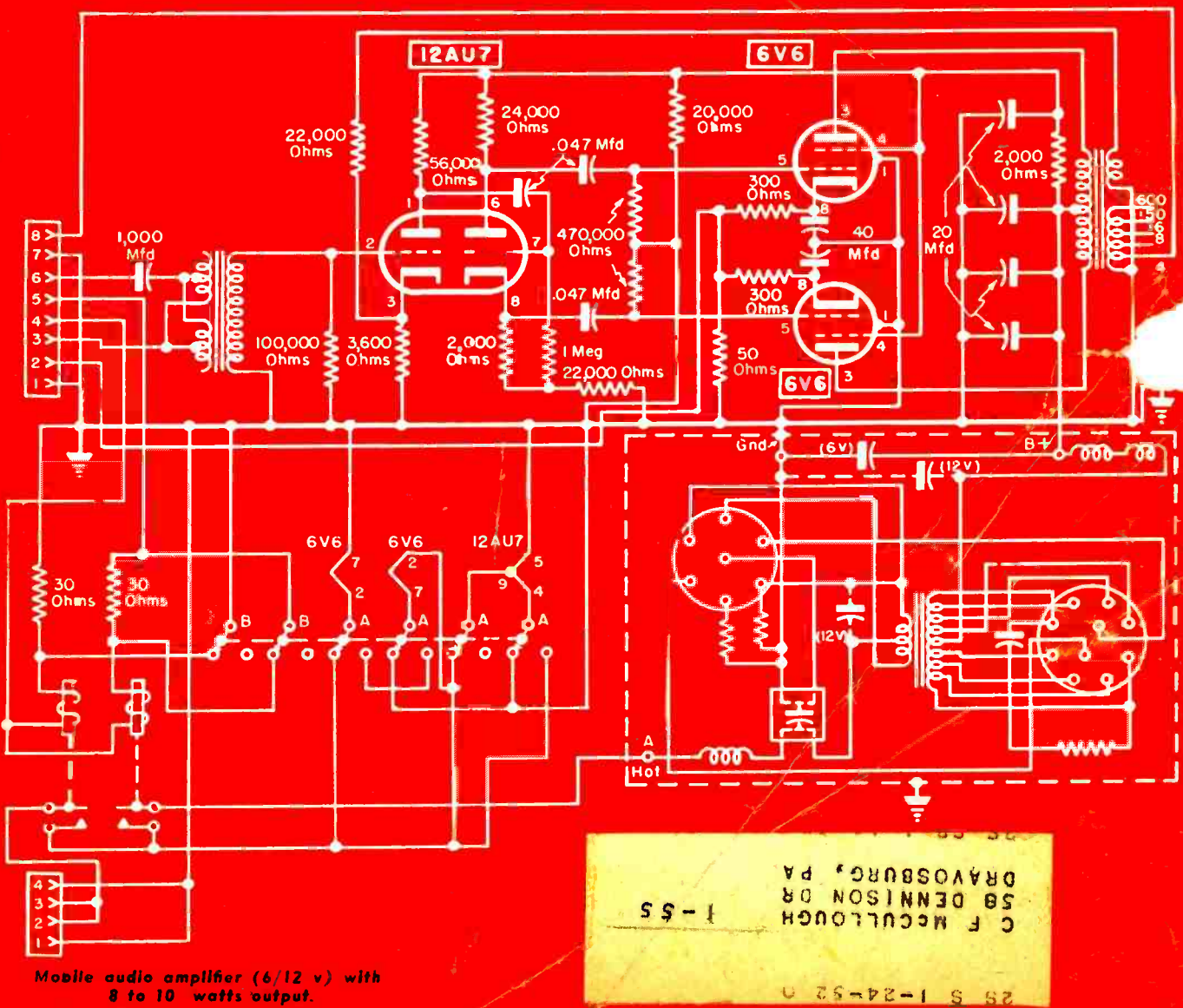
RADIO • TELEVISION • ELECTRONIC

SERVICE

VOL. 22

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

OCTOBER 1953

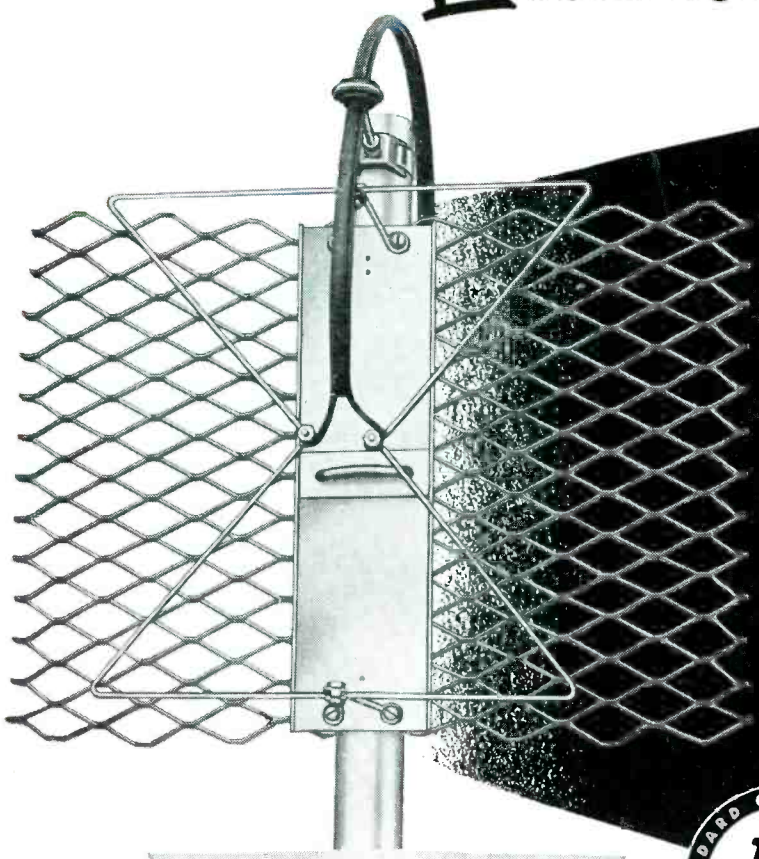


Mobile audio amplifier (6/12 v) with 8 to 10 watts output.

(See circuit analysis, this issue)

another original!

Entirely New!

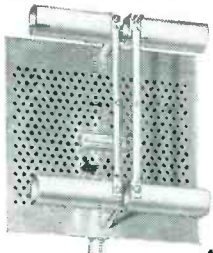


The last word in UHF TV Antennas the UW-2

Here is another ORIGINAL . . . entirely NEW UHF TV antenna that far excels anything yet seen! It is a completely balanced broad band antenna covering ALL channels from 14 to 82 and terminating in 300 ohms with a very low voltage standing wave ratio! Some of the features include:

- Minimum wind resistance, (a double stacked UW-2 offers less wind resistance than many single bay antennas).
- The UW-2 assumes NO potential difference between itself and the mast, allowing MAXIMUM lightning protection when the mast is grounded.
- COMPLETELY FREE of insulators and their offending results.
- Excellent directivity, single lobe horizontal field pattern, 470 to 850 M.C.

Here's The One They've All Copied!



...NOW AT NEW LOW PRICES

UHF TV Antennas MODEL U-4

A superb quality UHF antenna featuring uniform gain with low vertical radiation (no ghosts). 300 ohm terminal impedance . . . measures 12x12x15 inches.

STANDARD OF COMPARISON RADIART

SUBSIDIARY OF CD

THE RADIART CORPORATION CLEVELAND 13, OHIO

VIBRATORS • AUTO AERIALS • TV ANTENNAS • ROTORS • POWER SUPPLIES

ASTRON *SM** CAPACITORS

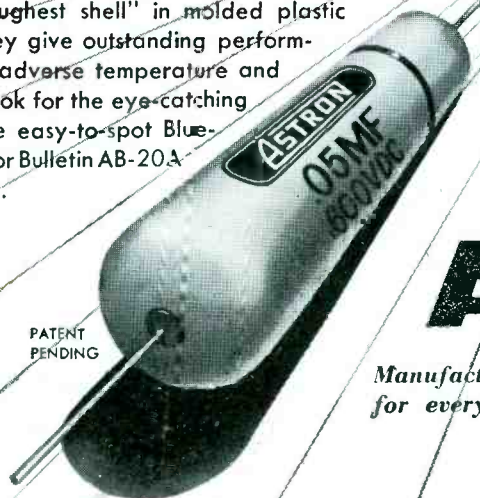
These SAFETY MARGIN capacitors offer the assurance of greater all-around built-in dependability because of the most exacting engineering specifications. To you, as it does to thousands of other service men, SM* means absolute customer satisfaction.

ASTRON *SM** TWIST PRONG

dry electrolytics are individually tested and guaranteed. They have earned wide acceptance by original equipment manufacturers. For quality replacement, you can rely on Astron's high standards of quality manufacture. Your jobber stocks all popular replacement ratings. Catalog AC-3A lists all available SM twist prong ratings.

ASTRON *SM** BLUE-POINT*

fabulous new member of the Astron line, offers the "tightest seal and toughest shell" in molded plastic paper capacitors. They give outstanding performance under the most adverse temperature and moisture conditions. Look for the eye-catching yellow jacket with the easy-to-spot Blue-Point end seal. Write for Bulletin AB-20A for the complete story.



*Trade Mark

PATENT PENDING

DEPEND ON—INSIST ON

ASTRON

Manufacturers of a complete line of capacitors and filters for every television, radio and electronic application.

ASTRON CORPORATION 255 GRANT AVE., EAST NEWARK, NEW JERSEY

ASTRON CORPORATION

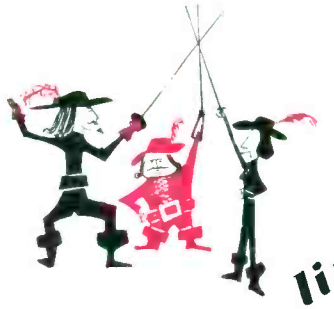
In Canada: Charles W. Pointon, 1926 Gerrard St. East, Toronto

NEW JFD "3-in-one" LIGHTNING ARRESTER

No. AT110 with hardware for wall or window sill mounting, $1.50, list.

No. AT110S with stainless steel strap for pipe mounting, $1.75 list.

Both feature the patented JFD strain-relief lips which prevent contact washers from ripping the lead-in wires apart!



one for all . . . all for one

1. for UHF or VHF tubular twin lead
2. for VHF flat twin lead
3. for VHF or UHF open wire

JFD Electronics

Burton brotherton advertising

JFD MANUFACTURING COMPANY, INC.

World's largest manufacturer of tv antennas and accessories; Brooklyn 4, New York

Use the JFD Cascode Yagi . . .

Put an end to "GOLDFISH BOWL" reception!

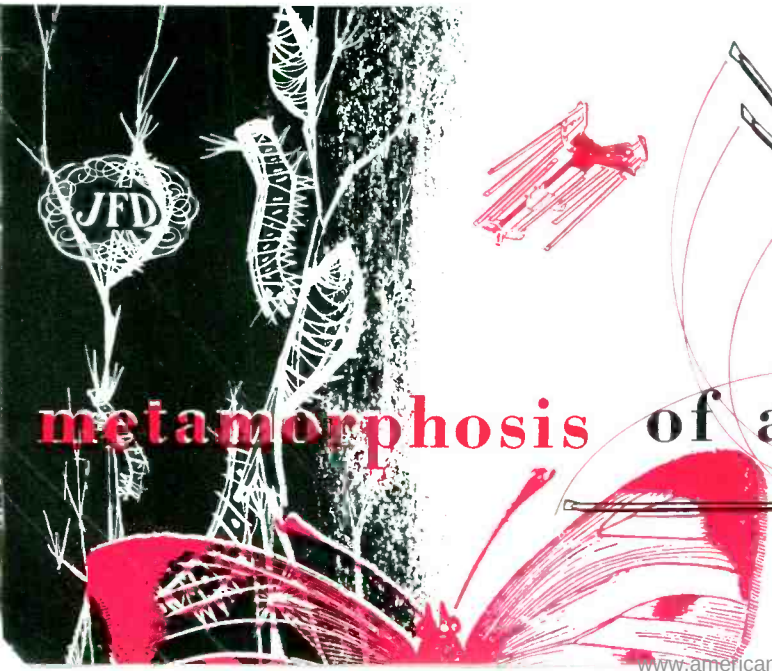
For sets whose TV world is as limited as the goldfish world, JFD teams up the gain and directivity of the Yagi with the broad band coverage of the all-channel antenna. The JFD Cascode Yagi crashes through the fringe barrier to bring brilliant VHF reception to formerly barren TV areas. Noteworthy too: the famous JFD "Baline" Balanced Line design, the aircraft aluminum construction and the "Quik-Rig" pre-assembly. Write for bulletin 207A.

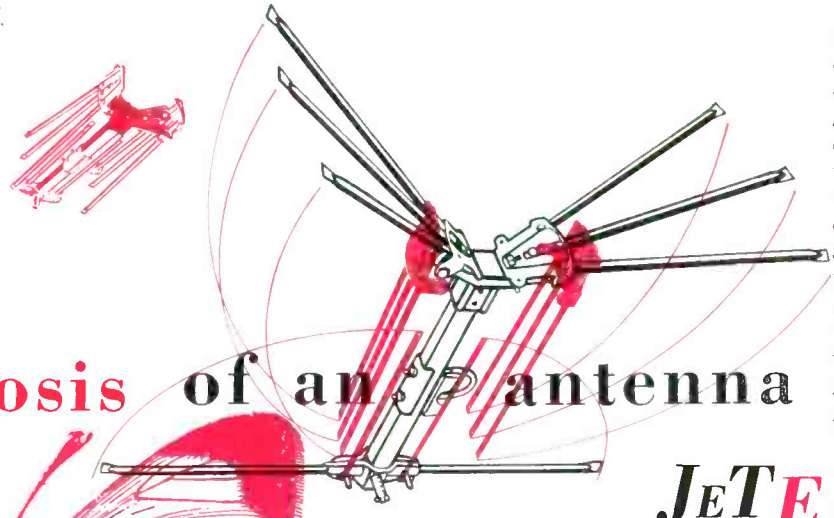
Order today in 5 or 10 element designs (5B or 10B series)

JFD MFG. CO., BROOKLYN 4, N. Y.
World's largest manufacturer of television antennas and accessories

5-Element Cascode Baline Yagi
Models
5B26 5B2345
5B345 5B3456
5B456 5B713

10-Element Cascode Baline Yagi
Models
10B26
10B2345
10B3456
10B456
10B713





metamorphosis of an antenna

Like a butterfly emerging from a cocoon, the JFD *JETENNA* is practically ready for work when it emerges from the carton! No other fan conical assembles so fast — performs so well! Available in single, two or four bays; including models JET 660, JET 661, JET 664. Write for bulletin 165.

JETENNA

JFD MFG. CO., BROOKLYN 4, N. Y.
World's largest manufacturer of TV antennas and accessories.

Vol. 22, No. 10

RADIO · TELEVISION · ELECTRONIC

SERVICE

October, 1953

LEWIS WINNER
Editor

B. BLOCK
F. WALEN
Assistant Editors

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CIRCUITS

COVER

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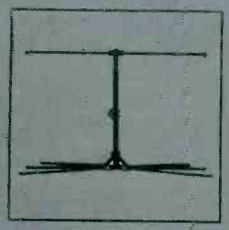
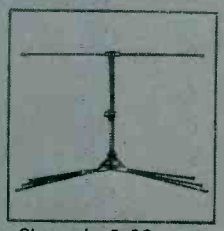
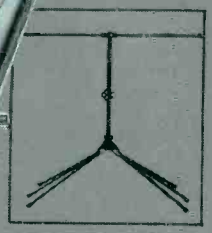
FALCON *Introduces -*



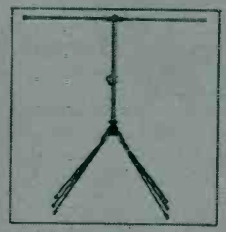
Channels 2-13, peaked for low channels (2 thru 6)



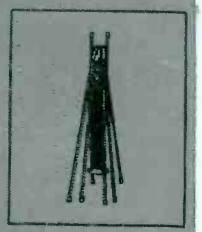
Channels 2-13, normal position, peaked for all VHF channels (2 thru 13)



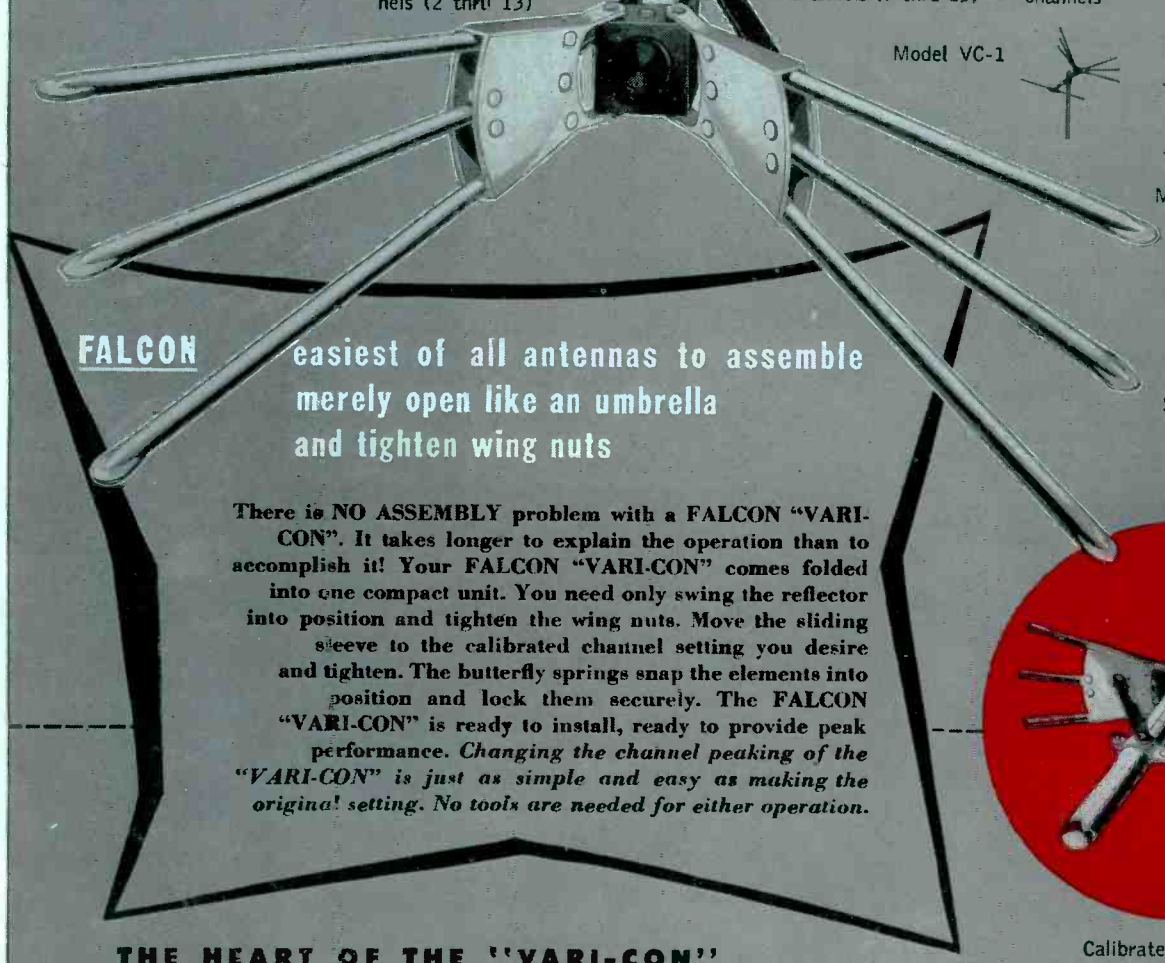
Channels 2-13, peaked for high channels (7 thru 13)



Channels 2-83, peaked for UHF channels



Falcon "VARI-CON" folded for packing



Model VC-1

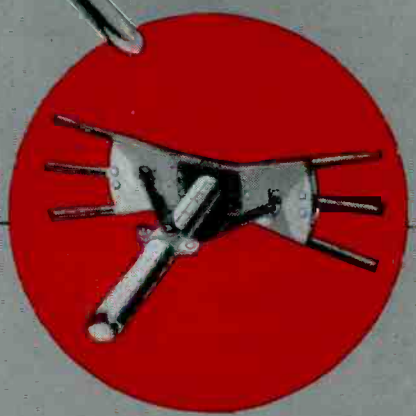
Model VC-2

Model VC-4

Stack them for added gain.

FALCON easiest of all antennas to assemble merely open like an umbrella and tighten wing nuts

There is NO ASSEMBLY problem with a FALCON "VARI-CON". It takes longer to explain the operation than to accomplish it! Your FALCON "VARI-CON" comes folded into one compact unit. You need only swing the reflector into position and tighten the wing nuts. Move the sliding sleeve to the calibrated channel setting you desire and tighten. The butterfly springs snap the elements into position and lock them securely. The FALCON "VARI-CON" is ready to install, ready to provide peak performance. ***Changing the channel peaking of the "VARI-CON" is just as simple and easy as making the original setting. No tools are needed for either operation.***



Calibrated sleeve for quick peaking of antenna.

THE HEART OF THE "VARI-CON"

Above is a view of the new mechanism which enables anyone to adjust the peaking of the FALCON "VARI-CON" to any range of channels desired. The sliding sleeve, on the calibrated boom, automatically fans out the elements to their correct position.

A simple, trouble-proof, snap-action spring in the butterfly keeps the elements solidly in place. The insulated hinge assembly is extremely strong, durable and weather-resistant and has an extra long leakage path. Weight has been kept to a minimum, strength at a maximum in order to assure long life and freedom from wind and weather damage. A heavily plated mast clamp is supplied.

the "VARI-CON"

(The conical that's variable)

Provides all Channel Performance...

Yet can be Peaked for Increased Gain on any Channel Range

The FALCON "VARI-CON" was designed for today, tomorrow and years to come. Its unusual construction permits setting the "VARI-CON" for all-channel performance peaked to provide the additional gain needed on special channels. In addition, the variable patterns obtainable are of great value in ghost elimination.

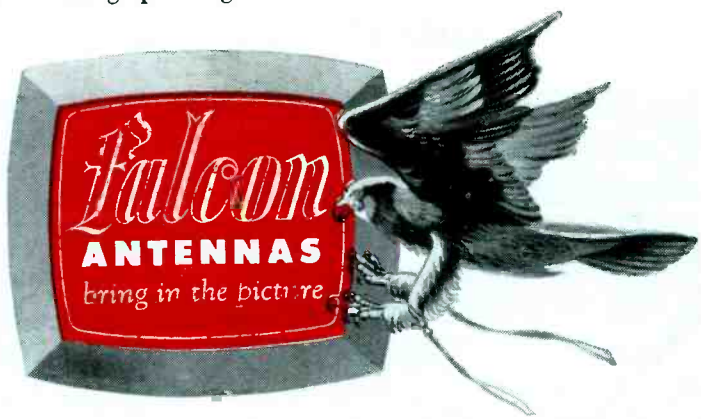
There is no guess work; no tedious assembly; no field strength equipment needed to peak the "VARI-CON" for high-gain, sharp pattern performance in your area. It's as simple and easy as opening an umbrella. Here's all you do: Unpack the "VARI-CON"— Slide the adjusting sleeve to the calibrated marking on the boom for the best reception of channels in your area — Fan out the reflector elements — Tighten the locking wing nuts. The "VARI-CON" is automatically peaked WHERE YOU WANT IT and ready to install. It is the only conical that enables you to provide a custom-made installation resulting in higher gain and increased customer satisfaction.

The NEW FALCON "VARI-CON" is ruggedly constructed. Heavy-duty heads will not crack or break. The steel spring snap-action butterfly assemblies are unbreakable. Full length, 48 inch, elements are used. One of the most capable engineering staffs in the industry has worked out every last detail of this truly remarkable TV antenna. To the high gain all-channel performance and excellent line match of the conical, FALCON engineers have added the "plus" feature — adjustable, calibrated channel range peaking!

FALCON

The new "VARI-CON" is one of the most significant additions to antenna design. Watch for the other new FALCON antennas which will be announced in the near future! Each will represent the most advanced, most efficient antenna design of its type.

WRITE FOR ILLUSTRATED FOLDER AND PRICES



FALCON ELECTRONICS COMPANY • 2003 CEDAR ST. • QUINCY, ILLINOIS

NATIONAL ADVERTISING TO BACK NEW FALCON "VARI-CON"

To stimulate sales on all levels, FALCON is conducting one of the most aggressive advertising campaigns in the industry. Full two-page color spreads are appearing regularly in many of the nation's top trade and consumer publications.

Your *BEST* antenna buy for channels 2 to 83!

telrex "DUO-BAND"

"CONICAL-V-BEAM"*

★ UNIFORMLY HIGH GAIN
★ EXCELLENT DIRECTIVITY
★ AUTOMATIC TRANSITION FROM UHF TO VHF
★ HIGH SIGNAL-TO-NOISE RATIO
★ ALL ALUMINUM RUGGED CONSTRUCTION

*REGISTERED TRADE MARK

Ask the DEALER!

INSTALL ONE ANTENNA, ONE TRANSMISSION LINE—Full UHF and VHF reception. The Telrex Duo-Band extends the famous "CONICAL-V-BEAM" principle The addition of two supplementary V splines compacts and adds in-phase the higher frequency signals.

AUTOMATIC, PERFECT TRANSITION FROM VHF TO UHF—No "lossy" filters or isolation networks are employed in the Telrex design. Both UHF and VHF signals are picked up at the same cone apex.

Ask the SERVICE MAN!

Ask the JOBBER!

ONLY A SINGLE TRANSMISSION LINE IS REQUIRED — Duo-Band provides uniformly high gain with one major lobe, channels 2 to 83 and actually improves reception on channels 7 to 13.

ASSURES HIGH SIGNAL-TO-NOISE RATIO . . . FREE FROM GHOSTS — Excellent directivity on VHF and UHF. A clear, unidirectional pattern makes Duo-Band the perfect array for reception near or far.

Ask the CUSTOMER!

DUO-BAND features include all aluminum rugged design, light weight. Practical design can be used single bay or stacked for increased sensitivity.

