Temperature Coefficient (Parts/million/°C)*
Black	0	1	± 20	± 2.0	0
Brown	1	10	± 1	± 0.1	— 33
Red	2	100	± 2	.....	— 75
Orange	3	1,000	± 2½	.....	— 150
Yellow	4	10,000	.....	.....	— 220
Green	5	....	± 5	± 0.5	— 330
Blue	6	....	.....	.....	— 470
Violet	7	...	.....	.....	— 750
Gray	8	0.01	.....	± 0.25	.....
White	9	0.1	± 10	± 1.0	.....
Gold	....	....	.....	.....	*Note A*
Silver	....	....	.....	.....	*Note B*

Fig. 3 (above, right) and table 1. Fig. 3 illustrates the color code for molded fixed composition capacitors. Capacitance values are in mmfd; 5 band or dot system. In the table we have the color code chart for molded fixed composition capacitors. Note A: Capacitance shall not change more than 50% from 25°C value as temperature is varied from +10° to +75°C. Note B: Capacitance shall not decrease more than 50% nor increase more than 25% from 25°C value as temperature is varied from —55°C to +85°C.

Knowing Their Relationship Can Cure All Types of COMPONTITIS

by ESMOND E. JOHNSON

Service Engineer, International Resistance Company

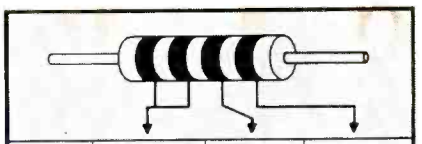
composition component with five color bands: Silver, gray, red, black, and white. From this table and Fig. 3, too, we see that such a component would be a fixed capacitor having a capacitance of 82 mmfd ±10%, with a temperature coefficient of capacitance as indicated in note *B* of the table.

Molded Capacitors (Less Than 10 Mmfd)

For molded capacitors of less than 10 mmfd there is also a color code; this is detailed in Fig. 4. Even though this component has the same number of equal width bands as the molded composition resistor, the third band will be either white or gray, which is never found on a molded composition resistor.

As an example, a molded capacitor with four equally spaced color bands (brown, black, white, silver) has a capacitance and tolerance of 1 mmfd ±10%.

It is very obvious that color codes can be quite troublesome, if one is not fully familiar with the color band variations that obtain, and the products and characteristics they serve to identify. Thus, one should study the assortment of color-band illustrations and tables carefully, and then entertain a self-quiz and see how well one does know what the various colors mean. To assist in such an examination, Figs. 5 (below), and 6 and 7 (p. 68) have been prepared.



COLOR BAND	FIRST & SECOND SIGNIFICANT FIGURE OF CAPACITY	DECIMAL MULTIPLIER	TOLERANCE OF CAPACITY (NOMINAL)
Black	0		
Brown	1		
Red	2		
Orange	3		
Yellow	4		
Green	5		
Blue	6		
Violet	7		
Gray	8	0.01	
White	9	0.1	
Silver			±10%
Gold			±5 %
No 4th Band			±20%

Fig. 4. Color code for fixed molded capacitors of capacitance less than 10 mmfd.

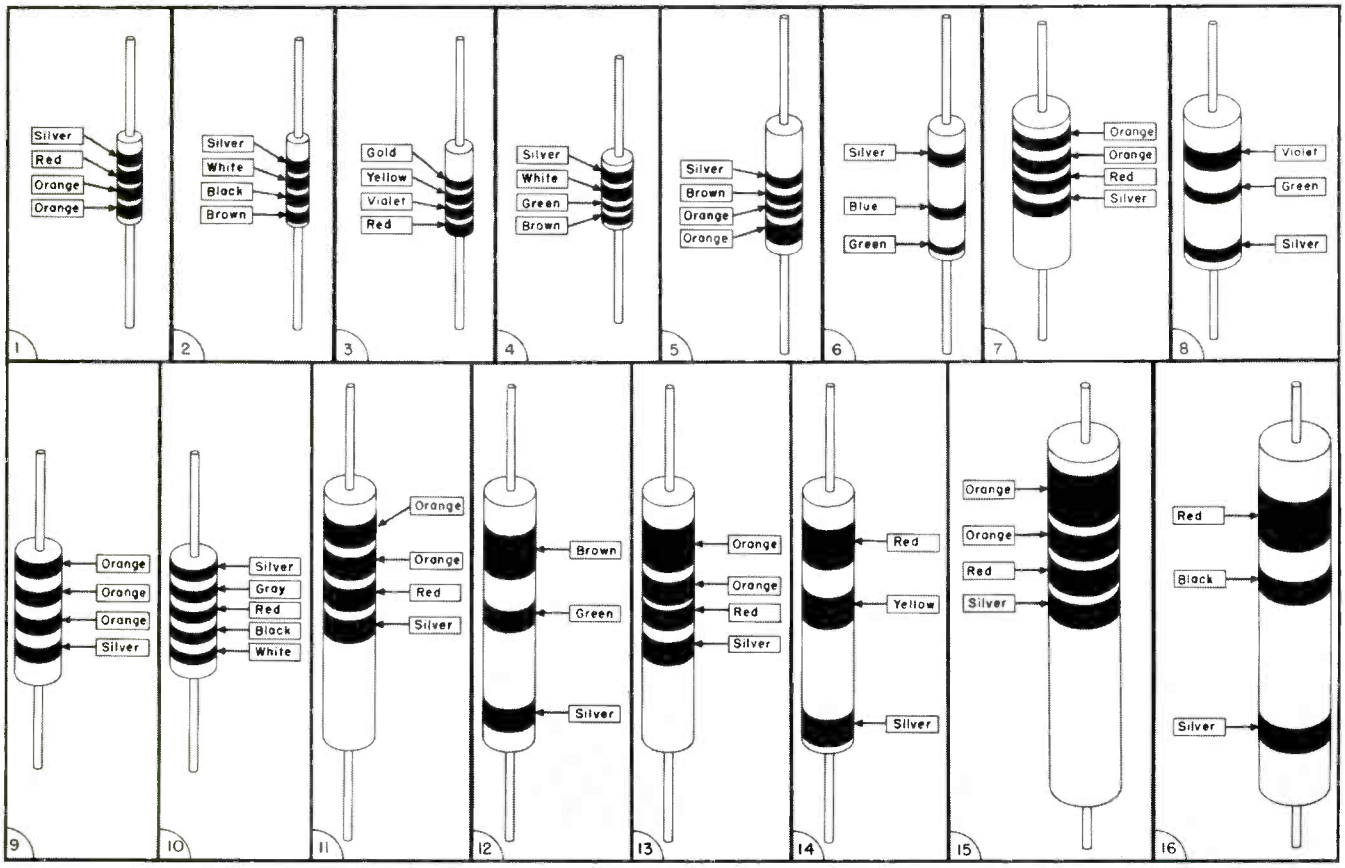
Test *1*, revolving about Fig. 5, requires one to identify each of the components shown and then detail their values and allied characteristics. Then you can check your answers against those listed in page 81 of this issue.

In Fig. 6 (p. 68) we have the underside of an FM chassis* where a number

(*Continued on page 68*)

*G.E. 409.

Fig. 5. Assorted components, with various types of bands, displayed to test one's component-identifying ability.



COLOR TV Troubleshooting With A Bar Generator

by JESSE DINES

IN THE MAIN, troubles found in a TV receiver are due to defective tubes. In color TV, in light of the increased number of tubes, the problem can become acute.

To repair a receiver, one should be able to recognize the pix-tube indications which appear when tube troubles occur; otherwise, pin-pointing can become a very laborious task. However, unlike the b-w picture, it is not always easy to analyze color-set faults via the pix tube, since it is sometimes difficult to determine whether or not false colors are being shown. Accordingly, it has been found, one must use a color bar generator in troubleshooting. The bar pattern contains all of the important colors necessary and thus one can detect the nature of the trouble accurately.

In analyzing this approach, the output of a bar generator‡ was fed to the antenna terminals of a 19-inch color receiver.‡‡ The results obtained in one section of the chassis are shown in the chart appearing at the right, on page 23. A chart covering the other circuits of this model will appear in another installment of this report next month.

Chart Information

The chart contains the tube symbol number, tube type, stage, function, abnormal bar indications, and reason for the trouble when a tube burnout occurs. Inasmuch as one tube may often form two stages, a dual problem can obtain. Where a trouble causes a false color bar pattern to appear, one should note that a somewhat different color pattern may result, with false colors still being indicated, but now only in different relative positions. This is due, mainly, to the tolerance characteristics of the set under test, its response characteristics and the type of bar generator being used. In many cases, what one sees as different shades of *blues*, actually represent different shadings of black and white.

Although the results shown pertain only to the 19″ model studied, the information can serve as a reference guide when checking other color sets.

‡Kay Electric Chromabar. ‡‡CBS-Columbia model 205.

Fig. 1. Block diagram of CBS-Columbia model 205 color chassis with 19-inch tricolor tube.

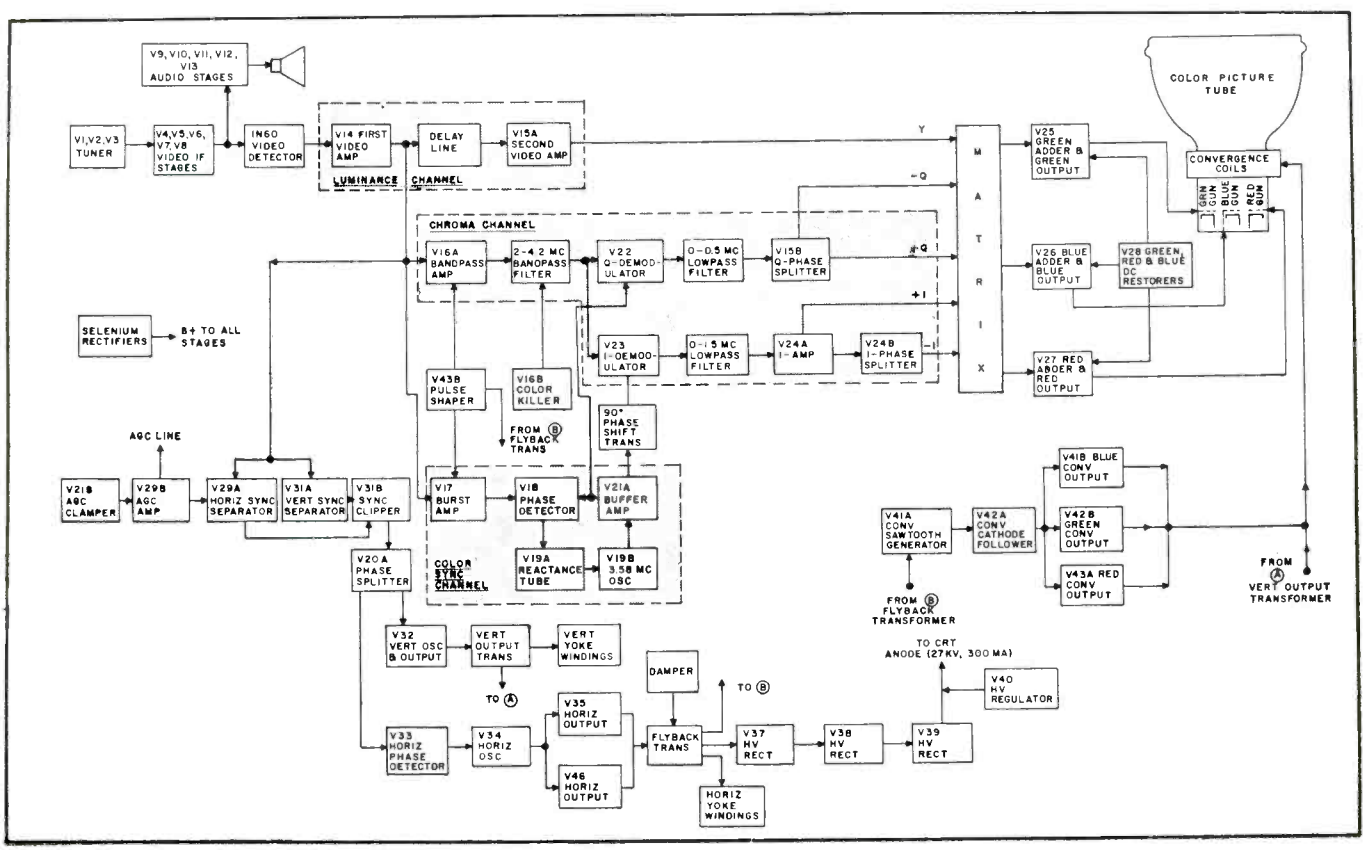


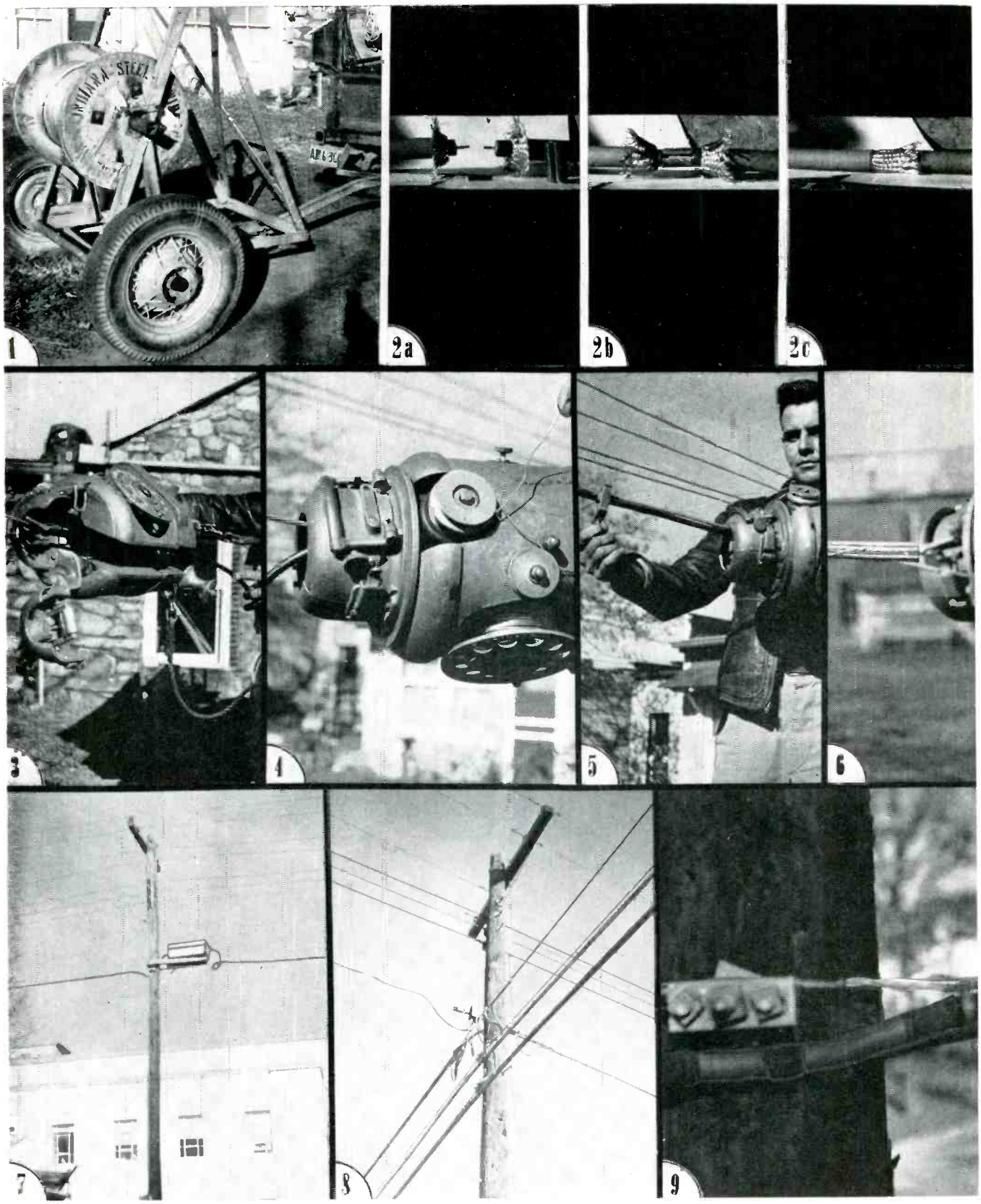
Chart Detailing Bar-Generator Results Obtained In Checking 19-Inch Color Chassis*

Tube Symbol	Tube Type	Stage	Function	Bar Pattern Indication (When Tube Burns Out)**	Other Abnormal Indications: General Comments	Reason for Trouble
V_{4}-V_{8}	6CB6, 6CL6	IF amps	Amplify *if* signals	B-W raster (no bar pattern)	Brightness control must be at maximum to see raster	Bar pattern signal stopped in *if* section; tuner stages also cause same troubles
V_{14}	6CL6	First video amp	Amplify video signals	B-W raster (no bar pattern)	Brightness control must be at maximum to see raster	Bar pattern signal stopped in video section
V_{15}	6AN8	Second video amp and *Q*-phase splitter	(*1*) Amplify luminance level and (*2*) Apply phased signals to matrix	Blue | Cyan | Red | Cyan | Blue | Blue | Black	Pattern is *washed out*	(*1*) Luminance level lost and (*2*) *greens* and *magentas* lost
V_{16}	6AN8	Bandpass amp and color killer	(*1*) Amplify chroma signals and (*2*) Disable color during b-w reception.	Medium Blue | Light Blue | Dark Blue | Medium Blue | Very Dark Blue | Medium Blue | Light Blue	A b-w pix is actually seen with different luminance levels	Chroma lost
V_{17}	6CB6	Burst amp	Amplify color signal	A horizontal movement across screen causes all colors to change from true to false colors at a very rapid rate	Horizontal movement constantly changes speed and direction	Loss of color sync
V_{18}	6AL5	3.58-mc phase det	Produce *dc* error voltage to get correct color sync	Light Blue | Cyan | Dark Blue | Light Blue | Very Dark Blue | Very Light Blue | Green	Color lines drift up and down (and diagonally) making it difficult to see actual colors of bar pattern	Loss of proper color sync
V_{19}	6AN8	Reactance tube; 3.58-mc oscillator	(*1*) Provide an automatic frequency for 3.58-mc oscillator for proper color sync and (*2*) generate color sync signal	Dark Blue | Light Blue | Black | Dark Blue | Black | Medium Blue | Light Blue	A b-w pix is actually seen with different luminance levels	No 3.58 carrier is fed to *I* and *Q* demodulators. Chroma signal cannot be detected in chrominance channel
V_{20}	12AT7	Phase splitter	Separate horizontal and vertical sync pulses	Loss of horizontal and vertical sync; bars change movement horizontally, vertically and diagonally	Only red, green and blue colors are seen when bars slow down in movement	Horizontal and vertical sync lost
V_{21}	6AN8	Quad amp; *agc* clamp	(*1*) Provide 90° phase shift for color sync signal to *Q* and *I* demodulators and (*2*) clamp horizontal sync pulses for *agc* action	Dark Blue | Light Blue | Black | Dark Blue | Black | Medium Blue | Light Blue	A b-w pix is actually seen with different luminance levels	No. 3.58 carrier is fed to *I* and *Q* demodulators. Chroma signal cannot be detected in chrominance channel
V_{22}	6BY6	*Q* demodulator	Demodulate *Q* signal in chrome channel	Light Blue | White | Red | Cyan | Dark Blue | Light Blue | White	Green-magenta colors are lost giving false color pattern	*Q* channel, which supplies green-magenta colors, is inoperative
V_{23}	6BY6	*I* demodulator	Demodulate *I* signal in chroma channels	Green | Magenta | Dark Blue | Light Blue | Dark Blue | Magenta | White	Orange-cyan colors are lost giving false color pattern	*I* channel, which supplies orange-cyan colors, is inoperative
V_{24}	6AN8	*I* amp; *I* phase splitter	(*1*) Amplify *I* signals and (*2*) apply properly-phased signals to matrix	Green | Magenta | Dark Blue | Light Blue | Dark Blue | Magenta | White	Orange-cyan colors are lost giving false color pattern	*I* channel, which supplies orange-cyan colors, is inoperative

*Another chart covering tubes V_{25} to V_{43} will appear in the March issue of SERVICE.

**Tests made with Kay Electric Chromabar generator; normal pattern obtained with this generator is shown at right.

Green	Yellow (Red-Green)	Red	Magenta (Red-Blue)	Blue	Cyan (Blue-Green)	White



(Top)

Figs. 1 and 2. A homemade reel-trailer, for hauling large reels of messenger-cable and coax while installing new lines, is illustrated in Fig. 1. Three steps in splicing large coax cable are shown in Fig. 2: In (a) we have two ends of cable, prepared for splicing. In step 2 (b), the ends are joined by a slipover splice of copper tubing, soldered, a piece of polyethylene insulation is removed, slit and replaced. The completed splice, ready for soldering of shield and taping, appears in (c).

(Center)

Figs. 3, 4, 5 and 6. Fig. 3 shows operator loading coax cable into a spinner, preparing for fastening to messenger cable. In the next view (Fig. 4) operator is threading lacing-wire around loading-spools to insure proper tension of wire, while lacing. Clamping of lacing-wire to messenger cable, to hold end while spinning, is illustrated in Fig. 5. Final view shows closeup of back end of spinner, detailing how lacing-wire spirals around messenger cable to hold coax up in place.

(Bottom)

Figs. 7, 8 and 9. A distribution amplifier mounted on pole is shown in Fig. 7: A meter-loop and meter for power supply is on lower part of pole. Next view (Fig. 8) shows line-splitter mounted on pole. From this unit, several taps are taken off for nearby subscribers. Main transmission line, going four ways, visible above splitter. A closeup of a mounting for cable-support on pole appears in Fig. 9. Messenger cable visible above large coax cable. Here we have a loop in coax to compensate for unequal rates of expansion of messenger cable and coax. If tap is contemplated later, longer loops can be left.

Selecting Proper Lines . . . Installation Precautions . . . Routing Techniques . . .

The Cable Network In Community TV Systems

by T. C. MASTERS, *Chief Engineer, Television Signal Service*

ONE OF THE most important elements in the community antenna system is the cable network, which carries signals to subscribers. Care must be taken to prevent leakage of TV signals from the cable network; such leakage can not only damage reception, but cause annoying interference. This problem must be overcome at time of installation; tracing of minute leakages after the entire system has been installed is a very difficult task.

For the initial run of cable, from the antenna site down into town, a husky coax should be used.[1] The large cable has much lower attenuation than the smaller types, permitting longer runs between repeater amplifiers. This can effect a great saving in the initial cost of the system; also in the operating expense. Smaller types of cable such as RG11/U are useful for branch lines, and the still smaller RG59/U can be used for *drops;* the actual leadin into the subscriber's home from the *tapoff*.

A detailed survey of the entire territory to be covered is absolutely essential. One should use a street-map of the town in this study; they are available from architects, surveyor's offices, real estate brokers, or as a last resort, the municipal street and sewer department. If a map of this type can't be purchased, then borrow one and have an enlarged tracing made, showing all of the principal streets, alleys and geographic obstacles. It is also important to consult with those who operate the local power and telephone companies, and ask them for the exact locations of as many of their poles as possible. These locations should be spotted on the map in color.

A rough outline of the projected cable system should then be made on the map (also in color), indicating types of cable, lengths needed, possible locations for line and repeater amplifiers, tapoffs, line splitters, and other accessories. This detailed map will serve as a valuable guide, for one will be able to make up a fairly close estimate of the total number of feet of each type of cable required, and the number of amplifiers, quantity of *pole-hardware*, and other materials that will be needed for the complete installation. With this information available, large-scale purchases can be planned and corresponding bulk-buying economies effected.

The main cables, of the large coax, should be so routed, with respect to secondary or branch cables, amplifiers, etc., as to insure maximum efficiency in the overall layout. Density of population will have a large effect on the plan, as the runs will vary with the total number of potential subscribers.

Constructional Details of Cable System

The installation of a community system follows, in part, the pattern employed in the construction of a telephone multi-conductor cable system. That is, the cable itself is not suspended directly from the poles, as conventional power wiring, but due to its more delicate structure, it is instead strung on a steel messenger-cable, which carries the weight. The coax is secured to the messenger cable by a spiral wrapping of wire, which is applied by a special machine.

Messenger cable which is a heavy galvanized stranded steel cable, must be run first over the route to be covered. For supporting the heavier coax, a size known as *6-M* is used. Translated, this means that this wire has a tensile strength of 6,000 pounds. For the lighter coax, a smaller messenger *(Secmans-Martin stranded),* with a tensile strength of 3,150 pounds, is used.

Required are a few special tools to speed up construction. One of these tools is a *reel-trailer,* which one can construct in the shop. This item (shown in Fig. 1) has a framework composed of light angle-iron and pipe, and wheels from any old car. A large reel is used to hold a 5,000′ reel of messenger cable. The top axle, visible in the photo, has a *roller* made of a piece of pipe, designed to make the job of loading the heavy reels of cable with a chain-hoist much easier.

Another very useful item is a small 110-volt *ac* generator. Mounted in the back of the *construction-truck,* it can be used to furnish power for a half-inch electric drill motor, soldering irons, test equipment such as field strength meters, and anything requiring electric power. This generator, with a long heavy-duty extension cord, will ease the task of construction. To illustrate, the heavy duty drill can be used to bore holes in poles for mounting hardware, for fastening the messenger cable, and so on.

The messenger cable is secured to each pole by a 5⁄8″ galvanized steel bolt, which passes all the way through the pole; on the *head* of this bolt is mounted a *3-bolt clamp*, which holds the messenger cable. To make an initial installation, the cable is secured to the first pole in the *run*, and then raised to the rest of the poles, looping it over the hardware for temporary support. All hardware must be in place and assembled before this is done, of course. After setting a *back-guy* behind each end pole, to help carry the added strain, the messenger cable must then be tightened with a chain-hoist or block and tackle. When sufficient tension has been attained, the messenger cable is secured in the clamps at each pole.

After the messenger cable has been installed, the coax cable is laid out, and fastened to it. This may be run off the large reel on the reel-trailer. Common installation practice is to string the coax along the run to be covered, under the messenger, then *spin* it to the messenger. The end of the coax is hoisted to the first pole, and temporarily fastened. The installer then sets up the *spinner*.[2] This machine automatically wraps a single-strand 0.61″ steel wire (that has been *Bethanized* or softened) around both coax and messenger, tying them to-

(Continued on page 78)

[1] Such as FTR K-14 or Amphenol 21-125.
[2] Neale Cable Spinner (Model B).

Service Engineering — field and shop notes

by

LEO G. SANDS

Installation, Servicing and Maintenance of Tailored Intercom Systems

THE SALE, INSTALLATION, servicing and maintenance of custom intercom systems, has become an extremely lively and lucrative activity for Service Men. The intercom system utilizes an audio amplifier for communicating in two different directions, consecutively but not simultaneously. In essence, it is a two-way low-power public address system providing simplex or one-way-at-a-time communication.

Permanent-magnet loudspeakers are used both as loudspeaker and microphone since a *pm* speaker performs well as either. When talking from one point to another, the *pm* loudspeaker at the originating point is connected to the input of the amplifier and the speaker to the output. When the person at the listening end replies, the speaker then becomes a microphone, and the action is thus reversed, with the originating source now being connected to the amplifier's output and producing, instead of creating.

The simplest intercom system consists of a master unit and a remote unit. Calls are generally originated at the master unit, although the remote unit can be equipped with a switch to permit originating calls at the remote unit.

More complex intercom systems, consist of one or more master units and several remote units. Generally, in such systems intercommunication is provided between master units and to and from master units and their satellite remote units. Intercommunication between remote units is not possible except in special custom-built systems.

A master unit generally contains an audio amplifier, a talk-back loudspeaker, a talk-listen switch and a remote station selector switch. It is normally possible to select any one remote unit, although some types of master units are designed to permit calling two or more remote stations simultaneously, or even paging over all remote units at once.

A remote unit usually consists of a metal, plastic or wooden loudspeaker baffle equipped with a *pm* speaker and optionally a call-back switch or push-button. In high-noise areas, a re-entrant high-efficiency horn-type loudspeaker is often used in lieu of a cone speaker.

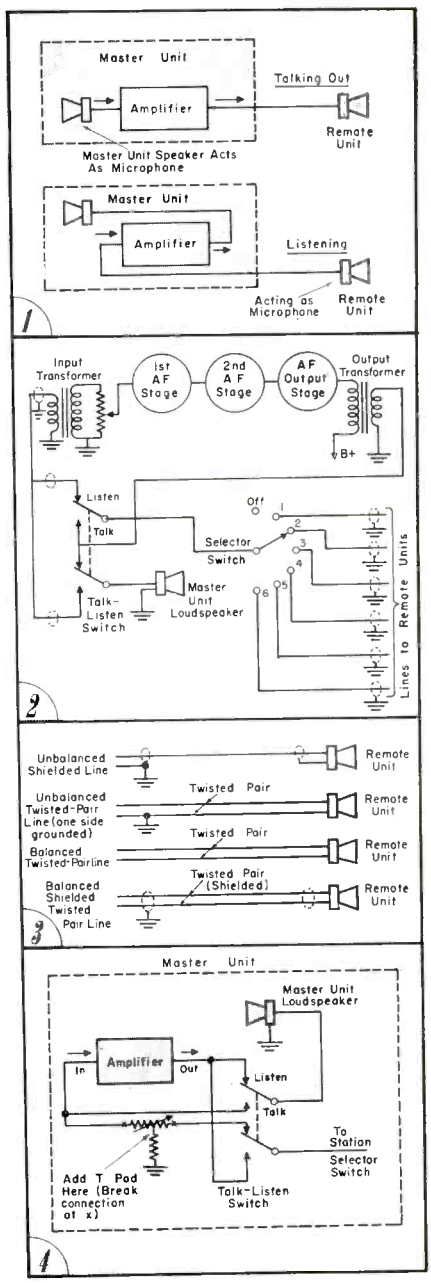
Most intercom systems require wire interconnection between the master unit and satellite remote units. There are, however, several makes of wireless intercom units which are essentially miniature radio transmitters and receivers, using the power lines to convey low-frequency radio signals between units.

The wired-type intercom system, by far the most popular, is generally more satisfactory and permits a wider variety of system hookups. The wireless type unit, to be capable of selecting any one of several satellite units, must utilize several radio frequencies and thus is limited in its expandability. With the wired type it is possible to have as many remote units as desired, by simply adding wire lines and expanding the selector-switching system.

Wire lines for interconnecting master and remote units may be separate pairs, run in diverse routes, or a multiconductor cable tapped for remote units as required. Some intercom systems utilize single-conductor shielded cable for feeding remote units, using the shield as the grounded side of the line. Others use a twisted-pair balanced line, with or without shielding, while others use a twisted-pair unbalanced with one side grounded.

The amplifiers used in most wired intercom systems are of simple design, similar to the audio end of an inexpensive radio or TV receiver. The

(*Continued on page 74*)



Above: Figs. 1-4.

Fig. 1. Typical intercom system.

Fig. 2. Types of lines used in intercom work.

Fig. 3. Method of adding an auxiliary volume control for incoming signals only.

Fig. 4. How a privacy earphone can be added to an intercom master unit.

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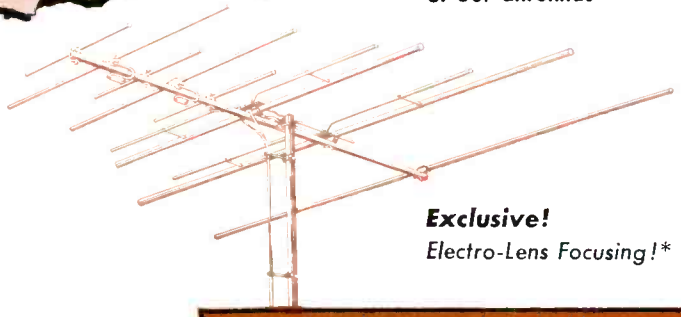

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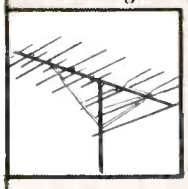

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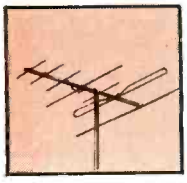

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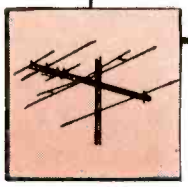

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RF Signal Pickup in

Lucid Analysis of a Serious Problem That Not Only Affects Radio and

THE PHENOMENA known as *rf* detection in audio stages, usually occurring in the first audio amplifier, is often the cause of a host of receiver quirks that are quite baffling.

Rf rectification or demodulation in audio stages, a type of interference that is becoming much more common, can occur in the audio stages of a number of devices: TV receivers, FM or AM radios, phono amplifiers, public address amplifiers, motion picture sound amplifiers, disc or tape recorders, *hi-fi* audio systems and has even been found in hearing aids. *Rf* rectification can occur in small *ac/dc* portable receivers, as well as in large console TV receivers. To sum up, any high-gain, low-level improperly filtered or shielded audio unit can be subjected to this difficulty when it is placed in a strong radiation field.

The interference, when it occurs in TV receivers, will be found to be present regardless of the channel to which the receiver is tuned. The symptoms may be in the form of whistles, hash, pops, clicks and other noises.

A recent memorable case of this trouble appeared in a power amplifier used with a record player. The audio system, without an *rf*, mixer, oscillator or *if* system, reproduced the music and voice of radio programs transmitted by a local radio station. In this instance, the radio programs could be plainly heard in the background of records being played, as well as when records were not being spun.

Magnetic fields induce these interference *rf* voltages and they can be generated by almost any electronic device in common public use. The average wall light switch, when the circuit is opened or closed can easily be the cause of clicks in a radio or phono amplifier. These signals do not need to travel through the power lines or be picked up on an antenna system to be heard. If the audio stages are permitting *rf* demodulation to take place, the *rf* amplifier, mixer and *if* tubes can be removed and the disturbance will still persist.

This radiated interference energy does not always stem from radio transmission. Oil burner thermostats, motors used for oil burners, fans and electric razors can also be the cause of this trouble. Even electric lamps, fluorescent lights and neon signs, as well as many other electric devices can radiate sufficient energy to bring this about.

When the volume control shaft of an audio amplifier, being subjected to interference is rotated, so that the variable arm is placed at ground potential, it will be found that the interference is usually removed. This would lead one to believe that the trouble is due to poor or insufficient selectivity in the front end of the unit if it happens to be a radio. If a power audio amplifier is involved, a real mystery obtains, since here we do not have selective circuits for the *rf* voltages.

When the problem occurs in radios or TV receivers, the Service Man often attempts to trap out the interference signals at the antenna or eliminate it by working in the front end of the receiver. The complete overall alignment may frequently be gone through to no avail. Naturally, if the cause of the interference being experienced is *rf* demodulation in the audio system the trouble remains after this extensive work has been performed.

There are many interfering signals that work their way to the audio amplifiers from the antenna and front end or break through the selectivity of the *rf* or *if* stages, but these are of a different nature than those being considered in this report.

Identifying RF Demodulation at The Audio Grid

Naturally, if the objectionable signals are traveling through either the *rf* or *if* stages, grounding the plate or grid element of the last *if* tube for *if* signals with a capacitor will remove the interloper. If these interfering signals are not removed by an *rf* short circuit placed in the *if* stage by a capacitor, the remaining interference signal will most probably be due to demodulation of an *rf* voltage in the audio amplifier. Another easier way of confirming this can be accomplished, as previously mentioned, by simply removing from the socket the last *if* tube or the detector tube, if it is not being used as the audio amplifier. Now, if *rf* detection is occurring, it will be found that the interference from the loudspeaker is still present and it can be controlled somewhat with the volume control.

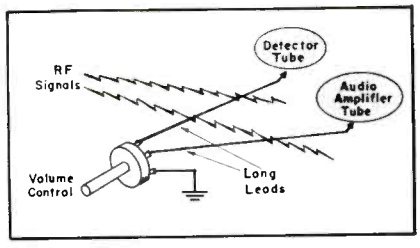

Fig. 1. Long leads associated with the volume control can be a source of interference trouble with rf voltages of large amplitudes being induced across them.

At the audio-amplifier grid the bias requirement can be anywhere from a fraction of a volt to several volts, dependent upon the particular tube used in the circuit design. Also, in the audio grid circuit there is a very large grid-leak resistor, usually in the order of 10 megohms in many receivers. In association with this 10-megohm resistor there is very often a long lead to the volume control, since it is invariably mounted on the front of the equipment for accessibility. Across this lead and the others associated with the volume control, it is relatively easy to induce an *rf* voltage, since the circuit is of such a high impedance. This can occur in those audio systems that are in operation in reasonably strong radiation fields.

Rf signals powerful enough to induce, in the audio stage, signals that can overcome the grid bias will be rectified. This is shown in Fig. 3.

This illustration shows how the modulation of the *rf* signal swings about the normal bias of the audio amplified stage. If the strength of the *rf* stage is sufficient in amplitude to extend into the positive grid voltage region, grid current will be drawn for this portion of the *rf* signal; positive excursions and demodulation will be performed as in any detector. The grid current will flow through the grid-leak resistor on these positive excursions, developing the amplitude-modulation voltage from the rectifica-

Audio Stages

by DOUGLAS STEVENS

TV Receivers, But Phonos and Practically All Forms of Electronic Gear

tion of the *rf* signals across the grid-leak resistor. This amplitude modulation, being the audio signal in the case of AM broadcast transmissions, represents the interfering audio voltage and is thereby present at the grid of the audio amplifier. Thus, we find that *rf* detection can occur in low-level audio circuits even though there are no tuned circuits for these *rf* frequencies. The full modulation may not be recovered, but this will only cause the interference, as heard, to be distorted, if it is a discernible audio signal. Since the demodulation signal (interference audio voltage) is across the grid-leak resistor, the audio amplifier will amplify it and pass it along with any of the desired signals.

If the *rf* carrier is unmodulated, it may affect the desired audio presentation by distorting it. This type of undesired pick-up or unmodulated *rf* may reduce the audio output level. FM signals can cause this same effect and in some cases introduce hum.

As a point in passing, it is this first audio stage that is very susceptible to hum pick-up. Filament and poorly-filtered *B+* leads, or *ac* leads in close proximity to the grid circuit components and leads, can easily induce considerable hum voltage into the audio system.

Remedying the Demodulation Problem

Since the basic cause of the trouble is *rf* rectification or detection occurring at the audio grid, anything that can be done to prevent the *rf* signal voltages from reaching the tube grid will alleviate the condition. Once the *rf* signals are rectified it is impossible to separate the undesired signals from the desired signals. Therefore, we must separate the interfering *rf* signals from the audio signals before demodulation can take place.

Of course, if at all possible, the cause of the interference should be removed. If electrical devices are radiating the annoyance they should be examined for possible correction. These corrections involve the blocking of the radiation with shielding, or filtering, if practical. The power supplied to the radiating unit can be filtered with chokes and bypass capacitors, thus preventing the *rf* energy from being passed along the power line or being radiated from it.

In determining where the interference is being picked up, it might be possible to disconnect the suspected leads and thereby determine which is picking up the interference. However, it probably will be found that more than one lead is at fault or the whole chassis is hot with *rf* energy.

Actually the correction of the interference problem resolves into two aspects, as far as the audio stage is concerned:

A: To determine the point of pick-up of the *rf* energy in the audio system and then eliminate the reason for the *rf* voltages being induced.

B: Once the *rf* voltages are in the circuit it must be rectified or detected to be heard from the audio output. If the detection process of the *rf* signals can be prevented by removing the *rf* signals from the grid-rectifying point, the problem will have been resolved.

The prevention of grid rectification (demodulation) can be brought about through three possible alterations:

1: Shielding of the circuits and leads to prevent the induction of the *rf* voltages.

2: Installation of a low *rf* impedance from grid to ground or *B–*, depending on the point to which the tube cathode is tied.

3: Installation of a high-*rf* impe-

(*Continued on page* 80)

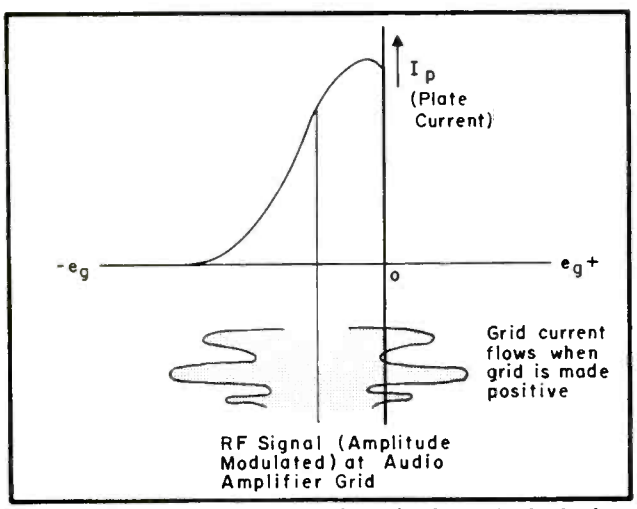

Fig. 2 (right). Magnetic fields induce rf voltages in the leads and across components of audio system. This signal is rectified at audio grid and amplitude modulation voltage is amplified.

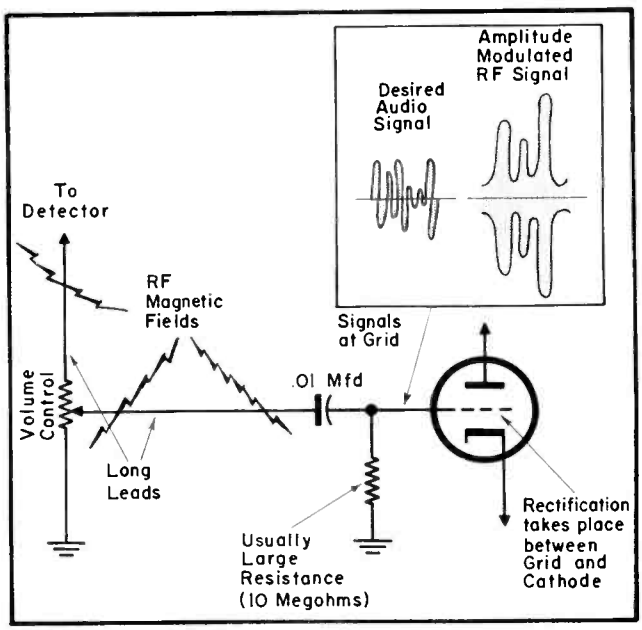

Fig. 3 (above). Grid rectification occurs when rf signal voltage is large enough to drive the grid positive and cause grid current to flow.

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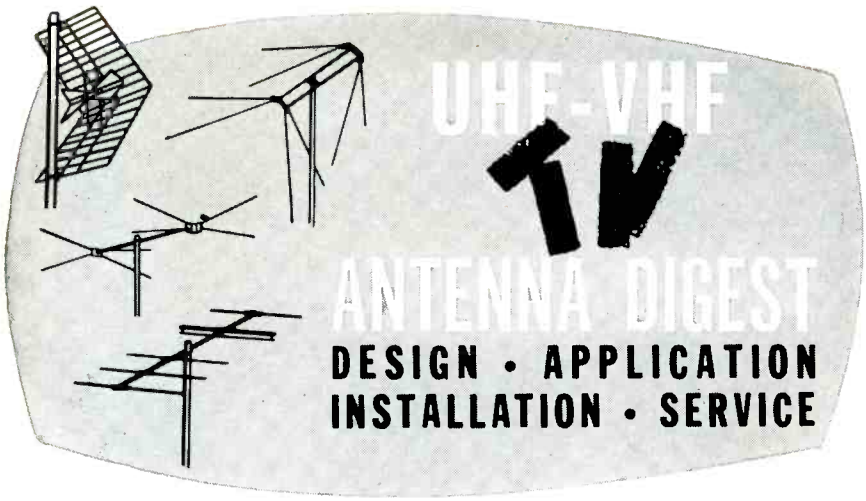


Linear-Coupling Antenna-Amplifying System for Multiple Sets

by RALPH G. PETERS

NEGATIVE FEEDBACK and balanced push-pull operation have been utilized by electronic scientists at the Naval Research Laboratory in Washington to develop a linear-coupling antenna-amplifier circuit for multi-receiver use, that is claimed to afford increased sensitivity.

Basic Design

Originally developed for high-frequency receivers (2-16 mc), it is also possible, it is said, to apply the principles of the circuit to amplifying systems designed for the TV frequencies.

For the higher frequencies, it was noted, one would have to alter the values of those components that are required to distribute the antenna voltage equally to each amplifier across the *vhf* range, and the transformers necessary to provide balanced operation at both input and output. Furthermore, since the amplifier does not provide a high degree of isolation between output and input terminals (about 30 db at 30 mc), its use in weak signal areas would require that the unwanted frequencies, appearing on a receiver's terminals from its own oscillators, should not be more than 30 db above the weakest signal to be received.

In strong signal areas, the signal should have no difficulty in overriding the spurious voltages from other receivers.

Purpose of Study

The multicoupler investigation at NRL was described as having two main purposes: *(1)* to establish the relationships between the parameters of a multicoupler and the individual circuit variables, and *(2)* to develop standard methods and techniques for evaluating the performance of a multicoupler.

The Circuit

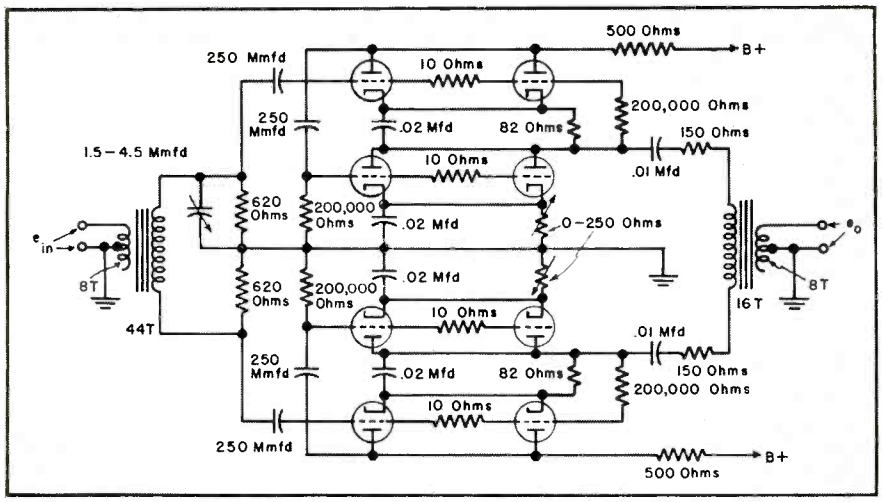
In Fig. 1 is the NRL negative-feedback circuit. Eight paralleled 6BQ7A tubes are used in push-pull operation, with the required input and output transformers, an output decoupling resistor, and variable bias controls.

Assuming a receiver with a 3-kc bandwidth, which requires one microvolt at the input to establish a 20 db signal-to-noise ratio at the output, this circuit, according to NRL experts, will not degrade that sensitivity by more than 1.48 db; this compares with a maximum of 5.16 db for multicouplers in use today.

Intermodulation Test Results

Intermodulation distortion for this experimental circuit was 82 db below a 0.25-volt level, as compared with 50 db for the same multi-coupler.

Additional improvements in performance are seen possible with the development and availability of more linear tubes and better transformers.



(Left)

Fig. 1. Experimental coupling antenna amplifier circuit, developed at NRL for multi-receiver use, which features push-pull operation of 6BQ7As.

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4	21.	11.5:1
5	20.	10:1
6	20.	10:1
7	10.5	3.5:1

Chan.	DB	Rel. Volt.
8	18.	8:1
9	19.	9:1
10	25.	18:1
11	22.	12.5:1
12	25.	18:1
13	13.	4.5:1

HERE'S HOW THE JFD HI-PLEX SYSTEM WORKS!

Current Distribution (Channels 2-6)

ON LOW BAND

Full sized low band half wave folded dipole develops maximum in-phase current across its length on low band channels 2 to 6. Entire dipole length acts as effective capturing device because it operates totally on fundamental frequency unimpeded by additional radiating devices used in other broad band systems to raise high band gain.

Current Distribution (Channels 7-13) Without Helix

ON HIGH BAND

When operating on high band frequencies, JFD *Hi-Plex phasers* transform each low-band collector extremity into separate high band dipoles. These electrically isolated elements function as independent collectors operating on their fundamental frequency, each developing maximum in-phase current on channels 7 to 13. Out-of-phase voltage of center section of folded dipole is minimized and isolated from other high band dipoles by blocking action of two anterior high band phasing elements.

Current Distribution resulting from connection of Helix (channels 7-13)

ON BOTH LOW AND HIGH BANDS

Special phasing harness feeds channel 7 to 13 energy produced by flat plane helix into *Hi-Plex* collector in same phase and magnitude of other 2 high band dipoles. Result in in-phase additive operation of 3 half-wave antennas balanced for increased high band gain and unlimited signal strength on low band channels — *Plus* 300 ohm impedance to assure 100% energy transfer.

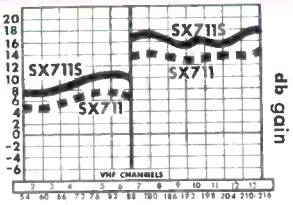
COMPARE THE PERFORMANCE OF THE STAR HELIX WITH ANY VHF ANTENNA YOU ARE NOW USING!

ANTENNA	CHANNELS 2	3	4	5	6	7	8	9	10	11	12	13
"STAR-HELIX" SX711	4.75	5.	6.25	7.25	7.	14.5	14.	13.25	13.5	13.75	13.75	14.5
"STAR-HELIX" SX711S	8.	8.5	9.	10.5	10.5	17.5	17.	15.75	16.	16.	16.	17.5
"DODO" Screen Type REFLECTOR	4.75	4.5	7.2	7.1	7.	11.	11.2	11.8	11.5	11.1	12.1	12.
"SUPER DODO" Screen Type REFLECTOR	6.3	6.8	8.8	7.8	7.5	9.5	11.2	11.8	12.	11.1	12.1	12.
Broad Band Yagi with Phasing Stubs	4.3	5.7	4.5	7.1	9.	13.	14.	13.5	14.	13.	14.	15.
Inline Yagi with Phasing Stubs	5.2	5.5	6.	8.	8.	11.5	9.5	10.	9.	11.	11.5	11.8
Inline Yagi with Triple Dipole	5.25	6.25	7.	7.5	7.75	10.5	10.25	8.75	9.5	10.25	11.	11.75
Super-Inline Yagi with Triple Dipole	6.75	7.	9.2	9	10.	11.5	12.2	12.8	13.5	13.1	14.6	15.5

65.6% S/N Figure of Merit*

**The S/N Figure of Merit sums up the major individual characteristics of an antenna in one concise value. Write for S/N Figure of Merit engineering folder No. 315 for complete details.*

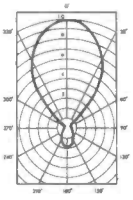
Gain Represents That Over ½ Wave Reference Folded Dipole



Up to 18 db on High Band* **Up to 11 db on Low Band***

*Tested in strict accordance with RETMA antenna measuring standards

Horizontal Pattern (Relative Voltage) Channel 2-6



Today's Fastest Installing Broad Band Antenna! As Easy to Handle as Power Steering. The Slowest Part Is Opening the carton! Remarkable new JFD Hi-Tension Aluminum Bracket Design Cuts Installation Time 250%. No tools or labor necessary. No screws or hardware to tighten. Just flip elements into place.

JFD MANUFACTURING CO., INC. Brooklyn 4, New York

INTERNATIONAL DIVISION
15 Moore Street, New York 4, U. S. A.

Phase-Splitter Circuitry . . . Curing Overload Due to Strong Signals

by T. L. GILFORD

ONCE the input signal to an amplifying system is *single-ended*, it must be converted for balanced or push-pull operation. Whatever device or circuit is used for this purpose can be called a *phase-splitter*.

It is possible, however, to *feed* an all push-pull amplifier (both voltage and power amplifiers in push-pull) from a balanced source, such as a magnetic pickup or FM detector, where one side of the line is not grounded. When this is done, of course, no phase-splitter is required.

In Fig. 1, we have a grounded-grid, cathode-coupled arrangement that looks as though no phase-splitter is required. Actually, phase-splitting occurs in the output circuit itself; the voltage from V_1 is coupled to V_2 through the common cathode resistor. This circuit is not generally considered appropriate for high-quality amplifiers because of the tendency to poor balance.

Curing Overload Due to Strong Signals[1]

WHEN TV stations increase their power, often receivers in the immediate vicinity of the transmitter are not able to handle the signal without producing an overload condition. Although severe overload is generally recognized by Service Men, a slight amount of overload is not always easy to diagnose. The strength of the received signal may be just great enough to produce a condition of poor sync due to clipping in the *if* stages, bending or distortion of the picture, or limited range of contrast.

The most effective method of correcting this condition is to attenuate the received signal by padding the antenna input to the receiver. The amount of attenuation must be determined by experiment.

It is possible that a similar overload condition could exist in receivers connected to a multiple outlet or a community cable system, where the received signal is amplified before it is distributed to the receivers. In this case, reducing the signal at the antenna input of the receiver will correct the overload condition. However, if the amplifiers of the community system are being overloaded by the signals they are receiving, then padding the antenna input to a receiver will not correct the overload condition. The signal handling capabilities of the amplifier should be increased or the signal applied to the amplifier should be decreased.

The values of the carbon resistors needed to construct three pads that will produce a ten to one, three to one and a two to one reduction in signal strength, are disclosed in Fig. 2.

Made In Holland Replacement Tubes[1]

Some *Made in Holland* RCA tubes have been made available recently. Among these are: 1R5, 6AU6, 12AT7, 12AX7 and 35W4

In addition, there's also a 12AU7 Holland tube; because of its variable heater-to-cathode spacing, which can affect *if* response, this tube should not be used as a pix detector.

Some of these *Holland* tubes light up very brightly when the receiver is turned on, but this operating condition has no adverse effect upon the performance of the tube.

Curbing Sync Buzz[1]

Sync buzz describes the sound heard from the speaker of a TV receiver whenever vertical sync information is coupled into the audio circuits. This might occur as a result of improper lead dress of the leads connected to the volume control. The leads from the ratio detector to the tone switch and phono jack should be shielded and dressed close to the chassis and away from video and sync circuits.

There is another way that sync and audio circuits could be coupled. The

(*Continued on page* 40)

[1]Based on notes prepared by RCA Service Co.

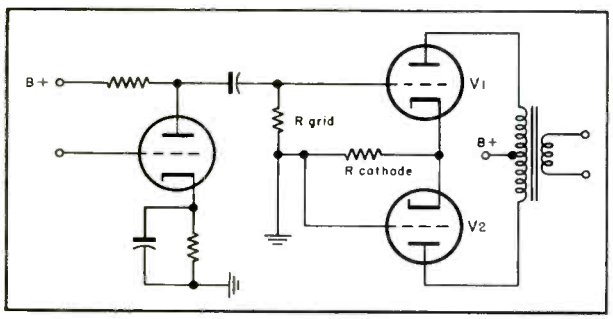


Fig. 1. Grounded-grid cathode-coupled circuit, in which phase-splitting occurs in the output.