60 Models Available to meet every Antenna Requirement. Write for Illustrated Catalog on the Complete TELREX Line.

"CONICAL-V-BEAMS" are produced under Re-issue Patent No. 23,346. Canadian and Foreign Patents Pending.

telrex INC. BETTER BY DESIGN
"CONICAL-V-BEAMS"

SERVICE MEN! Modify existing "CONICAL-V-BEAMS" with DUO-BAND! Existing antennas can be modified to operate efficiently on channels 2 to 83 by means of the new Telrex Modification Kit.

ASBURY PARK 11, N. J.

Originators and Manufacturers of "CONICAL-V-BEAMS" — insist on the Original! Look for the Telrex Trademark.

YOU'VE HEARD ABOUT THE Telechief®

It's HERE—Sangamo's new premium molded paper tubular capacitor that will outlast and outperform any other tubular . . . built for better TV performance.

NOW...

see your jobber for this

SPECIAL INTRODUCTORY OFFER!

Only $24.00

Slightly higher in Canada

Here's a deal you can't afford to miss. You get a basic balanced inventory of fast-moving "Telechiefs"—assortment based on national popularity—*PLUS* a heavy gauge steel chest with two extra drawers for small parts—*PLUS* 100 attractive folders of your choice to promote your business. You get all this for only $24.00—the dealer net price of the capacitors alone. (They list at $40.00.)

Get acquainted with the Telechief today—your Jobber has these kits in stock.

You can have 100 of any of these business-building folders without extra cost—a sample of each is enclosed in the kit.

Those who know...choose Sangamo

8C53-12

SANGAMO ELECTRIC COMPANY MARION ILLINOIS

Versatile!

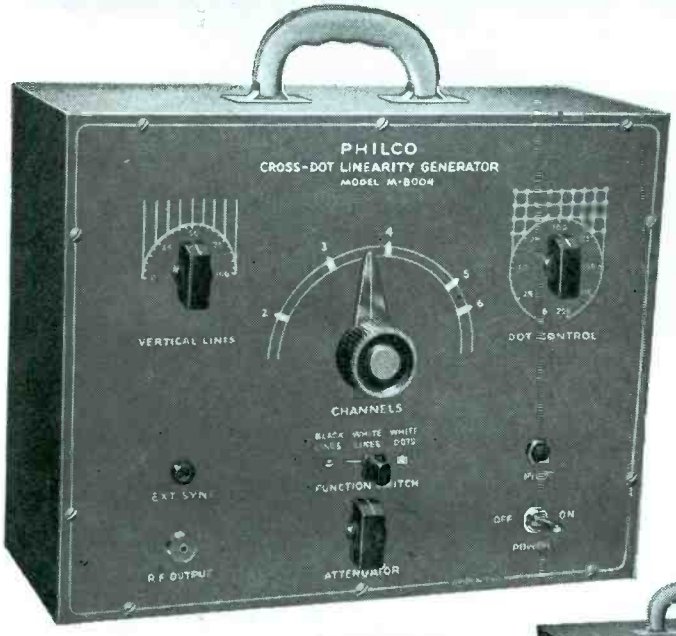
NEW! Exclusive!

PHILCO®
Cross Dot
TV Linearity Pattern
Generator

More Stable Operation at
1/3 the Cost
of Comparable Generators

Again . . . Philco leads the field! For the finest possible linearity adjustments without station pattern, here is the all new *cross dot* linearity pattern generator. This unit not only lets you make TV linearity adjustments more quickly and accurately but also permits precise routine adjustments and trouble shooting with amazing economy of operation . . . Light, rugged, portable, heavy gauge steel case . . . finished in durable gray hammertone . . . See your Philco distributor now or write Philco, Accessory Division, "A" & Allegheny, Philadelphia, Pa.

Now Yours on New Special Payment Plan



Model G-8004

Specifications: — Self stabilized oscillator • Variable output frequencies • Power consumption approximately 10 watts • Power supply—105-125 Volts, 60 cycles • large easy-to-tune dial • high level output controllable with variable attenuator.

Model M-8104—TV Field Strength Meter • Offers more features than any unit at this popular price . . . Super Colorado Tuner for low noise and high gain . . . May be used to check TV boosters, antenna combinations, interfering signals and picture signal strength.

Model 7008—Visual alignment Generator • Combines in one economical unit functions ordinarily found only in a cumbersome collection of costly devices . . . Includes extra sensitive built-in oscilloscope . . . AM, FM, and audio generators. Sweep output flat to within .2 DB/MC.

PHILCO
Test Equipment
Specifically Designed for the Serviceman

2 NEW SERVICE AIDS . . .

DESIGNED BY AND FOR YOU!

Open back view.

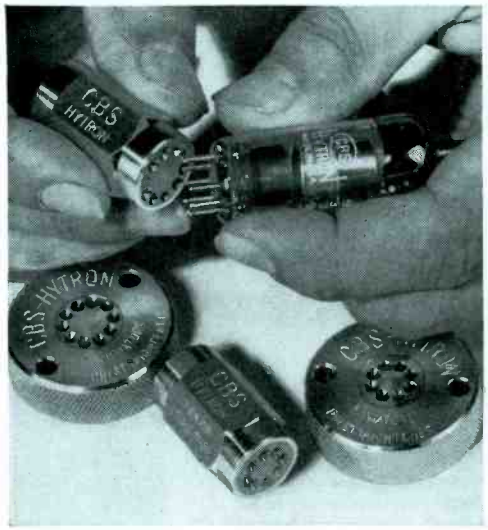
Open front and top views.

New CBS-HYTRON Tube-and-Tool Caddy

Another Tube Caddy? Yes, but *you* service-dealers helped us design this one. Helped us throw out a dozen almost-right designs. Stayed with us until the CBS-Hytron Tube-and-Tool Caddy became *your* Caddy. Built the way *you* want it.

Your new Caddy has literally dozens of features . . . many unique. Here are only a few: *Roomy* . . . holds 218 tubes! Also all your necessary tools, small parts, volt-ohmmeter, flashlight, and reference data. *Compact* . . . functional design wastes not one inch of space. *Accessible* . . . everything in sight and reach. *Rugged* . . . strong, tip-proof — used safely as seat. *Test Mirror* . . . reversible for protection — mounted in cover supported by adjustable friction hinge.

Sorry, there's just not enough space to tell all. But *see* your new Caddy yourself at your CBS-Hytron distributor's. He has a red-hot deal for you. He'll show you how *amazingly easy* it is for you to own this unique CBS-Hytron Tube-and-Tool Caddy. See him today.



New CBS-HYTRON Twin Pin Straightener

Ever wished you had a combination 7-Pin and 9-Pin Straightener? One that was handy, compact, light? But also a precision job, just like CBS-Hytron's original 7-Pin and 9-Pin Straighteners?

Here it is: The new CBS-Hytron Twin Pin Straightener, SH79. Same life-time, wear-and-corrosion-resistant steel dies. Same individually drilled, precision pin-circle holes. Same absence of guide-posts, permitting that final touch of sidewise straightening. The "Twin" is also roll-proof.

And the Twin is only 98¢ net. Get at least two . . . for pocket, tool kit, bench. Call your CBS-Hytron distributor today. Yes, he still has the famous individual CBS-Hytron 7-Pin and 9-Pin Straighteners at only 65¢ each net. Get them, too.

CUTTING YOUR CALL-BACKS WITH CBS-HYTRON CTS-RATED* 5AW4 and 6CU6?

They're the most talked-about tubes in TV today. CBS-Hytron CTS-Rated 5AW4 and 6CU6 are both rated for dependable *C*ontinuous *T*elevision *S*ervice. Heavy-duty work horses, they replace the 5U4G and 6BQ6GT respectively.

Brand new designs, not just improved tubes, the 5AW4 and 6CU6 have big safety factors. Give you long . . . long trouble-free life. Loaf in those hard-working, heavily loaded rectifier and horizontal amplifier sockets . . . even in 21-inch jobs.

Start slashing your call-backs with these tubes right now. 5AW4 and 6CU6 are available only from your CBS-Hytron distributor. See him today. Ask for complete 5AW4 and 6CU6 data. Or write direct. Above all, don't let another day slip by without trying these wonderful, new CBS-Hytron CTS-Rated tubes.

*Rated for Continuous Television Service

P.S. Yes, more CBS-Hytron CTS-Rated tubes are coming. Watch for them.

CBS HYTRON

Manufacturers of Receiving Tubes Since 1921

CBS-HYTRON Main Office: Danvers, Massachusetts

A Division of Columbia Broadcasting System, Inc.

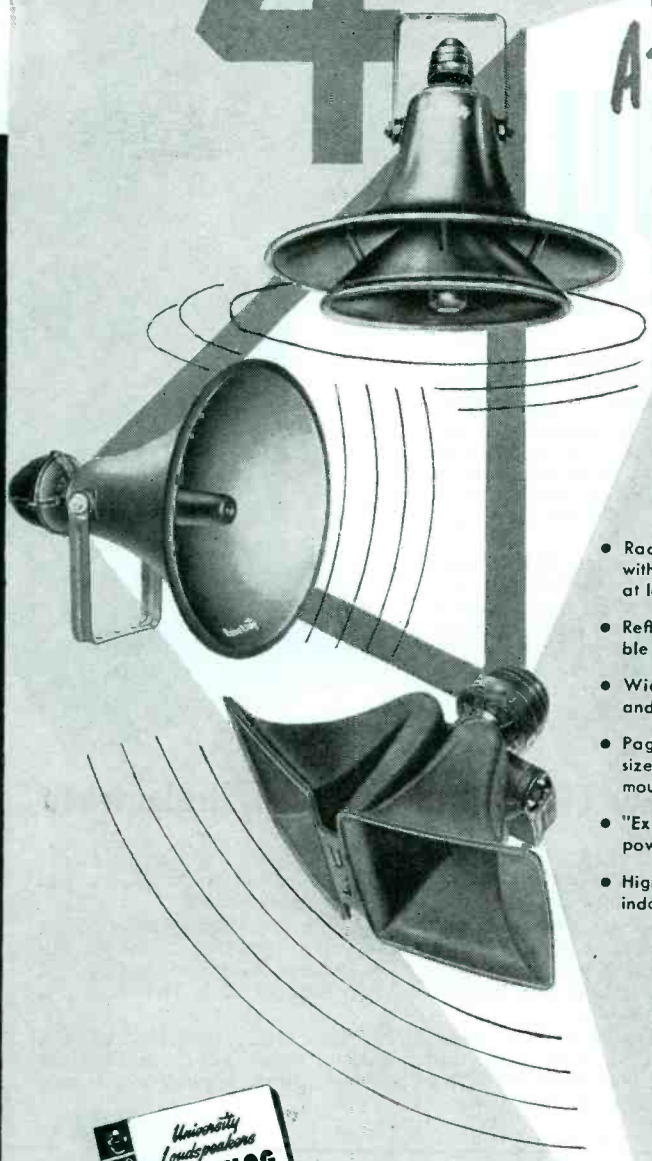
A MEMBER OF THE CBS FAMILY: CBS Radio • CBS Television • Columbia Records, Inc. CBS Laboratories • CBS-Columbia, Inc. • and CBS-Hytron

RECEIVING . . . TRANSMITTING . . . SPECIAL-PURPOSE AND TV PICTURE TUBES • GERMANIUM DIODES AND TRANSISTORS

there are 4 points to a triangle...

THE POINT OF APPLICATION

determines the type of loudspeaker best capable of providing optimum performance at lowest possible cost. There are over 50 different University models to choose from... each designed to serve most efficiently and economically in its intended application.



- Radial type projectors and paging speakers with 360° dispersion for maximum coverage at lowest cost and ease of installation.
- Reflex trumpets in various sizes for incomparable efficiency, distance, and noise penetration.
- Wide-angle and bi-directional types, marine and submergence models for heavy industry.
- Paging and "talk-back" speakers in numeraus sizes, power and frequency characteristics and mounting arrangements.
- "Explosion-proof", blastproof, and even superpower types from 100 to 720 watts capacity.
- High fidelity, full-frequency response types for indoor and outdoor use.

University Loudspeakers are application-engineered to assure customer satisfaction, avoid waste of amplifier power and speaker capacity and reduce initial equipment and installation costs. University helps you to sell more sound jobs... make more profit you can pocket. ***Why spend more for more than you need—CHECK UNIVERSITY FIRST!***

FREE—new 1953 copy of the University Technilog • Complete up-to-date manual of sound theory, application and installation requirements • SEND for your copy today.

University

UNIVERSITY LOUDSPEAKERS • INC.
80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

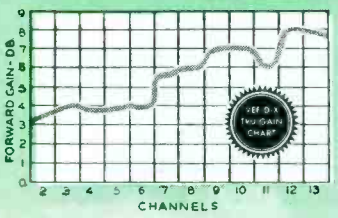
VEE-D-X PROUDLY PRESENTS . . .

THE ONE AND ONLY **ALL-CHANNEL YAGI**

VEE-D-X tra Special

MODEL SP

AT LAST YAGI POWER AND DIRECTIVITY WITH *ALL-CHANNEL PERFORMANCE*



CAUTION: It is the policy of VEE-D-X not to falsify gain charts for advertising purposes. This Tru-Gain Chart is exact and is based on standard specifications using a single dipole as reference.

FEATURES

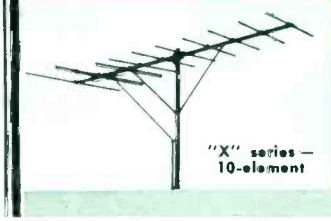
- *Powerful all-channel VHF performance*
- *High forward gain and sharp directivity*
- *Extremely high front-to-back ratio (important toward eliminating interference from unwanted stations)*
- *Rugged, pre-assembled construction*
- *One piece drawn aluminum boom*
- *Better rooftop appearance with clean yagi lines*
- *Ideal for use with VEE-D-X Antenna Rotator*

VEE-D-X engineering has produced another truly great antenna – the VEE-D-Xtra Special. Think of it – all the desirable features of a yagi – yet with all-channel performance in a single easy-to-install antenna. Technically, it is a nine-element hi-low yagi (5 elements on high channel – 4 on low) "T" matched. The hi-low sections are phased together with the new isolation filter (MM-25). Here is the ideal all-channel antenna – and especially wherever interference from unwanted stations must be eliminated. A honey for use with the VEE-D-X Rotator.

La Pointe **ELECTRONICS INC.**
ROCKVILLE, CONNECTICUT

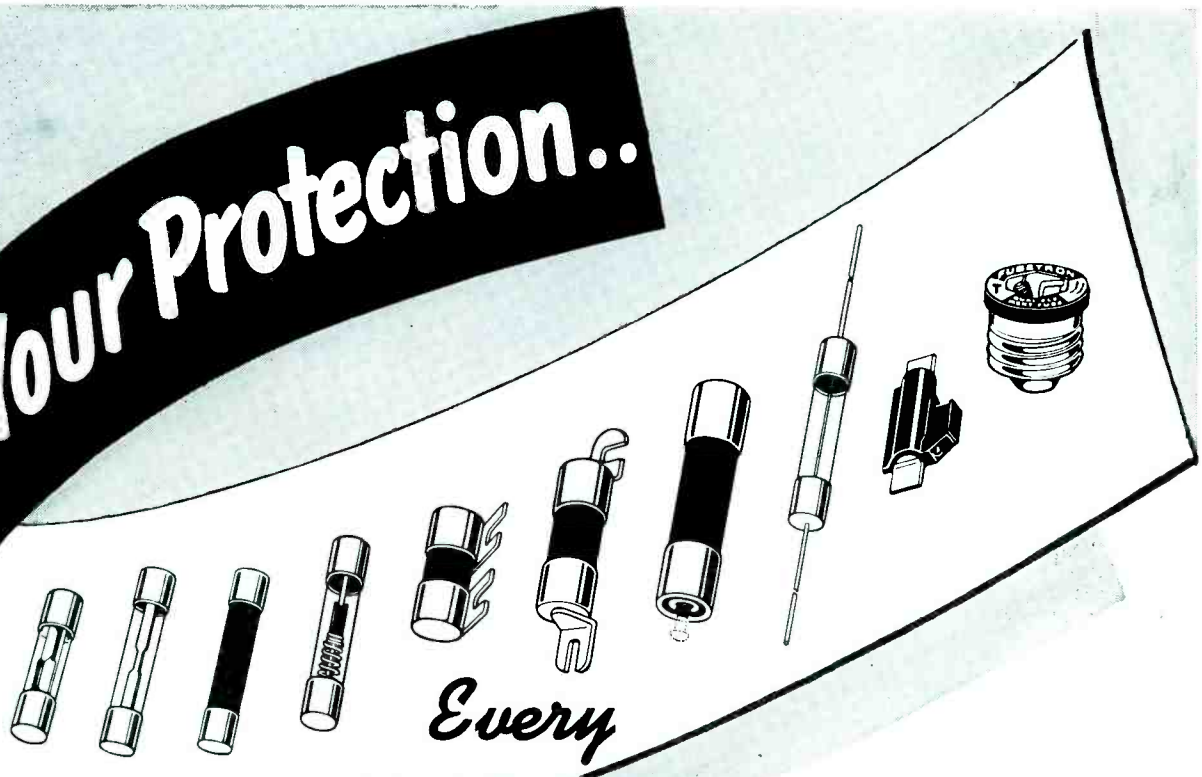
VEE-D-X

VEE-D-X also announces two great new series of Broad Band Yagis. The extra powerful "X" series 10-element and the "V" series 5 and 6-element. Both in three cuttings, 2-6, 4-6, 7-13.


"X" series – 10-element


"V" series – 5-6 element

For Your Protection..



Every

BUSS FUSE

IS ELECTRONICALLY TESTED to give flawless protection

in Television • Radio • Radar • Instruments • Controls • Avionics

For 38 years, BUSS has emphasized quality . . . finding new ways to make fuses better . . . designing new testing equipment . . . developing precision production methods.

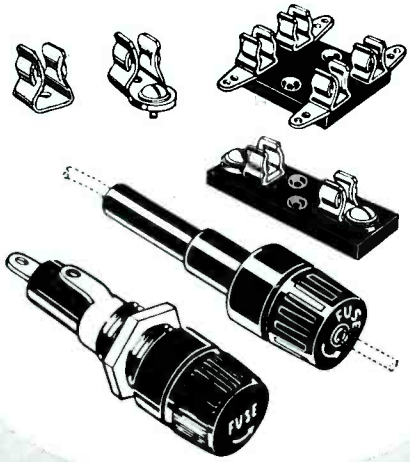
Today, every BUSS fuse is electronically tested on highly sensitive devices for proper construction, correct calibration and accurate physical dimensions.

These safeguards assure you and your customers perfect electrical protection . . . whenever it is needed.

PROTECT YOURSELF . . . as well as the circuit, by always installing genuine BUSS fuses. Your customers have confidence in the BUSS name, famous for dependable protection in homes, industry and on the farm.

And there's—

A COMPLETE LINE OF FUSE BLOCKS, CLIPS AND HOLDERS



FOR MORE INFORMATION

Mail this Coupon Today.

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

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

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ S-1053

over 99%* hit the bull's-eye for quality!

that's why we call

Federal PICTURE TUBES "BEST-IN-SIGHT"

Thousands of famous-name picture tubes were quality-tested by a famous-name TV set manufacturer.* When the scoring was over, Federal led all the brands tested . . . with an "OK" on over 99% of its tubes!

Here's proof, Mr. Serviceman, that it pays to replace with *Federal* . . . here's assurance of top performance . . . of less time wasted on call-backs . . . of more profit per tube replaced!

Federal quality brings to servicemen a tremendous opportunity to create customer-goodwill . . . to build steady replacement business.

Federal quality *stands by* servicemen, because it *stands up* in service . . . backs up their years of experience and know-how . . . their *trained* judgment. That's one of many big reasons why more and more servicemen are specifying Federal "Best-in-Sight" picture tubes.

Join the trend today . . . ask your Federal Distributor about the popular-size line that takes care of over 90% of all TV replacements . . . ! For information, write to Dept. N-356.

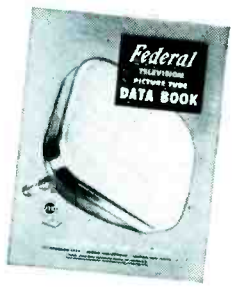
"Federal always has made better tubes"

Federal
Telephone and Radio Company
100 KINGSLAND ROAD, CLIFTON, N. J.

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

Get Your Copy of Federal's TV Picture Tube DATA BOOK

12-page booklet with information on interchangeability, basing diagrams, bulb outlines, dimensions, characteristics. Address your inquiry to Dept. listed above.



"OUR CUSTOMERS TELL US THAT THE PICTURES ARE BETTER THAN WHEN THEIR SETS WERE BRAND-NEW."

Says W. T. Gerlach
Roselle Radio and TV Service
1027 Chestnut St., Roselle, N. J.

"Since the first TV sets were delivered in this area, we've installed almost every type and brand of picture tube, but we've yet to find any that gives a picture like the G-E Aluminized Tube.

"Our tube customers are not only satisfied—they are downright pleased! As a result, **more than two out of every three tubes we are installing are G-E Aluminized Picture Tubes.**"

"2 OUT OF EVERY 3 TUBES ARE G-E ALUMINIZED

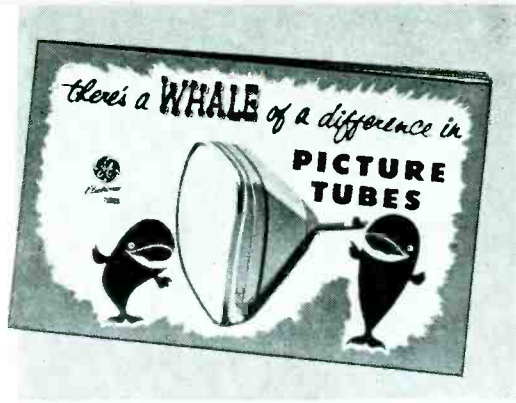
Give your customers TV's finest picture—and make more money!

"65% OF OUR PICTURE TUBES SOLD ARE G-E ALUMINIZED. ONE OWNER TELLS ANOTHER."

Says Kenneth L. Middleton . . . HILLENS
740 N. Garey Ave., Pomona, Cal.

"GENERAL ELECTRIC ALUMINIZED PICTURE TUBES ARE ONE OF MY REAL BIG MONEY-MAKERS!"

Says Norman Foster . . . Foster Television
2922 Milwaukee Ave., Chicago, Ill.

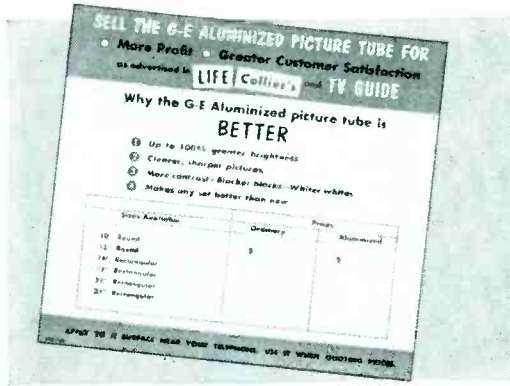


FACT-CRAMMED BOOKLET FOR TV OWNERS

COLORFUL STREAMERS

WE INSTALL PICTURE TUBES!"

Ask for new 6-piece promotion kit!



PHONE-SELLING PRICE GUIDE

MAIL CARD THAT BUILDS INQUIRIES

All these helps are waiting for you at your G-E tube distributor!

GET the full kit of G-E Aluminized Tube sales aids! Use them to sell better-than-new TV! It's a sure-fire way to lick competition from inferior picture tubes offered to your customers.

This mirror, booklet, and other helps will work hard for you, developing *profitable* tube sales. General Electric further supports your efforts by a strong coast-to-coast advertising campaign to TV owners. Ads in LIFE, COLLIER'S, and TV GUIDE, reaching some 40,000,000 readers, tell why the G-E Aluminized Tube is brighter, better, the finest tube any set can have!

Today many leading TV builders are featuring new-model receivers with General Electric Aluminized Tubes. Demand for replacement tubes will skyrocket as the finer performance of the aluminized tube is made known by enthusiastic set owners.

Take a tip from successful service dealers everywhere! Sell TV's finest picture *profitably! Tube Department, General Electric Co., Schenectady 5, New York.*

1878 75 1953
YEARS OF ELECTRICAL PROGRESS
Diamond Anniversary

GENERAL ELECTRIC

NEWSPAPER AD MAT

are you ready... **ALLEZ OOPS!**

You'd better be ready for a big turnover this fall, because REGENCY is flipping thousands of interested customers right into your hands! LIFE! HOUSE BEAUTIFUL! HOUSE AND GARDEN! ATLANTIC MONTHLY! SATURDAY REVIEW! AND NATION-WIDE TELEVISION! Aimed at FIFTY MILLION customers! This biggest-ever promotional program is comprised of the kind of sales-stimulating REGENCY advertising that has always proved so effective for you! And you'll hear about and see more of this functional merchandising program in the sales packed months ahead.

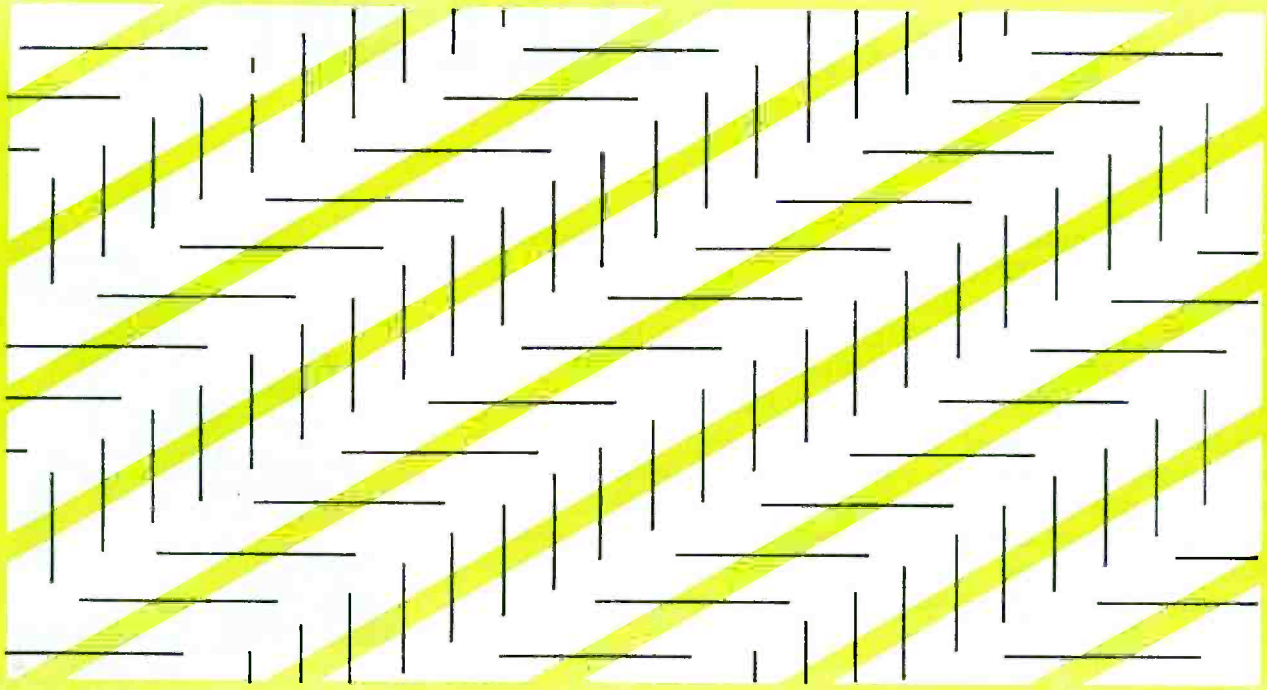
Regency

DIVISION OF I.D.E.A., INC.

Makers of VHF Boosters, FM Boosters, UHF Converters, Professional High Fidelity Equipment and Remote Control for Television

Barton browne advertising

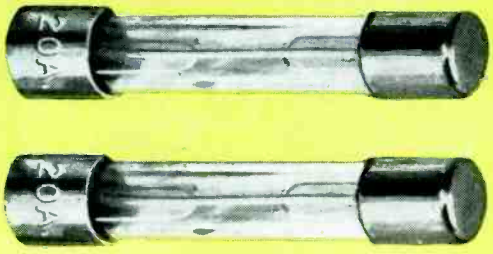
Burton browne advertising

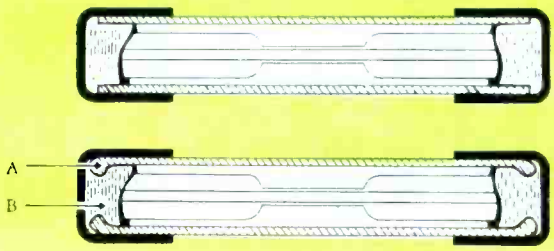


THINGS ARE NOT AS THEY SEEM...

The long lines are strictly parallel—
that they appear otherwise is an optical illusion.

This fuse merely has the metal caps cemented to the glass.





The difference between these two fuses is no illusion . . .

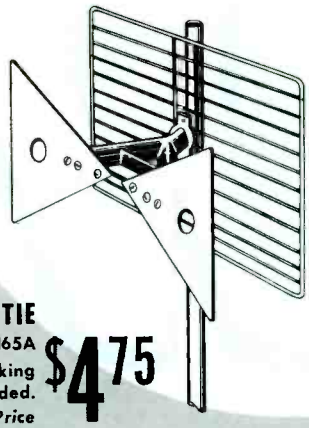
This Littelfuse has the caps locked to glass like this.

The ends of the glass are formed[A]. The solder which is bonded in a separate operation to the cap reflows through the small aperture and spreads out to form a permanent collar-button lock[B] between cap and glass—impervious to moisture and vibration. The exclusive Littelfuse feature eliminates fuse failure due to loose caps.

Littelfuse leads all other fuse manufacturers in design patents on fuses. Lock-cap assembly patent no. 1922642

LITTELFUSE

DES PLAINES, ILLINOIS



Admiral BOW TIE
UHF Antenna, No. AN65A
Each antenna furnished with stacking bar. Mast mounting bracket included. Mast not included. *Suggested List Price* **$4.75**

Admiral CORNER REFLECTOR
UHF Antenna No. AN56A
High gain, 14 db. Front to back ratio 15 to 1. Mast mounting bracket included. Mast not included. *Suggested List Price* **$9.95**

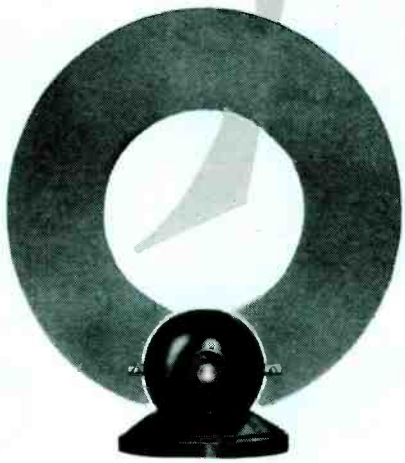
Admiral all-channel UHF antennas

HIGH GAIN
LOW COST

Now you can make an extra profit on installations using these high gain UHF antennas. In good signal areas, the Admiral Bow-Tie No. AN65A gets excellent reception on any of the 70 UHF channels...*and lists for only $4.75!* For troublesome locations, where ghosts, reflections and interference are encountered, install the Admiral Corner Reflector Antenna No. AN56A. It lists for only $9.95.

Both these antennas are made with aircraft aluminum antenna elements and vibration-proof reflectors. Both come completely assembled, ready to mount. "A-frame" insulators provide plenty of free air space around elements. The units have high mechanical strength, low wind resistance, and are treated to resist weathering. They can be easily fastened to existing masts and towers.

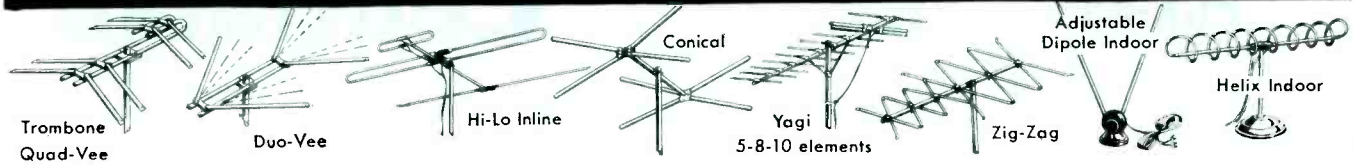
Where an indoor UHF antenna is needed, give your customer the Admiral Target No. 94A10-7. Smartly styled in rose-gold colored anodized aluminum with mahogany phenolic base, it stands only 10 inches high. The base is weighted and felt padded...can be placed on top of receiver...picks up all UHF channels. Order by part number from your Admiral distributor.



Admiral TARGET
Indoor Antenna No. 94A10-7
Complete with lead-in
Suggested List Price **$4.95**

Admiral Corporation
Accessories and Equipment Division • Chicago 47, Illinois

A COMPLETE LINE OF ADMIRAL TV ANTENNAS . . . NOW AVAILABLE FROM YOUR ADMIRAL DISTRIBUTOR



NEW!

4 P.E.C.* KITS

(NO EXTRA CHARGE FOR CABINETS)

PCK-18 18 P.E.C. units. Replace 42 old-style resistors and 52 old-style capacitors. Net - - - - - **$9.00**

PCK-110 110 P.E.C. units. Replace 255 old-style resistors and 52 old-style capacitors. Net - **$55.80**

PCK-220 220 P.E.C. units. Replace 525 old-style resistors and 620 old-style capacitors. Net **$115.80**

Handy P.E.C. Guide No. 2 is included with each kit. Shows part listings, schematics, and test data.

PCK-45 45 P.E.C. units. Replace 106 old-style resistors and 133 old-style capacitors. Net - **$24.00**

Write for a list of the Centralab distributors in your area who have P.E.C. Kits.

Centralab

CRL

A Division of Globe-Union Inc.

908J E. Keefe Avenue • Milwaukee 1, Wisconsin

In Canada, Box 208, Ajax, Ontario

*Trade Mark — Printed Electronic Circuit

TO SELL MORE MASTS

be a BAKER Dealer

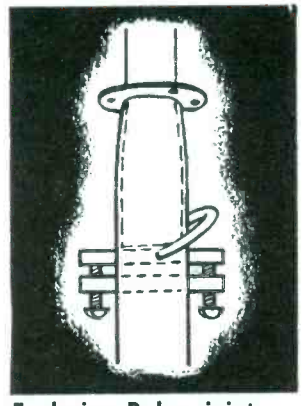
Sales pick up quick when you stock Baker Television Masts—Most in demand by dealers.

Dealers prefer Baker 10', 20', and 30' television masts because they are better engineered and better built for quicker sales, quicker installation and more complete buyer satisfaction.

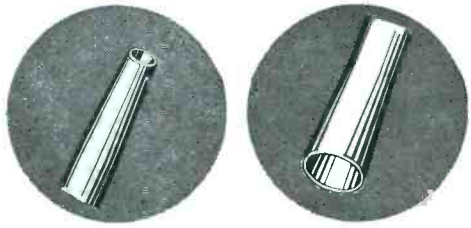
And not only are Baker masts built better, sold quicker and installed faster but they are priced better too.

BAKER 20' AND 30' TELESCOPING MASTS

The Baker telescoping masts feature an exclusive patented Baker joint for quicker, easier vertical erection eliminating cumbersome tip-ups. The sections stop and lock automatically in place when fully extended and will not pull completely out. The special snap action safety catch prevents sections from sliding back during erection. Installer has hands free.



Exclusive Baker joint



◀ 10' FITTED END MAST

FOR MORE MAST SALES AND PROFITS—
BE A BAKER DEALER

SEND FOR COMPLETE DEALER INFORMATION TODAY. →

BAKER MFG. COMPANY
EVANSVILLE, WISCONSIN

BAKER MFG. COMPANY
DEPT. B
EVANSVILLE, WISCONSIN

Please send me complete information concerning Baker Television Masts . . . . . ____

Name _____

Company _____

Address _____

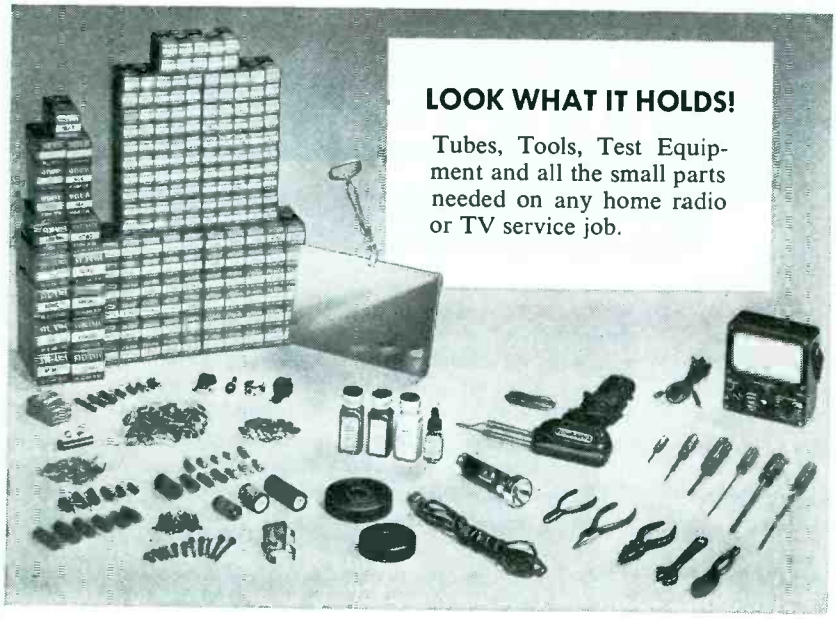
City _____ Zone ____ State _____

Servicemen! Here's Your Sylvania

T-N-T CHEST

(TUBE AND TOOL)

The Most Valuable Service Aid You've Ever Seen!



Talk about a useful servicing aid . . . this Sylvania T-N-T (Tube and Tool) Chest is really it! Carries more tubes, tools and parts than any chest on the market!

LOOK AT THESE FEATURES:

- Bass and fir plywood case
- Waterproof Du Pont Fabrikoid cover
- Holds 187 receiving tubes
- Lightweight folding aluminum tool and parts tray
- Unbreakable plastic handle
- Brass-plated hardware
- Room for mirror and ohmmeter
- It's a complete, portable service shop!

ACT NOW . . . Offer Limited!

This chest is now yours for only $5.00 and 30 Sylvania Premium Tokens. Offer good only between August 1st and November 15th. See your Sylvania Distributor who has these kits now.

Remember, you get 1 Sylvania Premium Token with every 25 receiving tubes or with every picture tube you buy.

SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

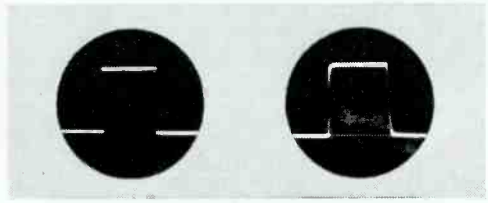
LIGHTING · RADIO · ELECTRONICS · TELEVISION

In Canada: Sylvania Electric (Canada) Ltd.
University Tower Building, St. Catherine St., Montreal, P. Q.

RCA WO-88A...

ONLY $169.50
Suggested User Price
Complete with Matched Probes and Cables

Read P-P Voltage as you observe TV wave-shapes!



Unretouched photographs of 60-cycle and 50 Kc square waves reproduced on screen of WO-88A. Note fast retrace.

INSIST UPON THESE IMPORTANT FEATURES . . .

- Direct-coupled, push-pull, two-stage vertical amplifier; push-pull horizontal amplifier.
- Frequency-compensated and voltage-calibrated attenuators.
- Front-panel source of 1-volt peak-to-peak calibrating voltage.
- Graph screen scaled directly in peak-to-peak voltage.
- Metal shield enclosing CRT gun to minimize hum-pickup from stray fields.
- Plus and minus internal sync.
- Built-in 60-cycle sweep with phasing control.

SPECIFICATIONS —

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

ESSENTIAL for Critical TV Deflection Circuit Measurements, the New WG-216B Low-Capacitance Probe gives the WO-88A an overall input resistance of 10 megohms shunted by less than 10 uuf.

The WO-88A combines the features required for TV receiver servicing, and the high stability and ruggedness essential for continuous production-line duty.

The outstanding feature of the WO-88A is its remarkably true square-wave response, obtained by adequate band-width, negligible phase shift, and a complete absence of peaking circuits. Vertical and horizontal sync pulses, as well as other complex wave forms, are reproduced with fidelity characteristic of expensive laboratory instruments. Furthermore, uniform frequency response is maintained over the entire range of the attenuators.

The two-stage dc vertical amplifier has more than enough gain for all usual applications. Moreover, all of the gain is useable because the input circuits are shielded against extraneous noise and hum right out to the probe tips. Push-pull circuitry in *both* stages of the vertical amplifier minimizes "line bounce"; and direct coupling provides instantaneous "recovery" time.

For operating convenience, the controls for push-pull balance, astigmatism adjustment, and interstage dc coupling are accessible from outside the cabinet.

Voltage measurements and wave-shape observations can be made simultaneously with the WO-88A. A front-panel terminal provides a 1-volt peak-to-peak reference voltage; the green graph screen is scaled in peak-to-peak voltage divisions, which are multiplied by the settings of the step attenuator to determine the voltage.

The WO-88A incorporates other quality 'scope features such as fast retrace, 60-cycle sweep and phasing, and a shield around the CRT gun.

For complete details on the WO-88A, see your RCA Test Equipment Distributor, or write RCA, Commercial Engineering, Section 56JX, Harrison, New Jersey.

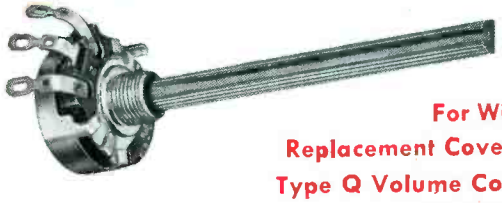
RADIO CORPORATION of AMERICA
TEST EQUIPMENT **HARRISON, N. J.**

FOR ALL OF TODAY'S REPLACEMENT CONTROL NEEDS

IRC Volume Control Plant, Asheville, North Carolina.

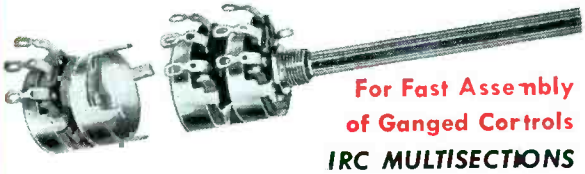
Name your requirement; it's in full production *now* at IRC's new volume control manufacturing plant. From no other single source can you get such wide replacement coverage. And no other replacement control gives you the IRC combination of easy installation and trouble-free performance.

Compare IRC's Replacement Control Line with any other:



For Widest Replacement Coverage Type Q Volume Control

82 values—7 tapers—give greatest TV, AM, FM coverage with least stock. Flatted, knurled and slotted Knobmaster Fixed Shaft fits most knobs without alteration. 13 Interchangeable Fixed Shafts give fast conversion to "specials" with fixed shaft security. Small ¼" long bushing and compact 15/16" design ideal for small sets—yet handle large set needs as well. Cushioned-turn rotation. Quiet element. Handsome appearance.



For Fast Assembly of Ganged Controls

IRC MULTISECTIONS

In just a few minutes you can assemble standard duals, triples, even quadruples—with IRC Multisections and Q Controls. Simply remove control cover and attach Multisection. Over 15,000,000 combinations. 20 resistance values. Switches can be added. Use to provide low-cost L Pads and T Pads.

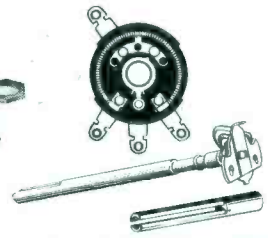
Factory-Assembled

IRC EXACT DUPLICATES

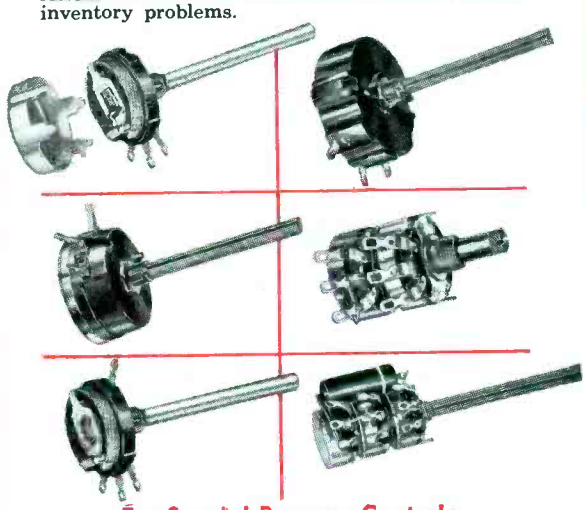
IRC's complete line includes 492 Factory-Assembled Exact Duplicate Concentric Duals. Mechanical fit and electrical operation double-money-back guaranteed—specifications are based on set manufacturers' procurement prints. Resistance values are matched; tapers are closely followed; shaft lengths are never less than manufacturers' nominal—never more than 1/32" longer. Cover more than 5,000 TV sets. Carbon and wire wound.

For Concentric Duals in Less Than A Minute

IRC CONCENTRIKITS



Here's coverage of more than 5,000 TV models. Revolutionary 4-piece Universal Concentrikits assemble with shafts and elements in less than a minute to give you the exact duplicate replacement control you want. Mechanical fit and electrical operation double-money-back guaranteed. Assemble both carbons and wire wounds. Fewer inventory problems.



For Special Purpose Controls IRC's Complete Line

2-Watt Wire Wounds—2 styles, full rounded shaft and Knobmaster shaft. *High Voltage Controls*—2-watt carbon-element control with Knobmaster shaft. *4-Watt Wire Wounds*—2 styles, short, knurled and slotted shaft or Knobmaster shaft. *TV Attenuators*—Carbon-element control for adjustment of signal input. *TV Centering Controls*—2-Watt Wire Wound Control with centering tap. *Loudness Controls*—Continuously variable, bring higher fidelity to ordinary audio.

No other brand of replacement controls offers you wider variety — greater efficiency. Send for New IRC Control Catalog DCID.

For one-source-service on all your control requirements, order from your IRC Distributor.

IRC

INTERNATIONAL RESISTANCE COMPANY

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

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

Wherever the Circuit Says

RADIO · TELEVISION · ELECTRONIC

SERVICE

To EARN the *ABC* insigne displayed here, SERVICE has joined with more than 2,500 other publications, with many of the companies who talk to you through advertising in our pages and with professional advertising agencies who prepare their messages, to set firm, well-understood rules through mutual agreement for the important intangible commodity called *circulation*. As a reader of SERVICE, you benefit directly by our *ABC* membership. How?

Before 1914, the word *circulation* had dozens of meanings. *Circulation* was so loosely defined that one would have found clear facts almost unobtainable.

Then, in comparing rival publishers' circulation claims, or trying to determine if a publisher's advertising rates were fair and reasonable, one found it necessary to match page rates asked with such claims as . . . "First in buyer coverage" . . . "Vast circulation of proven reader interest" . . . "Preferred by more verified readers" . . . "Complete nation-wide coverage," and then doubt the validity of one's own conclusions.

The advertising and publishing industry thirty-nine years ago successfully met this critical need for dependable, standardized circulation figures instead of optimistic coverage claims. To bring order out of chaos that existed before 1914, either of two solutions was possible.

Every business man knows the first possibility—regulation by government. Laws could have been enacted and circulation practice restricted by government edict.

But, wisely, our business chose a better way—voluntary self-regulation *through mutual understanding and by self-imposed rules of good practice.*

The instrumentality set up was the Audit Bureau of Circulations; the first step in the Bureau's work, an accurate definition of just what *net paid circulation* meant. With this as a starting point, answers to important questions such as: How much circulation as measured by this definition? How much do people pay to get this publication? Where does the publication go? What do the readers do to earn their livings? became possible on an industry-wide basis. Sixty-five skilled circulation *ABC* auditors today answer such questions accurately for business men.

Methods for obtaining circulation, once limited only by the ingenuity and consciences of publishers, are disclosed today. The fact that *ABC* membership makes circulation-getting actively public, has discouraged marginal practices of dubious value. And any buyer of space can today form a considered judgment as to the advertising value of any *ABC* publication by going beyond summary paragraph *8* in its *ABC* report, and analyzing the precise audited figures in the other paragraphs.

Modern advertising practice is based on the *ABC*-audited facts that have made space-buying an investment in known values, and have made publication advertising the effective marketing instrument that lowers unit sales costs by increasing sales, and therefore production and employment in our dynamically-expanding economy.

But, you may ask: "What's in this for me? What do I get out of *your ABC* membership? I can see that you profit—show me where I come in."

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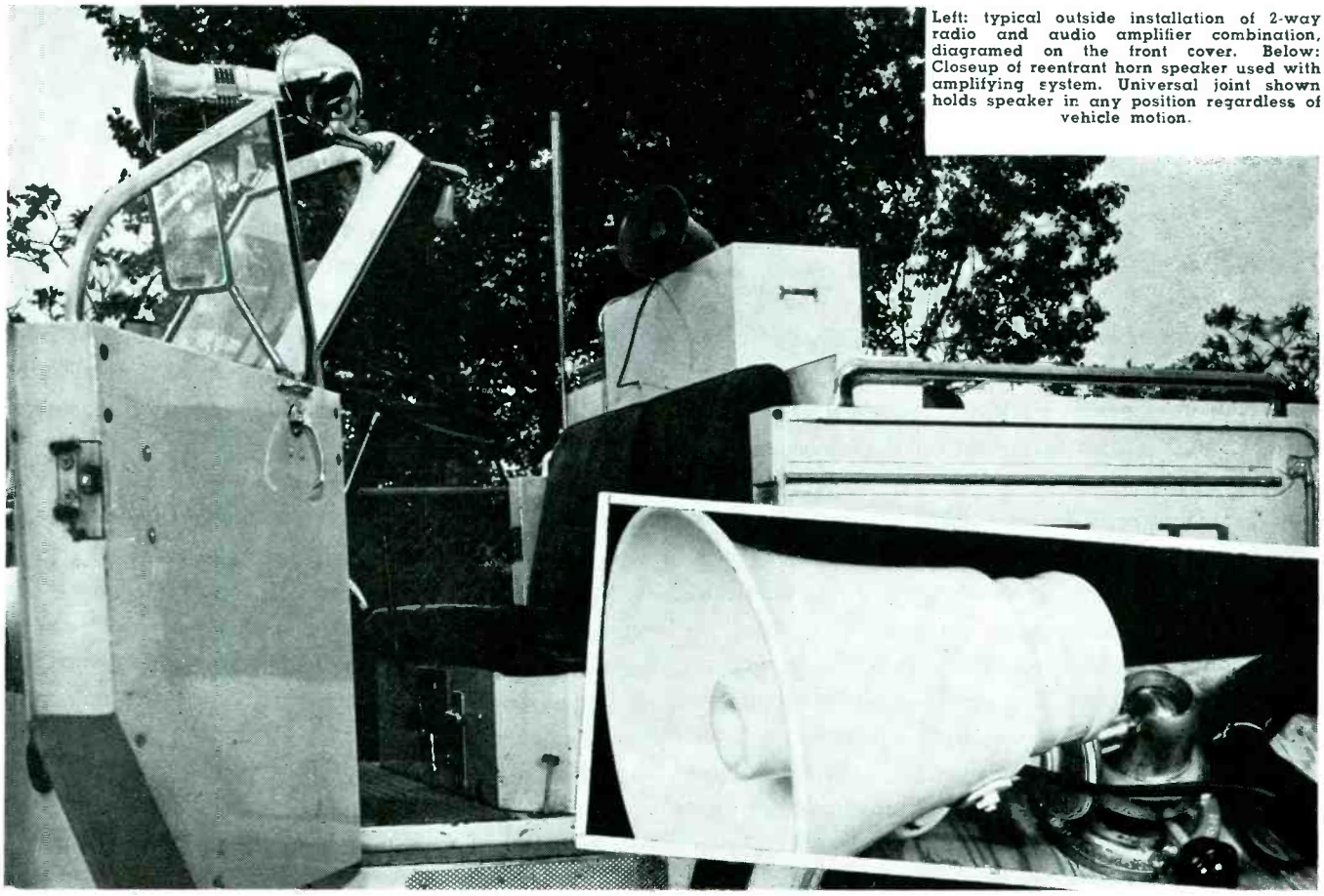
For almost two decades SERVICE has been a member of the Audit Bureau of Circulations and proudly displayed the *ABC* emblem . . . a symbol of publication integrity.—L. W.

by G. H. FLOYD
Electronics Division, General Electric

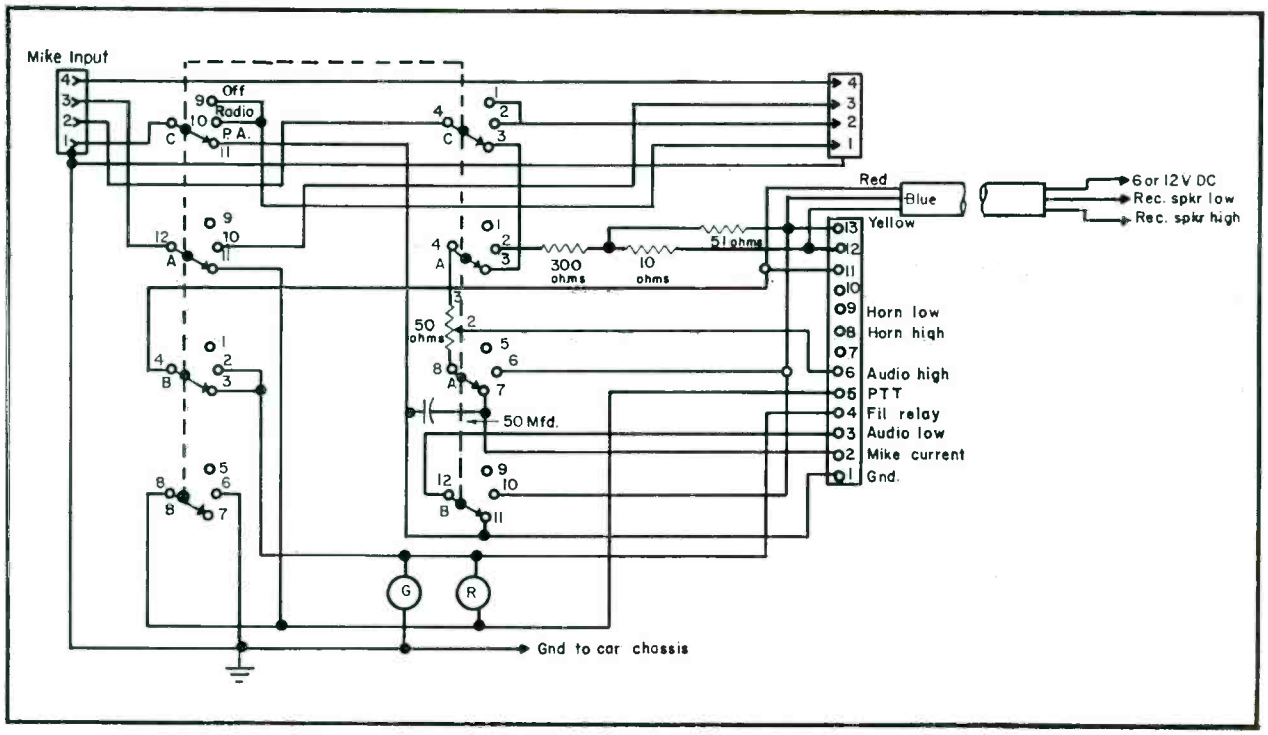
10-Watt 6/12-Volt



Left: typical outside installation of 2-way radio and audio amplifier combination, diagramed on the front cover. Below: Closeup of reentrant horn speaker used with amplifying system. Universal joint shown holds speaker in any position regardless of vehicle motion.