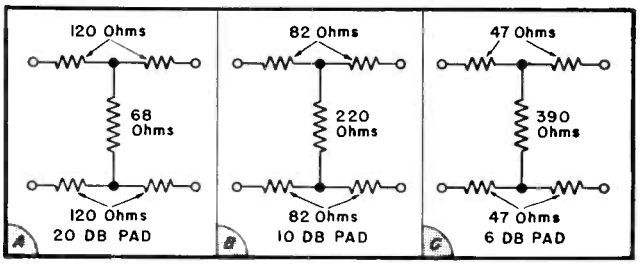
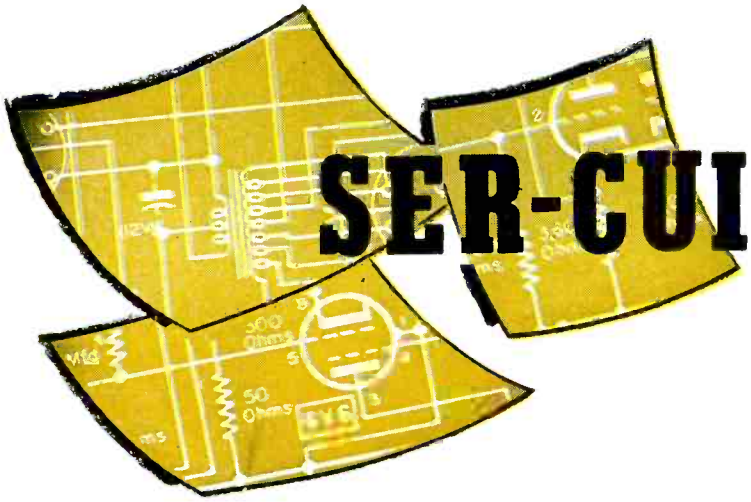


Fig. 2. Pad circuits for 1/10 of input voltage at output (a); about 1/3 of input voltage at output (b); and ½ of input voltage (c). These pads are designed for matching a 300-ohm transmission line to a 300-ohm antenna input connection on the receiver.



SER-CUITS

[*See Front Cover*]

by L. RICHARD CHASE

Sectionalized Printed-Circuit TV Chassis

APPLYING MANY of the techniques which have proven so valuable in the production of reliable military equipment, engineers have developed a plug-in, sectionalized 25-tube TV receiver; excluding the picture tube. Brightness, contrast, focus, fine tuning and sweep sync are all automatically controlled, once set up at the factory or by a Service Man.

The receiver, introduced by Walsco and designated *model PC-9,* diagramed in part on the cover and in Figs. 1 and 2, features nine plug-in sections; these are visible in the overall view of Fig. 3, and in Figs. 4 and 5, at right.

Component-Tube Selection

In the development of each of the sectional units, the factors of performance and reliability, were considered primarily. To illustrate, in conferences with tube and other component manufacturers, who aided by advising which of their component products would be the most reliable in a given circuit use, it was found that the 6SN7GT would serve best in the horizontal sweep oscillator circuit rather than any other tube type. There is, it was learned, greater uniformity in production units of the 6SN7GT over other types.

The Nine Basic Elements

As a result of the foregoing planning program, nine circuits were developed to serve as:

(1) Video *if* amplifier
(2) Video amplifier
(3) Audio *if* amplifier
(4) Low-voltage power supply
(5) Horizontal deflection generator
(6) Vertical deflection generator
(7) Sync separator and horizontal *afc*
(8) High-voltage power supply and horizontal deflection control
(9) Brightness and contrast control

The *rf* tuning head and audio amplifier are not included, although the *af* amplifier is actually a printed wiring assembly. However, *rf* tuning is accomplished with a *Standard Coil* advanced cascode tuner equipped with a motor-driven remote control that is automatically stopped at the selected channel position. The selector switch for the remote control is attached to a 20′ cable, along with an audio volume control, and on-off power switch. These are the only controls which the viewer requires in operating the set.

Circuit Blocks

The overall circuit has been arranged in the form of circuit blocks; each block is a separate printed wiring plug-in assembly. The interconnections between the blocks are made behind the vertical chassis panel. In Fig. 4 a view of this panel is shown.

Video IF Amp

Fig. 5 shows one of the printed circuit plug-in assemblies; schematic of

Below: Figs. 1 and 2. Circuits of printed board sections in Walsco chassis.

Fig. 1. The video if amp pc section in the Walsco chassis; see cover.

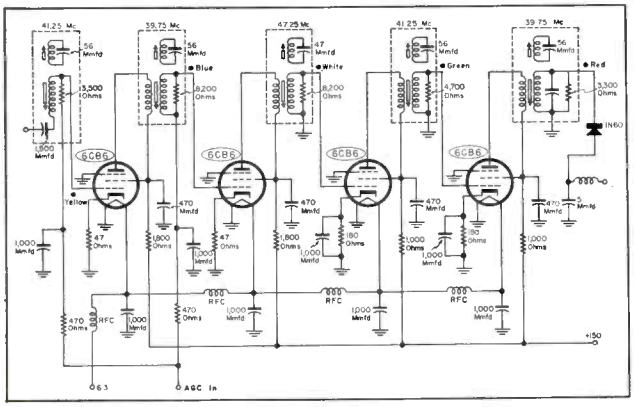
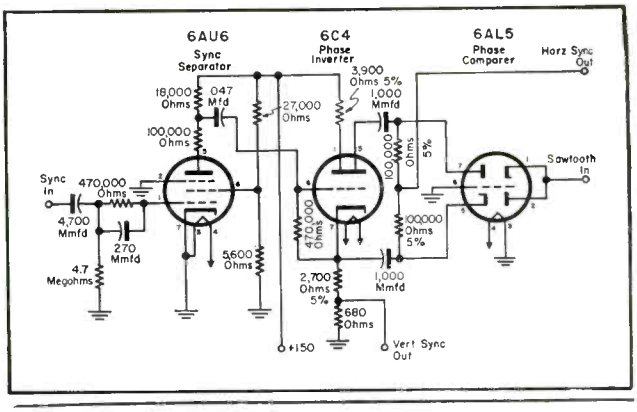


Fig. 2. Sync separator and horizontal phase discriminator pc unit in Walsco set.



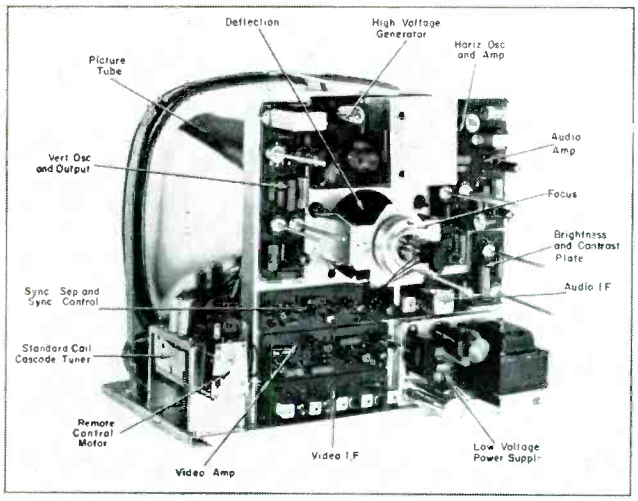
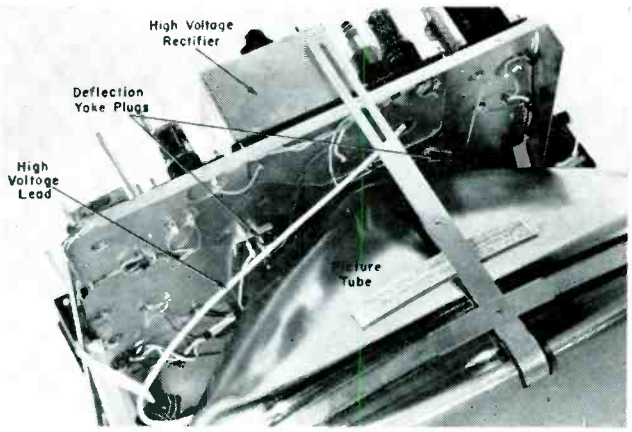


Fig. 3. Overall rear view of pc TV chassis.

(Below)

Fig. 4. View of rear of vertical chassis to which plug-in printed wiring boards are attached.



the assembly, the video *if* amp, is shown in Fig. 1, and on the *cover*.

Safety Factors

Each printed wiring board features components with substantial operating safety factors; as 400 working-volt capacitors in 200-volt circuits and 600 working-volt capacitors in 300-volt circuits, etc.

Stagger-Tuned IF

Four stages of stagger-tuned *if* in the 41-46 *mc* range are used; a sensitivity of 3 to 10 microvolts over the *vhf* band is said to obtain. The tuner can readily be adapted to *uhf* operation.

Other Circuit Details

A crystal diode is employed as the video detector. Two stages of video amplification are provided. There is a three-stage sync separator and synchronizing circuit. The *agc* is keyed and delayed. Brightness and contrast, once adjusted, are automatically controlled along with focusing. Picture stability is maintained with a horizontal automatic-phase control circuit.

Test Points

Upon removing the rear panel of the receiver, all controls and adjustments are available. All parts and tube socket terminals are accessible for test. The sectionalized construction of this *pc* chassis has been found to lend itself readily to streamlined diagnoses of problems.

Soldering Tip

Since none of the actual point-to-point printed wiring is exposed there is little likelihood of need for repair of the wiring side of the circuit boards. However, should this be necessary, a dab of solder will generally suffice.

Alignment Facilities

With respect to replacement of components or tubes, this can be done by removing the back cover. Alignment adjustments can be made without removing the chassis from the cabinet.

Replacements

Should any repairs be required on any of the printed wiring boards, the *factory-rebuilt* replacement technique can be applied. That is, the circuit section in which the trouble exists should be replaced with a known good unit. Such a unit may be either a new assembly or one which has been reconditioned at the factory, or for that matter by a Service Man.

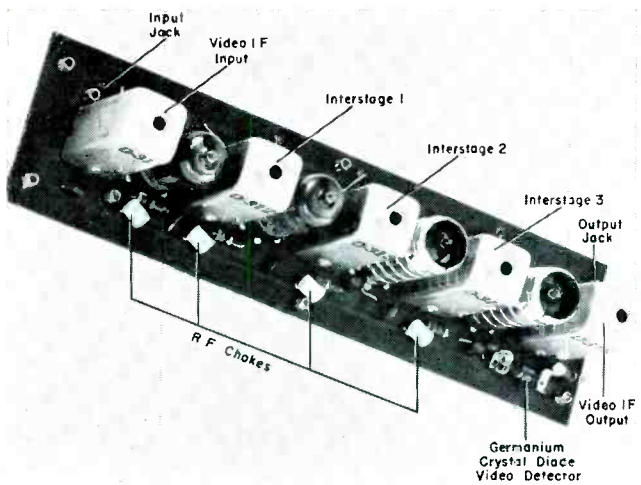
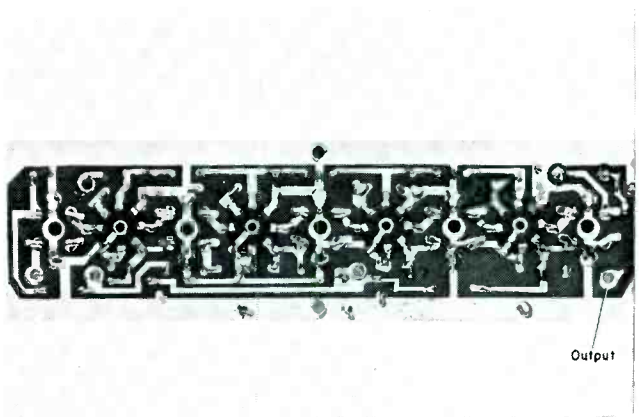
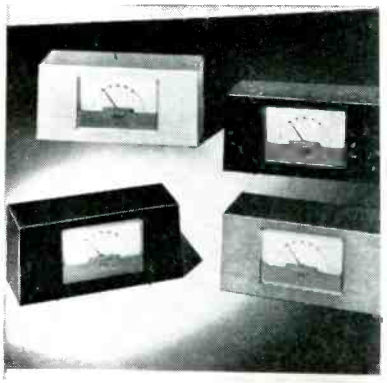


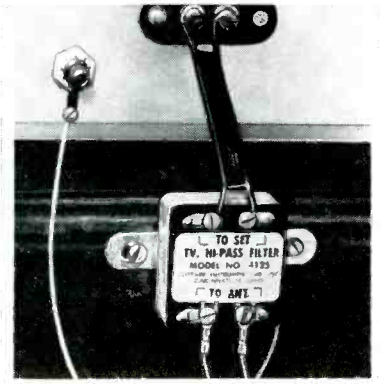
Fig. 5. Top and bottom views of one of the pc plug-in assemblies; circuit of this assembly (the video if amp) is shown in Fig. 1.



TV Antennas-Accessories for UHF/VHF

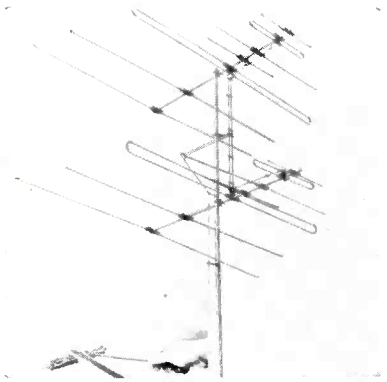


Colored rotator control cases designed to match receiver cabinetry or other room accessories. Cases slide over control mechanisms and are interchangeable. (Aristocrat; Trio Manufacturing Co., Griggsville, Ill.)

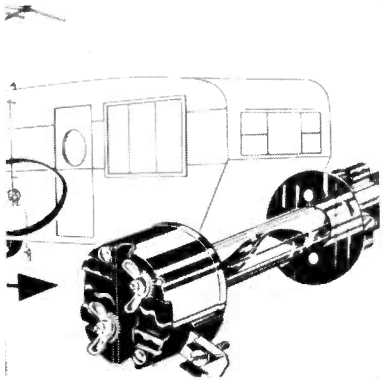


High-pass filter, for use with receivers having a 40-mc if channel. Designed to reject or attenuate below 50 mc. For use with 300-ohm input. (De Luxe Hi-Pass Filter, model 4125; Clippard Instrument Laboratory, Inc. (Cy Cadwell, sales manager), 7390 Colerain Road, Cincinnati 31, O.)

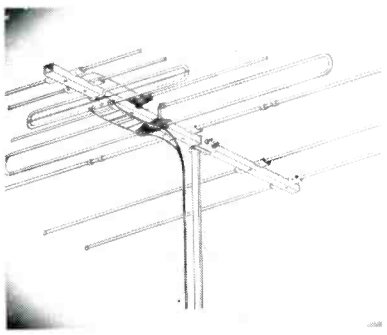
Lightning arrester with twin lead grip. No disassembly of cup-toothed washers is said to be required. Also features ground wire grip, and provision for standard types of 300-ohm twin lead (open, jumbo, flat or tubular). (Model LA 75; Radion Corp., 1130 W. Wisconsin Ave., Chicago 14, Ill.)



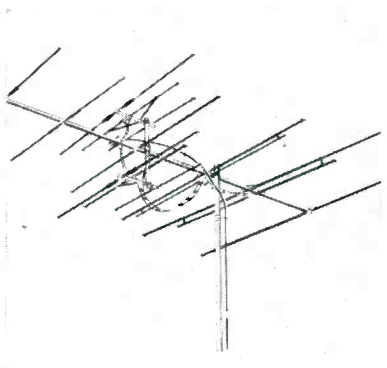
Inline, broad-band antenna for vhf-uhf. Design is based on reverse-phase multiplex dipole system, said to permit dual-band operation of all elements for channels 2 through 13. Has wide-spaced booster and parasitic elements. Oversized folded dipole, it is claimed, cuts interference and multiplies the signal strength. (Single bay (FB500) and stacked models (FB 500S); JFD)



Combination lightning arrester and leadin tube for mobile home TV installations. To use, a 3/4" hole is drilled in trailer wall and leadin tube pushed through hole. Outside leadin wire (any standard type) is attached to lightning arrester's serrated teeth. Ground wire is also fastened to arrester. Leadin wire from TV set is then connected to a standard antenna plug at the other end of tube. (Catalog No. 8644; Television Hardware Mfg. Co. (Division of General Cement), 919 Taylor Ave., Rockford, Ill.)



Flat type inline yagi, designed to operate in fringe areas in vhf range and in primary uhf signal areas. Has a new snap-lock bracket, all aluminum in construction. Antenna is said to require but 29" of stacking. Available in a four-bay stacking kit, and a two-bay version plus a stacking harness. (Models TV-357 and TV-356; Ward Products Corp., Division of the Gabriel Co., 1148 Euclid Ave., Cleveland 25, O.)



(Left)
Eighteen-element yagi composite that is said to combine a half-wave broadband yagi on the low band with a full wave broadband yagi on the high band. System is phased together with a dyna-phase system. The full-wave design for the high channels is claimed to equal on channels 7-13, the gain directivity and front-to-back ratio of a single channel 10-element yagi. All-aluminum construction; preassembled. (Vee DXer; LaPointe Electronics, Inc., Rockville, Conn.)

(Right)
Indoor antenna, which it is said, can be adjusted to a half wavelength at any frequency (uhf, vhf and FM) **by a knob, which lengthens or shortens the antenna arms to provide resonance at frequency.** (Channel King; Marjo Technical Products Co., Linden, N. J.)

Your Best Buy...

for Black-and-White...and COLOR TV

RCA WR-89A
Crystal-Calibrated
Marker Generator

RCA WR-59C
Television Sweep Generator

RCA WV-97A
Senior VoltOhmyst®

In color receivers, all of the color information is contained in the region from about 2 Mc to 4.1 Mc on the over-all rf-if response curve, as shown in Fig. 1. Any loss of gain in this region will weaken the color signals. If the loss is appreciable, it may result in such effects as poor color sync, poor color "fit" (incorrect registration of color and brightness information on the kinescope), or cross-talk or color contamination between I and Q channels.

The rf-if amplifiers must be aligned correctly to provide flat response for modulating frequencies up to 4.1 Mc. *The RCA WR-59C Sweep Generator and WR-89A Marker Generator provide the flatness of sweep output and crystal accuracy essential for aligning color circuits.*

In color receivers, there are a number of video-frequency sections, including the video amplifier, the bandpass amplifier, the demodulator channels (see Figures 2, 3, 4), and the green, red, and blue matrix networks—including the adders and output stages. A flat video sweep extending down to 50 Kc is a necessity in checking or aligning the tunable bandpass filter and the I and Q filters. *Late model RCA WR-59C Sweep Generators provide a flat video sweep extending down to 50 Kc. They also cover all rf and if ranges required for both color and black-and-white receivers.*

Get full details today from your RCA Distributor.

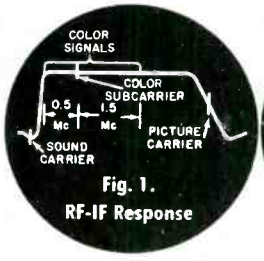


Fig. 1.
RF-IF Response

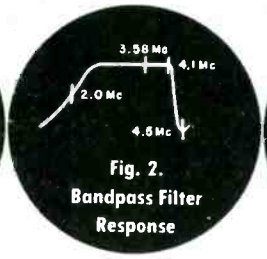


Fig. 2.
Bandpass Filter
Response

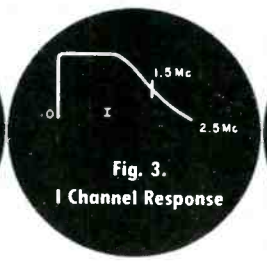


Fig. 3.
I Channel Response

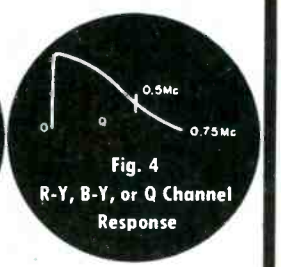
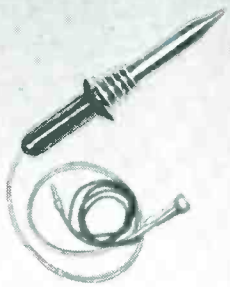
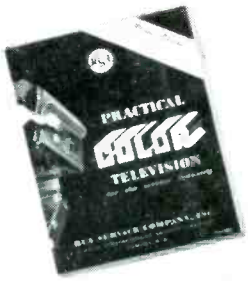


Fig. 4
R-Y, B-Y, or Q Channel
Response



REMEMBER that the high voltage (up to 30,000 volts and more) must be set to the specified value before adjusting purity and convergence. The RCA Volt-Ohmysts can be used with the RCA High Voltage Probe (WG-289 and WG-206 Multiplier Resistor) to measure dc voltages up to 50,000 volts.



Now off the press—RCA's new enlarged, 2nd edition of "Practical Color Television for the Service Industry." Price: $2.00—from your RCA distributor.

RADIO CORPORATION of AMERICA
TEST EQUIPMENT HARRISON, N.J.

Servicing Helps

(*Continued from page* 35)

$B+$, common to both circuits can provide the coupling, if the voltage is not properly filtered. For example, the filter capacitor, C_{132B}, in the RCA KCS-87 or KCS-88 stabilizes the voltage at this point and prevents sync pulses from modulating B+. If this capacitor should open it probably would cause sync buzz in the sound.

Height and Vertical Linearity Adjustments

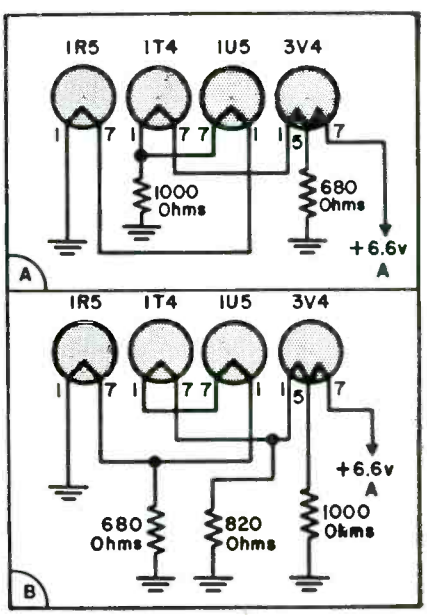
MAGNAVOX receivers shipped from the factory have all rear chassis controls preset for normal operation. To allow for picture *shrinkage,* line voltage variations and transmitter blanking-time variations, the tube is overswept in both horizontal and vertical directions, so that the screen will always be filled completely.

The 74° picture tube, with its higher screen (the width is the same as 70° tubes), demands greater care in setting the height and linearity controls.

If it is apparent that these preset controls are out of adjustment, one should operate the receiver for at least 15 minutes, and then overscan vertically ¼" at the top and ½" at the bottom.

Should it be impossible to fill the screen during this adjustment or if there is *foldover* at the bottom, the vertical output tube, or if necessary, the vertical output transformer, should be replaced.

Fig. 3. Old (a) and new (b) filament circuitry employed in RCA 3-BX-5 portables.



TV WEEK STATUETTE

Symbol of National Television Servicemen's Week, to be sponsored by RCA, March 7 to 12; a 14" gold-finished electronic statuette which holds aloft an electronic symbol and stands on a black plastic base enscribed with an RCA tribute to TV Service Men. The Week, registered with the U. S. Chamber of Commerce, will be marked by a comprehensive ad and promotion campaign. Prizes totaling more than $10,000 will be distributed. A complete set of five RCA test instruments for color TV servicing, valued at $1337, will be awarded in each of RCA's eight sales regions. Service Men can qualify for the competition by describing, in 50 words or less, their efforts to publicize and promote National TV Servicemen's Week. The entries, acceptable up to midnight, April 30, will be judged on the basis of originality and initiative by a board of editors of leading radio and TV service trade publications. Preliminary announcements of the observance will be carried during the February telecasts of the Sid Caesar TV Show. A similar tribute will be featured on the March 7 NBC color spectacular TV show. The program also includes a package of display, promotion, and ad material for use by Service Men at point-of-purchase. Available from RCA distributors are: a National TV Servicemen's Week display unit and streamers for window or in-store use; a promotions kit containing newspaper ad mats, radio and TV commercials, and direct-mail literature; window decals; an electric clock display designed around the electronic symbol featured on the statuette; and an illuminated sign for interior display.

•

AT PLANT EXPANSION SITE

William J. Slawson, assistant jobber sales manager of Pyramid Electric and Jack K. Poff, jobber sales manager, watching progress of construction of 27,000 square-foot addition to Pyramid plant which will house engineering and research laboratories, jobber division warehouse, shipping department, and general and executive offices.

VTVM Circuitry

by W. H. BRESEE and J. E. SNOOK

Senior Design Engineer *Sales Engineer*

Sylvania Electric Products, Inc.

Analysis of Basic Amplifier (Signal Balancing) Design . . . Compensating and Current-Measuring Circuit Features . . . RF Probe Applications

ONE OF THE MOST USEFUL BENCH and field instruments is the *vtvm*. An extremely flexible test device, it provides for a variety of measurements.

In the evolution of one such device[1], developed not only for servicing, but the lab, too, a basic amplifier was included for signal amplification and balancing.

The basic amplifier's design features are illustrated in Fig. 1, where we have a block diagram of the circuit used when measuring *dc* voltage. Here the meter measures the difference in voltage between the output of a pair of *dc* amplifiers.

Signal Amplifier

The signal amplifier is composed of ½ of V_{101} and ½ of V_{102}; the balancing amplifier consists of the other half of V_{101} and V_{102}. Two stages of amplification are used rather than the conventional one stage to allow the use of a 1-milliampere meter movement, rather than the conventional 100 or 200-microampere movement. This was done because it was found that the 1-milliampere movement is more rugged and retains its accuracy better with the vibration and shock encountered in a portable instrument. Two stages of amplification also allow the use of tube plate voltages below the ionization point of any remaining gas in the tube; this was found to eliminate errors due to grid current passing through the divider resistors, causing a reading on the meter when no voltage is present at the input probe.

Balancing Amp Operation

The purpose of the balancing amplifier (with a grounded input) is to compensate for changes in line voltage and tube aging effects, such as changes in emission, or *gm*, or increase in gas. For example, a decrease in line voltage would decrease the gain of the signal amplifier, but it would also decrease the gain of the balancing amplifier by the same amount. Therefore, no change will result in the voltage read on the meter. The same condition results with changes due to tube aging, so that maximum accuracy is obtained at all times. A 17-megohm input resistance on *dc* was included to insure a minimum of circuit loading. This was found to be particularly important when measuring grid bias or any voltage in a high-impedance circuit. A low-impedance meter can load a high-impedance circuit enough to change the voltage reading.

[1]Sylvania 302 Deluxe Polymeter.

Other Basic Amp Uses

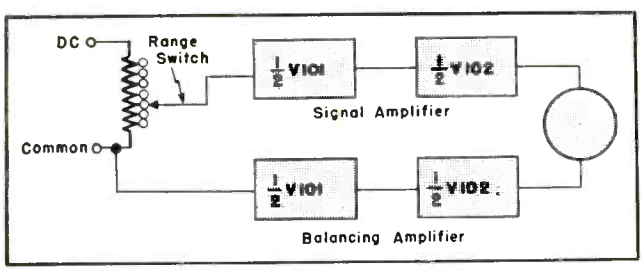
The same basic amplifier is used on *dc, ac, rf* and ohms, with some additions in each case. A block diagram of the circuit for the *ac* scales is shown in Fig. 2. In this instance, ½ of V_{104} and ½ of V_{105} are the peak-to-peak rectifiers. All voltages registered are true peak-to-peak readings and not readings doubled. A doubled-peak reading made on a TV sync pulse would be a false reading. Tests have shown that only a peak-to-peak meter reveals the true reading on a sync pulse or any other non-symmetrical waveform.

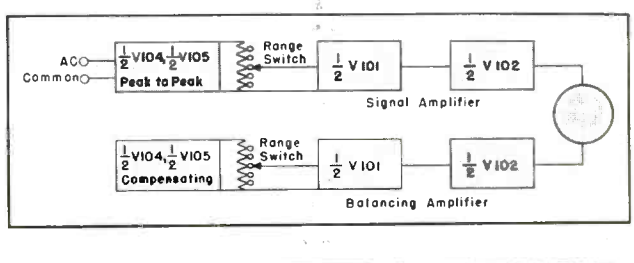
For sinusoidal waveforms there's another set of scales, calibrated in *rms* voltage. The other halves of V_{104} and V_{105} are used in a compensating-diode circuit[2] feeding an amplifier used to make the 3 *v* and 10 *v ac* scales more linear and more accurate, as well as to compensate for changes in contact potential in the peak-to-peak rectifier tubes.

Compensating Circuit

Fig. 3 illustrates how the compensating circuit works. Curve *a* shows the *dc* output of the peak-to-peak diode versus the *ac* input at low voltages. Curve *b* is the same curve for the compensating diodes. Curve *b* is ⅓ of curve *a*, because that is the amount of voltage fed back to the compensating diodes. Both of these curves are non-linear, but the difference between them is a linear function. Each voltage, curves *a* and *b*, is fed to a *dc* amplifier and the difference is read on the meter. (The non-linearity problem is often

Figs. 1 and 2. Fig. 1 illustrates the dc ranges of the Sylvania vtvm; model 302 Polymeter. A block diagram of the circuit for the ac scales is shown in Fig. 2.





solved by using a linear scale and suffering the additional error, or a separate non-linear scale is used.) On the higher *ac* ranges a divider network is placed ahead of the range switch; the diodes thus do not have more than rated voltage placed across their elements.

High AC Impedance

A high *ac* impedance is especially useful when measuring audio stage gain; thus 2.7 megohms are used. Here, again, a low-impedance *ac* meter can give false readings because of circuit loading.

The *ac* diodes have a special tapped heater, so that the power into each half of the heater can be adjusted to balance the contact potential in each half of the tube. This does away with the need for selecting tubes. It also makes it possible to change tubes in the unit without reducing the calibration accuracy.

RF Probe Structure

A tube was chosen for the *rf* probe to gain a higher-frequency response and a higher voltage rating than would be available with a crystal. This probe, using a 1247 subminiature diode, can handle 300 *v*, is about 1 db down at 300 mc, and found to be usable to 500 mc.

Fixed DC Voltage

On the *rf* ranges the compensating diode is replaced by a fixed *dc* voltage from the power supply; this voltage is controlled from a front-panel *rf* zero set. The *dc* output of the *rf* diode goes directly into the *dc* amplifier. (An extension is provided for the probe for more flexible access to crowded circuits. However, the extension adds inductance and should only be used for frequencies under 25 mc.) The probe can be used for checking *rf* stage gain in radio and TV sets and ham transmitter *rf* voltages.

Ohmmeter Circuit

The block diagram for the ohmmeter circuit is shown in Fig. 4. This is a conventional circuit with the *dc* voltage being sent through the *dc* amplifiers to the meter. Two cells are used instead of one; thus the ohmmeter readings match the resistor manufacturer's test which are usually made at 3 *v*.

Current Measuring

A simplified diagram of the current-measuring circuit appears in Fig. 5. The universal switching method has been used for the shunts. In this circuit the meter shunt is never open-circuited during switching to change ranges; this damps out any surges or inductive kicks which might damage the meter.

Switch Contact Resistance

The switch contact resistance is never in shunt with the meter, but in series. This approach was applied to avoid any errors due to dirty or corroded switch contacts after long periods of use. In the 10-ampere range the current does not pass through a switch contact, therefore avoiding contact burning at these high currents. The 10 ampere-current range is useful in testing auto radio sets and vibrators for proper operation.

In all of the meter multipliers, which must withstand a high voltage, 1% accurate deposited carbon resistors were used; this construction, it was found, prevents errors due to a change in resistance which occurs at high voltages in composition resistors.

Voltage Measuring Circuit

The voltage-measuring circuits are all insulated from the cabinet so it is possible to measure the difference between two higher voltages or current in a high-voltage circuit without having a dangerous voltage on the cabinet.

The peak-to-peak voltage readings are valuable for measurements of TV sync-pulse and other complex waveforms needed in TV servicing.

The *rf* probe provides a means for directly checking the *rf* stage gain and finding trouble in the *rf* circuits.

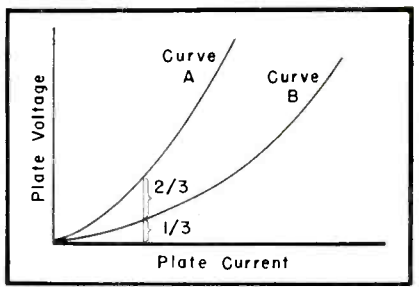
Alignment Applications

The instrument may be used as a resonance indicator in alignment of the *rf* amplifiers of television receivers, as well as all AM and FM receivers. In each case the unit is connected across the detector diode load resistor, turned to the *volts dc* position, and a signal of the frequency of the stages under test fed into the set.

FM Detector Alignment

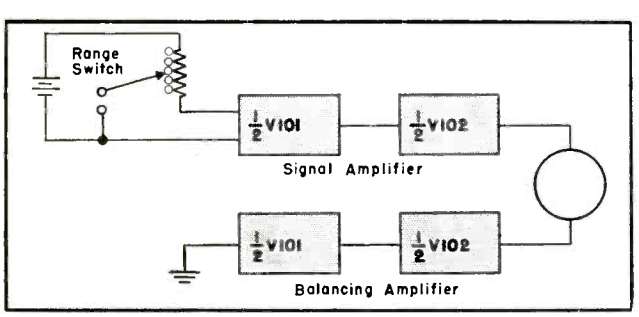
An FM detector may be aligned by connecting the *vtvm* in such a way as to indicate point of balance. For the balanced discriminator or ratio detector, the *if* frequency of the set is fed in from an unmodulated signal generator somewhere ahead of the detector, and the secondary of the detector inductance is tuned for zero indication. On one side of perfect balance there will be a high plus reading obtained, and on the other side, a high minus reading. The zero center scale on this *vtvm* is specifically provided for this purpose.

[2]Patented.



(Right)

Fig. 3. Curves illustrating vtvm linearity circuit operation.



(Left)

Fig. 4. Block diagram of ohm ranges available in vtvm.

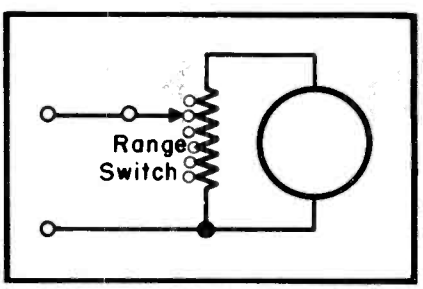


Fig. 5. Simplified diagram of instrument's current scale measuring circuit.

Associations

TEA, Texas

THE ANNUAL SERVICE convention of the Texas Electronics Association has been scheduled for August 30 at the Gunter Hotel, San Antonio, Texas.

* * *

SPRTTA, Pa.

WILLARD STREYER has been elected president of the Southern Pennsylvania Radio Television Technicians Association. *Joseph Hauser* was named vice president; *James Nease*, secretary; *Eugene Klinedinst*, treasurer; *G. W. Dean*, public relations; and *Clarence Bissinger*, corresponding secretary.

* * *

SRTA, Springfield, Ohio

MARVIN A. MILLER was recently installed as president of the Springfield Radio and Television Association.

Other SRTA officers include: *Frank H. Gross*, vice president; *Jack Carpenter*, treasurer and *Paul Boller* now serving for his third term as secretary.

* * *

ARTSD, Columbus, Ohio

DAVE ARICK is now prexy of the Associated Radio-Television Service Dealers, Columbus, Ohio. *Paul Herman* has been elected vice president; *Jim Cumbow*, treasurer; and *Dick Dewitt*, secretary.

Committee chairman include: *Bob Hawthorne* (membership); *Dick Kassian* (publicity and public relations); *John Graham* (ethics); *Bob Tyo* (trade relations); *Clem Getz* (price stabilization and trade practice); *Charles LeRoy* (educational and technical); *Fred Oberle* (entertainment); and *Paul Herman* (program). John Graham will continue to serve as editor of the association's news bulletins.

* * *

STTA, Syracuse, N. Y.

THE SYRACUSE TELEVISION TECHNICIAN ASSOCIATION'S new monthly newsletter, the *STTA News*, now has an editorial staff of three: *Edward Richardson* (business editor); *Robert Salisbury* (photo editor); and *Donald Roberts* (technical editor). The board of directors will direct the overall editorial policy of the magazine. Richardson will also handle advertising.

NATESA, Chicago

THE ANNUAL NARDA convention, held recently in Chicago, featured a talk on the relationship between independent service and sales, by *Frank J. Moch*, prexy of the National Alliance of Television and Electronic Service Associations.

Stressing the import of the Service Man to a dealer, Moch said that the receiver is actually nothing more than an assortment of resistors, capacitors and tubes, until the Service Man installs it properly and provides that spark of life. It is the Service Man, continued the association headman, who is primarily interested in keeping all sets sold and making sure that all repairs hold and repetitive breakdowns are avoided.

* * *

ESFETA, New York

REPRESENTATIVES of five associations from New York, Long Island, Buffalo, Binghamton and Syracuse, attended a recent meeting of the Empire State Federation of Electronic Technician's Associations.

The delegates discussed the forthcoming state-wide lecture series, being planned by *ye ed.*

TEN YEARS AGO

PRESENTING TV as an outstanding separate service that it is and not as an adjunct to or successor of the radio and phono, was cited as an immediate postwar problem by *Frank Freiman*, executive vice prexy of Magnavox. He felt that the industry must take a more realistic view of TV and the effect it will have on the radio market as a whole, as well as for the long pull growth of TV itself. . . . Bills to regulate radio servicing were introduced in the California and Oregon legislatures. . . . A thirty-watt 4-stage *ac*/battery amplifier with two high-gain inputs was the front-cover feature. . . . *Jack Gaertner* was named sales manager of the Electronic Corp. of America. . . . *Walter R. Jones* was appointed general engineering manager for radio receiving tubes of Sylvania Electric. . . . *Adolf Gross* was named president of Newark Electric Co., Inc. *Stanley Cojala* was appointed manager of the New York City branch, assisted by *Ed Cornfield*. . . . *F. A. Klingenschmitt* was elected president of The Radio Club of America, Inc. Other officers elected included: *O. James Morelock*, vice prexy, and *Austin C. Lescarboura*, publicity chairman. . . . *L. R. O'Brien* and *R. W. Metzner* were appointed sales managers in the tube division of G. E. . . . *W. Myron Owen* became president of the Aerovox Corp. *Stanley Green* was named vice president and chief engineer. . . . *Ed DeNike* was appointed distributor sales manager of National Union. . . . *George S. Ryan* was named assistant to the vice president of Westinghouse. . . . *H. G. Kronenwetter* became manager of advertising production of Sylvania radio products. . . . Clarostat, for the third time, received the *Approved Quality Control Rating* from the *Army Air Forces.*

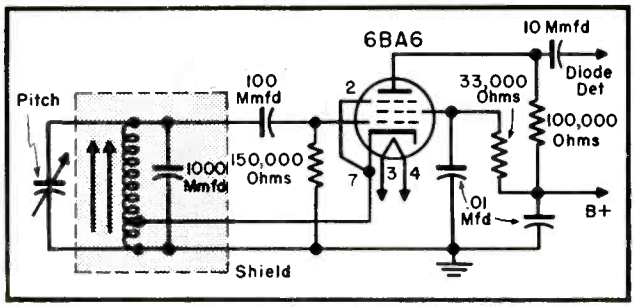


Fig. 1. Electron coupled Hartley oscillator, as used in the Collins 75 A-2 receiver.

Communications

by RONALD L. IVES

THE MOST common complaint with beat frequency oscillators is that they have stopped producing a beat. If the customer reports that the trouble came on gradually, the trouble is most probably the tube. As some sudden failures are also due to tube trouble, checking of the tube is indicated as the first test with any nonfunctioning beat-frequency oscillator. It is usually desirable to replace the *bfo* tube with one known to be good, even if the tube checker shows that it is okeh, as some tubes that test *good* are very poor oscillators.

Once tube trouble is ruled out as the cause of nonoperation, circuit checking is in order. Being sure that the *bfo* is turned on, plate and screen voltages should be measured with a high-resistance voltmeter, and grid and cathode voltage checked with a *vtvm*. Grid voltage should be negative with respect to cathode, and the bias should change appreciably if the coil is loaded (put a finger on it) or shorted. If the grid is positive with respect to cathode, the most probable trouble is leakage in the grid capacitor, which should be replaced with a new mica or ceramic of the same value.

If all voltages are correct, except that the grid voltage is zero or very low, the circuit is probably not oscillating, and the trouble is probably in the tuned circuits. These are best checked with a grid-dip meter, to see if they will resonate, and if so, at what frequency. Most common difficulties here are open or shorted capacitors, or an open coil. Capacitor troubles are easily solved by direct replacement. Coil troubles are not so easily solved, as many of the coils used in beat-frequency oscillators are special.†† One coil of an *if* transformer makes a satisfactory replacement in a Colpitts *bfo*. It is perfectly possible to rewind a *bfo* coil by hand, but it is usually very uneconomical.

Other causes of nonoscillation include a shorted or open pitch control capacitor (or the line to it), and a shorted or open coupling capacitor. This is usually a gimmic, and in several instances it will be found that the cut end of the *bfo* lead touches the chassis, effectively shorting out the beating frequency.

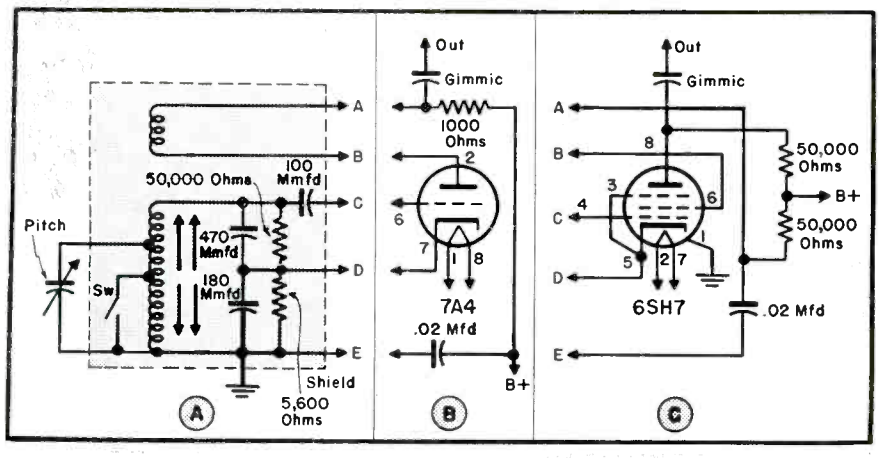
Occasionally a *bfo* will be found that operates perfectly, but that will not beat with an incoming signal. This usually occurs when the *avc*-disabling control fails. With the *avc* operative when the *bfo* is on, the sensitivity of the entire receiver is drastically reduced because the *bfo* output, rectified, is applied to all the *avc* controlled *rf* and *if* circuits. In consequence, the *bfo* has no signal to beat against, and there is no audible output.

A second general category of complaints is *bad tone*. This occurs when the *bfo* coupling is too tight, so that a circuit is overloaded; or when the *bfo* is oscillating at more than one frequency, or *squegging*. Causes of this trouble, in addition to too much coupling to the *if* system, include parasitic oscillation in the *if* system, wrong value of grid capacitor or resistor, gassy tube, and sundry coil defects.

Complaints of erratic tuning are common. The most usual trouble is that the *bfo* will not beat at low frequencies, such as 300 cycles. When signal frequency is approached from either side, the audible frequency decreases uniformly to a certain point, such as 400 cycles, then jumps to zero beat. This annoyance is known as pulling, and is reduced or eliminated by loosening the coupling between the *bfo* and the *if* system. A small amount of pulling is almost inevitable if a triode *bfo* is coupled directly to the *if* system, and it is for this reason that most of the better receivers are now equipped with electron-coupled beat-frequency oscillators.

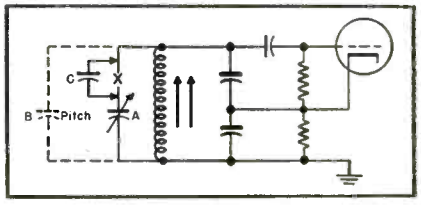
In several receivers made before World War II, *bfo* circuits suddenly changed their characteristics, and would oscillate only at an unusably high fre-

††Hartley coils for replacements in communications receivers having an *if* of about 455 kc are made by Miller, Meissner, and several others.



(Left)

Fig. 2. Converting triode bfo for electron-coupled operation: a—tuned circuits unchanged; b—original; c—revised.



(Above)

Fig. 3. How to modify tuning range of the bfo.

Receiver BFO Servicing

Solutions to Beat-Frequency Oscillator Service Problems . . . Modifying Tuning Ranges . . . Installation of BFO in Existing Receivers

quency. It was found that the trouble was in the slug-tuned coil; the powdered iron slug would come apart, and fall to the bottom of the coil form as a mass of black granules. A new slug served to repair the trouble. Similar difficulties may occur when the tuning slug loosens on its supporting screw.

Improving BFO Performance

Performance of the beat-frequency oscillators in some of the older receivers is not very satisfactory, and can be improved by some relatively minor circuit changes. Occasionally, also, the owner of a communications receiver is dissatisfied with *bfo* performance, and wants some improvements made.

A competent Service Man can improve the circuit isolation of a *bfo;* he can adjust the tuning range to suit the customer's requirements; and he can change the power output within reasonable limits, or make the power output manually adjustable.

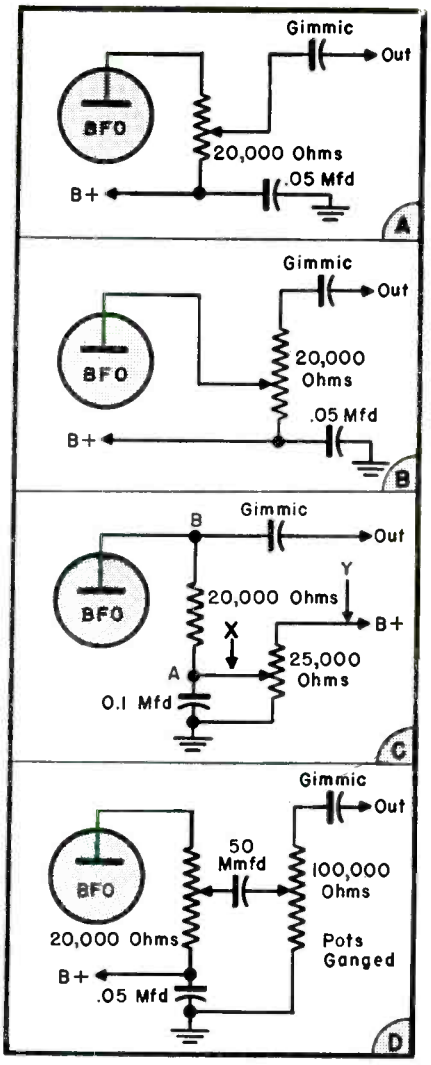
Circuit isolation of a triode *bfo* can be improved greatly in most instances by converting the oscillator to electron-coupled operation, in accord with general principles worked out by Lt. W. J. Caron.[1] *Before and after* circuit diagrams, based on Caron's circuits, but using an octal pentode in place of the loktal tube in the original, comprise Fig. 2. Changing this *bfo,* and others of similar design, from triode to electron-coupled operation requires only a new tube and socket and two resistors. Labor involved should not exceed one hour, including alignment time.

Although an oscillator-buffer combination is slightly superior in performance to an electron-coupled *bfo,* the net gain is slight, and the cost of installation very high, even when the receiver has adequate reserve filament and plate power for the buffer amplifier, and adequate chassis space is available. Conventional buffer amplifiers for use with beat-frequency oscillators are substantially identical to broadly-tuned *if* stages.

Tuning ranges of beat-frequency oscillators can be modified in a number of ways, depending upon the original construction, and upon the customer's requirements. One of the most common complaints is that the pitch control is entirely too critical in its adjustments. This difficulty can be removed by use of a planetary vernier drive. These must be installed with great care, so that the vernier mechanism runs smoothly in all positions. If exact alignment is unattainable, a flexible coupling between the vernier

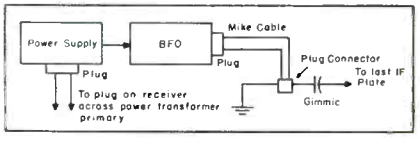
(*Continued on page* 48)

[1]Caron, Lt. W. J., *Improved BFO Circuit for the SX-42.* QST: June, 1950.



(Above)

Fig. 4. Circuits designed to provide variation of bfo output power.



(Above)

Fig. 5. Outboard bfo connections.

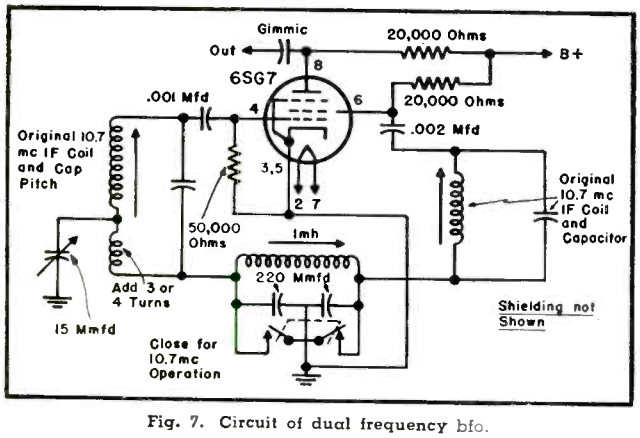
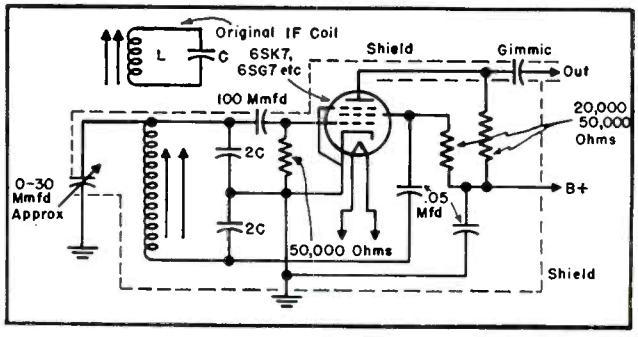


Fig. 7. Circuit of dual frequency bfo.

(Below)

Fig. 6. Circuit of electron-coupled Colpitts bfo for if of about 455 kc.



Communications BFO

(*Continued from page 47*)

mechanism and the pitch control capacitor should be used.

Another common complaint is that the entire useful tuning range of the *bfo* occupies only a small portion of the pitch control dial; sometimes as little as 20° of a 270° dial. This trouble is commonly caused by using too large a pitch control capacitor, and is remedied by use of series and shunt capacitors, as in Fig. 3 (p. 47). Steps in this modification are:

(1) With pitch control capacitor, *A*, set at 10 per cent of full capacity, tuning slug should be adjusted until maximum desired frequency is attained; a shunt capacitor, *B*, can be added if necessary.

(2) With pitch control capacitor, *A*, set at 90 per cent of full capacity, series capacitor, *C*, should be inserted, changing its value until minimum desired frequency is attained.

(3) With pitch control capacitor, *A*, set at 50 per cent of full capacity, one should make minor adjustments of the tuning slug or shunt trimmer until center frequency of *bfo* is in dead center of the pitch control adjustment range. This is the position of zero beat with a properly tuned-in unmodulated carrier, and the center frequency of the *if* passband.

Occasionally it will be necessary to repeat steps *1, 2,* and *3,* several times, arriving at the desired range and center frequency by the method of successive approximations.

With this adjustment, maximum beat frequencies should be at equal distances on each side of zero beat, and approximately ten per cent in from the ends of the pitch control dial range.

In a few obsolete military receivers, the pitch control capacitor does not have enough range. A few such devices permit beat notes not exceeding 500 cycles on either side of zero beat. Most satisfactory solution here is to install an electrically larger pitch-control capacitor.

With several of the newly-developed single sideband and surpressed carrier transmission systems, it is necessary to use a local oscillator for carrier reinsertion. Because this oscillator must have about the same tuning range and overall characteristics as a *bfo,* and is never used when the *bfo* is needed, most operators use the receiver *bfo* for carrier reinsertion. This is not too successful unless the *bfo* has an appreciable power output, which is about four times that needed for ordinary *cw* reception.

The simplest method of providing a local oscillator, having a variable power output, is to use an oscillator-buffer combination, with the gain of the buffer made variable by any convenient method, such as by varying the screen voltage. Because of space and power limitations, installation of a buffer with adjustable gain is not practicable in most existing receivers.

A rather satisfactory working compromise is possible here, provided the receiver has an adequate plate power supply, and a *bfo* that is either electron-coupled, or can be so connected. This consists of increasing the power of the electron-coupled *bfo* by installation of a power tube, such as a 6AG7, in place of the usual voltage-amplifier pentode, such as a 6SK7, and then tapping down on the plate-load resistor of the *bfo* tube until the desired amplitude is reached.

Four methods of varying the output power of an electron-coupled *bfo* are shown in Fig. 4 (p. 47). Simplest and most obvious of these is shown at *a*. When the coupling to the *if* system is close, such as when the gimmic is replaced by a capacitor of 10 mmfd, or more, adjustment of the *bfo* output changes the frequency response of the *if* system slightly, and the detuning effect

is greatest when the smallest *bfo* output is in use.

Considerable reduction of this loading effect is brought about by reversing the potentiometer connections, as in Fig. 4*b*; and *if* loading by connection of the *bfo* circuit can be made nearly constant at all settings of the *bfo* by use of the circuit of Fig. 4*c*. The loading cannot be made absolutely constant, even though the variable resistor (25,000-ohm pot) is dead-shorted for *bfo* frequency by the 1-mfd capacitor, because of the changing characteristics of the *bfo* tube as the plate voltage is varied.

By use of a ladder-type attenuator circuit, as in Fig. 4*d*, the tube characteristics remain constant at all output settings, and the loading on the *if* system varies so little from zero *bfo* output to maximum, that it can be detected only with precision lab instruments of high sensitivity.

Although all four of these circuits will work, and will work well if skilfully constructed, circuit *c* is probably best for installation in existing receivers, because the output control circuit is *cold* with respect to *if*, so that the control can be put at any mechanically convenient location without becoming a shielding problem. Theoretically, an *rf* choke should be inserted at point *X*, to keep *if* out of the control line. In practice, however, this is not necessary, as the *if* potential at point *X* is only about 1/5,000 that at the tube plate.

To minimize the number of panel controls needed with a variable-output *bfo*, screen voltage can be tapped off at the top of the pot, and a switch, actuated by the pot shaft, connected at point Y in Fig. 4*c*. A *dpst* switch can be used here to perform a second function, such as disabling the *avc* system when the *bfo* is in use.

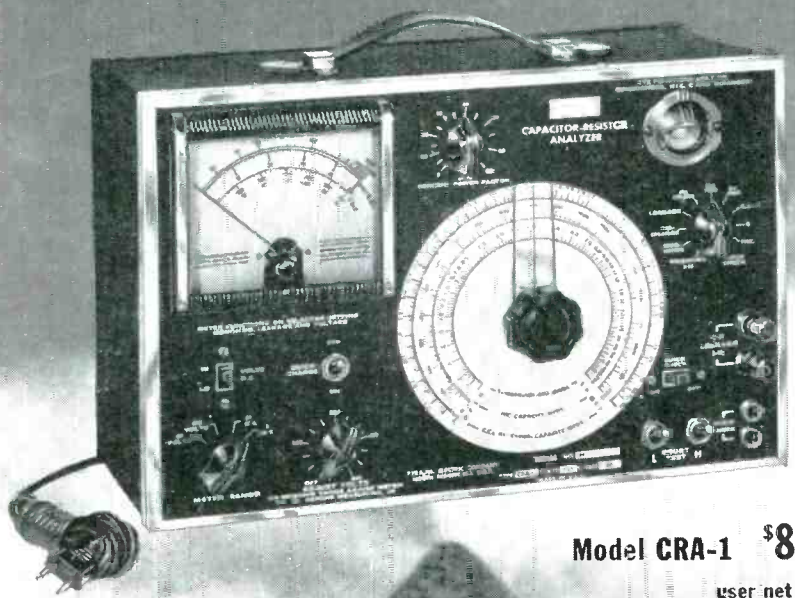
Installing BFO in Existing Receiver

Owners of short-wave receivers occasionally want a *bfo* installed, and usually want the installation done promptly and reasonably. In many of these receivers, space is at a premium, and the power supply is already loaded to nearly maximum capacity. Where installation of a *bfo* within the receiver is impossible without major surgery, the best solution is an outboard *bfo*, constructed in a steel utility case of convenient dimensions, such as 5″ by 6″ by 9″. By use of a small *TV booster* power supply transformer, a selenium rectifier, and an *rc* filter, a compact *bfo* power supply can be constructed in the same case. The outboard *bfo* should be connected so that it is usable only when the main receiver is turned on.