(Below)

Control unit schematic for 2-way mobile-system amplifier.



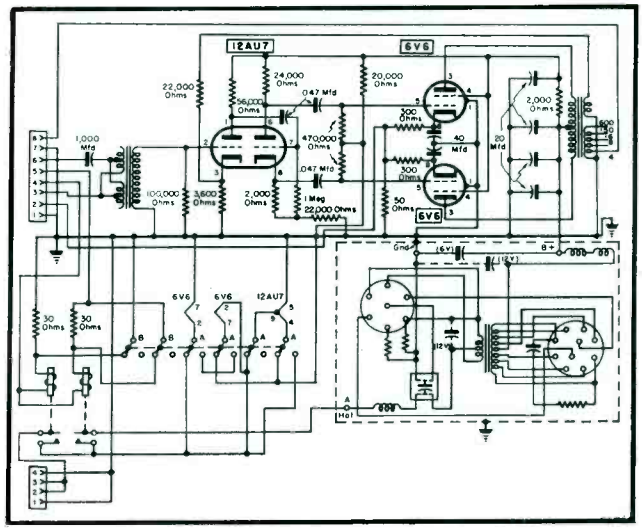
MOBILE AUDIO AMPLIFIER

[See Front Cover]

THE AUDIO SYSTEMS of most mobile receivers are designed to provide adequate listening volume inside a car or truck only. Once the user of a two-way radio unit leaves his mobile unit, it is effectively out of service. This has been found to be a distinct disadvantage to many two-way radio users, such as the fire departments or public utility service units.

At the scene of a fire, for example, it is essential that incoming radio messages be received quickly and accurately, even though the chief may be directing the fire-fighting at some distance from the fire truck. For this and similar applications, there has been developed a 10-watt amplifier which is capable of relaying audio from the receiver to the horn-type speaker with sufficient volume, so that messages can be understood over the noise of pumpers, engines, and a crowd.

The amplifier can also be used as a public address system.



Circuit of mobile audio amplifier designed to operate from 6 or 12-volt sources and provide 8 to 10 watts output; see cover.

Circuit Details

With an input signal of .25 volt (*rms*) the audio amplifier will deliver its rated 10 watts output. This input signal can be obtained either from the mobile receiver output (which is normally padded down to this level), or a carbon microphone. Current for the mike comes from the cathode circuit of a 6V6 push-pull output stage.

An input transformer is used to control the ground loops between the mobile receiver and the audio amplifier. The secondary of this transformer connects directly to the voltage-amplifier section of a 12AU7 input tube. The second section of this tube acts as a split-load phase inverter to drive the push-pull output stage.

Tertiary feedback is used around all three stages, to provide stabilized gain, substantially flat frequency response, and low distortion (less than five per cent harmonic distortion, at rated power output, over a 100 to 10,000 cps range.

6/12-V Six-Position Switch

A six-position switch allows the unit to be changed from 6-volt to 12-volt operation, or vice versa. This switch changes the voltages applied to two relays (*filament on* and *plate power on*) and also connects the filaments of the tubes in the proper manner. When the unit is changed from 6 use to 12-volt use, it is necessary to plug in a different vibrator power supply, and change the fuse and pilot lights.

Control Unit

A separate control unit is supplied with the audio amplifier. This control head has been designed for mounting on the dashboard of the mobile unit. Normally this control head is connected to a two-way radio control head, although in applications where only the audio amplifier unit is employed, the control head can be wired to serve as the complete control unit for the audio amplifier.

The control head is essentially a switching device. When the switch is in the *radio* position, the mobile receiver output is fed to the audio amplifier input, and plate supply power is continuously applied to the audio amplifier stages. In the *pa* position of the switch, the microphone is transferred from the transmitter to the input of the audio amplifier, and plate voltage is applied to the audio amplifier only when the microphone push-to-talk button is depressed. This feature means that the idling drain of the amplifier is low or 1.2 amperes.

A reentrant horn-type loudspeaker* is used with this amplifier. It is a weatherproof type and features a dispersion angle of 70°. Its voice coil impedance is 4 ohms.

*University.

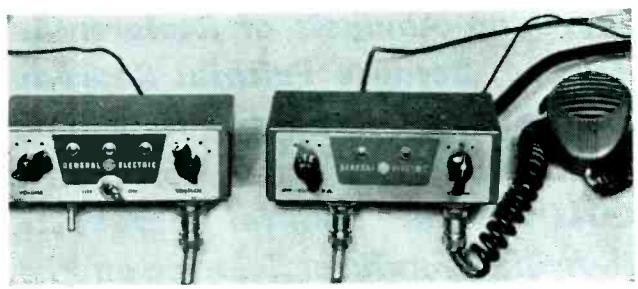
Flexible Speaker Mount

Complete flexibility of speaker positioning is permitted by a universal joint arrangement[1] on which the speaker is mounted. The holding pressure of the clamp has been found to be sufficient to hold the speaker in position even when the mobile unit is traveling a high speed.

Electrical Specifications

Standby current drain of the amplifier is 1.2 amps or less at 6.6 v and .7 amp or less at 13.2 v. Operate current drain is 7.5 amps or less at 6.3 v and 3.2 amps or less at 12.8 v. Amplifier has a harmonic distortion of less than 5 per cent over the frequency range stated, when operated at rated power output. Gain is 40 db ± 3 db measured at 1,000 cps at 5 watts output. And noise level is at least 55 db below rated output. Input impedance is 50 ohms, and output impedances are 4, 8, 16, 150, and 600 ohms.

[1]Universal joint, called a *Powerarm*, supplied to G.E. by the Wilton Tool Mfg. Co.

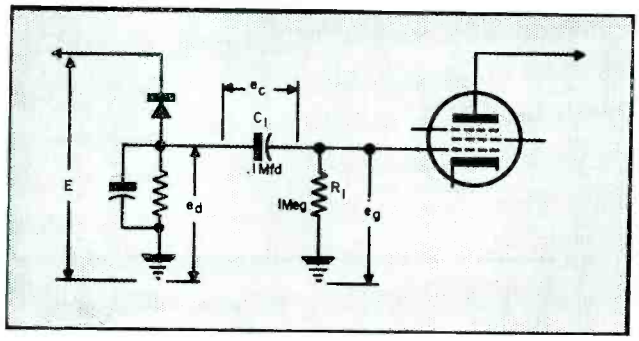


Control heads for (left) 2-way radio and (right) audio system. Units are designed for dashboard mounting.

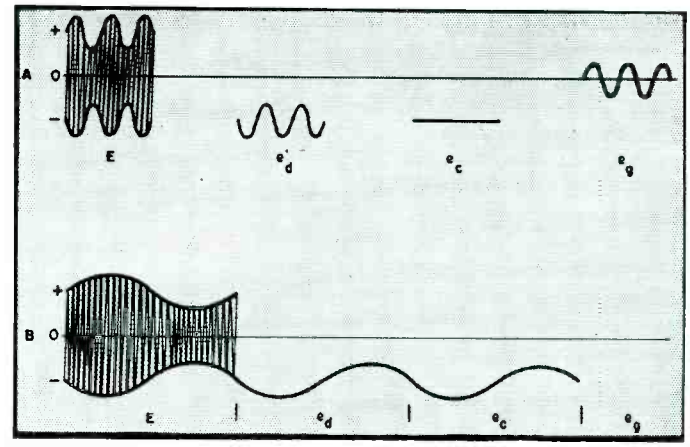
by J. C. GEIST

What Happened to the Will It Return

(Below)
Fig. 1. Video detector operating into a class A amplifier; peaking coils have been omitted for simplification.



(Right)
Fig. 2. Detection of sound modulation in AM: Carriers with sine-wave modulation, illustrating voltage relationships for two conditions of carrier modulation.



THE DESIGN CONCEPTS involved in TV receiver video *dc* restoration have changed considerably since television was introduced as a practical working system just after World War II. This new trend has been prompted by a demand for circuit simplicity and control ease, felt to be more important than faithful reproduction of average brightness levels.

To trace the relationship between reproduction requirements and circuitry let us review the process of demodulation and video amplification.

Stage-Coupling Time Constants

As a first, let us consider the video detector operating into a class-*A* amplifier shown in Fig. 1. Peaking coils have been omitted for simplification, since they are not pertinent to the discussion. Voltage relationships in the circuit for various conditions of carrier modulation are shown in Figs. 2 to 4. A carrier with sine-wave modulation is shown in Fig. 2. Let us assume that the modulation frequency in *a* of this illustration is 1,000 cps. well within the operating range of the circuit. The voltage developed across the detector load, e_d, follows the peak value of the negative half of the carrier and is therefore a signal corresponding to the modulation signal superimposed on a *dc* voltage representing the average value of the carrier. The carrier frequency is eliminated by the detector load bypass capacitor. Voltage e_d is impressed across C_1 and R_1 in series. Under steady-state conditions, C_1 takes on a charge equal to the average value of e_d, as shown by e_c: That is, the total *dc* voltage drop is across the capacitor: no *dc* voltage is across R_1, and no *dc* signal is applied to the grid of the video amplifier. C_1 offers very low impedance to the *ac* component of e_d, so the total *ac* voltage drop is across R_1. This *ac* signal is impressed on the grid, as shown by e_g, and is amplified by the video amplifier. The charge on C_1 is not able to respond to the 1,000-cps modulation, because the rate at which it can change its charge is limited by the time constant of the circuit, which in this case is R_1C_1 or .1 second. Since the time required for the 1,000-cps signal to change from its maximum to its minimum value is only a small fraction of .1 second, the charge on C_1 cannot change rapidly enough to be affected by the signal.

Now let us assume that the modulation frequency in (*b*) of Fig. 2 is 1 cps. As before, e_d follows the value of the negative half of the carrier and constitutes a 1-cps signal superimposed on a negative *dc* voltage. In this case the time required for the modulating signal to vary from its negative peak to its positive peak is .5 second and C_1 is capable of changing its charge at this rate. Hence, all of the 1-cps voltage drop is across the capacitor, as shown by e_c, and none is across R_1, as shown by e_g. In other words, the low-frequency response is determined by the grid-coupling time constant R_1C_1 and for this circuit performance would start to fall off at about 50-cps.

Fig. 3 shows the performance in the presence of a step increase in carrier level. As before, the detector follows

Searching Analysis of Restorer Systems and Design Philosophy, Recently Revised, Because Faithful Reproduction of Average Brightness Levels Has Been Found Secondary—in Monochrome Chassis—to Ease of Adjustment, Maintenance of Good Contrast and Circuit Simplicity: With Advent of COLOR, Where Faithful Reproduction of Brightness Levels Will be Necessary to Avoid Unnatural Coloring on Picture Tube Screens, the Restorer May Return

DC Restorer: with COLOR?

the peak values of the negative half of the carrier. Since C_1 cannot charge instantaneously, a step voltage is developed across R_1, as shown by e_g. This signal gradually decreases to zero in about .2 second as C_1 takes on a charge equal to the new peak carrier level. The length of step function which can be faithfully passed to the grid then depends on the low-frequency response or time constant of the circuit. In this case any step function or square-wave duration longer than about .02 second (25-cps) will be noticeably distorted.

Let us now consider the performance of the circuit in the presence of a TV-signal, such as in Fig. 4. In this figure the spikes represent horizontal sync pulses. The video signal is representative of a dark object against a background gradually changing from light to dark. In (*A*) the change in background level is relatively fast, taking place in less than one field, as might be encountered in a scene with a light sky above a landscape, and hence represents a fundamental signal frequency of 60 cps. In a manner similar to that previously discussed, C_1 is holding a charge representing the average value of the carrier level as shown in e_c, and e_g represents a faithful reproduction of the *ac* component of the modulating signal. The circuit is therefore able to reproduce the relatively fast changes represented by the sync pulses; the black object and the changing background brightness. (It will be noted also that the bottom of the sync pulses are all at the same negative voltage level.)

The signal shown in Fig. 4*b* is similar to that in (*a*) except that in this case the change in background level is relatively slow, taking place over a large number of fields, as might be encountered as the background lighting of a scene shifts to a new darker level in a few seconds. Vertical sync pulses are not shown, to simplify the presentation. In this case, the charge on C_1 is able to follow the background level change as shown by e_c. This change therefore is of a lower frequency than can be passed by the circuit, and the voltage impressed on the grid includes only the signal representing the sync pulses and the dark

(*Continued on page 86*)

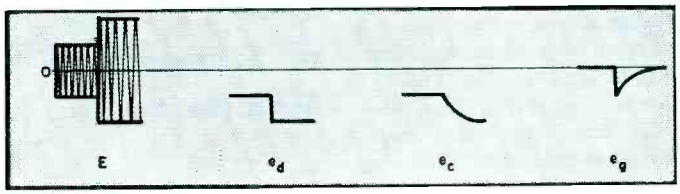


Fig. 3. Circuit performance in the presence of a step increase in carrier level.

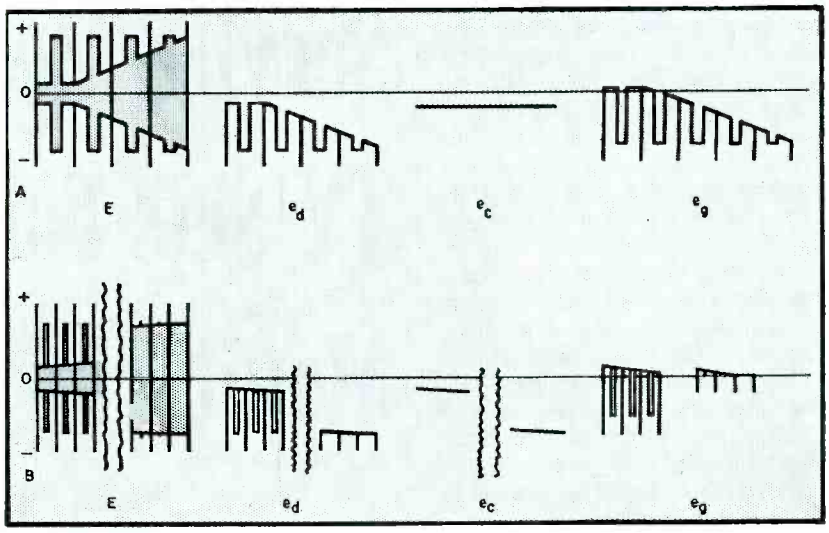
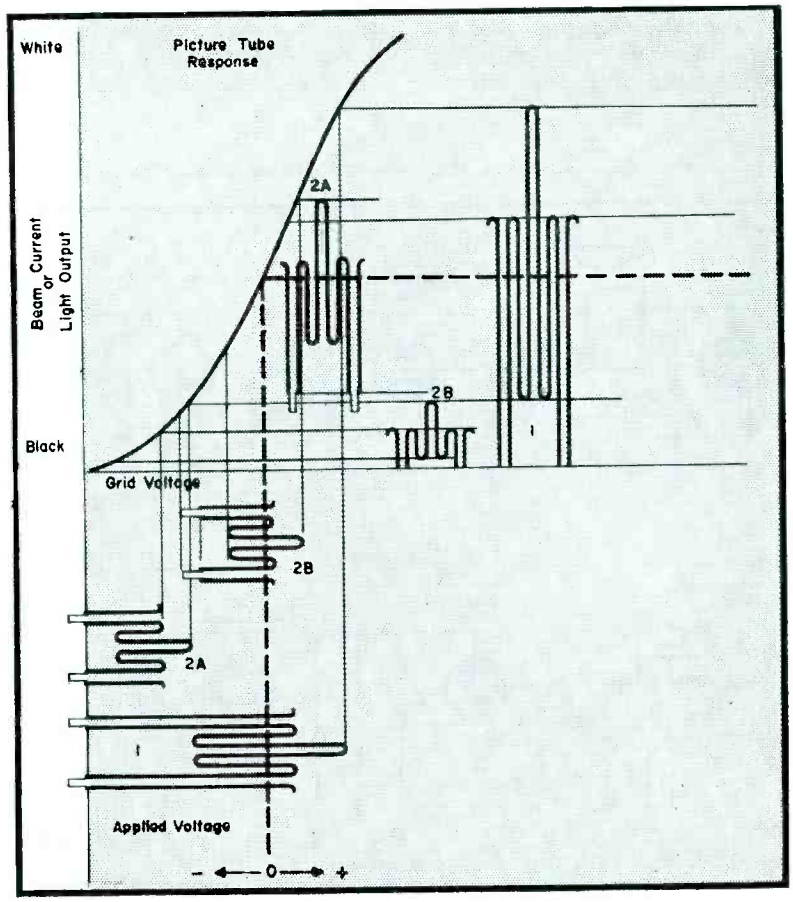


Fig. 4. Performance of the circuit in the presence of a TV signal. Spikes represent horizontal sync pulses.

Fig. 5. Significance of the elimination of the dc component of e_g in B of Fig. 4, when it is amplified and applied to the picture tube, is illustrated here. Curve represents the grid voltage versus beam current or brightness characteristic of a picture tube.



Simple Modifications in Video and Audio Sections of Standard TV Chassis Provide Effective Video Monitoring Unit for New VHF or UHF Broadcasters

Service Men Can Convert TV Sets For Station Monitoring and Cueing

by JOHN B. LEDBETTER

IN A TELEVISION broadcast station, it is both desirable and necessary to provide a number of video monitors for continuous indication of the quality and condition of the transmitted picture, both by air pickup from the transmitter, and by direct monitoring at various points in the studio.

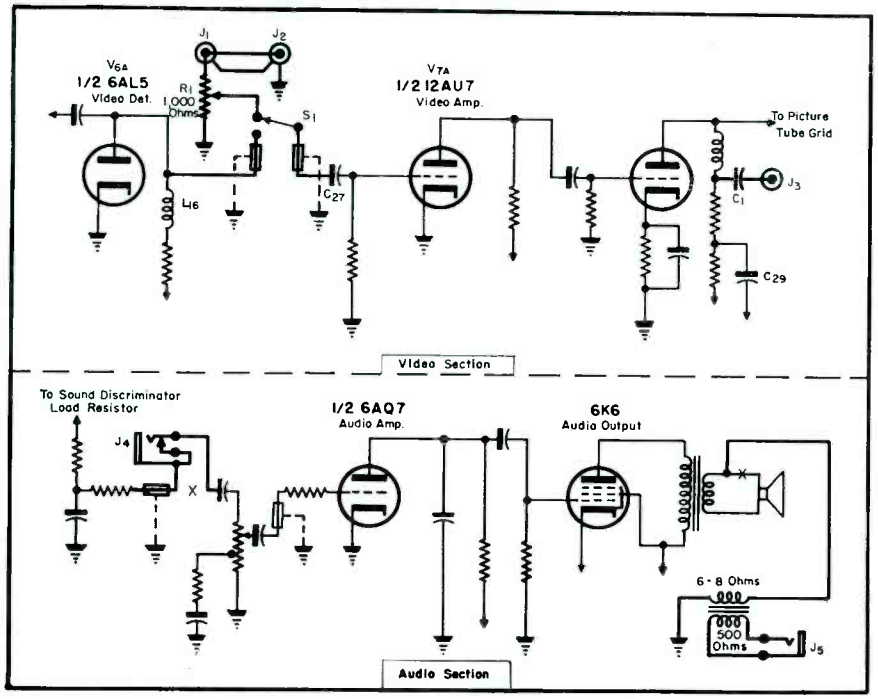
Because of the tremendous demand for TV station equipment, many new stations have found that all of the required video monitors are not immediately available. Moreover, many of the smaller stations may not be able to afford as many monitor units as good operating practice would dictate. (This applies also to facilities for pickup and rebroadcasting video programs from another station). Obviously, then, the station is faced with two alternatives: (*1*) It must forego many special events and carry out normal operations with a minimum of monitoring equipment, or (*2*) it can install a home TV chassis modified for its use.

The latter offers a simple and economical solution to the problem since standard household TV receivers can be converted very easily to conform to the desired applications.

Modification Steps

The changes required in a typical home receiver are shown in Figs. 1 and 2; changes are denoted by the heavy black lines. For a complete conversion, the following parts are required: a 1000-ohm, wire-wound potentiometer (used as contrast control when receiver is operated directly from the studio distribution amplifier); a 6 to 8 ohm/500-ohm line transformer (for feeding audio output of receiver into audio control console); an open-circuit output jack; a closed-circuit audio jack; a pair of female coaxial connectors, and a 1-mfd (or higher) 600-volt paper capacitor. The contrast control is necessary since the studio output video voltage (under normal conditions) is somewhat higher

Fig. 1. Video and audio section of a TV chassis (G.E. 835) modified for broadcast station monitoring use. Heavy lines indicate alterations.



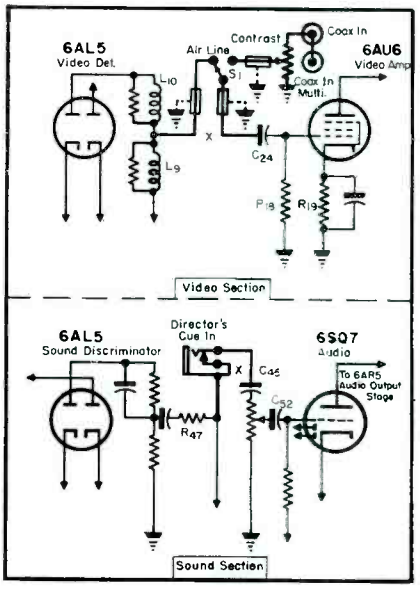
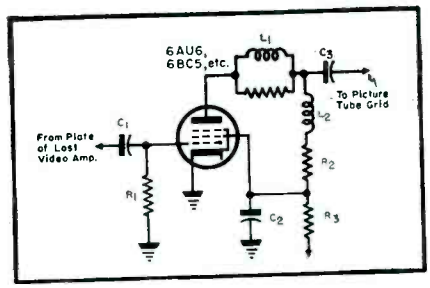


Fig. 2. Video and sound section of another chassis (Sentinel 401) modified for air-line and cueing purposes.



(*Right*)

Fig. 3. Typical video amplifier circuit that can be added to chassis to obtain proper picture polarity.

than that delivered by the receiver's video detector and consequently would overload the video amplifier, with resultant tearing or picture instability.

Coax Connectors for Inputs

Two coax input connectors (one used as a multiple) allow any number of monitor receivers to be bridged across the line. (If only one receiver is to be operated, increased stability and better contrast will result if a 75-ohm terminating resistor (see Fig. 4) is plugged into the multiple coax connector. This assumes, of course, that the line is a normal 75-ohm monitor bus, without previous termination at another unit.) If the monitor line has been previously terminated, the 75-ohm resistor must be left off at the receiver end to prevent double-termination and degradation of signal. If the receiver is to be a permanent installation, it is suggested that the terminating resistor be mounted *at* the receiver input.

Monitor for Switch Leads

The two leads used to connect the monitor selector switch (S_1) to the points indicated by (x) can be scrap pieces of 75-ohm coax line. (This coax section is not necessary insofar as matching the circuit impedance is concerned, but it does help to shield the video detector plate circuit and the amplifier grid leads. The leads to the audio jacks are somewhat longer, and should be completely shielded to keep hum pickup at a minimum.)