[To Be Continued]

NEW Capacitor Resistor-Analyzer AND Quick Capacitor Checker

another Pyramid first



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This fine double duty instrument provides you not only with the complete setup for checking and analyzing all types of capacitors and resistors, but also the "Quick Check" feature enables you to test capacitors while they are wired in a set.

With the Pyramid analyzer there is no need to remove capacitors from the circuit to determine if they are open, shorted or intermittent.

This new development that saves time in servicing and production testing serves the function that required two instruments previously, actually costs less than the older type analyzer plus a separate "quick" capacitor checker.

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PYRAMID

SERVICE...The National Scene

$12-MILLION IRE CONVENTION TO TEEM WITH DYNAMIC EXHIBITS . . . PROGRESS REPORTS--Two huge arenas, covering acres of ground, will house the largest and costliest display of radio-TV-electronic gear, ever assembled, during the annual conclave of the IRE, March 21 to 24, in N.Y.C. The gigantic show will be supplemented by a four-day technical-paper program bristling with lab and field reports that will disclose the latest developments in industry. . . . Among the timely subjects to be discussed will be mobile communications design trends. Described for the first time will be a 450-mc direct FM system, featuring a double-conversion superhet employing a disc-seal triode in a coax cavity as the input rf amplifier. In tests, the noise figure of this receiver was found to be 10 db, and sensitivity (on a 12-db signal-to-noise basis) was .5 microvolt.

AUDIO WILL ALSO RECEIVE FEATURED ATTENTION at the sessions. Complete details on an electronic music synthesizer, which provides means for the production of a tone with any frequency, intensity, growth, duration, decay, timbre, vibrato and variation, will be presented. . . . In operation, the device produces music from a coded record, which can be produced by one who has a fundamental understanding of the composition of sound. . . . The accoustical effects achieved and the techniques used in the radiation of electronic organ tone, which are quite different from the conventional effects and practices of both public-address systems for auditoriums and hi-fi systems for the home, will be analyzed in another audio report. The paper will explain the fundamental acoustical design principles of organ tone chambers, and offer specific examples of tone cabinet design and installations under typical conditions. . . . Tape life, of deep concern to a growing number, will be reviewed in a profound transaction by a government expert. Described will be the effects of continuous replay of recorded tapes upon the physical structure of current oxides and backing, and upon the information recorded on the tape.

THE ART OF INSTRUMENTATION will be surveyed by a panel of specialists. Two consultants will offer a report on an instrument designed to measure automatically the noise figure of transistors. The new device is said to operate on the basic principle of synchronously connecting and disconnecting a calibrated noise generator to the input of a transistor or transistor amplifier under test. By automatically comparing the internal transistor noise with that of the external noise source, a continuous direct reading of noise figure is obtained. . . . A transistorized 'scope will also be unveiled by another instrument engineer. A battery-operated model, the unit is claimed to have a frequency response of 20 to 200,000 cps, a deflection factor of .2 volt per inch and a sweep range of from 20,000 to 5 microseconds. Equipment features a feedback amplifier, multivibrator and turn-off and lock-out circuitry.

TRANSISTORIZED RECEIVER DESIGNS will also be on stage at the convention. In one paper, a pocket-sized set with eight junction-transistors will be surveyed. A superhet, the circuit in this set uses a single-transistor frequency converter to perform the functions of both mixer and oscillator. Refined detector and automatic-gain control circuits and an audio amp embodying further developments of the principle of complementary symmetry are incorporated.

COLOR WILL ALSO BE IN THE LIMELIGHT--Conferees will be told about a new color tube whose brightness has been increased 3-4 fold by virtue of enlarged mesh holes and ensuing post-deflection focusing; secondary emission from the mask, which dilutes color, has been minimized. In contrast to other post-accelerating tubes, the designers of this tube report that mask holes and fluorescent screen dots are uniformly spaced over the entire area. The design has been incorporated into 19-inch round and 24-inch rectangular models, now being tested.

THE EXTENSIVE CONVENTION PROGRAM will be presented at the Waldorf, the Belmont Plaza and the Kingsbridge Armory; the electronic spectacle will be held at the Armory and Kingsbridge Palace. . . . Don't miss this outstanding industry event. . . . We'll be at the Armory, in booth 892 on Audio Avenue. . . . Look forward to seeing you!

SERVICE...The National Scene

PLATED-BOARD CHASSIS WINNING WIDE ACCEPTANCE--The swing to printed-circuit panels, indicated as a broad trend several months ago, has gained industry-wide momentum. Scores of receiver and instrument makers have announced that they are now using or will soon use pc sections or complete chassis with plating instead of wiring. . . . One set manufacturer has become so sold on the plated technique that he has set up a special plant for pc-operations. Present plans call for the use of pc panels and in some instances, pc chassis, for the complete line of radios. . . . Another manufacturer, specializing in TV set production, disclosed that his company was experimenting with pc sub-assembly or modules, which can be integrated into a complete chassis. . . . Still another TV maker has produced a complete receiver with sectionalized plated boards. Features of this model are detailed in this issue on pages 36 and 37. . . . The problems of silver migration, formerly believed to be a serious affair with printed circuits, has been found to be about non-existent in radio-TV receivers, a recent survey has revealed. The fault, particularly acute in areas with high humidity, does not appear in radio and television chassis, because the high heat generated by the receiver's tubes dissipates moisture, the basic cause of silver migration.

THE PLATED-CIRCUIT MARCH has also prompted the development of unusual production equipment that is expected to introduce more flexibility to chassis design. . . . One machine, operated by a glass-based cloth tape, which requires about four hours to prepare, in which master holes are punched to produce any combination of component holes in a plated panel, replaces drill and punch-die equipment, which requires from a week to a month to produce. The machine, it is said, can be used with either glass-based or paper-based laminate boards, in 1/16" to 1/32" thickness, and in pattern sizes up to 6" by 17½". It is possible to perforate, in less than a minute, any combination of holes in any number of circuit patterns contained on the largest size board at a rate of 12,000 holes per minute.

COMMUNITY TV ACTIVITY IN SMALL TOWNS BOOMING IN NORTHWEST--Throughout Oregon, Washington and Idaho, scores of limited distribution community-antenna systems are being planned or installed. . . . In Astoria, Oregon, there's a three-channel setup under study, with antennas mounted on two sites to insure maximum reception from stations located at opposite points. . . . To serve the Winthrop and Twisp communities in Washington, a reflector type antenna has been installed. . . . In Idaho, there's a system which serves both Ketchum and the famed Sun Valley with signals from Salt Lake, Boise and Idaho Falls. . . . And in Conconully, Washington, a popular vacation spot, a community of about 140 are now enjoying reception from three stations in Spokane, thanks to a community TV installation.

NEW COLOR-TV TRANSMISSION TECHNIQUE DEVISED--An improved method of sending color signals, which it is said, simplifies color registration and eliminates fuzzy black and white pictures, even when registration has been misadjusted at the studio, has been developed. In the new scheme, a separate black and white image is picked up, and a color picture is then added; in present methods, the b-w picture is formed by superimposing red, blue and green pictures, one on top of the other. The sharpness of the picture, in the new system, is claimed to be accomplished by forming the luminance, or b-w pix, directly from a sequential color camera, before registration problems are met. The b-w pix is then fed, unchanged through a conversion device at the station. At the same time, the color signals, which were also picked up by the sequential camera, are encoded for the simultaneous color signal as required by present standards. The two independent signals, one b-w, and the other color, are mixed and transmitted as one signal.

AUTOS NOW ABSORBING NEARLY 40% OF ANNUAL SET PRODUCTION--Two out of three cars on the highway today are equipped with radio, compared with only one out of three in '41. As late as '47, the sale of three and a half-million auto radios accounted for just 17.3 per cent of the total set market. . . . Last year, car-radio sales raced up to 5-million plus, representing close to 40% of the total production of radios. . . . This mounting acceptance of the auto radio strikes a buoyant note for every Service Man, spotlighting the fact that Highways Are Happy Ways, as the old song said.--L. W.

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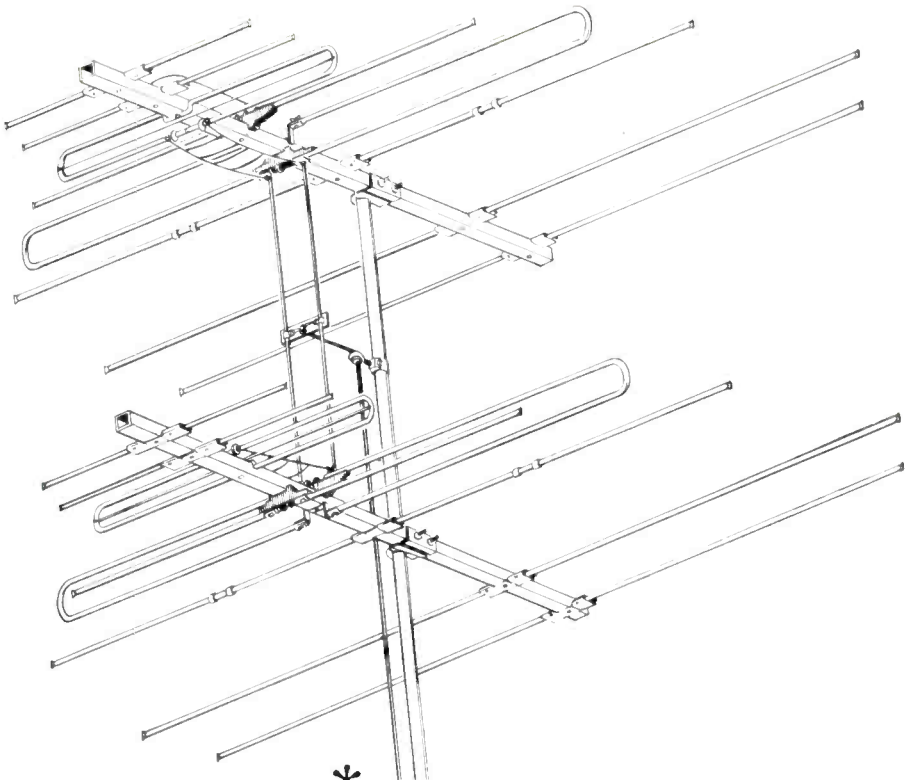

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WARD Products Corp., Cleveland 15, Ohio

COLOR TV Test Equipment Specifications

by **ROBERT G. MIDDLETON***

Chief Field Engineer, Simpson Electric Company

A Report on the Required Properties of Color TV Instruments Used for Installation, Maintenance and Servicing in the Field and on the Bench

MOST SERVICE MEN are aware of the fact that *rf* and *if* alignment is more critical in the case of the color-TV receiver, than in a monochrome receiver. This requirement is imposed by the presence of the color-signal voltages, which are located at the upper end of the *if* response curve; only 920 kc from the sound carrier, as shown in Fig. 1. This small separation between the chroma frequencies and the sound-carrier frequency means that unless the *if* alignment is made accurately and carefully, the chroma signal becomes attenuated or mixed with the sound signal; the result is a strong 920-kc beat in the picture, accompanied by complete loss of color.

Even when the sound traps are properly set (and sound rejection is adequate), and the 3.58-mc color-subcarrier point is placed on top of the response curve, color distortion occurs unless the top of the curve is flat. Since the eye is less tolerant of chromatic distortion than of gray-scale or detail distortion, sweep- and marker-generator requirements are stricter in color-TV alignment procedure than in monochrome alignment.

Sweep-Gen Output Voltage

Unless the output voltage from the sweep generator is uniform (flat), the Service Man will come to grief, because he will misadjust the receiver circuits in unknowingly compensating for the generator deficiencies; Fig. 3. Likewise, unless the marker generator is accurate (crystal calibrated, and with a flatness rating of .2 db per mc of sweep width or better), it will be difficult or impossible to set the sound traps correctly with respect to the color-subcarrier point.

The front end of a color-TV receiver is no less critical than the *if* section. Those who tune a color receiver for the first time are invariably surprised at the extreme accuracy with which the fine tuning control must be adjusted. A slight misadjustment of the local-oscillator frequency results in the sudden disappearance of color from the picture, which is replaced in many instances by strong interference. Not only must the local oscillator operate at exactly the correct frequency, but the *rf* and mixer response curves must be flat-topped and have adequate bandwidth. Of course, commercial front ends do not always permit one to obtain a perfectly flat-topped response. In this case, acceptable color reproduction can often be obtained by compromising the *rf* and *if* response, so that the *over-all* response will be flat, as shown in Fig. 2.

Such compromises necessarily fall short of perfect *rf* response plus perfect *if* response, but are evidently required in some of the practical situations which are encountered. It is clear that the necessity for making compromise adjustments is in itself a sufficient complication, without the additional burden of inaccurate generators.

Video-Frequency Response

Satisfactory color reproduction depends upon proper response of the *video amplifiers* as well as upon good *rf* and *if* response. The video amplifiers respond to frequencies from 60 cycles to 4.5 mc, although not all the video amplifiers respond over this complete range. The *Y* (luminance or brightness) amplifier often responds over the complete video-frequency range, except for a 3.58-mc trap point. However, the chroma or bandpass

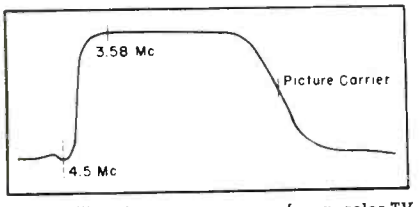
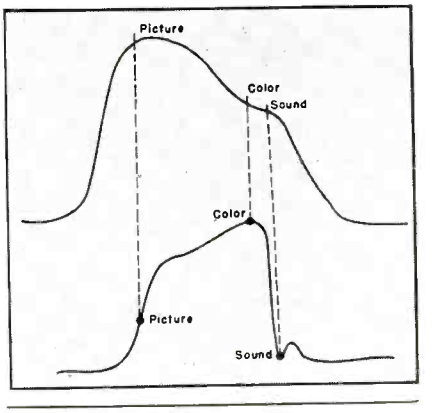


Fig. 1. The if response curve for a color-TV receiver not only has a flat top, but exhibits a very rapid rise to maximum from the sound-carrier trap, located 4.5 mc from the picture-carrier point. The rise is so rapid that it appears quite dim on the 'scope screen (due to high spot velocity) when the if circuits are in proper adjustment. All of the color information is located in the vicinity of the 3.58-mc color-subcarrier point, and must be amplified at full voltage to avoid poor color reproduction, or complete loss of color.

*Author of *TV Troubleshooting and Repair Guidebook* (Volumes I and II), and coauthor (with Alfred A. Ghirardi) of *How to Use Test Probes*; published by John F. Rider.



(Right)

Fig. 2. An rf response curve (above), with color and sound attenuation; and if response curve (below), with a compensated shape, so that the color signal is boosted in the if amplifier. This procedure is necessary when the front end cannot be brought into proper alignment, but is undesirable from the standpoint of a poorer phase characteristic which is obtained. When the phase response is poor, the color signal rings, much as in monochrome reception.

COLOR TV INSTRUMENTATION

Color-TV *installation* men need two new instruments to put color receivers into operation:

(1) White-Dot Generator
(2) Color-Bar Generator

Color-TV Service Men need, in addition to these new instruments, the following gear to maintain and repair color-TV chassis:

(1) Video-Frequency Sweep Generator
(2) Wide-Band 'Scope

These requirements, of course, are based upon the assumption that the TV shop is already properly equipped for monochrome service, with a minimum complement of *vtvm, tube tester, sweep* and *marker generator, alignment scope* and *calibrator,* and *field-strength meter.*

Certain accessories[1] for *rf* and *if* sweep and marker generators have become available; these units make it possible to *convert* the *rf* and *if* generators into video-frequency sweep instruments.

[1]Such as the Chromatic Probe and Chromatic Amplifier.

amplifier responds only from 2.1 to 4.2 mc; the *I* amplifier responds from 60 cycles to 1.5 mc, and the *Q* channel responds from 60 cycles to 0.5 mc. The red, green, and blue video amplifiers have somewhat wider response.

It is sometimes supposed that these video amplifiers can be tested by beating the outputs from an *if* signal generator and an *if* sweep generator through the picture detector, as in the case of a monochrome receiver. However, this supposition is false, *because the chroma channels are blocked off from the Y amplifier by the bandpass amplifier.* In other words, the *Y* amplifier feeds into the *I* and *Q* (or *R-Y* and *B-Y*) circuits through the 2.1 to 4.2-mc bandpass filter; and since the *I* and *Q* circuits respond in a low-frequency range between 60 cycles and 1.5 mc, it is apparent that no test signal can be driven through the chroma circuits from the picture detector.

To test the chroma circuits, the sweep generator which is used must be capable of providing a video-frequency sweep signal extending from at least 50 kc to 4.5 mc. This low-frequency limit of 50 kc can be advantageously extended down to 5 or 10 kc, when practical, to obtain a more complete test of the circuit response.

Some of the better sweep generators provide a video sweep output from 50 kc to 4.5 mc, but to the best knowledge of the writer, there is no sweep generator available which sweeps from lower frequencies, such as 10 kc.

However, *if one has a good rf/if sweep generator, it is not obsolete.* Accessory items, such as *chromatic probes* and *chromatic amplifiers* can convert the *rf* or *if* generator into a flat video-frequency sweep which extends typically from 8 kc to 4.5 mc.

In other words, the central requirement for accurate video-amplifier testing is a good *rf* or *if* sweep generator; *if the sweep generator output is flat, conversion of this output to a flat, video-frequency sweep is a simple matter.*

Accordingly, sweep generators which are not sufficiently flat for *rf* and *if* alignment of color-TV receivers are also obsolete for video-frequency testing. But, if a sweep generator is flat, it can be used for video-frequency testing with the aid of an accessory.

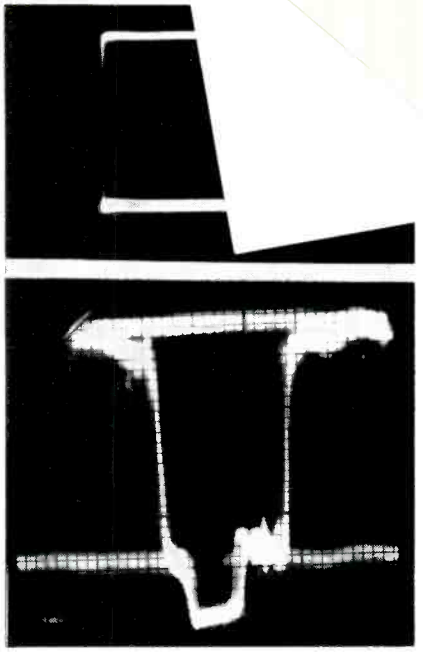
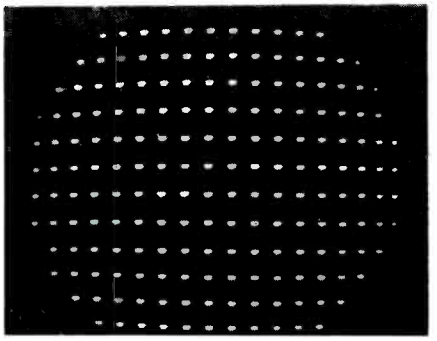


Fig. 3. 'Scope pattern (above) represents flat output voltage from sweep generator, suitable for color-TV servicing. Appearance of a horizonal sync pulse from a color-TV receiver, displayed on screen of a wide-band 'scope, is shown below.

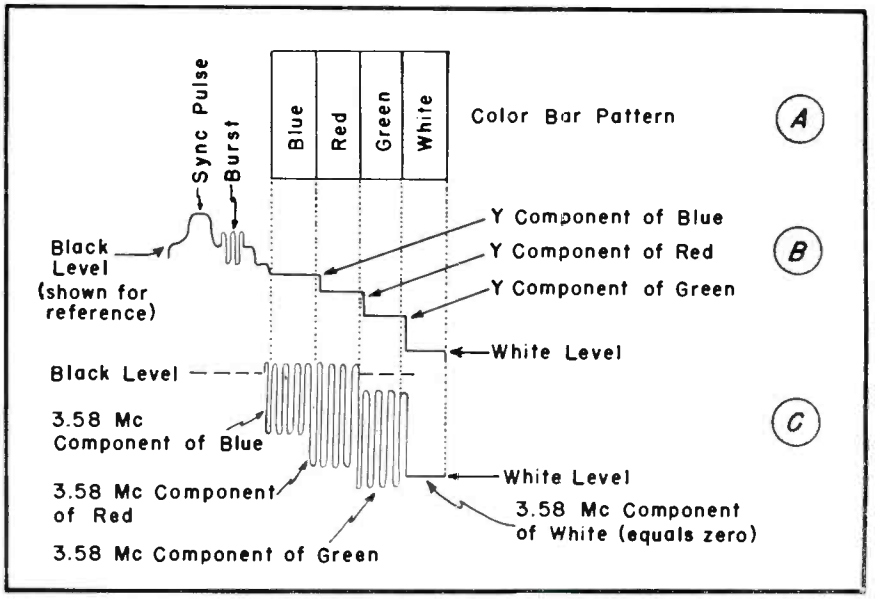
(Below)

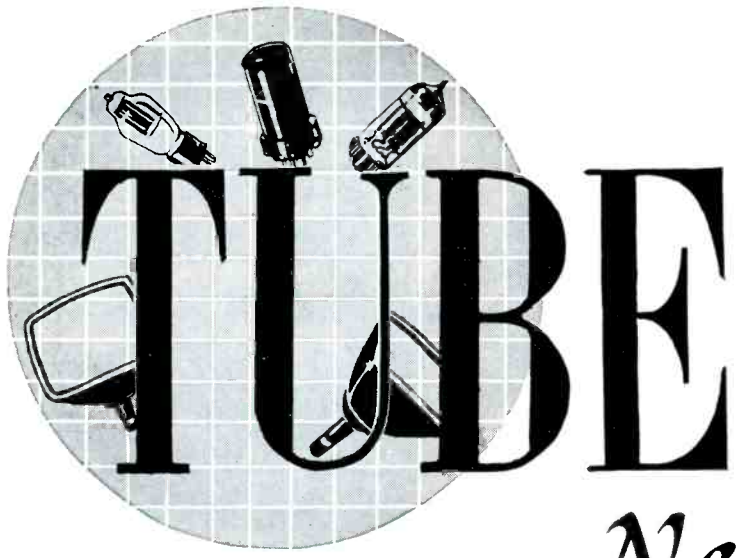
Fig. 4. Appearance of white dots when height of dot is three scanning lines.



(Right)

Fig. 5. The output from a color-bar generator contains a sync pulse, burst, brightness information, and color-subcarrier information, as shown here. If a 'scope is used to observe the generator output, only the stair-step Y component will be seen, unless the 'scope has ample response at 3.58 mc. However, with a wide-band 'scope, the sine-wave 3.58-mc component of each bar will also be seen. From bar to bar, the 3.58 mc component exhibits a different voltage, and a different phase. Both voltage and phase can be measured on the 'scope screen, if desired.





News

Replacing Obsolete 83 Mercury-Vapor Rectifiers With 5Z3

by **MICHAEL MACHAS**

Electronic Tube Division, Westinghouse Electric Corporation

THE 83, a glass-type full-wave mercury-vapor rectifier, was originally designed to supply *dc* at essentially constant voltage, in spite of rather wide range in output current. However, since the 83 is no longer manufactured and because a considerable amount of industrial equipment still uses this tube, a suitable replacement is necessary.

Of the gas-filled rectifiers now being made, there are none suitable as a direct replacement for the 83 without elaborate circuit changes. It has been found possible, however, to substitute the 5Z3 full-wave high-vacuum rectifier in some equipment.

5Z3 As Replacement

The 5Z3 has the same basing, physical appearance, and ratings, *but* it has a tube-voltage drop of approximately 55, compared to the 15 volts for the 83. The extra tube-voltage drop of the 5Z3 may be detrimental in some applications because of lower $B+$ supply, but may perform adequately in others.

In replacement, it is recommended first that the substitution be made directly and tests conducted to determine if the replacement is adequate. If it is found that the 5Z3 does not perform adequately, a slight circuit change may solve the problem.

In many circuits employing the 83, it will be found that choke-input filters, similar to those shown in Fig. 1, are used. In other equipment, capacitor-input filters are used; Fig. 2. Where the 83 feeds a choke-input filter, a higher $B+$ can be realized by adding a 4- to 10- mfd, 1000-volt capacitor between filament and ground. This higher $B+$ should be sufficient to overcome the extra tube voltage drop of the 5Z3.

Equipment using a capacitor-input filter can realize only a slight increase in $B+$ power, by adding an additional capacitor between filament and ground. The value of this capacitor, plus the original capacitor input combined, should not be greater than 40 mfd.

Tube Developments

A HEATER-CATHODE type medium-mu-triode-sharp cutoff pentode, the 5AV8[1], of miniature construction, the *series string* counterpart for the 6AN8, has been developed for color TV chassis.

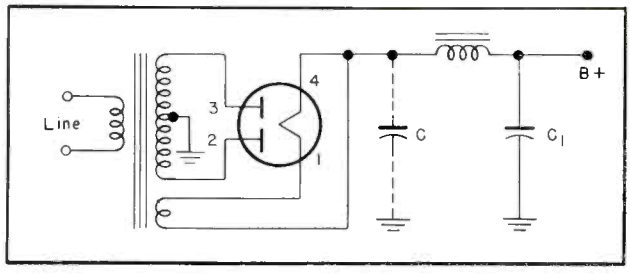
For service in vibrator-type power supplies of auto receivers, using 12 *v* storage batteries, and for *ac*-operated radios, a 12X4[1] heater-cathode full-wave rectifier has been designed.

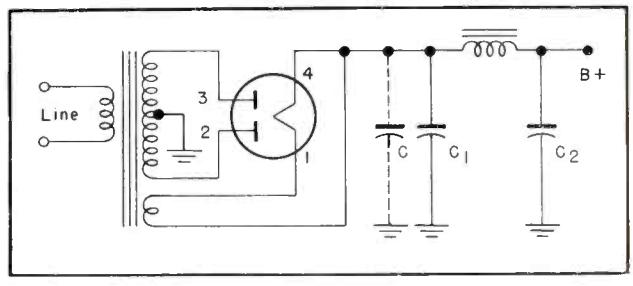
For TV, there's now available a direct view, electrostatic focus and magnetic deflection picture tube, the 21ALP4[1], with a spherical rectangular filter-glass face plate. Tube has been designed for external ion-trap magnet of the single field type to prevent ion-spot blemishes.

Also available is a spherical rectangular filter-glass face plate, low-voltage electrostatic focus and magnetic deflection picture tube, with an aluminized screen; model 21AVP4A[1].

[1]Raytheon.

Figs. 1 and 2. Circuits, originally designed for the 83 mercury-vapor full-wave rectifier, that can be modified to permit use of a 5Z3, by the use of additional capacitance.





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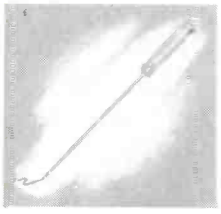

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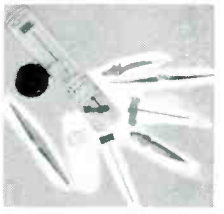

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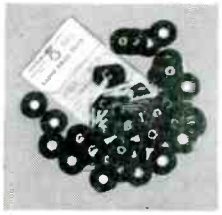

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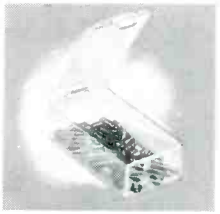

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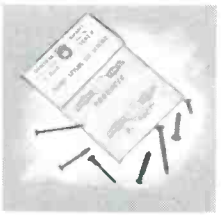

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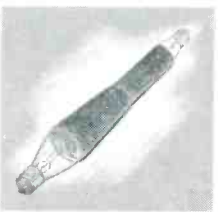

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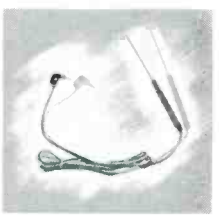

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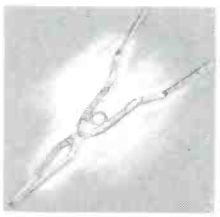

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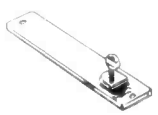

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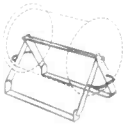

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HI-FI Results Through Audio

NEGATIVE feedback, as noted in our earlier analysis[1] can serve to reduce distortion. How this is accomplished is shown in Fig. 1. The distorted output signal, E_{out}, is applied out-of-phase back to the input and mixed with the undistorted input signal E_{in}.

The input signal waveform then takes on a shape which contains the inverse of the distortion which it is to encounter in the amplifier, and it is thus precompensated for the distorting influences of the amplification to come.

Neg Feedback Advantage

The advantages of negative feedback are not confined to reduction of distortion. Hum and noise within the feedback loop are reduced, and the source impedance of the output stage is also reduced. This last feature is very important in audio work; the increased damping factor has a marked effect in reducing speaker hangover and producing a clean bass, without boom.

Feedback Circuits

There are various methods of applying negative voltage feedback over the output stage. To begin with, however, it is necessary to make sure that the amplifier in question has a sufficient surplus of voltage amplification or gain. This means that with the volume control all the way up, the output stage can be driven past the point of its rated output power.

Most commercial radios do have this surplus gain. Evidence of this characteristic appears when one simply turns up the volume control and goes beyond a given point, producing blasting at the output.

Applying negative feedback uses up such surplus gain in a useful way. The amount of negative feedback that can be used is determined experimentally; feedback is increased until the maximum volume that the radio or phono is capable of has been reduced to the desired level, and no lower.

Coupling Capacitors

Secondly, all coupling capacitors within the feedback loop should be at least .05 mfd, when working into a 500,000-ohm grid resistor, and .1 mfd when working into a 250,000-ohm grid resistor.

Feedback Circuits

The circuit of Fig. 2*a* is that of a common arrangement for push-pull amplifiers, modified to include negative feedback. The cathode to which feedback is applied has its bias resistor divided into bypassed and unbypassed sections, to avoid the loss of gain that would result from a large unbypassed cathode resistor.

When there is plenty of surplus gain, this is unnecessary; the bypass capacitor and 330-ohm resistor can be eliminated, and the feedback lead connected directly to the top of the cathode resistor.

Figure 2*b* illustrates essentially the same circuit, with the feedback applied to the grid circuit rather than to the cathode circuit. The use of the grid circuit in the latter case is made necessary by the common cathode of the dual-triode stage.

Voice Coil Polarity

In either case, the question of which of the voice-coil winding terminals is grounded and which connected to the feedback resistor (that is, the polarity of the feedback leads) is determined by connecting and trying. With the correct polarity the output signal will be reduced, while with incorrect polarity the output signal will be increased and the amplifier may break out into oscillation. It will be found that the polarity of leads required by the cathode-input circuit is opposite from the polarity required by the grid-input circuit. It will also be found that taking the feedback loop back over an additional stage will require lead reversal.

Feedback Resistor Value

Once the polarity of the feedback leads has been determined, it is necessary to determine the value of R_F, the feedback resistor. This resistor must not be so small as to reduce the maximum volume of the radio or phono below the desired level, nor so large as to prevent the desired amount of feedback from being applied.

The practical procedure of determining the value of R_F is thus to begin with a fairly large resistor, let us say several hundred thousand ohms, and to reduce progressively the value of this resistor until the maximum volume has been cut down as much as can be afforded.

Use of Series Rheostat

Quiet records or stations must be considered in the final decision, and it must also be remembered that there is no purpose in providing gain past the point where the set blasts and produces high distortion levels.

A .5-megohm volume control, connected as a series rheostat, may be convenient in making the above determination; the value being measured with an ohmmeter after the amount of feedback has been set.

HF Oscillation Checks

Although it is unlikely that commercial amplifier stages will allow for too much feedback, checks should be made to guard against high-frequency oscillation or low-frequency motorboating caused by phase shift within the feedback loop. The danger of such oscillation increases with the amount of feedback applied.

Oscillation Symptoms

High-frequency oscillation may produce a symptom that sounds very much like speaker rattle. It can be observed on a 'scope as a breaking out of the single-line waveform into oscillatory sine-waves[2], appearing as a solid area of light on the screen.

Low-frequency oscillation produces the motor-boating commonly associated with open filter capacitors. The responsible phase shift usually occurs in the output transformer.

Output Transformers

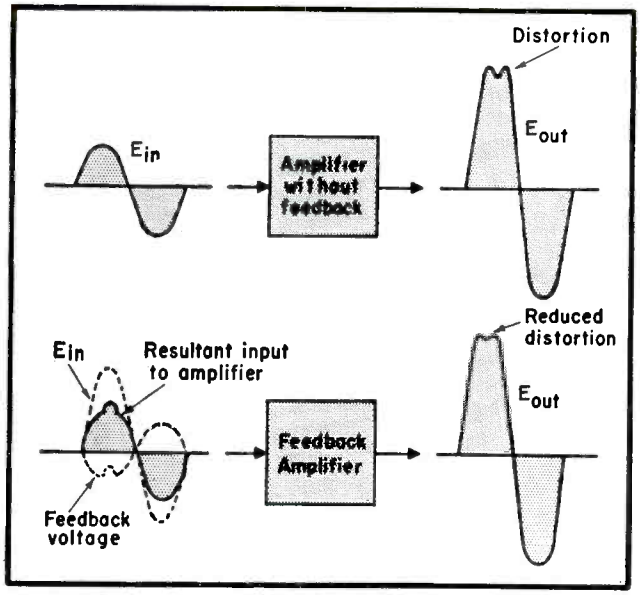
The output transformer is the most critical component of the audio amplifier, and often it is well worth replacing the original unit with a quality transformer, properly matched to the output stage and speaker. With a good output transformer the feedback cir-

[1] SERVICE, Jan., 1955.

Amplifier Conversion

by MARK VINO

Application of Negative and Primary-Secondary Feedback to Extend Range



cuits illustrated in Fig 2, referred to as *secondary* feedback, are probably the simplest. Where the quality of the output transformer is in question, however, or where the amplifier tends to oscillate with feedback, a circuit of the type appearing in Fig. 3, providing *primary* feedback, should be used.

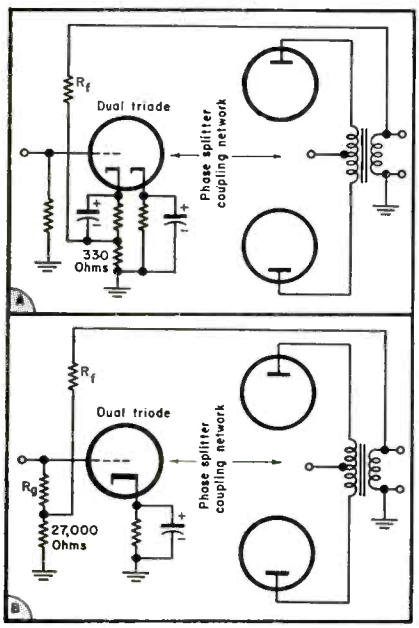
Purpose of Primary Feedback

Primary feedback prevents the phase shift and possible discriminative attenuation of the output transformer from appearing within the feedback loop, but can only be used when the plate supply for the output stage is well filtered; thus only choke filter amplifiers can have primary feedback applied to them. This is so because the *ac* voltage fed back is that between plate and ground, including the ripple voltage between $B+$ and ground, and not merely the voltage across the transformer primary winding.

Bias Resistors

The value of the feedback resistor in primary feedback is determined in the same way as for secondary feedback. It will be noted that there is no isolating capacitor in the feedback loop of Fig. 3; thus a certain amount of *dc* voltage appears across the 330-ohm resistor. The value of the bias resistor, R_c, must therefore be determined by noting the value required to produce the correct bias voltage from cathode to ground. If it is desired to avoid the foregoing procedure, a .1-mfd isolating capacitor may be inserted in series with the feedback resistor. When the voltage amplifier of Fig. 3 is a combination duo-diode detector and triode audio amplifier, a change from contact potential to cathode bias will make it suitable for the feedback application.

[2]Vino, Mark, *The Maintenance of Hi Fi Audio Systems*, SERVICE; Oct., 1953.



(Above)

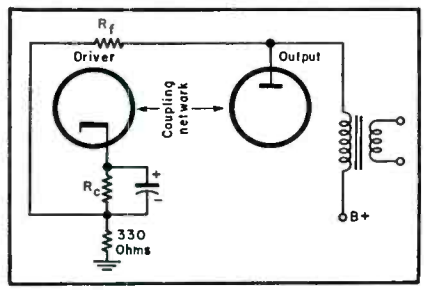
Fig. 1. How negative feedback reduces distortion. The same output power at lower distortion is produced by the feedback amplifier, but a greater signal input is required.

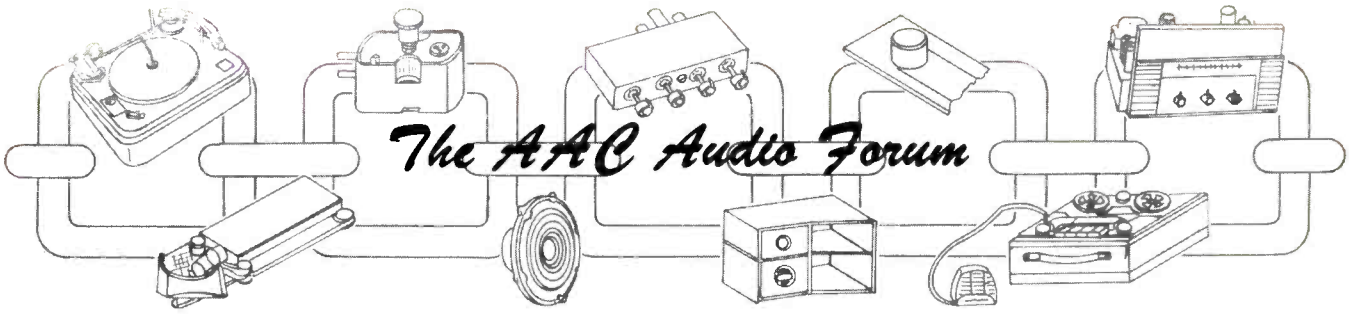
(Left)

Fig. 2 a and b. In a we have a push-pull amplifier modified to include negative feedback from an output transformer secondary to a voltage amplifier cathode. Where there is ample surplus gain the feedback may be brought directly to the first cathode, and the cathode bypass capacitor and 330-ohm resistor eliminated. Polarity of feedback leads and value of R_F must be determined experimentally. Negative feedback to voltage-amplifier grid circuit is shown in b.

(Right)

Fig. 3. Feedback from an output transformer primary in a single-ended amplifier. Part of the driver bias is provided by the direct-coupled feedback circuit. Values of R_C and R_F must be determined experimentally.





Part VII of a Series of System-Component Evaluation and Progress Reports

High Fidelity Aspects of Record Changers

by William Brown†

To MEET THE requirements of a high-fidelity phono reproducing system, Service Men should be familiar with a number of record changer design and operational characteristics.

Modern changers will handle a one-inch stack of records automatically. If it is an intermix, records do not have to be of the same diameter, although the diameters may have to be arranged in certain sequence.

One general design employs a small lever inside the center spindle to push out the bottom record of the stack. Another uses a push-off shelf that bears against the side of the record causing it to drop off the center spindle shelf. Both types use a cushioned turntable. A large diameter spindle, that fits over the small standard spindle, for handling 45s is a worthwhile accessory.

Position and Velocity Trips

A *position* trip causes a changer to cycle at a fixed radius from the center spindle. The *velocity* trip, however, cycles the mechanism when the stylus enters the trip grooves at the end of the recording.

Other Changer Features

Other desirable features include an automatic last record shut-off; a manual position allowing the stylus to be placed on any portion of the recording; and a neutral speed position that withdraws the rubber-tired idler from the motor shaft so it will not get out-of-round.

Speed

For true pitch reproduction, neither sharp nor flat, speeds must be precise. To accomplish this, specially engineered shaded-pole motors and precision manufacture of all rotating parts are mandatory. Stroboscopic disks are available for checking speed.

Extraneous Reproduction

A variation in speed, once or twice per revolution, causes the music pitch to vary, producing a *wow* sound. At a higher rate *flutter* appears. Prevention is accomplished by a completely balanced rotor, close tolerances on the run-out and eccentricity of all shafts and wheels, and precision fits on all bearings. Rumble (which is low pitched and erratic) can be minimized by the foregoing measures, plus complete vibration isolation.

The *tonearm assembly*, a vital phono component, must not only be free of any objectionable resonances, but must also provide proper tracking for the stylus in the record grooves.

In addition to fundamental overall design, it is necessary to consider such important features as an easily accessible needle-point pressure adjustment, and provision of installation of a variety of cartridges and plug-in heads.

Tonearms should also be so designed that they can be grasped or lifted at any point in their travel without damaging the mechanism.

†*Assistant to Vice President, Charge of Engineering,* ***Webster-Chicago Corp.***

The *AAC Audio Forum* is being presented as a service to industry, in cooperation with the Audio Activities Committee (through its Promotion and Public Relations Subcommittee) of the Sales Managers' Club, Eastern Division, who have arranged for members of the audio industry to contribute authoritative data on all phases of audio in which they are most expert. Comprehensive reports feature technical and merchandising information on amplifiers, preamps, speaker enclosures, speakers, turntables, record changers, cartridges, needles, arms and accessories, recording discs and tapes and accessories, tape recorders, special output transformer kits and tuners.

Loudspeaker Crossovers

by Alexis Badmaieff††

IN DESIGNING a *hi-fi* loudspeaker system having a woofer-tweeter combination, it is essential to maintain proper phase relation between the low and high-frequency speakers at the region of crossover. The woofer and tweeter are two separate and distinct sound sources. At the crossover point, they both radiate with equal intensity and if their phase is not correctly adjusted, their outputs may subtract or combine in quadrature. In the region of crossover, there exists various phase relations that will affect the response of the combined outputs, and serious irregularities in the frequency response may appear. To achieve proper phase relation without going to complicated phase-correcting networks, it is necessary to adjust the relative positions of the diaphragms of the high and low-frequency drivers so that they are substantially on the same vertical plane.

Duplex or Coax Models

In duplex or coax speakers, the same problem exists, with the further difficulty of preventing standing waves from appearing when the tweeter's radiation is reflected from the woofer's cone. In two duplex speaker models[1], the high and low-frequency drivers are in the same acoustical plane. To improve further the frequency response, the tweeter is mounted slightly off-center in relation to the woofer. This provides asymmetry, found to prevent standing waves between the two drivers.

Since phase relationship, and consequently the frequency response in the crossover region, is difficult to control, it has been found better to design systems having only one crossover region; dividing the audio spectrum in two parts by the use of wide range low and high-frequency speakers. When

(*Continued on page 62*)

††***Altec Lansing Corp.***

[1]Altec 601A and 602A.

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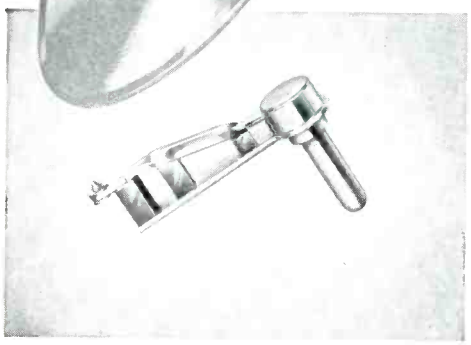
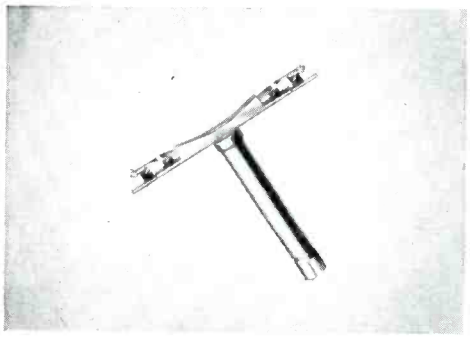
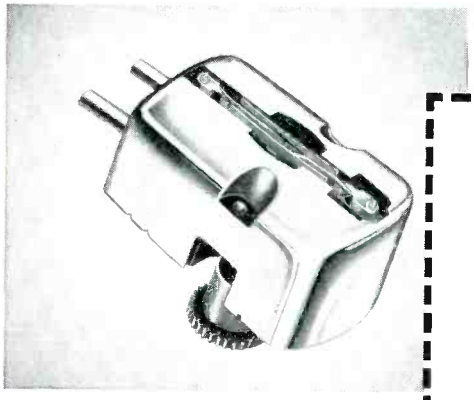
Hi Fi Cartridges and Styli



SINGLE TYPE STYLUS



DUAL TYPE STYLUS



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The AAC Audio Forum

(Continued from page 60)

using more than one crossover and more than two narrow range speakers to cover the spectrum, the difficulties in the crossover region are multiplied accordingly.

Poor Phasing Sources

A similar condition of poor phasing relation may exist in loudspeaker systems having back loaded, folded horns. The acoustical radiation originating from the front of the cone will have a shorter path to travel in reference to the radiation originating from the back of the cone, which must travel the additional distance of the folded horn. At some point, usually in the 200-300 cycle range, the two radiations will not be additive, due to improper phase relations, and may produce a serious dip in the frequency response.

Hi-Fi Power Amplifiers

by Victor H. Pomper‡

IN EVALUATING power amplifiers it is important to keep in mind their primary purpose of reproducing music for listening enjoyment. Measurements and specifications are valid only if they give a true picture of this basic purpose. The best amplifiers now available are so good that they have outgrown the yardsticks used to measure them. Many of the specifications and technical features enthusiastically argued about by the *hi-fi* hobbyists are no more pertinent to music reproduction than the hem lengths of this year's women's fashions. Overall performance is not obtained by one or more *gimmicks* which are loudly announced from the rooftops from time to time, but by painstaking attention to every detail, with music listening kept stringently in mind. The Service Man can be a tremendous help in clearing up the inevitable confusion on the part of music enthusiasts, created by misinterpretation or misunderstanding of often completely invalid specifications and sometimes advertising claims.

The basic features to examine critically are frequency response, the output stage, distortion, power handling capacity and damping. Little need be said about frequency response, other than it is an advantage that the response be reasonably flat over the audible spectrum.

Insofar as output stages are concerned, the triode versus pentode-with-feedback controversy has virtually disappeared as a source of enthusiastic dispute. Although lingering prejudice is occasionally encountered, it is now generally agreed by competent authorities that for equivalent degrees of circuit complexity and cost, the beam-power output circuit with feedback gives practically twice the power output and equal or better distortion and hum levels than do triode outputs. While *trick* output circuits involving class *A-B* or *B* operation still exist, impartial specialists generally agree that class *A* circuitry offers the advantage of essentially distortionless operation at even lowest listening levels as well as at high output. It is advantageous to have some automatic means of balancing the output circuit without need for laborious tube selection. A typical circuit is the self-balancing phase inverter[2] which, it has been found, balances the output circuit automatically to levels far below audible distortion, thereby eliminating the

‡*Hermon Hosmer Scott, Inc.*

need for manual tube selection after tube replacement or tube aging.

Amplifier distortion is a subject in which considerable confusion exists. Common harmonic distortion measurements are not very meaningful, insofar as audible results are concerned, because harmonic distortion is closely akin to those harmonics abounding in music. Therefore, distortion levels as high as several per cent or more have been found difficult to detect by ear. A commonly used rating is intermodulation or *IM* distortion.[3] This was originally developed to provide a means of specifying the degree of development to which motion picture film should be carried for reasonable distortion in motion picture sound reproduction. This intermodulation base, however, is virtually meaningless in describing high-fidelity amplifier performance. For example, a leading professional instrument used in the recording process has been found to exhibit intermodulation levels as high as 18%, and with *no* audibly adverse results. The most valid measure of undesirable audible distortion in a high-grade amplifier is the first-order difference tone intermodulation. This type of distortion is most closely akin to the harsh, discordant growling to which the ear is most sensitive and which is most annoying to the ear.

Power Handling Capacity

Power handling capacity of amplifiers is also subject to considerable misunderstanding. Sound reproduction is a highly complex technical subject, and the hobbyist often fastens to an apparently simple feature such as power capacity as a "hook to hang his hat on." Such over-simplification is dangerous, however. Most power output measurements are made on continuous sine-wave input. Music, however, consists of a jagged waveform with relatively low average power but high peaks, or sudden bursts of loud music. Even extremely high-powered amplifiers will clip some musical peaks. The normal undistorted power output rating determines where clipping takes place. Actually, insofar as audible results are concerned, this formal rating is much less important, than *how* the clipping occurs. To illustrate, a 10-watt amplifier, which clips cleanly and symmetrically, may actually deliver higher signal levels before audibly serious distortion takes place than, say, a 40-watt rated amplifier which breaks into parasitic oscillation

(*Continued on page* 64)

[2]Developed by H. H. Scott.
[3]As originally specified by the Society of Motion Picture Engineers (SMPE).

Audio Forum

(*Continued from page 63*)

as it clips, or otherwise clips raggedly and so causes a jagged top to appear on the clipped waveform. Yet, both amplifiers may be essentially distortionless below the overload point. It is difficult to rate this type of performance, but the results show up in listening.

Output Power Race

The automobile horsepower race is, in many respects, analogous to the amplifier output race, and is equally unnecessary. For average home use, with reasonably efficient loudspeakers and playing at reasonable levels, 10 or 12 watts of clean power output are more than adequate, and 20 or 30 watts are more than sufficient. After all, the difference between 10 and 20 watts is but 3 db, the minimum difference audibly detectable by acute hearing. Significantly higher-power outputs are needed only if many or particularly inefficient speakers are used or if, say, a thunderstorm record is to be played, at levels louder than the original program material, by the *real gone* hobbyist.

With such higher-powered amplifiers, there exists significant danger of damage to the loudspeaker, and therefore if such high powers are used it is advisable that some means of protection be provided.[4]

Amplifier Damping

The last factor to consider is that of amplifier damping, with *damping factor* a common means of describing the output characteristics of amplifiers. This damping factor is defined as the ratio of the load impedance to the internal output impedance of the amplifier. A recent survey among speaker manufacturers indicated that commercially-available loudspeakers in typical enclosures provide best results with damping factors from 15/1 to .5/1, depending on the speaker and enclosure. There are at present several contradictory trends toward very high-source impedances; low damping fac-

[4]Such as the H. H. Scott adjustable *dynamic power* monitor.

tor. High-source impedances are commonly obtained by high negative-current feedback, whereas low-source impedances are obtained by high negative-voltage feedback. Once again, it is particularly important for good listening to avoid extremes. Very high-source impedances are being promoted enthusiastically by some manufacturers, but unfortunately such operation most closely approximates the old-fashioned pentode output circuits without feedback, a method of operation deplored by many of the best speaker makers, because of the resulting exaggerated boomy bass response. Very low-source impedances have also been common, although the internal resistance and inherent mechanical damping in most speakers render such low impedances meaningless. Unduly low-source impedances are achieved by excess feedback, with the result that the clipping characteristic is generally ragged rather than clean and symmetrical. In some cases even negative output impedance is used. This, in effect, creates an oscillator circuit which is inherently unstable. To minimize oscillation, the regenerative effect is limited to low frequencies only, but this has the effect of an output impedance which varies with frequency, thereby causing variation in overall frequency response which, if needed, is obtained better by conventional tone controls and equalizers which do not introduce regenerative instability. A useful control is one which adjusts amplifier damping to that value giving best speaker matching. Automatic matching at any frequency of non-uniform speaker impedances is not possible, however, because amplifier internal output impedance cannot be a function of the load impedance. Therefore, the power absorbed by the speaker is not constant over the frequency range.

Amplifier's Basic Purpose

In summary, it is important to remember that facts, not fads, should be given primary attention. The basic purpose of the amplifier is reproduction of music for listening enjoyment. In many cases, the commonly-used yardsticks of measurements have been outgrown as the power amplifier approaches perfection. Such specifications and measurements are valid only in relation to how accurately they outline the amplifier's performance in its basic function; music reproduction. Once again, intelligent attention to every detail rather than *gimmicks* contributes to an overall balance which results in best listening.

TV SERVICE MONTH

Promotional material that will be used to advertise TV Service Month sponsored by G. E., which will include talking postcards, emblems, sidewalk footprints, mailers, streamers, entry blanks and banners. The program, designed to gain public recognition for Service Men, will also feature publication in a national weekly of a directory of Service Men that handle G. E. tubes. The concept of a nation-wide TV Service Month will be publicized, it is said, through every possible channel to focus attention on the Service Man as a friend and neighbor, and to call for direct action in ordering long-put-off repairs. Ad mats and other material have been prepared to alert newspapers and radio and television stations to the month. A TV Service Month emblem that identifies each shop as a headquarters for a $25,000 jingle contest is another promotion aid that will be used.

Latest in

A 12" speaker grille designed for custom installation of 12" speakers in new or existing construction. Available in chrome or neutral grey hammertone. For individual installation requiring a painted finish to match the surrounding decor, a prime coat finish is also available. Grille is packaged with woven saran grille cloth plus speaker mounting hardware. (D & M Products, 13144 W. McNichols Rd., Detroit 35, Mich.)

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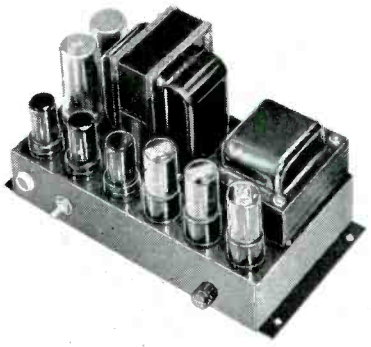
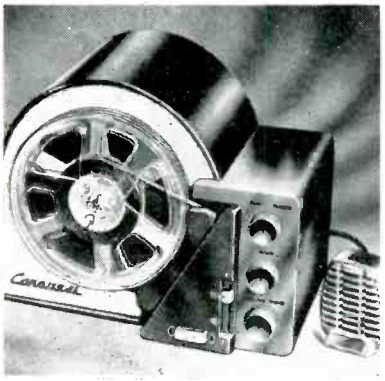
Cabinet, with pre-cut and pre-drilled panels, designed to accommodate amplifier or tuner, with any standard record changer. Available with optional wrought iron legs, as shown, which converts it to a consolette model. (Model CTC; Regency, Division of I.D.E.A. Inc., 7900 Pendleton Pike, Indianapolis 25, Ind.)

Audio



A 10-watt audio amplifier, said to have a frequency response, at one watt output, of 20 to 40,000 cps, flat within .3 db (down 2 db at 100,000); at 100 watts output, flat within .5 db, 20 to 22,000 cycles. Noise level is claimed to be –80 db below 10 watts. Output impedances of 4, 8 and 16 ohms are available on screw terminals. (Model 96-10; Webster Electric Co., 1900 Clark St., Racine, Wis.)

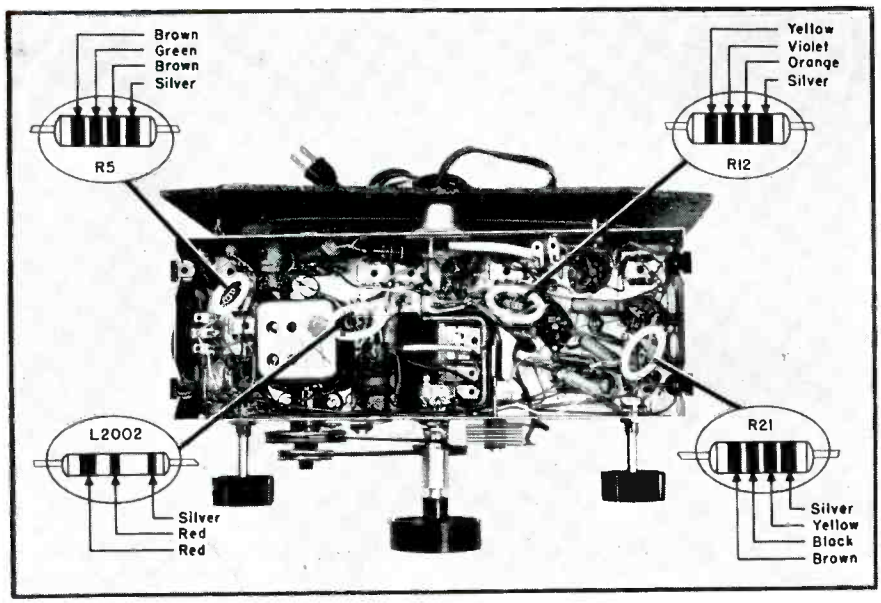


Two-speed, dual-track magnetic tape recorder, built to accommodate all reels up to 10½", mounted coaxially in a vertical position. Will play up to 8 continuous hours before repeating itself automatically and endlessly while set is in operation. Other features include high-speed, differential 2-way wind; 8" speaker; and all triode amplifier. (Carousel; Tape Recorders Incorporated, 1501 W. Congress St., Chicago 7, Ill.)