Modification for Rebroadcast Use

The coupling capacitor C_1 (1 mfd, 600-volts, or larger) and its associated female coax connector permit use of the chassis for rebroadcasting. With this arrangement, signals picked up by air (from another *vhf* or *uhf* station) can be fed into a stabilizing amplifier and into the master control console, or directly into the console if it has sufficient gain. With normal input at the receiver's antenna, an output voltage of 1 volt, peak-to-peak should be obtained.[1]

Coupling Capacitor Values

It is suggested that C_1 be at least 4 mfd to keep the vertical pulse wavefront as steep as possible. However, no serious depreciation in low-frequency response will be detected with a 1-mfd capacitor. This capacitor, whatever the value used, *must* be paper, with a voltage rating of at least 600 volts, *dcw*.

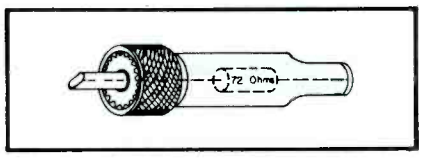
[1]A receiver modified some time ago by the writer was used to rebroadcast a special event pickup from another station some 45 miles away. Using a 6-element colinear array, the receiver picked up sufficient signal, even from a poor receiving location to result in a satisfactory rebroadcast. Although the leading edge of the vertical sync appeared slightly distorted on the 'scope, the receiver was extremely stable, and during the time it was used not one roll-over or inversion due to sync instability was noted.

Other Uses for Chassis

It can be seen that rather flexible operation can be obtained through the foregoing changes. In addition to the use described, the receiver's audio system can be fed from any desired source, independently of the video monitor input. The receiver can also be used as a master air monitor to feed a number of similarly modified receivers. As a studio monitor, the video input can be taken from either a local, network or remote distribution amplifier in the control room, while the audio can be fed from the regular audio console, remote or telephone cue line, or the program director's cue amplifier.

Circuitry Precautions

The main requirement in receiver conversion is that the input (or output) connections be such that the picture will maintain its proper polarity. Connecting to the *cathode* of the second half of the 12AU7 video amplifier in Fig. 1, for example, would result in 180° inversion, or a negative picture. If the particular receiver does not lend itself to conversion for the foregoing reason, a simple video amplifier (similar to Fig. 3) can be added to obtain proper picture polarity.

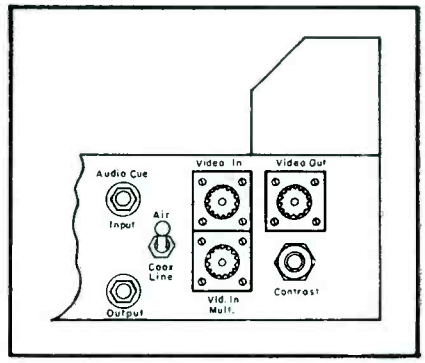


(*Above*)

Fig. 4. Construction of coax plug with line-terminating resistor. In circuit, shown in Fig. 1 (left), S_1 is a spdt toggle switch; J_1, J_2 and J_3 are the female coax connectors; J_4 is a closed-circuit phone jack, and J_5 is an open-circuit phone jack.

(*Right*)

Fig. 5. Layout of parts on converted chassis.



A Report on Dual-Track 2-Speed

First of a Series Detailing the Design, Operation and Servicing of Current Models

by D. S. CEVANS

MAGNETIC TAPE, not too long ago, completely restricted to involved and expensive equipment, is today being used in a host of simplified and popularly-priced units that are highly efficient.

The trend has been sparked by the improvement in tape and the development of ingenious mechanical and electronic advancements including electrical switching, positive-action indicators, compact motors, wide-range amplifiers and allied accessories.

Most tape instruments now being made are dual-track type and can be used for single or dual speeds. Some have been so designed that tapes from high-grade tape libraries or from other tape instruments can be used without sacrifice of frequency response or dynamic range. One series[1] provides this interchangeability feature via an absolute alignment of the instrument's azimuth to exactly 90° ±⅛ of 1°, in addition to an exact tape speed control.

Five push-buttons, in a row, control all of the tape transport mechanisms in these models, and in this instance no relays are used.

An Alnico *pm*[2] erase has been included to provide a positive erase of undesired material from the tape, if desired, even though the material has been inadvertently recorded at excessively high levels.

Also included are a pair of neon indicators set by an exclusive system[2] to provide correct *normal* as well as correct *overload* indications.

In addition to a microphone input there is a *radio, pa* and *phono* input jack.

The frequency response and impedance termination of the radio, *pa* and phono inputs are such that two tape units[1] can be connected together to make tape duplicates. The amplifiers of the tape recorders can also be used as *pa* systems when an external speaker is used.

In operation, to insure the full brilliance of recorded material, the *tone* control on these models is disconnected while recording, and thus the tape has the full frequency response of the source recorded upon it. The units feature bass and treble boosts, intentionally designed into the system so as to help compensate for most radio, microphone, etc., deficiencies. Yet, if one should ever be so fortunate as to record from a substantially flat source, the tone control can be adjusted to flatten out practically the region above 2 kc, and yet retain *bass* boost.

The response also varies with the volume-control setting, perhaps not as much to attain exact correlation to the Fletcher-Munson curves, but rather to overcome the deficiencies of microphones. For example, when recording for best signal to noise and best frequency response, one should hold the microphone about 8″ away from the mouth while speaking. It will be found that the volume should be set at about 50% rotation; since the signal is quite high the full bass and treble boost can be used to *assist* the microphone to make an excellent life-like crisp recording. On the other hand, when recording at say 15′ or 20′ from the microphone it will be found that less treble and bass compensation is desirable to reduce hiss and noise and rumble.

Even line-voltage variations, particularly those encountered during field applications, have been considered in the design of these new models. To provide complete operation at all practical line voltages rewind time has been set at 2 minutes and 45 seconds for a full 1,200′ reel (at 115 volts). The load so provided upon the motor and its oilite bearings is kept low enough to provide continuous service without overheating or overloading the motor or associated components.

The *stop* position on these models not only operates the self-actuating brakes, but disengages *neoprene* idlers as well, to prevent flat spots on the idlers.

Recording is possible at either 3¾ or 7½ *ips*. This together with dual track recording enables one to record as long as two hours on one 7″ reel.

Tube Types Used

In one model[3] four tubes are used in *play* position; a 5879 first preamp; 12AX7 as second and third stage amplifiers, a 6AQ5 as the fourth stage power amplifier, and a 6X4 full-wave rectifier. In *record* position the 5879 operates as a 40-*kc* bias oscillator.

Two other models in this series[4] are considerably different. The bias is 80 *kc*, and different tube types are used.

In *play* position, a 12AY7 serves as the first and second stage preamp; a 12AX7 as the third and fourth stage amplifier (and phase inverter); two 6AQ5s are used in push-pull output, and 5Y3 is used as a full-wave rectifier.

In *record* position ½ of the 12AY7 functions as a bias oscillator.

During development work, it was found that the very low hum of the 12AY7 was greater than desired in the high gain units; thus a special adjustable hum-balancing arrangement was inserted to reduce the hum another 6 to 12 db.

Since the signal picked up from the tape by the head is on the order of 150 to 400 microvolts, or about that obtained from a near-fringe television antenna, certain criteria exist for best design; namely, tube thermal noise, hum and in addition, microphonics.

These have been kept through adequate shielding, circuit design, components, part placement and tube suspension to provide a gain of approximately 12 db greater than that required to produce full output from a *normal* tape.

Normal Tape Signals

It has been found that signals from 4 to over 200 millivolts are adequate for making *normal* tapes when using the mike input. This is said to be adequate for controlled reluctance microphones, reluctance pickups, cera-

Based on on exclusive analysis prepared by* **Edward Jahns, *chief engineer of the Wilcox-Gay Corporation.*

[1]Wilcox-Gay Recordios 3A10, 3F10, 3F40.

[2]Pat. Pending.

[3]Wilcox-Gay 3A10. [4]3F10 and 3F40.

TAPE Recorder-Playback Equipment*

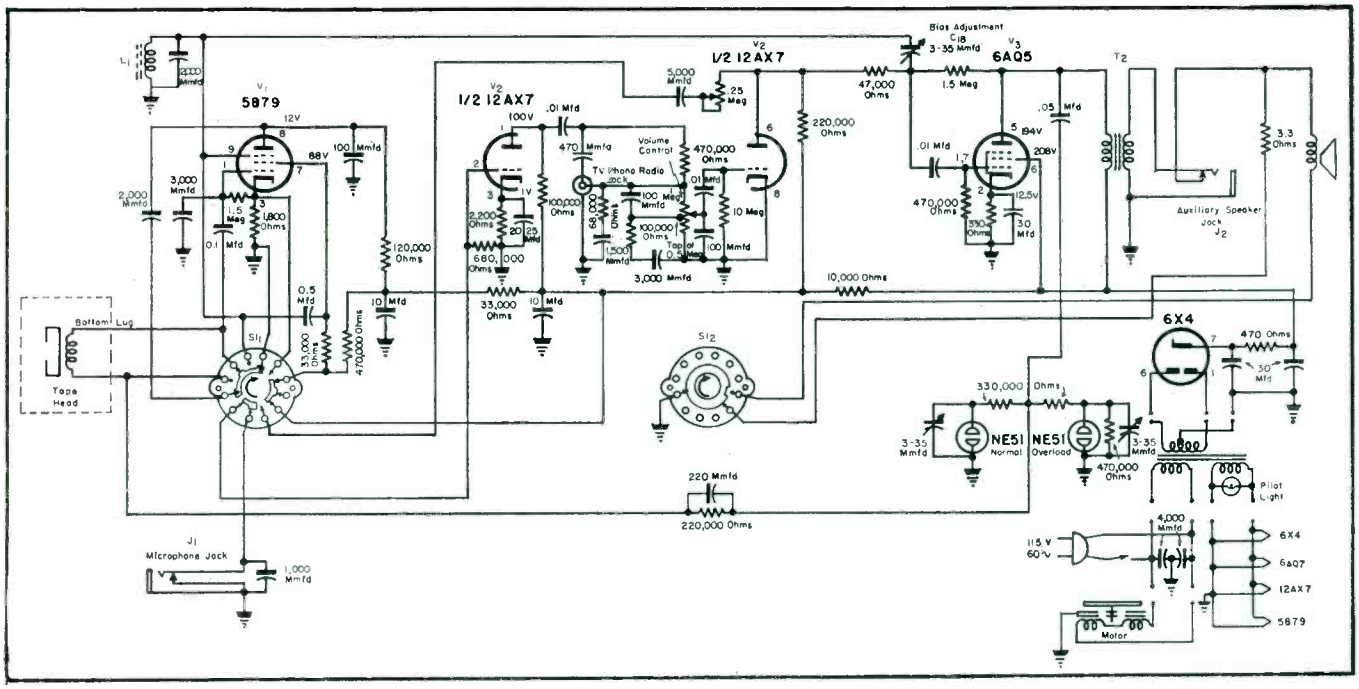


Fig. 1. Schematic of amplifying system used in Wilcox-Gay 3A01, which provides 2-watts undistorted output and 4-watts maximum.

mic and rochelle-salt crystals, as well as most dynamic microphones.

The second input handles signals of from 100 millivolts up to at least 30 volts *rms*.

Overloading Problem

Probably more tapes have been made poorly because of overloading them than all other reasons combined. This problem can be overcome by making a few trials to determine the correct level; adjusting the level so that the *normal* neon lights once for every three or four words which are spoken, and for music about once every five seconds, except when recording some passages in which case it should light even less often; and preventing the *overload* neon from lighting more than once every 20 or 30 seconds.

In repeated tests, it has been found that a properly made tape will have a greater dynamic range and lower noise level than any other medium and further does not deteriorate with replaying

Fletcher-Munson Curves

Considerable data has been prepared reviewing the advantages or disadvantages of the Fletcher-Munson curves. It has been found that unless the sound pressure output from the speaker is taken into consideration, a qualitative estimate of their action cannot be obtained. For one thing, the speakers and microphones furnished with these models display a decided increase in output at from 2 to 4 *kc*. as do practically all other microphones and speakers, regardless of size.

Speaker Capabilities

Enclosed speakers (5 x 7 and 6 x 9, respectively) are used in these units and are excellent for their size; but for maximum fidelity, it will be found that large, well-baffled, external speakers are best.

Hi-Fi Possibilities

The foregoing is not meant to belittle the enclosed speakers, but rather to point out that fidelity, low intermodulation distortion, low wow and flutter, high signal-to-noise ratio and wide range have been built-in to these recorders and a larger speaker system can capitalize on these features more effectively.

Fig. 2. Overall response at 7½ ips. In processing this waveform, the record volume was on full, and input was 2 millivolts. This response represents the result obtained from the entire system; recording on tape to playing back.

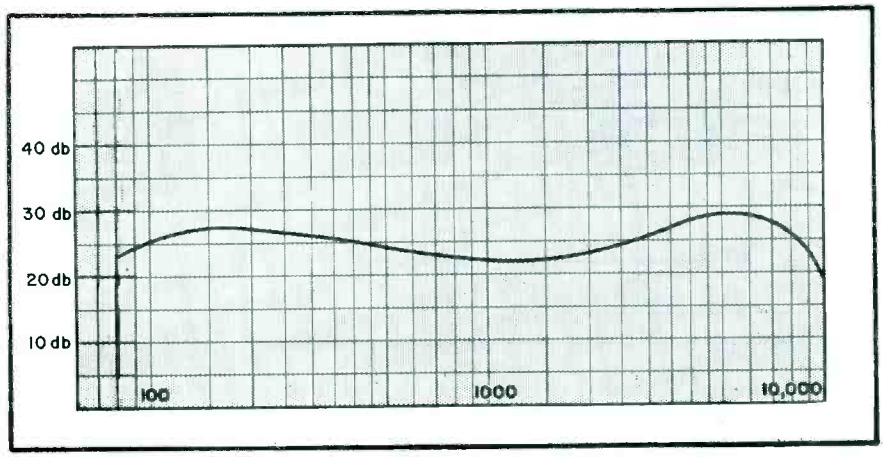
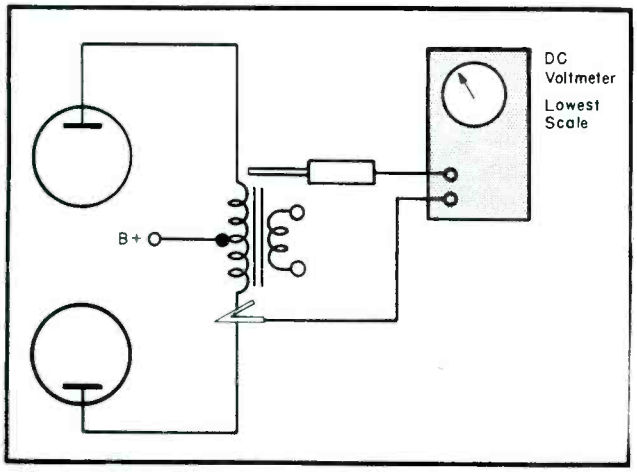
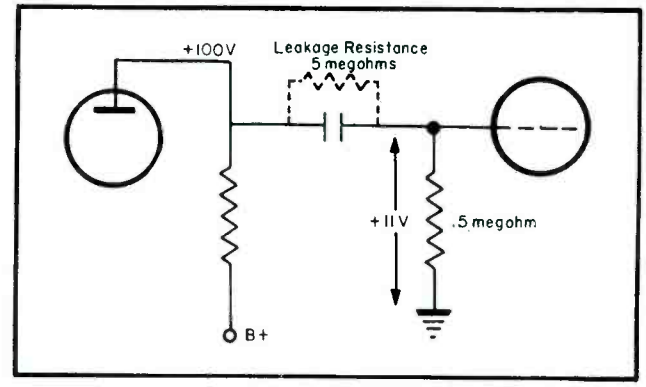


Fig. 2. Method of checking dc balance of push-pull output stage. The dc voltage across the whole of the transformer primary should be zero, or as close to zero as possible; preferably less than 1 volt.





(Above)

Fig. 1. Application of positive voltage to grid through dc leakage resistance of coupling capacitor, upsetting proper bias. A good paper capacitor will have a leakage resistance of hundreds of megohms.

The Maintenance of

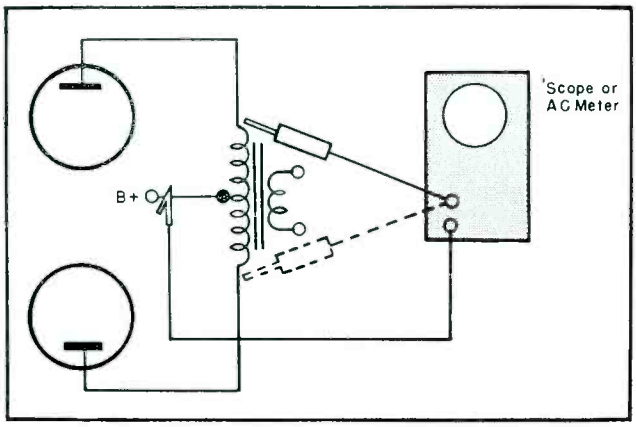
THE PROPER MAINTENANCE of *hi-fi* audio systems is as important as the proper design of the original installation.

The basic *approach* to the diagnosis of trouble in audio or radio and TV installations is the same, *but* there is *one change of emphasis.* Servicing of conventional radios is normally concentrated on the chassis, while in the audio field attention is directed to the whole system. For example, many small mechanical defects associated with cartridges, record player motors, or other components, which would have been obscured by poor frequency response and higher distortion levels of ordinary systems, create a dramatic contrast to normal performance in *hi-fi* systems.

In audio servicing, it is first necessary to localize the trouble, not to a single circuit, but to a complete unit or interconnecting cable network. Cable connections are especially liable to cause trouble when the separate units are not anchored in their places, and where the owner can move components around for the purpose of dusting the shelf underneath.

The best procedure for trouble localization is the substitution of a unit known to be in good working order, for each of the components of the ailing system in turn. While this may not be practical in many cases, the principle may be applied to units feeding the amplifier. If FM reception is bad, but AM and phono are normal, the amplifier and speaker are clearly not at fault: the trouble can be narrowed down to the FM circuits prior to the *AM/FM/Phono* switch, or to the switch contacts themselves. The tuner chassis alone, *with its associated cables,* can then be removed for servicing.

When the amplifier is not working, no opportunity is available to check between the various signal sources feeding the amplifier's input jack. The overall operation of the amplifier and speaker in a dead system can be checked very simply, however, by touching the *hot* input signal terminal with a finger or screwdriver. (The screwdriver should be in electrical contact with one's hand, and the test signal should not be grounded out by contact between the other hand and the chassis.) A healthy, raucous hum should result in the speaker. If the speaker is silent, or only emits faint sound, the amplifier-speaker system is at fault. Substitution of a test speaker, headphones, 'scope, or even a low scale *ac* voltmeter for the speaker will usu-



(Left)

Fig. 3. Checking signal balance of a push-pull output stage by comparing signal voltages across each half of the transformer primary.

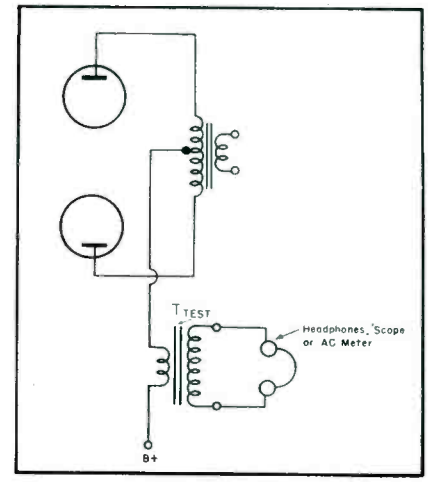
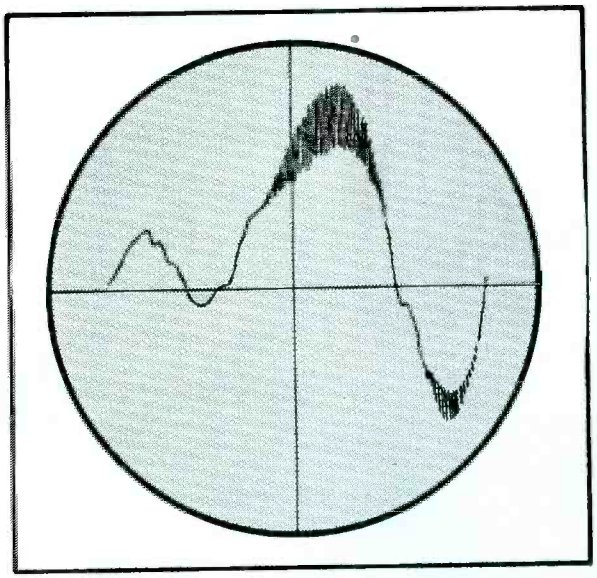


Fig. 4 (right). Circuit for checking push-pull signal balance with pair of headphones. *T* test represents output transformer; the position of the secondary and primary windings reversed. With the amplifier putting out a signal, there should be zero or very little signal in the phones.

Servicing Audio Amplifiers—Through Tube and Push-Pull Balance Checks . . . Tracing and Curing Amplifier Oscillation . . . Diagnosing Troubles in Record Players

by MARK VINO



HI-FI AUDIO Systems

ally, but not always, convict the amplifier. Quality speakers are not infallible, but they are very reliable.

Servicing Audio Amplifiers

Modern vacuum-tubes have been designed to plug into tube sockets, and for a very good reason. The experienced Service Man knows that, of all the parts used in electronic devices, the tube is the most subject to failure, and is the greatest single source of trouble. Before removing a defective amplifier from the system and turning it upside down, therefore, the tubes should be checked, preferably by temporary substitution of new ones.

Certain conclusions can be drawn from a visual inspection of the tubes in operation. A bluish glow in an output tube may indicate only slight gasiness, and is not necessarily a trouble symptom, although if the glow extends to the electrodes the tube must be suspected of being defective. A violet-pink glow, however, is an indication of air leaking into the glass-envelope, and means a bad tube. If the plates of the rectifier tube begin to turn cherry red, overload of the $B+$ supply is clearly indicated. The amplifier should be turned off immediately and not operated again until the short (whether in a filter, tube, or other component) is cleared up.

Similarly, if a rectifier tube checks bad, the resistance from $B+$ to ground should be measured prior to putting in a new rectifier. In many radios this resistance consists exclusively of filter capacitor leakage, and can be of the order of several megohms after the first initial acceptance of current from the ohmmeter. Most audio amplifiers, on the other hand, employ a *bleeder* resistor between $B+$ and ground, whose resistance may be 15,000 ohms or lower.

Even if the ohmmeter shows no short from $B+$ to ground, the new rectifier tube should be watched carefully during its first minutes of operation. The old rectifier may have been blown by a *hot* short; that is, a short within a tube that only exists when the electrodes bend with the heat. If there is any suggestion of cherry glow from the rectifier plates, or of fireworks from other tubes, the amplifier must be turned off again immediately. Operating an amplifier with a $B+$ short for any length of time will result in destruction of the power transformer if the rectifier does not go first.

Other techniques for localizing trouble within the amplifier are the same as those for conventional radios. Since the entire signal channel is audio, the use of an abbreviated signal injection technique, using a screwdriver as referred to, rather than a signal generator, is especially applicable. The grids of the tubes are stimulated in turn,

(*Continued on page* 81)

(Above, right)

Fig. 5. 'Scope trace of supersonic oscillation that breaks out on signal peaks only. This type of oscillation may sound very much like speaker rattle.

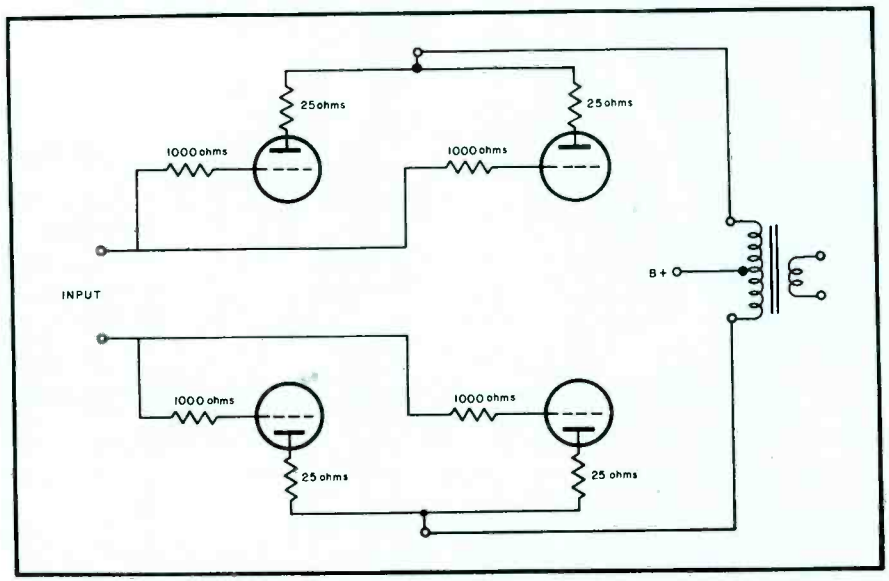


Fig. 6. Connection of stopping resistors in a push-pull parallel output stage, to prevent parasitic oscillations.

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the highest gain all-channel VHF antenna ever developed!