Tape player and recorder with a plug-in recording head, tape guide slotting device, neon recording level indicator, 3.75 and 7.5 playing speeds, preequalized amp, 5" x 7" speaker, and 6 tube superhet receiver. Has a mixer circuit which permits recording of both the microphone and radio at same time. (Tri-Fy Continental; Tape Recorders Inc.)

Color Bands, Codes and Components

(*Continued from page 21*)



of components that should be identified, have been circled. What you would see, or the position of bands and stripes, and their colors, for these components appears in enlarged drawings. Can you fill in the color codes for each of these components, and note which of the components is a resistor, choke or capacitor, and their values? Your answers can be checked against the correct ones on page 81.

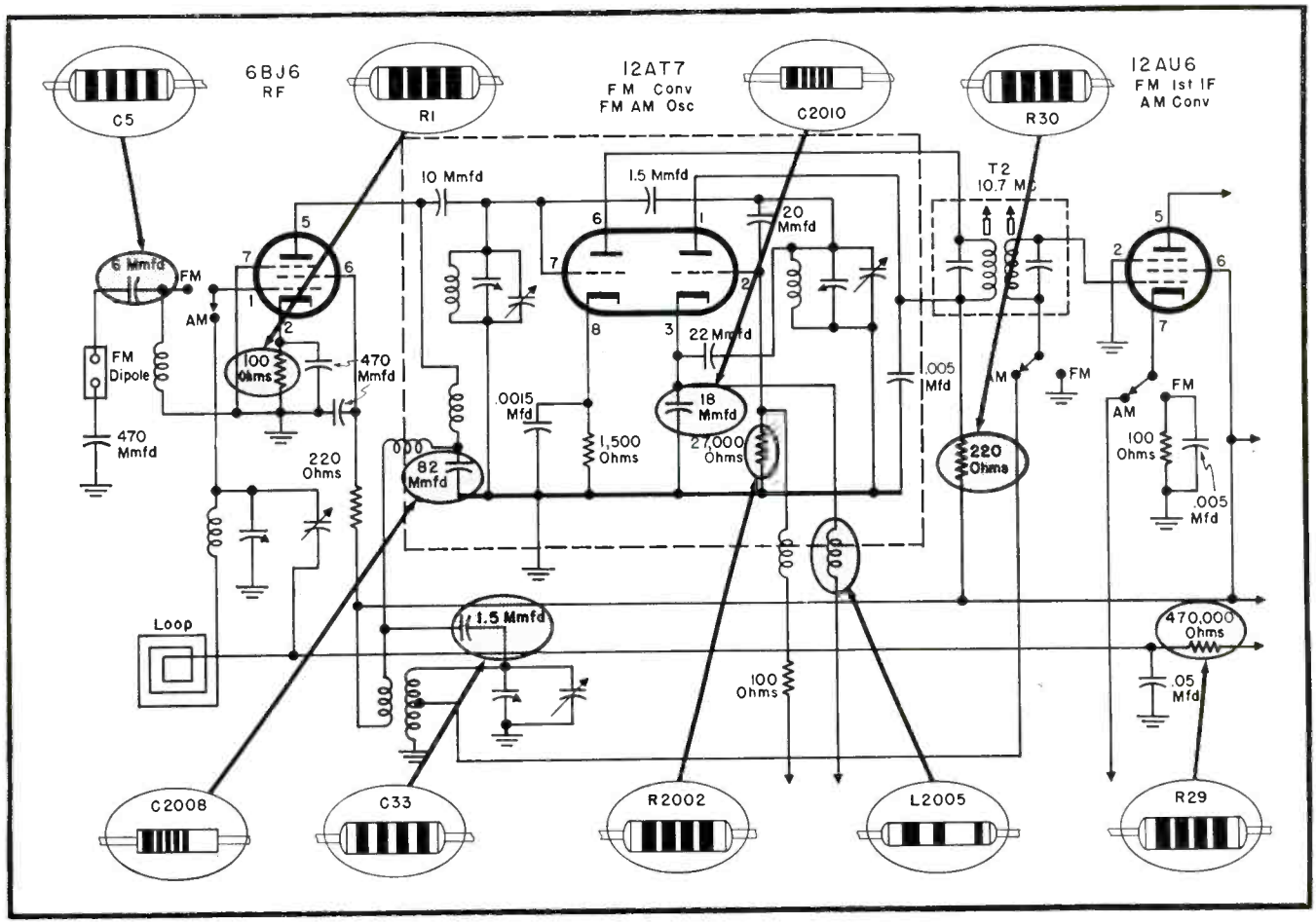
In Fig. 7 is the circuit of the tuning section of the FM set* illustrated in Fig. 6. Can you supply, for each circled component, the correct color code designation for it? Again, the correct answers are presented on page 81.

Save Time: Know Your Codes

The foregoing illustrations present the problems confronting Service Men on assignment. Either one can see the component and must know, from what is seen, what type of component it is and what is its value; or when one looks at a circuit diagram and reads the type and value of the component, one must be able to picture the color code on it, so that the right item can be picked out from a whole assortment of them. A Service Man who cannot do these two jobs quickly and accurately is in the same boat as the typist who has to fish for each letter; in other words, a very slow worker. To build up your component identification speed, the examples in Figs. 5, 6 and 7 should be reworked until you can do them at a glance.

Fig. 6 (above). Closeup of underside of typical FM tuner chassis. Reader should be able to translate color code for each circled item into type of component and its value. Answers on page 81.

Fig. 7 (below). Schematic of G.E. 409 tuner, illustrated in Fig. 6. One should be able to provide correct colors for each component. Answers on page 81.



New Instrument Developments

SIMPSON POCKET-SIZE VOLT-OHMMETER

A pocket-sized volt-ohmmeter, *Midgetester 355*, that measures 2 ¾" wide, 4½" high, and 1" thick, has been developed by the Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.

Instrument, which uses a core-type meter movement features 10,000 ohms-per-volt sensitivity on *ac* and *dc* voltage ranges of 0-3-12-60-300-1200 *v*; measures *dc* resistances from 0-10,000-100,000 ohms-1 meg-10 megohms. Accuracy is claimed to be 3% *dc* and 5% *ac* of full scale voltages, and is within 3° of arc from absolute value of resistance being measured. Incorporates full-bridge type rectifier and 1% carbofilm resistors. Complete with probe leads.

Descriptive bulletin *A-55* available.

* * *

APPROVED UHF SIGNAL GENERATOR

A *uhf* (450-900 mc) signal generator, *A-900*, with a cavity tuning system, has been developed by Approved Electronic Instrument Corp., 928 Broadway, N. Y. 10.

Unit also features a 3" calibrated output meter, 1 *v*; 50-ohm terminated output cable; and separate modulation control.

* * *

IFS CAP-CHECK

A capacitor checking instrument, *Cap Check*, designed to permit checking capacitors while in the circuit, has been announced by Instruments For Service, Inc., 96 S. Grand Avenue, Baldwin, Long Island. Unit has a built-in voltmeter and ohmmeter, all using one master function switch.

HICKOK PICTURE TUBE TESTER

A picture-tube tester, *590*, that is said to provide an accurate check of the overall light efficiency of a TV picture tube when used in conjunction with a dynamic mutual conductance tester, has been announced by The Hickok Electrical Instrument Co., 10521 Dupont Ave., Cleveland 8, Ohio. Also checks brilliance, condition of phosphor, possible ion burns and probable future life, emission, shorts, gas content, leakage and grid control.

Unit places a raster on the face of the tube. Tests both electrostatic and magnetic focus, glass or metal-shell types. Measures light with a photoelectric cell. Equipped with single and double ion traps. Provides 7000 *v dc*.

* * *

SENCO POCKET TUBE CHECKER

A pocket-sized filament tube checker, designed to check octal, loctal, and 7 and 9-pin tubes, is now available from the Service Instruments Co., 422 S. Dearborn St., Chicago 5, Ill. Unit, it is said, will check all 600-ma tubes used in series-filament TV sets.

Power is obtained by removing the standard TV line cord from TV set and plugging it into the checker; becomes a neon-voltage indicator if interlock plug is shorted and test leads are used as probes.

* * *

HEATH PORTABLE 'SCOPE

A portable 'scope kit, *OL-1*, has been introduced by the Heath Co., Benton Harbor, Mich.

Employs a 3" picture tube to perform all utility 'scope functions. Instrument features sweep operation up to 100,000 cps, and push-pull deflection amplifiers.

* * *

TELETEST CRT REJUVENATOR AND TESTER

A *Rejuva-Tester*, that is said to combine the separate jobs of testing a picture tube and rejuvenating it, is now available from Tele-Test Instrument Corp., 92-24 Queens Blvd., Rego Park, N. Y. As a tester, the instrument checks picture tubes for inter-element shorts in both hot and cold conditions. It rejuvenates by removing contamination from cathode surface and correcting gassy (soft) picture tubes.

EICO SIGNAL TRACER AND CAPACITOR SUBSTITUTION BOX

A signal tracer kit (also completely assembled), *147*, for *rf*, *if* and audio, has been produced by the Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

Instrument has separate high gain *rf* and low-gain audio input channels. Features 5" built-in speaker and magic-eye monitor for both channels. Noise-locater circuit applies a *dc* test voltage to suspected component and amplifies effect.

A capacitance substitution box, in kit and assembled form, 1120K and 1120, covering the .0001 to .22-mfd range, is also available. Silver-mica and molded plastic tubular capacitors are used. Unit is said to have a minimum accuracy of ±10%.

* * *

EMC BASIC TEST ASSORTMENT

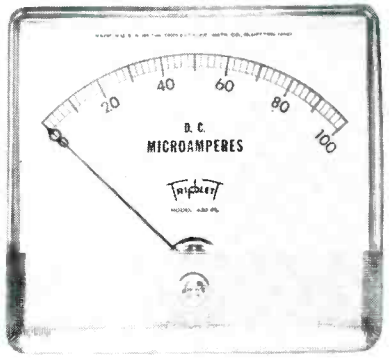
A *basic service shop test equipment*, plan has been announced by Electronic Measurements Corp., 280 Lafayette St., N. Y. Those who purchase the model *106 vtvm*; model *500 rf* signal generator, and model *208* tube tester will receive a picture tube adaptor, and two *Eye Level* instrument stands.

* * *

TRIPLETT FOUR-INCH PANEL METER

A 4" panel meter, *420-P1*, featuring a transparent plastic case with a molded base, is now available from the Triplett Electrical Instrument Co., Bluffton, Ohio.

Case front projects over the rim of the instrument providing, it is said, a longer length of the scale which can be read easier. Available in *dc* pm moving coil and *ac* iron vane types.

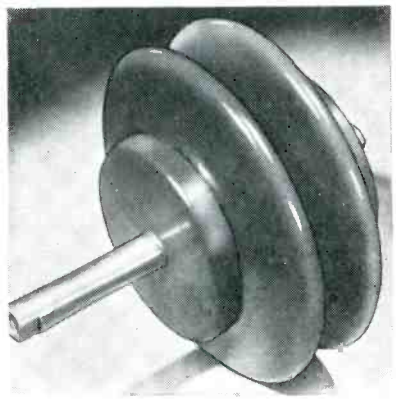


Tools . Parts

AEROVOX HV CERAMIC CAPACITORS

A ribbed-case ceramic capacitor, *Cartwheel*, designed to meet the higher operating voltages of color TV receivers, has been developed by the Hi-Q Division, Aerovox Corporation, Olean, N. Y.

Ribbed construction is said to provide an extra-long creepage path in a relatively small size. Rated at a working voltage of 30 *kv dc;* ceramic is encased in a cast insulating material, and provides an insulation resistance greater than 50,000 megohms. Power factor is 1.5% max, at 1000 cps. Units withstand 37.5 kv after exposure to 200 hours of 90-95% relative humidity at 40° *C*. Standard capacitance is 500 mmfd, with tolerance of +50% minus zero.



* * *

ATR MIDGET INVERTERS

Midget inverters for portable use, equipped with cigarette lighter cord sets, for use on 6- or 12-*v* storage battery systems, have been announced by the American Television and Radio Co., 300 E. 4th St., St. Paul 1, Minn.

When plugged into cigarette lighter receptacle on the dash, unit delivers 110 *v ac* 60-cycle power with output as high as 100 watts.

* * *

VIDAIRE TUBE SOCKET ADAPTER

A tube socket test adapter kit, *AT-K*, that contains three *Adap-Test* units (*AT-1* for octal tubes, *AT-2* for 7-pin miniatures and AT-3 for 9-pin miniatures), has been announced by the Vidaire Electronics Manufacturing Corp., 576 W. Merrick Rd., Lynbrook, N. Y.

Each unit has test points numbered for identification. Extension leads 20" long. Intended for use with any voltmeter.

* * *

RPC METER MULTIPLIERS

Meter multipliers, *MFA* and *MFB*, generally used with one milliampere instruments, as well as other measuring equipment, have been developed by Resistance Products Co., 914 S. 13th St., Harrisburg, Pa.

Each unit consists of a number of multiple pie, non-inductively wound resistors, electrically connected in series. Total voltage is divided into a large number of individual resistor sections with a low gradient between adjacent sections. Resistor assembly is hermetically solder sealed within a glazed steatite tube with metal end ferrules.

IRC RECTANGULAR POWER RESISTORS

Rectangular wirewound power resistor assortments, in 7- and 10-watt sizes, (*19* and *20*) supplied in Resisto-O-Card packages, have been introduced by the International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.

Assortment *19* contains 20 values of type *PW7*, including 3300 and 3900 ohms. Assortment *20* contains 20 values of type *PW10* including the 3300, 3900, and 6000-ohm values. Resistors are of rectangular shape with wirewound elements fully enclosed and sealed in ceramic.

* * *

ESICO LUGER-GRIP SOLDERING IRON

A soldering iron with a *Luger* grip and a fast-heating tip, has been announced by The Electric Soldering Iron Co., Inc., Deep River, Conn.

Contour and size of red, molded Luger-grip handle is said to fit the hand naturally so that balanced, comfortable position lessens fatigue and speeds spot-soldering. Dual or single heat. Twin lights illuminate work. Rests on its side when not in use.

* * *

C-D MIDGET PAPER TUBULAR CAPACITORS

Steatite-cased paper tubular capacitors, *STT Midget Budroc*, miniaturized versions of the regular *Budroc* line, are now available from the Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Capacitors range in size from 7/32" in diameter and 11/16" in length to ⅜" diameter and 1⅛" length. Those rated up to 400 *vdc* are impregnated in *ht* compound and have an operating temperature range from —40° *C* to +90° *C*, while those rated at 600 *vdc* are impregnated in *Vikane* and have an operating temperature from —55° *C* to +100° *C*.

Complete information in engineering bulletin *159*.

* * *

RYTEL PLIERS

The *Probe-O-Pliers*, designed to enable one to work in the smallest quarters in live units without, it is said, danger of shock, is now available from Rytel Electronics, 7100 Avalon Blvd., Los Angeles 3, Calif. At one end, there's a needle nose pliers with ¼" jaw opening that is operated by push-button action. At other end is a spade-shaped probe for scraping solder and checking high voltages, with neon glow warning bulb. Measures 9½" long by ⅝" and is molded of high-impact plastic.

The Model TV-50 GENOMETER

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A. M. Radio F. M. Radio Amplifiers Black and White TV Color TV

7 Signal Generators in One!

- R. F. Signal Generator for A.M.
- R. F. Signal Generator for F.M.
- Audio Frequency Generator
- Bar Generator
- Cross Hatch Generator
- Color Dot Pattern Generator
- Marker Generator

SPECIFICATIONS:

R. F. SIGNAL GENERATOR:

The Model TV-50 Genometer provides *complete* coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics. Accuracy and stability are assured by use of permeability trimmed Hi-Q coils. R.F. is available *separately*, modulated by the fixed *400 cycle sine-wave* audio or modulated by the *variable* 300 cycle to 20,000 cycle variable audio. Provision has also been made for injection of any external modulating source.

VARIABLE AUDIO FREQUENCY GENERATOR:

In addition to a fixed 400 cycle sine-wave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal. This service is used for checking distortion in amplifiers, measuring amplifier gain, trouble shooting hearing aids, etc.

BAR GENERATOR:

This feature of the Model TV-50 Genometer will permit you to throw an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. A Bar Generator is acknowledged to provide the quickest and most efficient way of adjusting TV linearity controls. The Model TV-50 employs a recently improved Bar Generator circuit which assures stable never-shifting vertical and horizontal bars.

CROSS HATCH GENERATOR:

The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines *interlaced* to provide a stable cross-hatch effect. This service is used primarily for correct ion trap positioning and for adjustment of linearity.

DOT PATTERN GENERATOR *(For Color TV)*

Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for *proper color convergence*. When all controls and circuits are in proper alignment, the resulting pattern will consist of a sharp white dot pattern on a black background. One or more circuit or control deviations will result in a dot pattern out of convergence, with the blue, red and green dots in overlapping dot patterns.

MARKER GENERATOR:

The Model TV-50 includes *all* the most frequently needed marker points. Because of the ever-changing and ever-increasing number of such points required, we decided against using crystal holders. We instead adjust each marker point against precise laboratory standards. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc. (3579 Kc. is the color burst frequency.)

The Model TV-50 comes absolutely complete with shielded leads and operating instructions. Only .....

$47.50 NET

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Try it for 10 days before you buy. If completely satisfied *then* send $11.50 and pay balance at rate of $6 per month for 6 months. **No Interest or Finance Charges Added!** If not completely satisfied return to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-98, 3849 Tenth Ave., New York 34, N. Y.

Please RUSH one Model TV-50. I agree to pay $11.50 within 10 days and to pay $6 per month thereafter. It is understood there will be no finance, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name.....

Address.....

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

Rep Talk

MARJORIE KENT has been named executive secretary of The Reps, succeeding *Mrs. Elvera Bendt*, who has resigned. . . . *Ben H. Newman* is now office manager of D. R. Bittan Co., 53 Park Pl., New York 7, N. Y. . . . *Marty Bettan* has been appointed national sales rep for Rogers Electronic Corp. . . . *William J. Purdy Co.*, 312 7th St., San Francisco, Calif., has been appointed rep for the Merit Coil and Transformer Corp., in the San Francisco area. . . . *Bill Kolaus and Co.*, 101 San Felipe Ave., South San Francisco, Calif., will represent Clarostat Manufacturing Co., in northern California (Fresno and areas north to the Oregon line) and Nevada. . . . Instruments for Service Inc., has named the following reps: *L. H. Harris Sales*, 382 Brannan St., San Francisco, Calif. (northern California); *Heeger and Co.*, 1011 Venice Blvd., Los Angeles, Calif. (southern California); *Gordon Fixman Engineering Co.*, 846 Pennsylvania Ave., St. Louis, Mo. (Missouri, Kansas and southern Illinois); *Fred A. Rosenwasser*, 1581 Coventry Rd., E. Cleveland, Ohio (Ohio, western Pennsylvania and Kentucky); *Ray Ripley*, 6633 4th Ave. S., Minneapolis, Minn. (Minnesota, North and South Dakota, western Wisconsin); *Michael A. LaManni Co.*, 115 Garden St., Lawrence, Mass. (New England); *Arthur Harris*, 210-02 43rd Ave., Bayside, N. Y. (metropolitan New York City); *Electronic Sales Corp.*, 136 Liberty St., New York City (Delaware, Maryland, Washington, D. C., New York State, and eastern Pennsylvania); *R. J. Gibbons Electron Sales Co.*, 3051 NW 4th St., Miami, Fla. (Florida); *J. K. M. Associates*, 13 W. Hubbard, Chicago, Ill. (Illinois, Wisconsin and Indiana); *John Zenkas*, 801 Crotona Park N., Bronx, N. Y. (Virginia and southern New Jersey); and *Bert C. Porter Co.*, 4310 Roosevelt Way, Seattle, Wash. (Washington and Oregon). . . . *James W. Eckersley*, 3150 S.W. Hamilton St., Portland, Ore., is now rep for Columbia Wire and Supply Co., in Oregon, Washington, Idaho and Alaska. . . . *Edward W. Brandt and Co.*, 780 Natoma St., San Francisco, Calif. (Nevada and northern California); *Henry Feldman and Co.*, 1244 S. Grand, Los Angeles, Calif. (Arizona and southern California); *Fred Gross Co.*, 3005 Wylie Dr., Dallas, Tex. (Arkansas, Louisiana, Oklahoma and Texas); *Jack Jacobs*, 136 Liberty St., New York, N. Y. (southern New Jersey, Maryland, Washington, D. C., Delaware, and southeastern Pennsylvania); *Charles Scheffler*, 330 Front St., Hempstead, N. Y. (Indiana, Ohio, Michigan, western Pennsylvania, and metropolitan New York); *Rodgers Associates*, 198 Old Farm Rd., Springfield, Mass. (New England); *Arthur Hess*, 62-07 68th Ave., Glendale, N. Y. (upper New York); and *Harry Halinton*, 5500 W. Devon, Chicago, Ill. (Illinois and Wisconsin) have been appointed reps for Authorized Manufacturing Co. . . . *Fred Spellman*, 24 West Dr., Plandome, L. I., N. Y., has been appointed Jensen Manufacturing rep for industrial accounts in the greater New York area. . . . *R. C. Nordstrom and Co.*, 580 N. Woodward Ave., Birmingham, Mich., has been named rep for Tobe Deutschmann Corp., in Michigan, excluding upper Peninsula.

TV Parts... Accessories

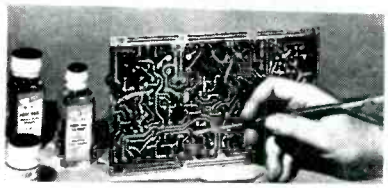
G-C PC REPAIR KIT, CHASSIS SUPPORT, LENS CLEANER

A printed circuit repair kit, *680*, for TV sets using that circuitry, has been developed by the General Cement Manufacturing Co., 919 Taylor Ave., Rockford, Ill.

Kit includes silver print material and silicone resin for protecting silver coating, plus special tools designed to expedite this type of work.

Also available from G-C are *TV Chassis Supports, 9176*, with a pair of steel feet, that permits turning set on its side without harm to either the chassis or picture tube. Support is made of plated steel, with each piece having a cleat and thumb screw to hold set in place. Tool, 11" long, may be fastened to bench for permanent use, or it can be carried in the kit.

G-C has also introduced a 4-ounce squeeze-bottle lens cleaner, *Kleer-Lens, 9081*, which can be sprayed on and wiped off.



Left above: Kleer-Lens; right above, TV supports; and below, PC kit.

* * *

WIN-TRONIX SWEEP CIRCUIT ANALYZER AND YOKE TESTER

A dynamic sweep circuit analyzer, *820*, designed to troubleshoot *b-w* and color horizontal and vertical deflection circuits, has been announced by Winston Electronics, Inc., 4312 Main St., Philadelphia 27, Pa.

Instrument is said to provide 60-cycle vertical sawtooth, 15-kc horizontal sawtooth and deflection transformer drive for both vertical and horizontal sweep-circuit troubleshooting by signal substitution; also said to provide a positive test for flyback transformers and yokes, using an oscillating neon indicator in conjunction with a *dc* amplifier.

A flyback-yoke tester, *810*, to test *b-w* and color horizontal output transformers and yokes, has also been developed by Winston. Instrument provides *good-bad* information by use of a *oscillating neon* indicator driven by a *dc* amplifier. Separate calibrated positions are provided for continuity and shorted turn tests on iron core and air core transformers, as well as yokes.

FEDERAL TVI FILTER

A *pc*-TVI filter, *3-Pi*, is now available from Federal Electronics, Federal Electronics Building, Rockville Centre, N. Y.

Unit is mounted in transparent polystyrene case. Designed to eliminate interfering signals whose frequencies range up to 54 mc.

* * *

POMONA SOCKET SAVER

A socket saver, designed to be installed on tube testers and other electronic equipment to prevent wear and tear of sockets on original equipment, has been introduced by Pomona Electronics Co., Inc., 524 West Fifth, Pomona, Calif.

Available in 7-pin miniature, 9-pin miniature and 8-pin octal types.

BEHR-MANNING PLASTIC TAPE

Vinyl plastic-backed electrical tape (7, 10 and 20 mils thick) *Behr-cat, (507, 510* and *520)* is now available from the Behr-Manning Corp., Troy, N. Y.

* * *

STANCOR ADMIRAL FLYBACK

Three exact replacement flybacks, *A-8253-4-5*, for Admiral TV chassis, have been introduced by the Chicago Standard Transformer Corp., Standard Division, Addison and Elston, Chicago 18, Ill.

Bulletin *501* provides a listing of Admiral chassis in which these units can be used as replacements.

Service Engineering

(*Continued from page 26*)

power output is in the order of one to two watts. There are, however, intercom masters with more elaborate amplifiers with power output ratings up to ten watts. Many of the lower-priced intercom master units employ *ac-dc* amplifiers, whereas the more expensive units are equipped with line isolating power transformers and are operable only on *ac*.

A typical intercom master unit amplifier uses three tubes; a dual triode cascaded, a beam output power tube and a rectifier. The input and output impedances may be 4, 40 or 600 ohms, depending upon the design.

The talk-listen switch in normal or standby position connects the master-unit loudspeaker to the output of the amplifier and the circuitry of the remote station selector switch to the input. When a call is to be placed, the selector switch, which may be a push-button assembly or a wafer switch, is set to the desired remote station, and the talk-listen switch is operated causing the master unit loudspeaker to be connected to the input of the amplifier and the remote unit through the selector switch to the output. To receive a reply, the talk-listen switch is released, so that the remote unit is connected to the input and the master unit loudspeaker is connected to the output.

Since a *pm* speaker serves as a sensitive microphone, it is capable of picking up sounds from a considerable distance and it is generally necessary only to speak up to be heard, and unless the gain is turned way down it is seldom necessary to talk right into a remote unit loudspeaker when used as a mike.

To meet special application requirements it may be desirable to add volume controls, telephone-type receivers and booster amplifiers. Generally, only one volume control is provided; this regulates incoming level to the master unit or in some cases both incoming and outgoing levels. Often, this is inadequate because different sound levels may be required in different areas. The installation of an L or T-pad at the remote unit does not solve the problem, because cutting the output level of the remote speaker in this manner will also decrease its sensitivity as a microphone.

An auxiliary volume control may be added to the master unit to regulate incoming signals without effecting the outgoing signal level. A typical circuit is shown in Fig. 3 (p. 26). However, this control affects the incoming level of all remote units and requires readjustment for different remote stations. To regulate the incoming signal level from one or more remote units requires additional wiring between remote units and the master unit, or trick circuitry at the master unit.

For privacy, it is sometimes desirable to install a telephone-type receiver at the master unit. A hangup switch, which permits reception through the loudspeaker when the receiver is on the hook, can be used. Removal of the receiver from the hook cuts off the loudspeaker; Fig. 4 (p. 26).

HALF-MILLIONTH ANTENNA

Honorary Mayor of Canoga Park, California, Bob Burns, receiving half-millionth Clear Beam antenna, manufactured in company's new Canoga Park plant at 21341 Roscoe Boulevard, from Carol Haworth, Miss Canoga Park of 1954, as Harold Florence, president of Clear Beam Antenna Corp., looks on.

NEWS

JENSEN NEEDLE WALL CHART AND GUIDE

A phono needle wall chart, that is said to list every needle used in all cartridges now on the market, and also offers needle silhouettes for matching customer needles to the proper cartridge, has been announced by Jensen Industries, Inc., 7333 West Harrison, Forest Park, Ill.

Two-color chart lists durosmium, sapphire and diamond point needles.