Featuring the unique new "Tri-Pole"

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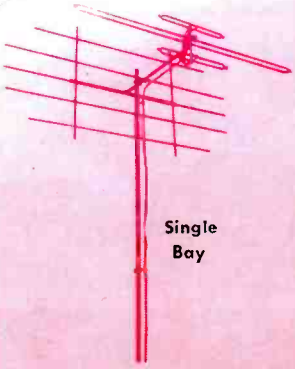

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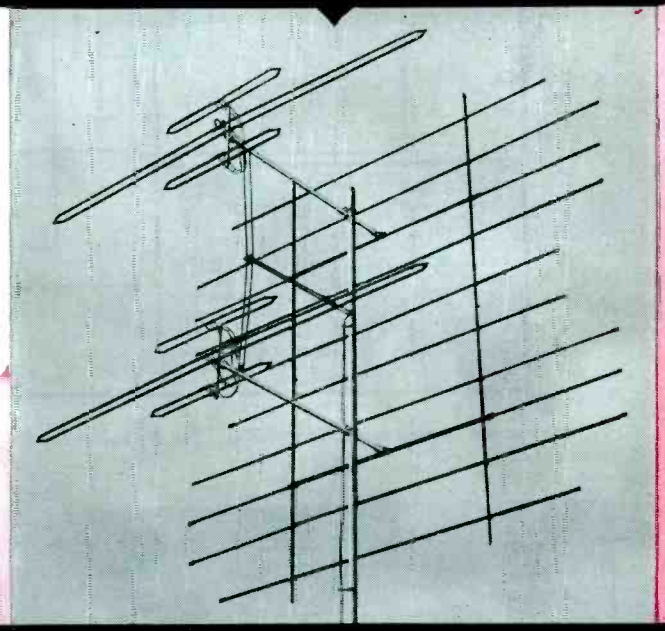
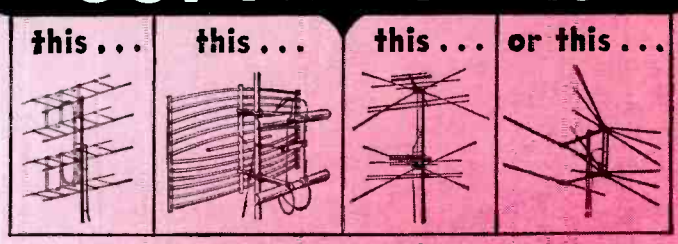


OUT-PERFORMS:



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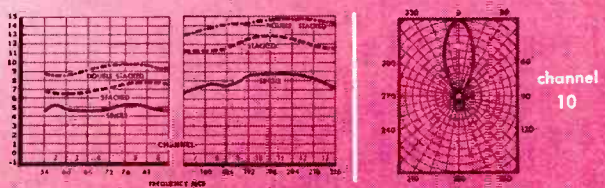

Model No.		List Price
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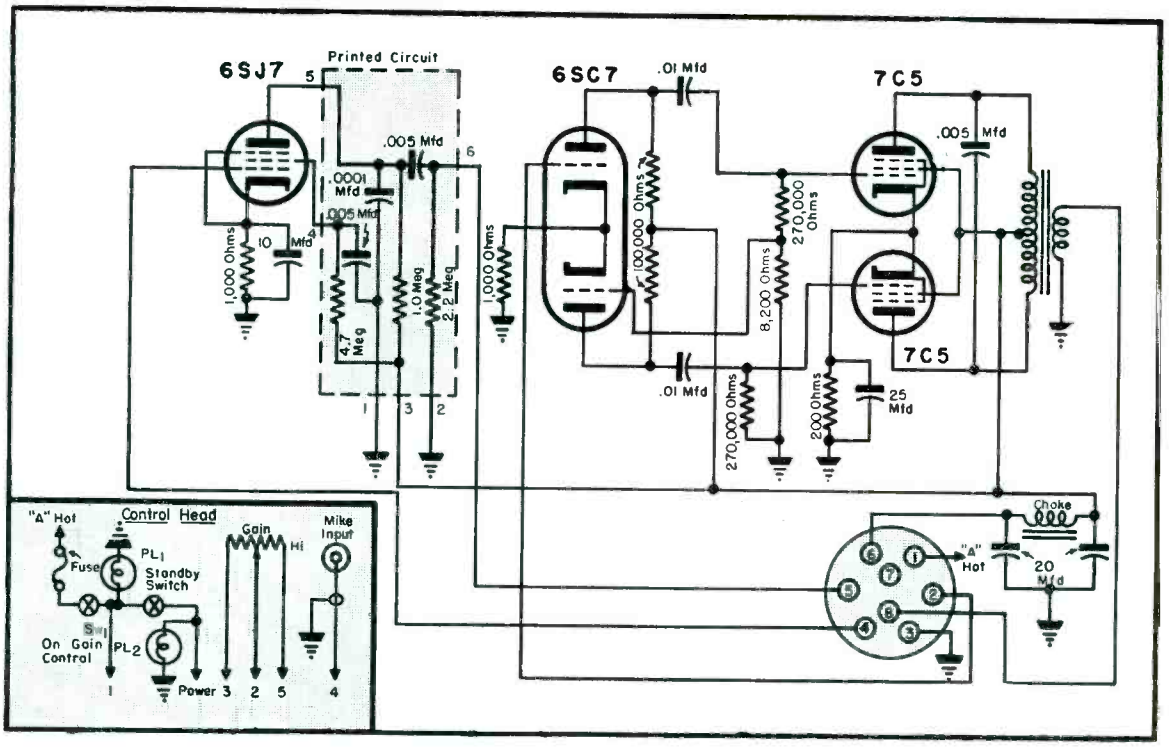
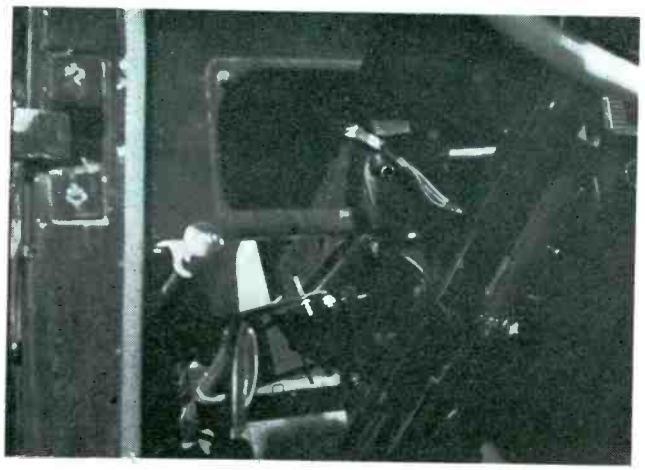
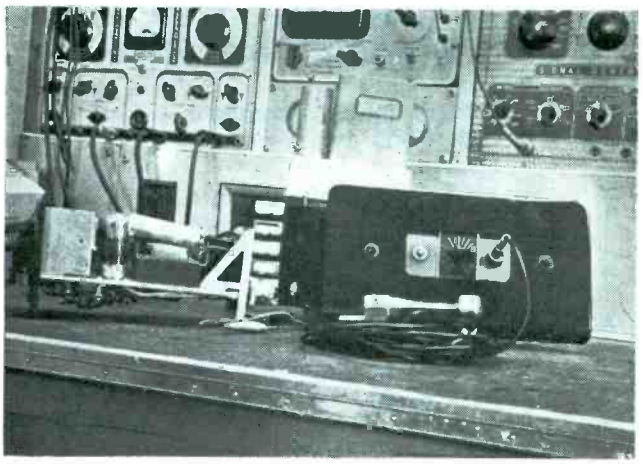


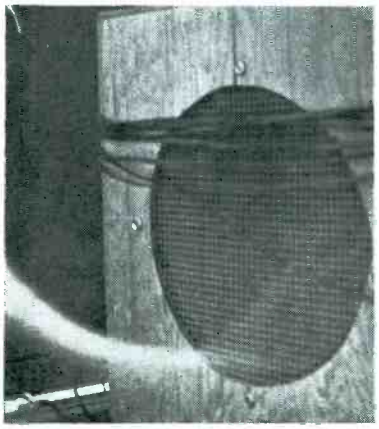
Schematic of printed circuit amplifier. The B supply can be switched on and off into standby by a toggle switch in the control head.



View of amplifier unit and power supply installed in car. Power pack is just to right of knob, while amplifier chassis is just above steering column. This view was taken through hole where control panel was eventually installed.



Side view of amplifier chassis at left. Control panel is at right and power pack at center atop cabinet. Microphone is on bench before control panel.



(Right)

Bottom view of amplifier chassis. Printed circuit is at upper end of chassis (light-color patch). Input plug is on bench below chassis. Back view of control panel also appears in this photo.

(Left)

Baffle with one of the 12-inch pm speakers mounted in car.

About As Much As Average Auto Radio

Miniaturized Mobile PA System Using Printed-Circuit Units

by JACK DARR

AT OUTDOOR REAL-ESTATE auctions and other events where *ac* is not always available or convenient, compact, low-drain mobile *pa* systems are mighty handy. Drawing less than 9 amperes, or about the same as a modern auto radio, such units can be used for periods ranging up to three or four hours, without undue drain.

Fig. 1 illustrates an amplifier of this type, *miniaturized* as much as possible. A printed circuit is used in the pre-amp stage and all other parts and wiring arranged to save as much space as possible.

High voltage is furnished by a separate-unit power pack,[1] with a reversible synchronous vibrator, enabling it to be used with any battery polarity. The *A* input and *B* output voltages are brought out to a two-terminal strip on one end of the chassis, while the chassis of the car itself furnishes the common return path.

The gain control, a .5-megohm unit, with audio taper and master on-off switch, high-voltage *standby* switch, microphone connector and the two pilot lights are mounted on the left-hand panel of the car's dash, in the area designed for the custom radio receiver. The dummy cover-plate and the two snap-buttons can be removed and saved. Another plate can be used to mount the controls; the two pilot lights will fit exactly into the two holes left by the snap-buttons.

The amplifier provides an overall power output of around ten watts. It uses two 7C5s, operating in class *AB*-1. These power amplifiers are driven by a twin-triode phase-inverter driver, using a 6SC7. A 6SJ7 serves as the microphone preamp; this is coupled into the input of the driver by a printed circuit.[2] As couplers, 01-mfd ceramics are used; all resistors except those used for 7C5 bias resistor are ½ watt size.

Originally, the circuit had the gain control in the very first stage, across the microphone itself. This was found to produce a bad hum, together with a tendency toward oscillation; thus the control was moved back to a better location, between the output of the first 6SJ7 stage and the input of the 6SC7 driver. This called for more shielded wiring, but gave considerably better results. All power, speaker output and audio input wiring goes to an 8-prong plug and socket assembly mounted on the back of the chassis.

Only one wire is used to feed the speakers, the other side being grounded. This type of arrangement provides plenty of good grounds; an extra grounding wire should be run from the control head to the chassis. If the grounded shield of the wiring carrying the gain control circuits is allowed to pick up any of the return currents flowing to the vibrator pack, a bad hum and possibly oscillation will result. If any hash is present after installation, the addition of extra heavy binding will probably eliminate it.

In a typical installation, the three units were installed in a car in the space provided for the car-radio. The dash panel was removed and amplifier chassis mounted on top of the wide brace running from firewall to dashboard. Two short *J* bolts were used, hooked into holes in the side of the chassis, and run through holes drilled in brackets mounted on the sides of the brace. The power supply chassis was mounted on the firewall itself; four spade bolts were placed on its underside. These were fastened to two heavy metal straps, with holes drilled in appropriate places, and the straps then bolted to the firewall.

A standard auto-radio fuse holder was used, and the hot end connected to the accessory bolt of the ignition switch. This was done to prevent operation of the amplifier by unauthorized persons and prevent accidental discharge of the battery; the amplifier cannot be turned on without the ignition key.

The volume control and microphone input cable are shown running in individual shielded leads, with the shields soldered together at intervals. Due to peculiarities of this circuit, it was found that better results will obtain if a three-conductor, overall-shielded cable is used for the gain control, and an individual shielded lead for the microphone input. These leads must not be allowed to ground anywhere outside of the amplifier: if they do, they will become a part of the return path for the supply current, and induce a loud buzz into the sensitive input. It may be necessary to insulate the *control-panel* from the chassis of the car to stop the hum and tendency toward oscillation in the front end.

The speaker wiring was carried up and over the doors on the left side of the car, being tucked inside the trim, out of sight. At the back, a hole was cut in a masonite lining, and a 6-prong socket mounted. The hot wire was connected to terminal *2* of this socket, and *5* grounded, by a wire under a nearby screw.

The system uses two light-duty 12″ *pm* dynamic speakers, enclosed in homemade plywood baffles. Extension cables and plugs were provided for them, so that they could be used either atop the car, as was originally planned, or carried some distance away. An extension cable was also provided for the microphone[3]. All microphone cables were provided with plugs[4] which have *floating* locking-rings: these may be screwed off the plug, permitting use as either a male or female type plug. Thus, all extensions can be readily joined into one long cord, for long runs. A total of 100′ of microphone cable was used.

---

[1]Mallory VP-552 Vibrapack.
[2]Centralab PS-91.
[3]Turner *candlestick* type used. [4]Amphenol.

Video Amplifier Performance Factors

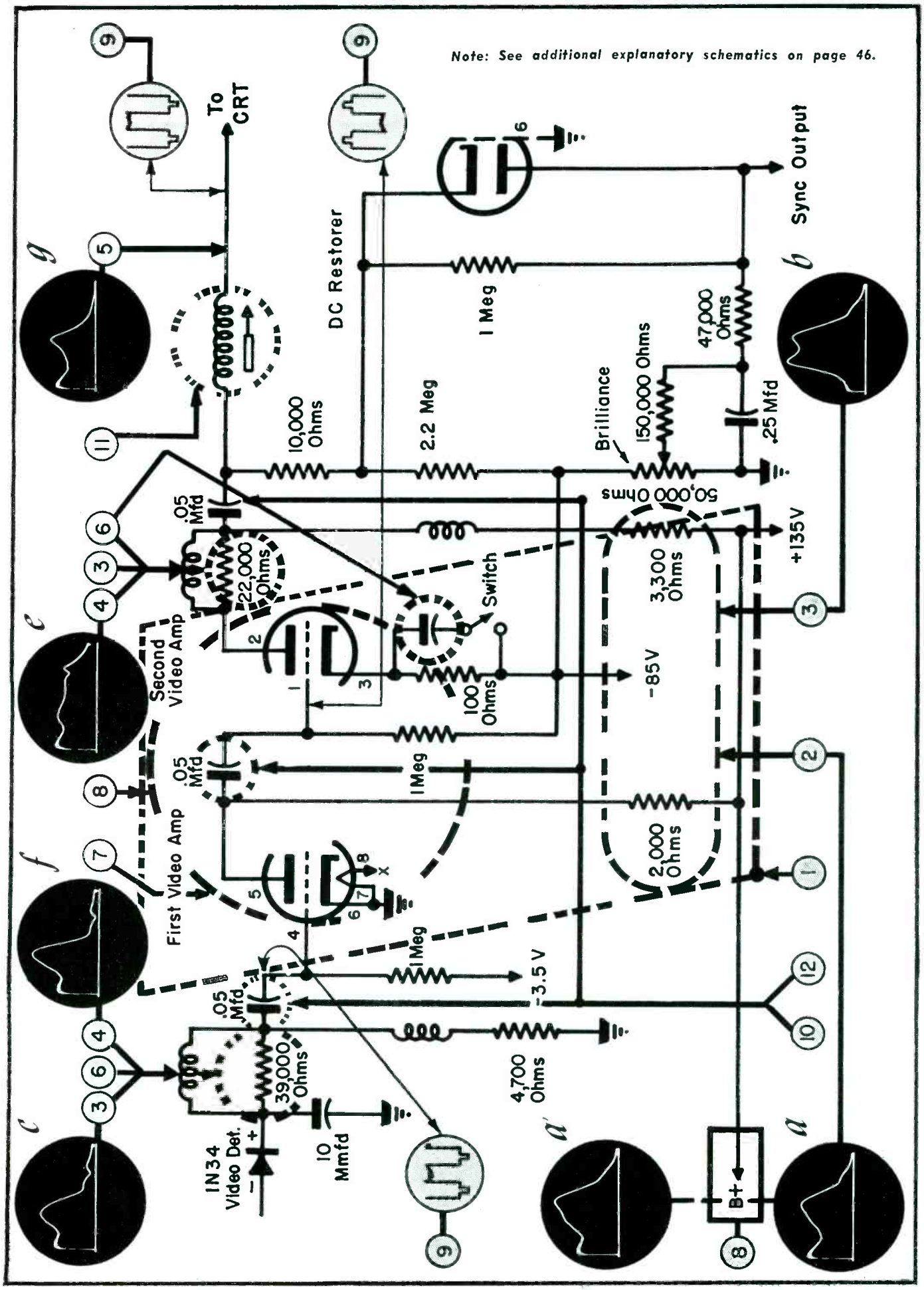
Chart Analysis of Buzz . . . Saturation . . . Hum Bars

by CLARK R. ALISEN

Grain . . Smear . . Trailing Reversal

Condition	Reason	Control Method
Buzz in the sound at high contrast levels; when not due to *if* amplifier trouble. (1)	Intermodulation of picture and sound signals due to non-linear tube operation.	The signal-handling capability of the video amplifier should be increased by using selected tube. Electrode voltages and value of plate-load resistors should be checked: **See circuit at right; circle (1).**
Horizontal wedges darker than vertical wedges; not due to *rf* or *if* misalignment. (2)	Rising response at low video frequencies.	Values of plate-load resistor and peaking coils should be checked; the latter for opens or shorts: **See circuit and characteristic waveforms at right; circle (2).**
Vertical wedges darker than horizontal wedges; not due to *rf* or *if* misalignment. (3)	Rising response at high video frequencies.	Values of plate-load resistors and damping resistors across peaking coils should be checked: **See circuit and characteristic waveforms at right; circle (3).**
Artificial ghosts, or ringing in picture; not due to *if* misalignment. (4)	Excessive peaking of video amplifier.	Values of damping resistors across peaking coils should be checked: **See circuit and characteristic waveforms at right; circle (4).**
Fine detail of picture weak; peaking coils and load resistors okeh. (5)	Excessive capacitance at output of video amplifier.	Dress of lead to grid of picture tube should be checked; must be dressed clear and run along chassis for any appreciable distance: **See circuit and characteristic waveforms at right; circle (5).**
Trailing reversal in picture; not due to *if* misalignment. (6)	Excessive high-video peaking.	Damping resistors across peaking coils, and possible bypass capacitor across video plate circuit, should be checked: **See circuit and characteristic waveforms at right; circle (6).**
Black and white saturation of picture; not due to overdrive, or to *if* amplifier trouble. (7)	Incorrect bias on video amplifier; subnormal plate and screen voltages.	The *dc* operating voltages should be checked and corrected as indicated: **See circuit at right; circle (7).**
Hum bars in picture; not due to *if* trouble. (8)	60-cycle modulation of video signal, or 120-cycle modulation.	Heater to cathode leakage in video amplifier tube should be checked; check also for *ac* in plate supply voltage: **See circuit at right; circle (8).**
Dark screen; not due to *rf* or *if* trouble, or to picture-tube difficulty. (9)	Break in video signal path.	Progress of signal should be checked with scope, and the faulty component repaired: **See circuit at right; circle (9).**
Picture weak and washed out; signal out of picture detector okeh. (10)	Leaky grid-coupling capacitor (grid of amplifier, or grid of picture tube).	Grid bias should be checked with *vtvm*; faulty capacitor should be replaced: **See circuit at right; circle (10).**
Grain (4.5-mc beat) visible in picture. (11)	Grain trap(s) tuned to incorrect frequency.	Trap(s) should be tuned for minimum grain in picture; may be in *if* (4½-mc trap may be wired in series with picture-tube grid): **See circuit at right; circle (11).**
Smear in picture. (12)	Time delay not constant for all video frequencies.	Values of coupling, bypass, decoupling, and low-frequency compensating capacitors should be checked: **See circuit at right; circle (12).**

(Right): Schematic of video detector, video amp and dc restorer of a typical TV chassis. Waveforms at (a)=video-response curve, plate-load resistance increased; (b)=video-response curve, plate-load resistance decreased; (c)=video-response curve, detector series-peaking coil shorted; (e)=video-response curve; output series-peaking coil shorted; (f)=video-response curve, damping resistor of detector series pc open; (g)=video-response curve, excessive capacitance of output lead to chassis. (Numbers in circle serve to identify portion of circuit similarly numbered and discussed in table.) Note: Curve A does not exhibit truly a loss of low frequencies, because practical commercial situations are involved in this report. In these instances, the normal condition utilizes a rise at high frequencies to compensate for loss of the highs in the if amplifier. Such a normal video curve appears in A[1].



Summary of Video Response Factors:

See chart, page 44

Due to Peaking-Coil, Load-Resistor and Damping-Resistor Changes

STANDARD VIDEO-AMPLIFIER arrangements utilize a shunt-peaking and a series-peaking coil, operating in combination with a plate-load resistor and a damping resistor, as shown in Fig. 1. The shape of the video response curve can be affected by values of these components as follows:

(*1*) Increasing the value of the plate load resistor *bumps up* the low-frequency end (up to 1 or 2 mc), and leaves the high-frequency portion of the curve essentially unchanged; the mid-band portion tends to *sag*.

(*2*) Decreasing the value of the plate-load resistor reduces the response at the low-frequency end, and flattens out the curve.

(*3*) Increasing the inductance of the shunt-peaking coil *bumps up* the central portion of the curve, and also reduces the high-frequency response somewhat.

(*4*) Decreasing the inductance of the shunt-peaking coil causes mid-band *sag*, and increases the high-frequency response somewhat.

(*5*) Increasing the inductance of the series, peaking coil decreases the high-frequency response by *bumping up* the response following mid-band, with a falling-off of response at high frequencies.

(*6*) Decreasing the inductance of the series-peaking coil merely causes the high-frequency response to fall off; the resonant frequency is now too far out of the response range of the amplifier to have much effect on the curve shape.

(*7*) Increasing the value of the damping resistor causes the high-frequency end of the curve to be *bumped up*.

(*8*) Decreasing the value of the damping resistor has the same effect as decreasing the inductance of the series peaking coil, and causes the high-frequency response to fall off.

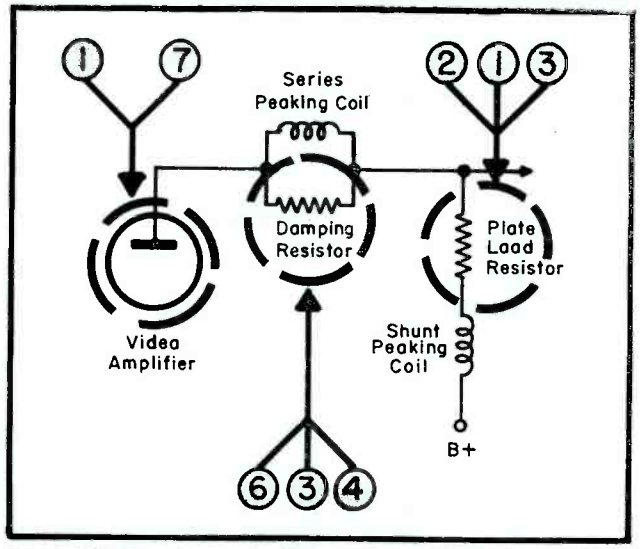
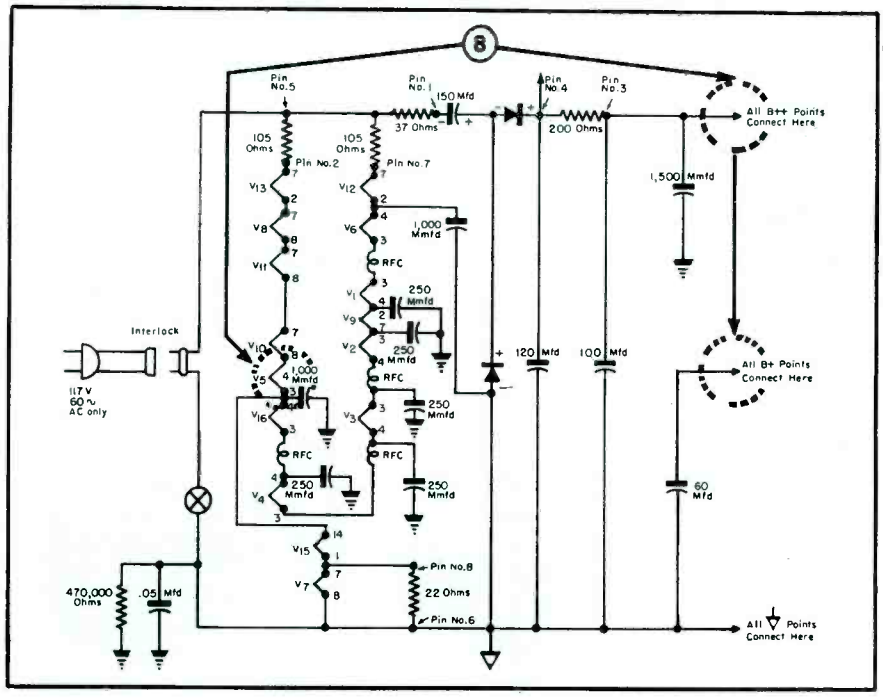
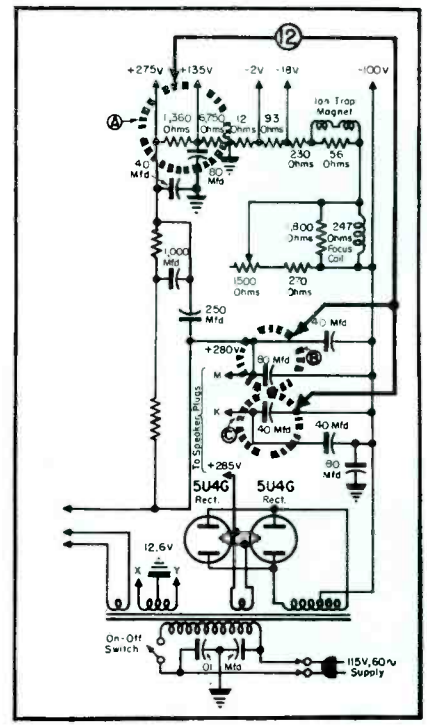


Fig. 1 (left). In the standard video-amplifier arrangement, shown here, the value of the plate-load resistor controls low-frequency response, the value of the shunt-peaking coil controls mid-band response, and the value of the series peaking coil controls high-frequency response. Flatness of the video-response curve depends upon proper relations between values of damping resistor, plate-load resistor, and peaking-coil inductances.

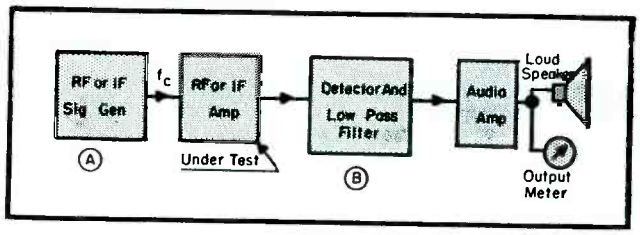
Fig. 2 (left, below). The heater-cathode voltage is higher in a transformerless power supply, as illustrated, than in the transformer type, and hence the tubes must sometimes be more carefully selected for heater-cathode leakage. (Courtesy Motorola)

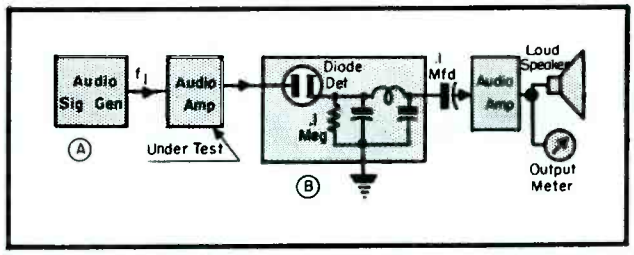
Fig. 3 (below). Power supply circuit showing import of 80-mfd bypass capacitor (A), which serves to keep the 275-volt line cold; this line feeds several receiver sections. When the capacitor opens up, and if other of the filter capacitors such as (B) and (C) have become aged, violent oscillation may occur, with howling from the speaker and complete breakup of the picture. Intermediate degrees of failure cause various obscure faults in circuit action.





Figs. 1 (left) and 2 (right). Intermittent test setups. In arrangement shown in Fig. 1 at (a), f_c from the rf or if signal generator is adjusted to be acceptable to amplifier under test, and the output amplitude is set for best sensitivity. The low-pass filter (shown at b) is adjusted to reject f_c. In the Fig. 2 setup, f_1 out of the audio signal generator is adjusted to 10-kc (approximately) and amplitude set for best sensitivity. Here the low-pass filter (b) is adjusted so that it will not pass f_1.





INTERMITTENT FAULT LOCATION In Electronic Equipment

by SIDNEY WALD

Carrier Amplification Technique Adopted to Simplify Troubleshooting and Predict Problem-Areas Before They Seriously Affect Equipment Usefulness

THE DETECTION OF intermittent faults in electronic equipment is an art in which the chief tools have been experience, ingenuity, intuition and patience. Technical skill and scientific ability have played comparatively minor roles because of the very nature of the problem; which by definition, exists only at random moments.

The general methods of attack have been to attempt to extend the duration of the fault; to attempt to apply orthodox maintenance routines such as signal tracing, voltage measurements and continuity tests. Not knowing the cause of the intermittent fault, however, it is difficult to prescribe a universal treatment designed to make it more amenable to leisurely analysis.

One of the *treatments* which has been attempted from time to time consists of applying excessive potentials to filaments and plate circuits in the hope that whatever has been breaking down or *opening* intermittently will be adversely influenced by such cruel treatment and revert to a permanent cessation of operation.

Too often this practice has no effect on the elusive original fault and succeeds only in creating a new one which obviously multiplies the difficulty.

Another popular treatment consists of standing by patiently until the fault should decide to show itself and then to creep up on it stealthily with either ohmmeter, spare capacitor or mallet, whichever way intuition seems to lead.

Finally, the method used most frequently also happens to be the most violent. The individual to whose sad lot the task has fallen grasps the equipment firmly, elevates it from the work bench and then sets it down with a mighty crash; the drop height varying approximately with the exasperation.

In direct contrast to the foregoing *brute-force* methods of locating *intermittents,* there is a rational approach to the problem.

The method is particularly adapted to receiving and amplifying systems normally handling modulated carriers or continuous signals.

Briefly, the technique consists of the following steps:

(*1*)—A strong, unmodulated signal of a frequency acceptable to the input of the system is applied.

(*2*)—The output of the equipment being tested is brought to an audio frequency detector or demodulator.

(*3*)—The detector output is increased further by means of an audio amplifier and the resulting output monitored by either a loudspeaker or an output meter.

Block diagrams of the setup are shown in Figs. 1 and 2. The system, now in a condition highly sensitive to random gain changes, is explored, component by component, for microphonism. That is, each component and junction is lightly tapped with an insulated rod. The defective component or joint will reveal itself as a high amplitude noise in the monitoring device.

The foregoing method, which has proved highly successful in practice, is based on the premise that most types of intermittent conditions, when they exist at all, are present almost continuously.

Due to their minute magnitude, however, during much of the time, they are difficult to detect and localize.

If we consider this condition as a continuously occurring random gain fluctuation, it is reasonable to assume that such variations may amplitude modulate on impressed carrier frequency, be amplified and reclaimed after detection as a noise output.

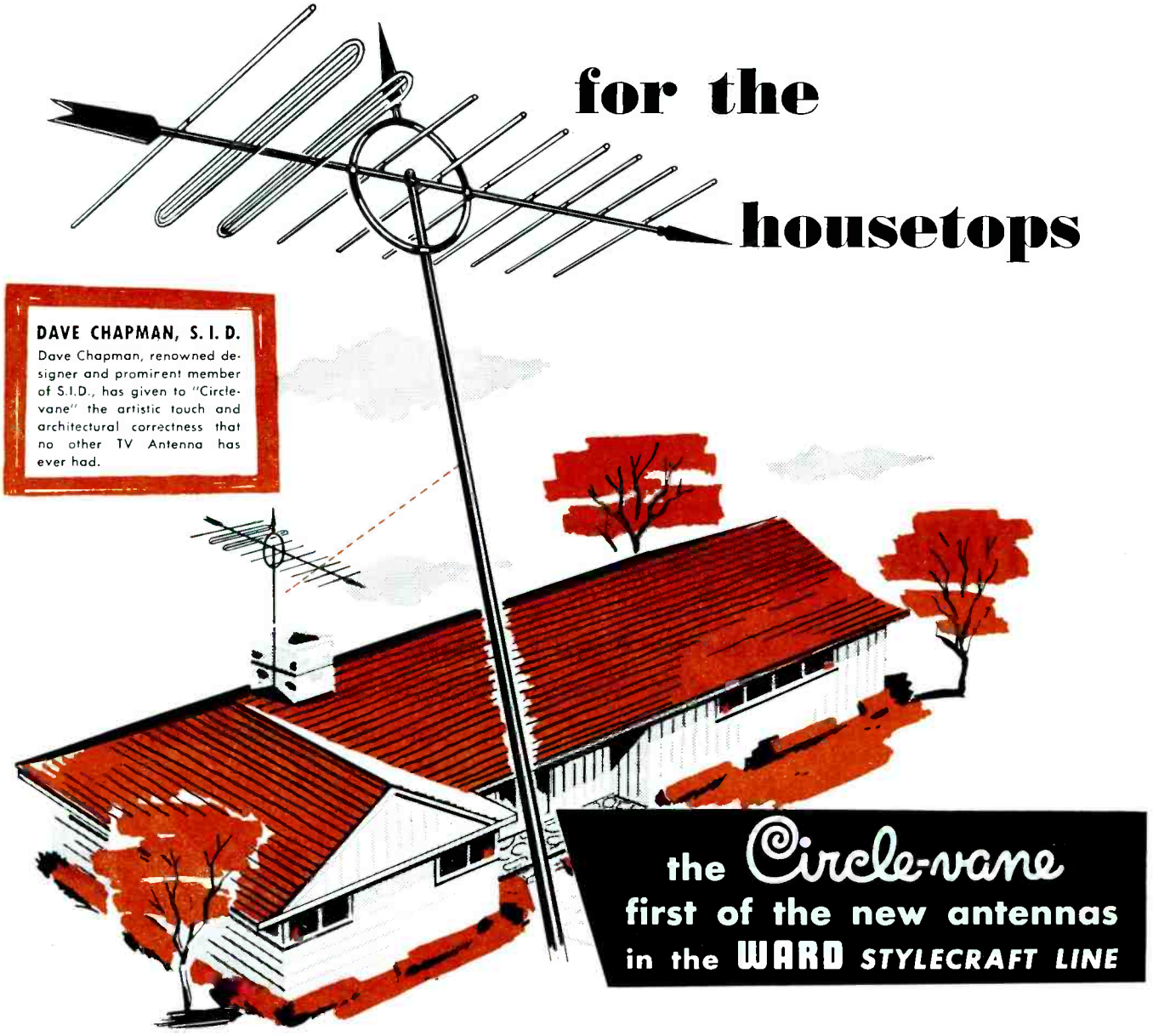
Typical intermittent faults which can be detected and located effectively by this method are:

(*1*)—Microphonic tubes:

A tendency toward microphonism, which may become progressively worse

(*Continued on page* 59)

now . . . new beauty for the housetops



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SERVICE... The National Scene

INGENIOUS WIRELESS MIKE SYSTEM UNVEILED AT ELECTRONIC CONFERENCE--An FM cableless-microphone system, designed for pa use to cover areas up to 5000 square feet, and utilizing induction coupling between transmitter and receiver, eliminating the need for a license, was described during the recent National Electronic Conference in Chicago.[1] Featuring a subminiature transmitter, completely contained in a stick-type microphone housing, the setup consists of a 5-tube, printed-circuit FM transmitter, self-contained ferrite antenna inductor, a microphone (with omnidirectional ceramic cartridge), and batteries, all weighing less than one pound. . . . To limit radiation, accommodate bandwidth required in an FM system, and avoid the use of broadcast, amateur, police and Loran bands which lie between .5 and 2 mc, a compromise carrier frequency of approximately 2.1 mc was chosen.

THE TRANSMITTER CIRCUIT, it was said, is divided into two sections; a two-tube audio stage, and a three-tube rf unit. A pair of tetrode voltage amplifiers are cascaded in the audio unit to provide a gain of 55 db at 1000 cps. A miniature volume control between these two stages permits adjustment of gain for the desired degree of modulation. . . . To obtain the best possible signal-to-noise ratio, 80 microsecond preemphasis has been included in the transmitter, and corresponding deemphasis in the receiver. . . . The rf section of the transmitter consists of a self-controlled oscillator, reactance modulator and rf amplifier. . . . The complete circuitry for the transmitter, excluding antenna and tubes, occupies a volume of only about 1 cubic inch. The chassis casting, which contains 8 capacitors, 11 resistors, 1 volume control, 5 subminiature tube sockets and a powered iron-core oscillator coil, is nothing more than a cylinder 1" in diameter and 1.3" long.

FOR POWER, the transmitter uses a 30-volt hearing-aid battery, and a 1.3-volt mercury cell. . . . The antenna, a ferrite core, is 3" long and weighs but 2 ounces.

THE RECEIVER employs a pentode mixer, separate triode oscillator, afc (via pentode reactance modulator), wide-bend if with two pentode amp stages, two cascaded triode limiters and discriminator. Output is fed through gated cathode-follower triode to af output of set. Triode dc amp is provided in a carrier-operated squelch circuit. The rf has a bandwidth of 150 kc.

IN ANOTHER REVEALING NEC PAPER, the significant value of ferrites was analyzed.[2] It was noted that the high permeability, low losses and high resistivity of ferrites, have made it possible to design many improved components for TV, highly efficient antenna cores of the types used in the wireless system described above, and miniature transformers. . . . In a comparison of metals and ferrites, it was disclosed that metals even when laminated have excessive eddy losses when used as a magnetic core for TV components handling the horizontal scanning frequency of 15.75 kc and related harmonics. Ferrites, on the other hand, are ideal for such an application, for at these frequencies all the losses, except hysteresis, are extremely small. . . . In a forecast of the future of ferrites, it was noted that this unusual material will find wide use in color-TV chassis because of its remarkably low-loss factors.

250 TV STATIONS NOW OPERATING IN 166 MARKETS--Of the 525 stations that have been authorized since the freeze lift, 250 are now actually on the air in 166 market areas. So declared the headman of the FCC at a meeting in Chicago. About 112 of these areas have but one station. And, in 48 of these one-station markets, additional stations have been approved for operation. . . . The FCC spokesman declared that by December at least 50 more stations will begin telecasting, and by the end of next year at least another 100 or more will be approved for TV broadcasting.

[1]Paper delivered by Thomas W. Phinney, Shure Bros., Inc. [2]Report offered by Robert L. Harvey, RCA.

SERVICE...The National Scene

ANTENNA REPAIR CODES RECEIVE NOD IN SOUTH AND WEST--Ordinances to control antenna installation and general TV repair, have been favorably received by legislatures and Service Men in Idaho and North Carolina. . . . In Idaho Falls members of the City Council cast a unanimous vote for a tentative code which would not only license all TV Service Men, but require those who install only to post a $10,000 bond. Special permits will be required for the installation of towers that are 15' or higher. . . . In Durham, N. C., a stringent measure, approved by dealers and Service Men, is now before the City Council. This ordinance would require the posting of a $500 bond by those who install, alter or repair antennas, and a general $2 fee for permission to operate as a installer. . . . Detailed specifications of the materials to be used in installation, and mounting positions, are emphasized in this new proposal. All antenna structures, it is noted, will have to be of corrosive-resistant materials, and capable of withstanding wind and ice loadings. It will be out of order to mount antennas more than 40' above the roof, and no part of any antenna system including the guy wires will be allowed to extend above or below any electric line carrying more than 250 volts. All external leadin conductors will have to either be of copper, copper-clad steel or bronze, and in sizes approved in the rules of the National Electrical Code. The ruling also prescribes the supports that shall be used for leadins. Specifically, it was noted, leadins will have to be rigidly supported on approved insulators which provide a clearance of 4" from the roof, wall, gutter, and electric and telephone wires; between any point and a lightning arrester and TV set it will not be necessary to provide any clearance. All outside antennas, the ruling continues, will have to have a ground conductor installed, and lightning arresters will be imperative in every installation. . . . The city electrician and his assistants will receive full authority to inspect these installations, and he will be empowered to issue complaints which will have to be satisfied within 48 hours before penalties are imposed.

FORT WAYNE GROUP PLEDGE TO STRINGENT AD-SELLING RULES--A tough code, specifying statements that should and should not be made by Service Men in their advertisements and during service calls, is now in force in Fort Wayne, Ind. Prepared by the Fort Wayne TV-Radio Appliance Association, the rules cover service offers, speed of service, and uhf converter and conversion service. No unqualified statement as to the speed of service to be expected shall be made, the code states. And, performance claims for various types of converters must be limited to provable facts, with supporting evidence readily available on request. No claims or statements about converters of conversion service must be used, the code continues, if such claims are conjectural or demonstrably at variance with the currently prevailing circumstances and stages of development of ultrahigh-telecasting facilities in Fort Wayne.

UHF ADVERTISING SCORED BY ST. LOUIS BBB--Charging that many manufacturers are still firing away with loose claims in their consumer ads on uhf performance, the Better Business Bureau of St. Louis warned, in a sizzling bulletin, that such misrepresentation can only lead to disaster. Conversion ads that make it look as if all that is needed by the setowner to assure himself of proper reception is a screwdriver and five minutes of his time, are dangerous, the BBB said. It is well known that in some locations even expert Service Men have to struggle for hours to locate the spot for an outside antenna that will insure best results. . . . The BBB pointed out that it would be wise for every manufacturer, dealer and distributor to avoid the use of the following statements in their consumer copy: "With ---'s powerful all-channel tuner, you can receive every uhf or vhf station within range of your home." (Can you, in every location without an outside antenna?) . . . "A ---- uhf converter can be attached easily and quickly to a vhf set. Every channel in your area, as well as those coming through in the future, will be available. No expensive installation service necessary. Just plug it in." (What happens if you plug it in and get nothing; will the consumer get a free outside antenna installation?) . . . "Top-of-set cabinet can be installed in 5 minutes with a screwdriver." (This is probably true, but what if the converter will not work without an outside antenna?) . . . Accolades to this vigorous group for their driving plan to help Mr. and Mrs. Consumer, and particularly, the Service Man.--L. W.

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UP TO **88%** LESS NOISE FACTOR

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***FACTS** from one of America's leading, independent research laboratories **proved** the WALSCO **Imperial** will out-perform **all** other UHF converters . . . anywhere!

	Average Power Gain DB			Average Noise Factor DB		
	500 mc	650 mc	400 mc	500 mc	650 mc	800 mc
WALSCO Imperial	10.0	9.5	9.5	15.0	15.5	16.0
Converter A	6.0	5.4	3.5	18.5	20.0	21.0
Converter B	7.0	6.5	5.0	18.0	18.5	20.0

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by T. L. GILFORD

Servicing Helps

Supply Voltage Harmonic Problems in 'Scope Work‡ . . . Crystal Demodulator Probe Applications . . . Buzz Analysis . . . Marker-Generator Calibration

IN VISUAL ALIGNMENT, one often encounters kinks and hangovers, caused, in some cases, by harmonics in a sine-wave 'scope sweep.

It is not always easy to interpret what is seen on the 'scope screen in terms of what is wrong, and what should be done about it. For example, Fig. 1 shows an *if* response curve displayed on a sawtooth sweep (*a*), and on a 60-cycle sine-wave sweep (*b*). The trouble present in the sine-wave sweep is due to harmonics in the supply voltage.‡

The supply voltage always contains harmonics, but the harmonic content is usually so small that no trouble is encountered. Trouble arises when the ground connection between the sweep and 'scope is defective, for example, so that the ground circuit has to be completed through the line-filter capacitors of sweep and 'scope; since the reactance of these capacitors is smaller at higher frequencies, the harmonic content of the sweep voltage is thereby increased, because the harmonics have higher frequencies than the 60-cycle fundamental.

Phase-shifter networks (Fig. 2) can be utilized to phase the trace and retrace together when 60-cycle sine-wave sweep is used; when the value of the phase-shifting capacitor is chosen too small, the harmonic content of the sweep voltage becomes increased.

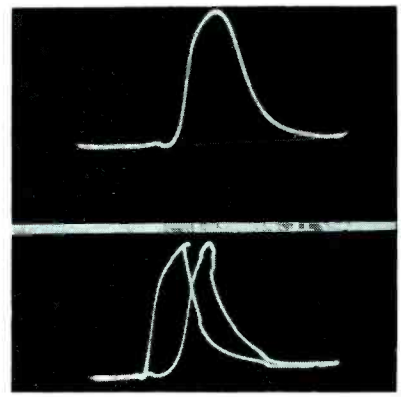
Crystal Demodulator Probe Application*

THE CRYSTAL DEMODULATOR probe has a number of very practical applications in general circuit testing. It can be used in signal tracing in *rf, if* and video amplifiers; buzz analysis in 4.5-mc amplifiers, or in the sound *if* amplifier strips (split-sound TV); ratio-detector marking; marker-generator calibration; stage-by-stage alignment, and any test which requires demodulation of the signal as long as the peak test voltage does not exceed approximately 65 *v*.

Signal tracing is a straightforward procedure, and can be done in the same general manner as conventional signal tracing of a broadcast receiver. The demodulator probe picks up the signal at any point in the tuned circuits or in the video amplifier, and will display

‡See *In the Field* notes, this issue p. 66.

*From notes prepared by the engineering department of *Precision Apparatus Co., Inc.*



(Above)

Fig. 1. How harmonics in the sweep voltage distort the response-curve display: (a) = response curve as seen on 60-cycle sawtooth sweep; (b) = same response curve as seen on 60-cycle line sweep when excessive harmonic content is present.

(Below)

Fig. 2. Typical phase-shifter networks which can be used in visual-alignment procedures. A defect in the circuit, which effectively places a small capacitance in series with the source, accentuates the harmonics in the line. The harmonic content of power lines in various areas also is subject to considerable variation.

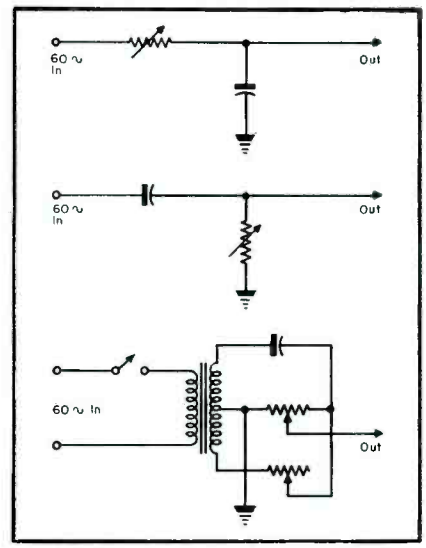


Fig. 3. Development of undershoot distortion in an if curve, caused by grid-current flow in the first video amplifier. (Courtesy Precision Apparatus)

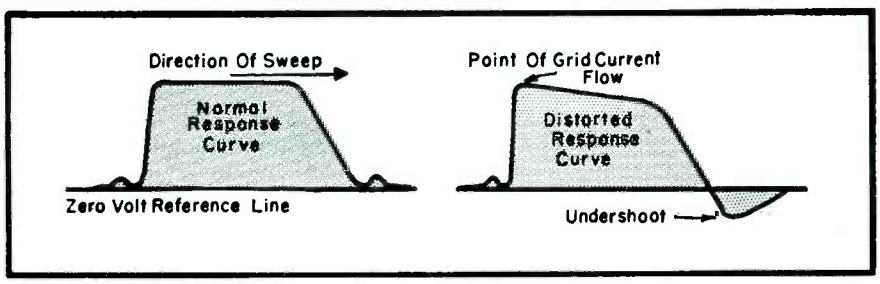
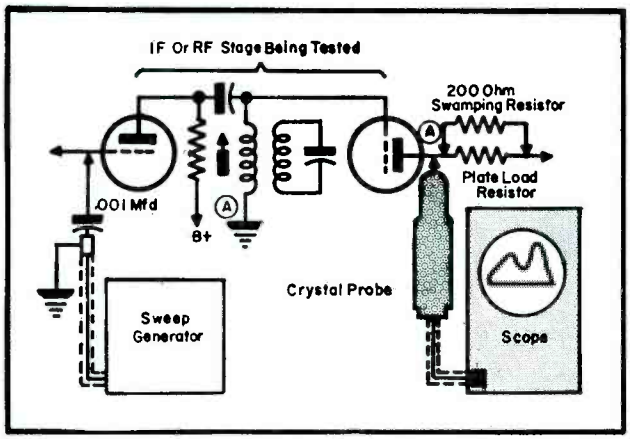


Fig. 4 (right). The operation of a demodulator probe in an if amplifier. (Courtesy Precision Apparatus)



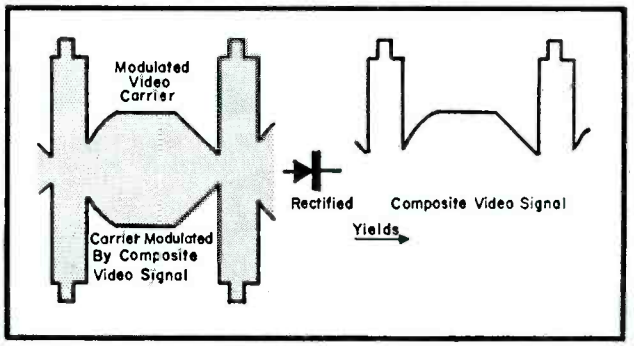


Fig. 5 (left). Test setup for checking single-stage response using a crystal probe.[2] (Courtesy Precision Apparatus)

[2]Precision Apparatus model SP-5B.

the waveform upon the 'scope screen. It should be noted that if signal tracing is necessary in TV *rf* circuits, it will usually be necessary to use a swept signal, rather than a TV station signal, because the signal voltage may otherwise be too low for satisfactory deflection on the 'scope screen.

By the use of the signal-tracing technique, it is possible to pinpoint a dead or weak *hf* stage, a regenerative or an oscillating stage. A dead stage develops no deflection on the 'scope screen. A weak stage will exhibit less deflection than the previous stage, i.e., a loss instead of a gain. A regenerative stage will show up in either of two ways, depending upon whether the Service Man is using a sweep signal or a TV station signal in the circuits; a sweep signal which passes through a regenerative stage will show an extremely large response at one end or in the middle, but very low response over the rest of the curve. If the regeneration is excessive, spurious markers may also appear. An oscillating stage shows up as a curve which has *gone to pieces* and also often exhibits undershoot due to the grid overdrive and flow of grid current. Strong oscillation may paralyze the stage, which may then be confused with a dead stage; however, the supplementary use of a *vtvm* and a *hf* probe will distinguish between the two cases, since the oscillating stage will cause a strong deflection on the *vtvm*, whereas a *dead stage* causes no deflection of the pointer.

If a station signal is used for the tracing procedure, regeneration may show up as severe distortion of the composite video signal, either with the equalizing pulses much lower than the level of the vertical sync pulse, or with severe overshoot and ringing along the top of the vertical sync pulse.

Buzz Analysis

Buzz analysis is also a straightforward testing procedure. When the 4.5-mc sound signal is displayed on the 'scope screen, excessive buzz voltage in this circuit will become apparent as a 60-cycle pulse which usually has a vague resemblance to the vertical sync pulse from which it is derived; in the case of tunable buzz. In the case of untunable buzz, the pulse more often appears as a sharply-pointed 60-cycle spike voltage.

Ratio-Detector Marking

Ratio-detector marking is sometimes a problem, in view of the fact that the inherent AM rejection of a ratio detector circuit is often sufficient to suppress completely a beat marker. In such cases, one should temporarily substitute a crystal probe for the circuit under test, i.e., the output of the sweep generator should be connected directly to the input of the crystal probe. The probe has no AM rejection, and the 4.5-mc marker will now be clearly visible along the horizontal baseline. The exact position along the horizontal baseline at which the marker appears should be noted. The circuit under test can then be reconnected in place of the crystal probe, and although the marker is now invisible, its position is now known, and will remain known as long as the tuning dial of the sweep generator, and the 'scope sweep controls remain untouched.

Marker-Generator Calibration

Marker generator calibration can be facilitated by the use of a crystal probe. To calibrate a marker generator, one should parallel the output from the marker generator and a 2-mc crystal oscillator. The mixed outputs should then be applied to the crystal probe. Although the frequencies from the generator and oscillator are too high to affect the 'scope directly, the crystal probe develops a beat envelope which will be visible on the 'scope screen. As the marker-generator dial is tuned from 20-25 mc, for example, it will be noted that sine-wave beat patterns appear in the vicinity of 20, 22 and 24 mc. That is, the beat pattern appears at integral multiples of 2 mc. The 'scope is swept at any convenient *If* rate, such as 60 cycles.

Stage-By-Stage Alignment

Stage-by-stage alignment is recommended when manufacturers provide stage-by-stage response curves, or if severe difficulty is being experienced in obtaining the proper curve. The sweep signal and marker should be applied at the grid of the tube in the stage under test. The crystal probe should then be applied at the plate of the tube following the stage under test, and a 200-ohm carbon resistor shunted across the plate-load resistor of the tube following the stage under test.

The Swamping Resistor

The swamping resistor shown in Fig. 5 flattens out the resonant response of the following stage, thereby permitting a view of the true single-stage response. The low impedance of the generator cable likewise flattens out the resonant response of the preceding stage, so that the true single-stage response is unaffected by the preceding stage.