A needle guide, *Jenselector*, that lists phono brand name, number of speeds, method of switching or removing the needle, with a cross-reference system for selecting the correct needle out of the more than 2500 possible choices, has also been announced.

Features a *test-yourself* gimmick on the back of the guide. Edition illustrates eight needle-switching techniques and seven removal methods for all current types of cartridges.

* * *

CARPENTER TO DIRECT REWRITING ELECTRIC CODE'S ARTICLE 810

Doug Carpenter, chief antenna engineer for the JFD Manufacturing Co., Inc., will serve as chairman of a RETMA committee, who will modernize the National Electric Code in accordance with new electrical developments. The modification request was submitted by the National Fire Protection Association.

The committee will rewrite Article 810 of the code, detailing proper installation techniques for transmitting and receiving television antennas, accessories and masting, and amateur radio transmitting and receiving systems.

To date, the members of the community section of the committee are: Lew Bonn, Lew Bonn Co.; H. M. Carpenter, Thurow Distributing; Jack Fisher, Radio Supply; Philip Gustafson, Hughes Peters Co.; Benjamin Krell, Dixie Radio Supply; and Fred Morris, Specialty Distributors.

Members of the industry section are: Ernest Amy, Amy, Aceves & King; J. B. Baxter, Cornish Wire Co.; Albert J. Borelli, National Electric Products Corp.; David Callahan, RCA Service Co.; J. T. Feehry, Montgomery Ward; Franklin D. Hurd, Walsco Electronics Corp.; Kendrick Lippert, Technical Appliance Corp.; William Rickards, Ward Products Co.; H. R. Pugh, Electronics Physics Lab.; R. C. Smith, RCA Service Co., and John W. Spack, American Phenolic Corp.

Arne Benson, JFD Electronics; and George Gimberling, Alliance Mfg. Co., will be rotator advisors.

Carpenter is also chairman of the RETMA antenna committee.

* * *

B-T ADDS NEWARK PLANT

A second plant, located in Newark, N. J., that provides over 30,000 square feet of additional manufacturing space, has been placed in operation by Blonder-Tongue Labs, Inc., 328 North Ave., Westfield, N. J.

Plant is said to be equipped and staffed with technical and production personnel to do contract manufacturing of commercial electronic equipment.

CHANNEL MASTER ADDS TEN DISTRIBUTORS

Appointment of ten new distributors has been announced by the Channel Master Corp., Ellenville, N. Y.

They are: C & O Electronics, 500 N. Third St., Monroe, La.; Central Mo. Dist. Co., Coats & Clark Sts., Moberly, Mo.; Standard Electronic Dists., 523 West Popular St., Harrisburg, Ill.; Wabash Electronics, 700 Plum St., Mount Carmel, Ill.; Warren Radio, Inc., 1057 S. Main St., Meadville, Pa.; Ewald Distributing Co., 309 South 9th St., Louisville, Ky.; Clyde E. Shaw, 200 So. Darling St., Angola, Ind.; Purchase Radio Supply, 605 Church St., Ann Arbor, Mich.; Main TV Supply Co., 1013 N. Main St., Akron, O.; and C. A. Winchell, 149 Main St., Cortland, N. Y.

ED BERLIANT ACQUIRES INSTRUMENTS FOR SERVICE

Edward Berliant, associated with the radio, TV and electronic fields for the past 25 years, has acquired control of Instruments for Service, Inc., 96 S. Grand Avenue, Baldwin, L. I.

Firm is engaged in manufacturing the *cap-check*.

* * *

DAYSTROM BUYS HEATH

Daystrom, Inc., 200 Elmore Ave., Elizabeth, N. J., has announced the purchase of the Heath Co., Benton Harbor, Mich. Company will be operated as a Daystrom subsidiary.

Robert Erickson, vice president of Daystrom, has been appointed president of Heath, while continuing as an officer of the parent organization.

WHEN YOU CHANGE YOUR ADDRESS

Be sure to notify the Subscription Department of SERVICE at 52 Vanderbilt Avenue, New York 17, N. Y., giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additonal postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

PERSONNEL

HAROLD F. BERSCHE has been appointed manager, marketing services department, tube division, RCA. . . . DURWARD M. BRANIGAN, formerly promotion manager for the receiving tube and transistor marketing department, has been named manager, distributor sales.

* * *

KENNETH S. BROCK, formerly ad manager for the electronics division of The Gabriel Co. prior to his entering the Army, is now sales and ad manager of Browning Laboratories, Winchester, Mass.

* * *

WILLIAM H. KELLEY has been elected vice president and general manager of all of the DUMONT manufacturing and sales divisions.

* * *

ROBERT G. SCOTT has been named general sales manager of DuMont's cathode-ray tube division, succeeding WILLIAM C. SCALES, who has been appointed manager of the DuMont receiver sales division.

* * *

EDWARD M. CAPPUCCI, formerly general manager, has been named director of sales of Radio Merchandise Sales, Inc., 2016 Bronxdale Ave., New York 62, N. Y.

* * *

WILLIAM H. MCREDMOND has joined the field service engineering staff of Crescent Industries, Inc., Chicago, Ill. McRedmond will assist LEE HICKS, service manager, in the appointment and establishing of factory service centers for *hi-fi* phonos, tape recorders and changers.

* * *

MORRIS SALIT has been appointed president of Industrial TV Utilities Co., 20 Vesey St., New York, N. Y. Salit will be responsible for the promulgation of a line of TV systems for multiple dwellings.

* * *

DR. A. MELVIN SKELLETT has been named director of color television tube planning and development for Tung-Sol Electric Inc.

* * *

MARION PETTEGREW has been appointed general manager of the parts division of Sylvania Electric, and will headquarter in Warren, Pa. . . . ROBERT G. LYNCH has been named assistant regional manager for equipment sales in the Eastern region.

* * *

LAWRENCE E. KEARNEY has been named sales manager of LaPointe Electronics, Inc. He has been with LaPointe since 1950, serving as design and sales engineer.

* * *

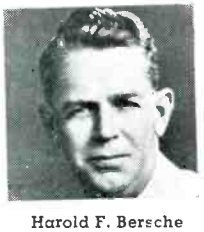

Dr. A. Melvin Skellett


Marion Pettegrew


William H. Kelley


Edward M. Cappucci


Durward M. Branigan


Harold F. Bersche

Catalogs-Bulletins

LEONARD RADIO INC., 69 Cortland St., New York 7, N. Y., has published a 160-page hi-fi *Audio Reference Guide*, listing hi-fi components and packaged units, including specifications and dealer net prices. Features an 18-page introduction describing the purchase and assembly of sound systems.

* * *

STACKPOLE CARBON CO., Electronic Components Division, St. Mary's, Pa., has issued an 8" x 11" plastic wall chart, which lists on one side, ½-, 1- and 2-watt fixed composition resistors in 269 RETMA preferred values from 10 ohms to 22 megohms, with tolerances of 5-10-20%, and 46 RETMA values for fixed composition capacitors from .10 to 10 mmfd, on the other. Also contains an explanation of the 3- and 4-band color code.

* * *

ROCKET DEVICES CORP., (division of *Star Expansion Bolt Co.*) 142 Liberty St., New York 6, N. Y., has released a catalog sheet, describing *Wallgrips*, a hollow wall screw anchor with ribbed locking wings, for fastening loudspeaker enclosures, brackets, etc. Also describes a special wrench that fits into holes in the collar of the bolt to keep it from turning while tightening.

* * *

CARTER MOTOR CO., 2644 N. Maplewood Ave., Dept. 34, Chicago 47, Ill., has issued catalog *155*, listing a line of dynamotor power supplies. Includes descriptions of *Change-A-Volt* dynamotor, which, it is said, permits use of 6-*v* mobile radio equipment in new cars without rewiring or tube replacement.

CINEMA ENGINEERING CO. DIVISION, Aerovox Corp., 1100 Chestnut St., Burbank, Calif., has issued a bulletin *C1034*, describing *PW* resistors for automation and printing wiring. Resistors are encapsulated in cast epoxy.

* * *

CLAROSTAT MANUFACTURING CO., INC., Dover, N. H., has prepared bulletin *753813* (*Linearities Defined and Compared*), designed to aid in the selection of the type of linearity which the application of a potentiometer demands; independent, zero-based, terminal and index-point types are detailed.

* * *

FRANK L. CAPPS AND CO., 20 Addison Pl., Valley Stream, N. Y., has published a 4-page brochure, describing a line of dynamic and capacitor microphones.

* * *

OHMITE MANUFACTURING CO., 3603 Howard St., Skokie, Ill., has released data on a code system used to identify power type wire-wound resistors in the latest issue of *Ohmite News*. Also detailed are tandem rheostat assemblies.

* * *

TOBE DEUTSCHMANN CORP., Norwood, Mass., has issued 2-page bulletin *F-102* (*Guide to Specification of Interference Filters*) with 27 electrical, environmental and mechanical check points that one should be familiar with in selecting and specifying noise filters. Includes a db-conversion chart.

Community TV System

(*Continued from page 25*)

gether into a single unit. A rubber-tired pulley inside of the back end of the machine furnishes the driving power for turning the movable part. Pulleys lead the coax cable into the slot, and the whole unit is supported by and rolls on others, along the messenger.

To set up the spinner, latches are opened and the spinner set astride the messenger cable. The coax is then fed into a slot in the bottom of the unit. The latches are then closed, and the *spinning-wire* is then brought over a pair of spools (Fig. 4; p. 24) to insure the proper tension being applied; it is then firmly clamped to the messenger cable, by means of a special bronze clamp; Fig. 5 (p. 24). In operation, the front end of the spinner, also the rear section, remain stationary, with respect to the ground, while the center section, carrying the reel of spinning wire, revolves, wrapping the spinning wire spirally around the two cables. The unit is moved from one pole to another by means of a rope, pulled by a man on the ground. Behind it, the coax cable is firmly lashed to the steel messenger; Fig. 6 (p. 24).

At each pole, the spinner must be dismounted, the spinning wire cut and tied off, and the spinner remounted on the other side of the pole. By the way, *when the coax is brought past each pole, a loop must be left!* This is necessary to compensate for the unequal rate of expansion of the steel messenger cable and the plastic coaxial cable. If this is not done properly, trouble may result in the future. Of course, when passing a pole earmarked for the installation of a future line splitter, tapoff or amplifier, a larger loop should be left, to allow for connection to the amplifier.

The distribution amplifiers are usually mounted on the poles, using a pair of standard *crossarms,* as used to carry telephone wiring. These are fastened to the pole with regular *pole hardware.* Operating power is generally supplied to these amplifiers through a *meter-loop* mounted on the same pole. In some cases, only certain amplifiers have their own meters; the actual current consumed is checked, and the result multiplied by the total number of amplifiers, which are then charged out on a flat-rate basis. This avoids the need for meters on each amplifier in the system.

In certain installations, the line amplifiers are not used as distribution points, but *line-splitters* are used instead. These are simply small matching-transformers used to equalize the impedance of the different tapoffs and provide proper termination for the lines, to avoid reflections, ghosts, and other troubles. For instance, one tapoff used in our system (Fig. 8; p. 24) has a total of 5 taps, going to nearby subscribers' homes. Coming off the main RG11/U cable, the smaller RG59/U cables feed the signals to the subscribers. For best results, these tapoffs must be made and installed with marked care.

[To Be Continued]

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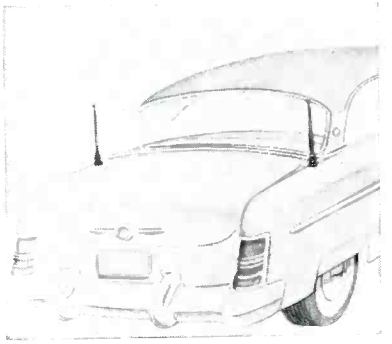
REAR-DECK AUTO ANTENNAS



Rear-deck dual auto antenna, designed to complement the lines of the new cars, now being marketed by Snyder. Has two three-section staffs, 13½" high when collapsed, and 27" high when extended. They are adjustable to 180°. Available in the swivel type (RD-8 and in RD-8B for country and low-signal area reception) and in the ball and socket type (RD-9 and RD-9B). Available for installation is a 22' hi-Q coax cable harness consisting of a 15' length (rear deck to radio), a 7' length T-connector lead (antenna to antenna), and one M/P plug adapter. Shielded cable interconnects dual antennas to the car radio and abolishes splicing and taping.

On Book Row

RADIO RECEIVER SERVICING . . . By JOHN T. FRYE: A simplified 15-chapter text, with sections covering no reception, unsatisfactory reception, intermittents and miscellaneous service problems. Chapters treat: *ac* receivers; *ac-dc* receivers and *ac-dc* battery receivers. . . . *192 pages, 5½"x8½", paper bound, priced at $2.50; Howard W. Sams and Co., Inc., 2201 E. 46th St., Indianapolis 5, Ind.*

* * *

INTRODUCTION TO UHF CIRCUITS AND COMPONENTS . . . By MILTON S. KIVER: A basic volume, reviewing circuits and components for those charged with production, maintenance and installation of *uhf* equipment. There are explanations of *uhf* for TV, microwave relay stations, *uhf* receivers and transmitters, resnatron and traveling-wave tubes, klystrons and magnetrons. Transmission lines, wave guides, *uhf* antennas and measurements are also covered. . . . *415 pages, 6"x9", priced at $7.50; D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y.*

* * *

UNDERSTANDING HIGH FIDELITY . . . By LOUIS BIANCOLLI AND LESTER H. BOGEN: Second, enlarged edition. Covers custom high fidelity in two parts; understanding high fidelity, and a guide to selecting and installing hi-fi equipment. The first section explains hi-fi in layman terms, while the second section details the numerous types of equipment available and how to utilize them in making up a custom home music system.—*56 pages, 6"x9", paper bound, priced at $.25; David Bogen Co., Inc., 29 Ninth Ave., New York 14, N. Y.*

* * *

TV MANUAL, VOLUME 14: Factory-authorized, factory-prepared service information on TV receivers produced during 1954. Includes all the schematics, chassis views, circuit descriptions, voltage data, alignment information, and other data which apply to all the production runs of each receiver. Also features service data on the large-screen color receivers produced by CBS-Columbia and Motorola.—*2,300 pages, 8½"x11", loose-leaf bound, priced at $24; John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y.*

* * *

THE BOOK OF THE TRANSISTOR . . . By J. S. KENDALL: A practical book with step-by-step instructions on the construction, forming, and testing, of home-made transistors. Basic and combination transistor circuits are featured. Chapters (seven) cover home construction; testing transistors; transistors and their peculiarities; power supplies for transistors; the transistor as an oscillator; and unusual transistor circuits.—*48 pages, 6½" x 10", paper bound, priced at $.56 (Remit International Money Order for 4 shillings); Bernards Publishers Ltd, The Grampians, Western Gate, London W6, England.*

RF Signal Pickup

(Continued from page 29)

dance in series with the grid circuit.

A quick setup that has been found to cure this difficulty revolves about the installation of a 75 to 100,000-ohm resistor, in series with the grid circuit, as shown in Fig. 4. This addition will form an effective filter.

However, if this does not satisfactorily eliminate grid rectification, more elaborate circuit changes will be required, as shown in Fig. 5.

The installation of an *rf* choke of 1 millihenry or larger presents a high impedance to any *rf* voltage induced in the circuit and it will block a large portion of the interference from reaching the grid of the tube.

If appreciable *rf* voltage is still present at the grid, it can be reduced to a non-objectionable level through the use of a capacitor of between 50 and 300 mmfd, connected between grid and ground, as shown in Fig. 5. This capacitor will short circuit or act as a low-impedance path to ground for the interfering *rf* voltages.

Usually the grid-leak resistor can be reduced to a value as low as two megohm without materially affecting the audio gain and fidelity designed into the circuit. In making these changes one should not install components of a value that will noticeably affect the overall audio fidelity and gain performance. Up to the limit of the desired audio range the inductive reactance of the *rf* choke coil should be very small and the capacitance reactance of the capacitor should be very large.

The capacitor, choke and grid-leak resistor should be installed right at the tube socket terminals with the leads maintained as short as possible.

Some of the *rf* fields that exist in areas adjacent to broadcast transmitter antennas are extremely strong. There have been cases where it was believed to be impossible to clean up the interference signals emanating from a local radio station, and people living in the immediate vicinity were forced to live with the annoyance.

The modification, shown in Fig. 5, is most effective, but there have been very stubborn cases in which even more complex changes were necessary to remedy completely the condition.

As pointed out, *rf* pickup on the volume control leads running around the front of the chassis is one of the major causes of this type of interference. These leads are too often long enough to have induced across them a considerable voltage. Shielded cable should be installed in place of the lead going to the top of the volume control as well as the lead to the variable arm. Actual shielding of the resistors and capacitors, such as the grid leak and plate load resistors, may be required; it might also be necessary to shield the audio circuit wires.

[Concluding Installment, Next Month]

Fig. 4. Reduction of rf signals that are rectified at the audio amplifier grid can be accomplished with the insertion of a 75 to 100,000-ohm resistor as shown.

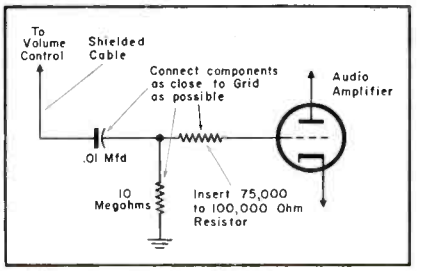
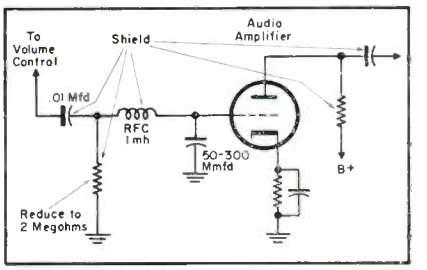


Fig. 5. The changes shown in this schematic will reduce the rf voltage at the audio grid to a level that will be too small to be detected.



ADVERTISERS IN SERVICE FEBRUARY, 1955

Color Bands and Codes

Answers To Questions On Pages 21 and 68

For Fig. 5

(1) 3300 ohm (± 10%) molded composition resistor

(2) 1.0 mmfd (± 10%) molded capacitor

(3) 470,000 ohm (± 5%) molded composition resistor

(4) 1.5 mmfd (± 10%) molded capacitor

(5) 330 ohm (± 10%) molded wire wound resistor

(6) .56 *uh* (microhenry) molded *rf* choke

(7) 3300 ohm (± 10%) molded composition resistor*

(8) 7.5 *uh* (microhenries) molded *rf* choke

(9) 33000 (± 10%) molded composition resistor

(10) 82 mmfd (± 10%) molded capacitor

(11) 3300 ohm (± 10%) molded composition resistor*

(12) 1.5 *uh* (microhenry) molded *rf* choke

(13) 3300 ohm (± 10%) molded wirewound resistor*

(14) 24 *uh* (microhenries) molded *rf* choke

(15) 3300 ohm (± 10%) molded wirewound resistor*

(16) 2 *uh* (microhenries) molded *rf* choke

For Fig. 6

R_5: Resistor, 150 ohms, ± 10%
R_{12}: Resistor, 47,000 ohms, ± 10%
R_{21}: Resistor, 100,000 ohms, ± 10%
L_{2002}: RF choke, 2.2 *uh*

For Fig. 7

(Colors, from left to right)

C_5: 6 mmfd (blue, black, white, silver)
R_1: 100 ohms (brown, black, brown, silver)
C_{2010}: 18 mmfd (silver, brown, gray, black, white)
R_{30}: 220 ohms (red, red, brown, silver)
C_{2008}: 82 mmfd (silver, gray, red, black, white)
C_{33}: 1.5 mmfd (brown, green, white, silver)
R_{2002}: 27,000 ohms (red, violet, orange, silver)
L_{2005}: 2.2 *uh* (red, red, silver)
R_{29}: 470,000 ohms (yellow, violet, yellow, silver)

*Variation in sizes are due to difference in wattage ratings; this subject will be reviewed in an early issue of SERVICE.

JOTS AND FLASHES

PARKING-LOT space-spotting by closed-circuit TV is now being used by the Downtown Merchants Parking Association for their 225 by 300-foot site in Oakland, Calif., according to the engineering products division of RCA. Attendant at entrance booth hastens spotting by looking at monitor and then directing motorists to vacancies on lot. A pan and tilt mechanism enables camera, mounted atop a light standard overlooking lot, automatically and continuously to scan parking area and project what it *sees* to a 21-inch receiver in booth. . . . *CBS-Columbia* has entered the industrial TV field and will manufacture closed-circuit industrial color-TV equipment. . . . *Recoton Corp.* is now located at 52-35 Barnett Ave., Long Island City 4, N. Y. . . . *F. P. Rice* is now director of manufacturing and purchasing for Allen B. DuMont Labs, Inc. Rice, who had been manager of DuMont's *crt* division, will supervise manufacturing and purchasing activities of the company's instrument, *crt*, communication products, government contracts, and receiver manufacturing divisions. . . . *Superex Electronics Corp.* has moved its offices and factory to 4-6 Radford Pl., Yonkers, N. Y. . . . *James D. McLean* has been appointed vice president—sales, of the Philco government and industrial division. . . . *Sylvania Electric* has commenced manufacturing operations in the TV picture tube plant owned formerly by National Union Electric Corp., in Hatboro, Pa. With the purchase of this plant, Sylvania's picture tube division now has a total of approximately 800,000 square feet of floor space. . . . *CBS-Hytron* is now preparing to sample the industry with a 22-inch rectangular color picture tube developed for mass production. Manufacture of the round color tube was concluded in December to concentrate engineering efforts on the rectangular model. . . . *Ben Snyder*, head of Snyder Manufacturing Co., and *Dick Morris*, sales manager, are now on a tour of the midwest and west coast markets. Included in the itinerary are Chicago, Dallas, Houston, Los Angeles, Seattle and Kansas City, Mo. . . . *Fretco Inc.*, recently announced its first anniversary in the field of semiconductors; transistors, diodes, photodiodes and crystal triodes. . . . *Sands Associates*, industrial marketing firm headed by Leo G. Sands, has moved to new quarters in the Miller Building, 136 E. Figueroa St., Santa Barbara, Calif. . . . *H. Ward Zimmer*, president of Sylvania Electric, died recently, after a brief illness.

P R MALLORY & CO. Inc. MALLORY APPROVED PRECISION PRODUCTS

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THE MALLORY *25th Anniversary* VIBRATOR

Now hear this! (if you can)

The Mallory 25th Anniversary Vibrator is the quietest ever...

You've never heard a vibrator as silent as the new Mallory 25th Anniversary model. Mechanical hum and shake are reduced practically to zero... by a unique "floating" design* that isolates the vibration of the reed element from the case. Hum is squelched to a level never before possible.

The experience of 25 years of pioneering development... and the manufacturing know-how gained by making more than 60 million vibrators... went into this latest Mallory model. Always the leader in performance, and in usage by service men and manufacturers alike, Mallory vibrators are now better than ever!

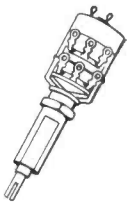
NO EXTRA COST. The new, ultra-quiet vibrators cost no more than previous models. They're a real bargain in performance.

NO CHANGE IN PART NUMBERS. Order by the same catalog numbers—and you'll automatically get the improved model.

Get ready to give your customers the best, by ordering your supply today from your nearby Mallory distributor.

**Patent applied for*

ON AUTO RADIO JOBS
BE SURE TO USE... *MALLORY MIDGETROLS*



The fast, sure way to get tailor-made replacements for carbon volume controls. High stability resistance elements, with accurate tapers. A small stock equips you to replace practically any control. In single and dual concentric types.

P R MALLORY & CO. Inc. MALLORY

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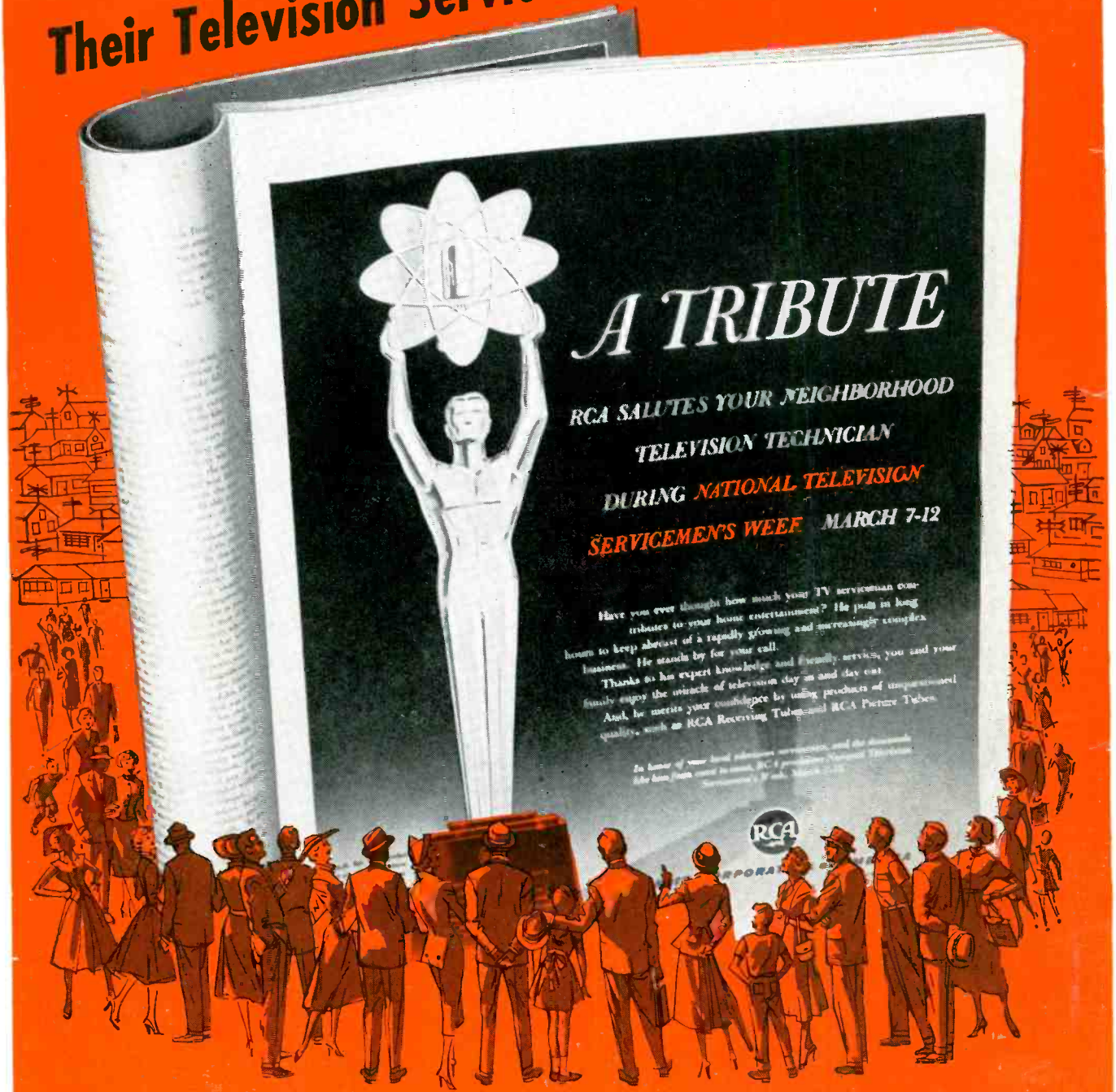
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

Millions of TV Owners Who Read LIFE will read about you . . . Their Television Serviceman . . . on March 7th



In the March 7th issue of LIFE magazine, readers all over America will see a special advertisement, sponsored by the RCA Tube Division, paying tribute to local television servicemen and dealers everywhere. This will mark the opening of the consumer phase of National Television Servicemen's Week—a perfect opportunity for you to tell your story to your community.

SEE your RCA Tube Distributor NOW

. . . for details about NATIONAL TELEVISION SERVICEMEN'S WEEK (March 7-12). Be ready to take full advantage of this big event planned by RCA—exclusively for YOU!

RCA®

RADIO CORPORATION of AMERICA

ELECTRON TUBES HARRISON, N.J.