Although the probe could be applied at the grid of the tube following the stage under test, this procedure is less desirable because the small input capacitance of the probe tends to detune slightly the stage under test under such circumstances, and does not provide an entirely true replica of the stage response.

General demodulation tests can also be made with the crystal probe, such as testing for parasitic voltages in audio amplifiers, checking for standing waves on transmission lines, etc.

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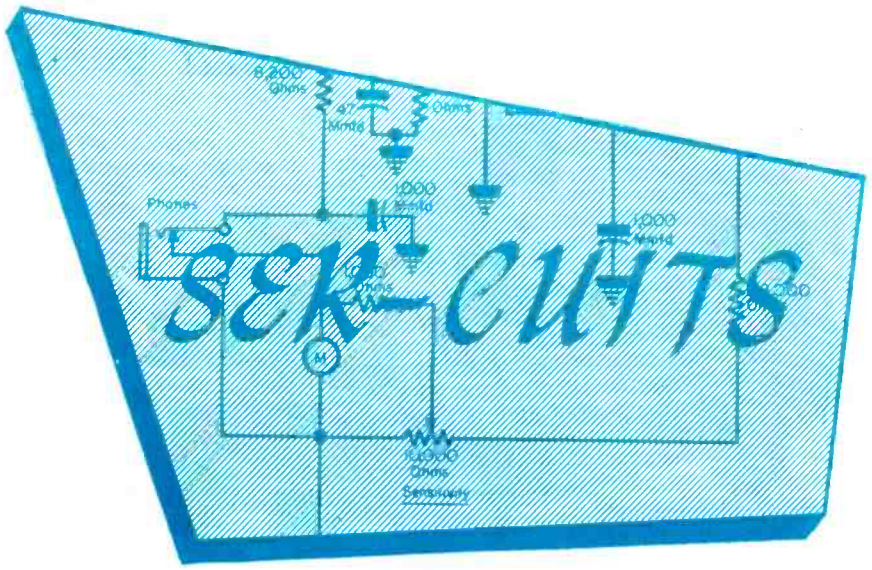
P.S. Please send me also entry blank with easy Contest rules.

Circuitry Report on 24-Inch TV Chassis Featuring Push-Pull Hi-Fi



by M. W. PERCY

AUDIO, once sadly neglected on most TV chassis, at long last has won the attention of the designers, who have become convinced that it merits careful attention.

An interesting example of this new trend appears in the circuit shown in Fig. 1; *Hoffman chassis 403*. A dual triode is used here, with the second half of the triode acting as an audio driver. This drives a push-pull network. A *hi-fi* push-pull type audio circuit, which incorporates two tetrodes, is used. A unique phase inversion scheme is employed; one of the push-pull tubes receives its driving voltage from the audio amplifier in the conventional manner, whereas the second tube receives its equal and opposite phase voltage from a tertiary winding on the audio output transformer, thus eliminating the need for a tube phase inverter. The triode in the audio stage is preceded by a ratio or second sound detector.

The receiver also features use of ½ of a miniature dual diode as a video detector, with the second half providing the clamping voltage for delayed *agc*. The output from this video detector is coupled directly to the video amplifier, through high-frequency compensating shunt and series-peaking coils. A single stage of video amplification is directly coupled to the cathode of the picture tube through high-frequency compensating shunt and series peaking coils. Direct coupling is employed; thus no *dc* restoration[1] circuit is needed. A keyer tube provides the necessary *agc* bias for the first and third *if* stages.

An intercarrier type sound system is employed, the 4.5-mc sound take-off occurring at the output of the video detector. The sound is fed into the first of two 4.5-mc *if* stages. A 39.75-mc adjacent channel picture trap, two 41.25-mc co-sound traps, and a 47.25-mc adjacent channel sound trap are employed in the video *if* stages. The picture carrier frequency is 45.75 mc.

Two Stages of Sync Separation

Two stages of sync separation have been designed into the receiver. They receive the composite video signal from a tap on a video-amplifier load resistor.

A second sync separator serves the additional function of a phase splitter for feeding approximately equal and opposite sync pulses to the balanced horizontal phase detector. A negative sync pulse is taken from a tap on cathode resistor, and this pulse is fed to a vertical integrating network to sync the vertical oscillator; a cathode-coupled multivibrator type. This drives a single-power output stage which is coupled to the vertical deflection coils through an output transformer. The positive pulse of the retrace portion of the vertical sweep output voltage is reversed in phase by the transformer action of the output transformer, and the resulting negative voltage pulse is coupled to the picture tube control grid through a .022-mfd capacitor which also serves to sharpen the pulse, so that it is only effective during the retrace portion of the sweep. The negative voltage pulse biases the picture tube beyond cutoff during the retrace portion of the vertical sweep, and the bright retrace lines are blanked out.

Cathode-Coupled Multivibrator

A cathode-coupled type of multivibrator serves as the horizontal oscillator. The stabilizing influence of a parallel tuned *l-c* circuit has been used as part of the plate load of one of the triodes in the multivibrator circuit. The natural frequency of the tuned circuit is very close to the horizontal sweep frequency. The frequency of the horizontal multivibrator has been further stablized by a balanced horizontal phase detector circuit which consists of a dual diode. The horizontal oscillator drives a stage of power amplification coupled to the horizontal deflection coils through an output transformer. The horizontal output transformer is also an active member of the high voltage supply.

Horizontal Phase Detector

The horizontal oscillator is preceded by a balanced horizontal phase detector, with many unique operational features.

Without a control voltage on the grid of the horizontal multivibrator, the horizontal sweep section operates at a free-running frequency which is determined by the inductance of the horizontal frequency coil and the horizontal hold control, all other factors remaining constant. These other factors are *r* and *c* component values, B+ supply voltage, and control voltage at grid *1*, which at the moment is assumed to be zero. The nature of the frequency versus *dc* control voltage, characteristic of the common cathode type of multivibrator used in these chassis, is such that a positive change in *dc* voltage on grid No. *1* produces a decrease in frequency and a negative change produces an increase in frequency, all other factors remaining constant. Since B+ supply voltage changes with line voltage variations and signal strength changes, and the *r*, *l*, and *c* component values change slightly with temperature and humidity, these frequency determining factors do not remain constant. It remains necessary to hold the multivi-

(*Continued on page* 58)

[1]See *Geist* article, this issue (p. 32) for revealing study of *dc* restoration.

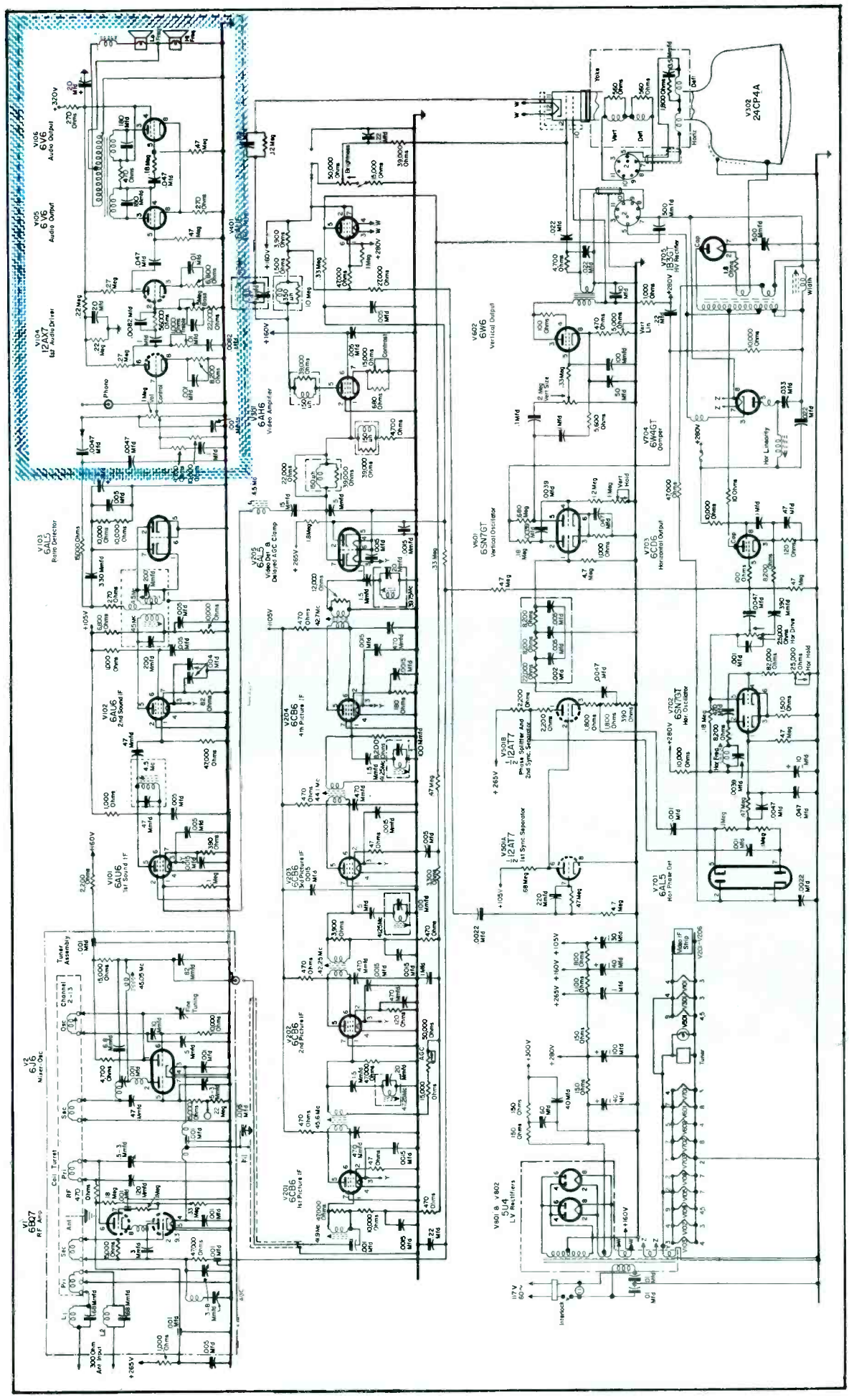


Fig. 1. Schematic of 24-inch Hoffman chassis 403, with a push-pull hi-fi output, indicated in dashed outline.

Ser-Cuits

(*Continued from page* 56)

brator to a constant frequency by employing some factor which does remain constant for all practical purposes. This factor is the horizontal sync pulse frequency which originates at the transmitting source. This source is not used directly because of its poor immunity from random noise pulses, but it is used as a reference standard from which the correct value of *dc* control voltage is derived.

It remains to be shown how the *dc* control voltage is made to vary in such a manner as to counteract changes in the other factors so that the frequency will remain constant. Fundamentally, this is accomplished by comparing a sampling of the instantaneous frequency of the multivibrator output with the standard frequency source.

The difference between the two frequencies is made to generate a *dc* control voltage of such magnitude and polarity that the difference tends to remain zero for all practical purposes. The saw-tooth potential at the input to cathode and plate of the 6AL5 phase-detector tube has an *ac* axis, since *dc* is blocked by a 1-mmfd capacitor in the grid circuit of the 6CD6 horizontal-output tube. The saw-tooth current frequency is the same as the horizontal multivibrator frequency so that the derived saw tooth is used as a sampling voltage. A pair of .001-mfd capacitors serve to couple the sync pulses to the phase detector and to block *dc* as well as to serve as an active part of the phase detector circuit. A 4.7-megohm resistor in the 6SN7GT grid input is used only as a grid leak for the horizontal multivibrator grid *1*. Without this grid leak, a failure in the horizontal control tube would leave grid *1* with insufficient bias. Therefore plate and screen dissipation of the 6CD6 would exceed the rated values.

Each diode in conjunction with its respective coupling capacitor forms a rectifier circuit. The capacitor charges during the conduction period of the diode by an amount which is a function of the voltage applied between the diode electrodes.

The most stable state of equilibrium and the one that produces the correct picture frame phase relative to the blanking bar is the zero voltage state. The multivibrator will operate in a state of equilibrium for which the *dc* output of the phase detector is either slightly positive or negative, but this state is less stable. The picture frame phase will be found wrong, and the multivibrator likely to lose sync (equilibrium) when switching channels or interrupting the horizontal sync pulse in some other manner.

Chassis Controls

Phono reproduction may be provided by the use of a double pull, double throw switch; this is accomplished by ½ of the brightness control switch. This selector switch performs the function of switching the audio amplifier from the ratio detector output to the phono input and switching the picture tube control grid from the brightness control circuit to ground, cutting off the picture tube raster when the phono is being played.

The *volume* control is part of a dual-type potentiometer, associated with a *contrast* control. The chassis power switch is mechanically linked to the volume potentiometer.

The *contrast* control varies the gain of the video amplifier. With the *agc* system used for maintaining constant signal level, the *contrast* control becomes primarily useful in setting background level for best viewing under various room lighting levels or different average program contrast levels.

The *agc* and its associated circuits regulate *rf* and *if agc* voltages (within

the limits of the *agc* system). When the *agc* control is turned full clockwise the greatest bias appears on the *if agc* bus, and the lowest bias appears on the *rf agc* bus for a given signal. When the control is reversed the *if agc* bias voltage is minimum and the *rf agc* bias is maximum for a given signal. This source of high *rf* bias is useful when strong signals cause the video stages to overload, clipping the sync pulses. In very strong signal areas the *agc* control must be turned counter-clockwise until loss of sync is eliminated. It must not be turned more than necessary because increased bias on the *rf* amplifier, with simultaneous decrease in *if* bias will lead to excessive noise in the picture after a certain point. Conversely, in weaker signal areas the control should be turned clockwise so that the *rf* bias is reduced and the *if* bias increased. This condition will improve the signal-to-noise ratio.

•

Fault Location

(*Continued from page 47*)

under conditions of vibration and shock can be predicted before the equipment becomes unserviceable.

(*2*)—Mechanical tube defects such as faulty or loose welds, partial shorts between tube elements will generate violent output noise signals under the influence of the lightest mechanical taps.

(*3*)—Cold or rosin joints in wiring to terminals or the points.

(*4*)—Intermittent wiring or component *shorts* to ground.

(*5*)—Fixed capacitors with intermittently *open* internal connections. This is one of the most elusive of random failures since it is not detectable through continuity checks and it is obviously impractical to remove each part from the circuit for a capacitance test. Much of the difficulty which has been experienced along these lines has been due to faulty soldering between the aluminum foil and the connecting lead in non-inclusive tubular capacitors.

(*6*)—Poor contact in circuit controlling devices, such as relays, rotary switches, toggle switches and the like.

(*7*)—Defective internal joints in molded composition fixed resistors.

(*8*)—Poor contact between shield cans and chassis in the presence of fairly strong fields or in weak fields associated with low level circuits. Faults of this type may cause random malfunction under changing environmental conditions.

Summarizing, the advantage in using *carrier-amplification* for intermittent fault location lies in the ease with which faults may be uncovered and in the ability to predict such troubles before they seriously impair equipment reliability.

The amplification of noise by modulation of a carrier can be deduced from an analysis of a modulated wave.

$$e = E_o\ (1 + m \sin W_n t) \sin W_c t \qquad (1)$$

where:

e = instantaneous amplitude of the wave.

E_o = average amplitude of the wave.

m = degree of modulation caused by the intermittent fault.

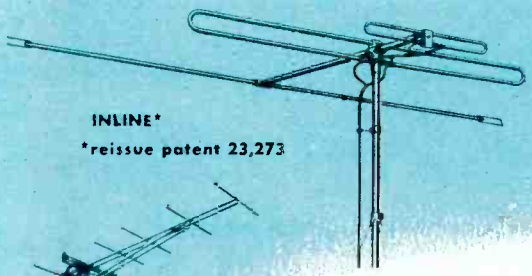
W_n = angular noise frequency component.

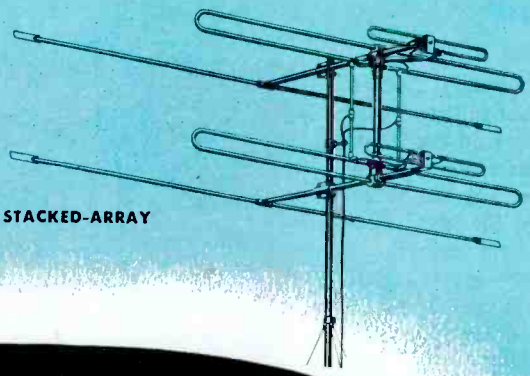
W_c = angular carrier frequency.

This may be rewritten as the sum of three voltages as follows:

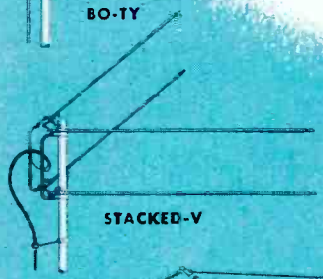
$$e = E_o \sin W_c t + \frac{mE_o}{2} \cos (W_c - W_n)\ t - \frac{mE_o}{2} \cos (W_c - W_n)\ t \qquad (2)$$

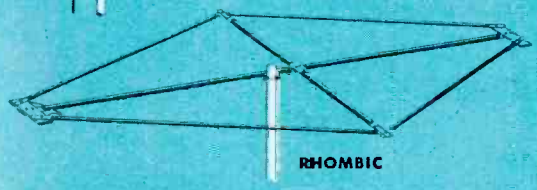
The second and third terms of equation (*2*) show output components whose amplitude is proportional to mE_o. Thus, the more intense the applied carrier frequency, the more susceptible the equipment becomes to the random gain changes induced by intermittent faults.





Better Installations





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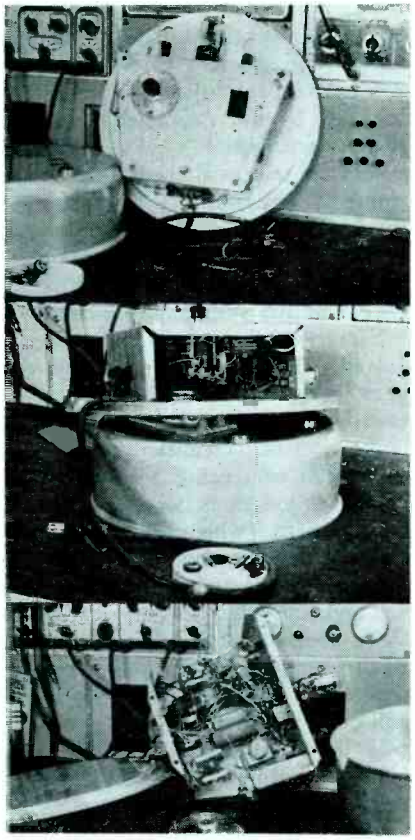


(Top)
Front view of timer chassis, cover removed, with timer dial-scale replaced.

(Center)
Right side view of timer. Relay visible in RL_1, the ac relay. Points of both are accessible from sides.

(Bottom)
Bottom view of timer chassis, removed from backplate. Filters are in center of chassis, two fuses are at bottom, calibrating potentiometer is at lower right side of photo.

Electronic Timer Operation, Maintenance and and Servicing* . . . 2-Way Installation Hints . . .

Service Engineering — field and shop notes

by THOMAS K. BEAMER

THE USE OF TUBES in timing devices has not only increased the effectiveness of timers, but mulitplied their application possibilities. Today, for instance, the electronic timer is a key device in the dairy industry; on countless farms such timers (electronic-interval type) are used to control milk flow to the opaque waxed-paper cartons.

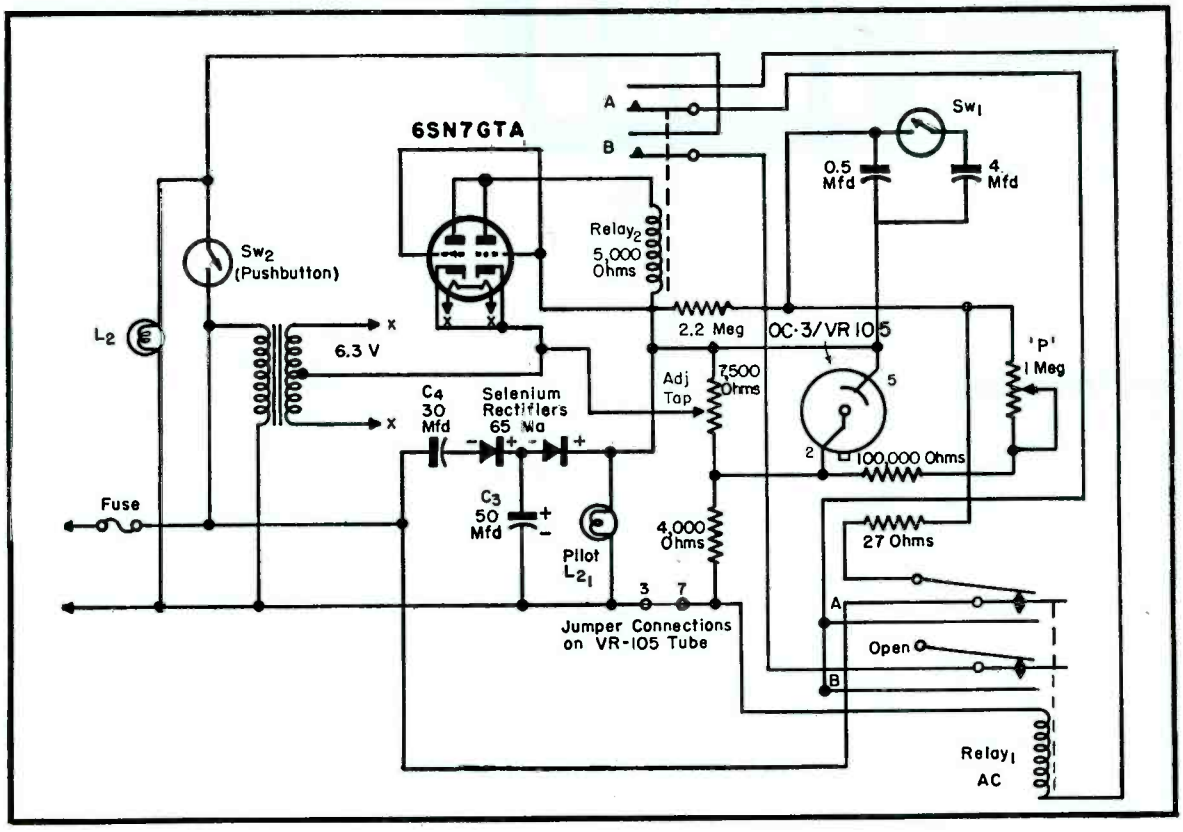
These timers control a solenoid-type flow valve. The milk-filling machines[1] employ a microswitch on a *filling-table*, which operates when an empty carton is pushed into position; it opens the valve, holds it open for a predetermined number of seconds, then closes it. When the machine has been properly set up, each carton receives identical amounts of milk.

The basic principle of the electronic interval-timer is not new, of course, having been employed in numerous circuits, chief among them photographic timers. This application, however, is decidedly novel. All electronic timers operate on the same principle, basically; the charging and discharging of a capacitor. The interval of time involved is determined by the electrical size of the capacitor, the charging voltage, and the value of

(Continued on page 62)

From notes prepared by* **Jack Darr.

[1]One typical machine is manufactured by the Mojonnier-Dawson Co., Franklin Park, Ill.



Schematic of electronic timer used to control filling of milk containers. P is a calibrating resistance.

Service Engineering

(*Continued from page 61*)

the calibrating resistance in the circuit.

This particular unit uses two capacitors; 4 and .05-mfd 600 working-volt types. For normal use, they are connected in parallel; for shorter time intervals, the larger capacitor may be switched out by means of SW_1 shown in the schematic (p. 61). This results in a much faster time-constant. The capacitors are charged through a 1-megohm calibrating resistance; P on the drawing. An OC-3/VR-105 voltage-regulator serves as the discharging element; action is initiated by a 6SN7GT, used with both triode elements connected in parallel.

When a carton is placed in the machine, the microswitch is closed, and the 6SN7 closes a 3,000-ohm plate relay. This closes the main relay RL_1, an *ac*-operated type, and the contacts of this unit open the solenoid valve, through a 6-contact plug. High voltage from the power supply, a half-wave voltage doubler using two selenium rectifiers, is applied to the capacitors. The voltage gradually builds up until it reaches the level set by the VR-105, which then fires, discharging the capacitors and opening the circuit, including the 6SN7 plate relay. The solenoid valve closes, and will not reopen until the cycle is again initiated by the microswitch or *test-switch* pushbutton, SW_2, which is across the microswitch contacts. Time elapsed is determined by the setting of the 1-megohm potentiometer; the more resistance in the circuit, the longer it takes for the capacitors to reach a charge of 105 volts and discharge.

Service of these units is not too involved. Tubes and all operating voltages must be checked, as on all electronic devices. The power supply, under normal conditions, will read about 300 *vdc*, using a *vtvm*. If the voltage is low, it is necessary to check the rectifiers, (which are 65-ma units) and the doubler and filter capacitors, (which are 30 and 50-mfd units), at 450 and 150 volts, respectively; C_3 and C_4 on the schematic. The 30-mfd unit is the input doubler capacitor; if it weakens or opens up, the high-voltage will drop considerably. Other troubles will be found mainly in the relay points, as might be expected. These units operate under conditions of extremely high humidity; in the milk-room of a dairy, due to the constant sterilizing, washing, etc., the room is always pretty steamy. Some trouble will be found due to corrosion of the points. Although the units are fairly well sealed, some trouble, due to internal dampness will be encountered. A rubber ring gasket, provided under the outer cover, must be carefully replaced each time the unit is serviced.

Two pilot lights are used; a red and a green. The red light indicates when the unit is turned *on*, and the green lights when the unit is actually cycling.

To insure best continuing results, monthly maintenance checks are a must. During such inspections, contact points can be probed. If they are *papered* each time, they will give fairly long life. In this operation a small strip of clean, fairly-course paper should be drawn between each pair of points, while holding them closed; the surface of the paper will polish them to a high degree, and will not cause pitting. If the points are found to be badly pitted, they should be removed from the relay, and smoothed on a very fine oilstone, keeping them perfectly flat; finishing can be completed by polishing with jeweler's rouge or *plug-polish* as used in telephone exchanges, until a mirror-smoothness is obtained.

Wiring in the cable, connecting the timer unit and the solenoid, etc., on the filling table is subject to trouble. In one instance, the *strain-relief* clamp on the plug was not fastened properly;

this must be checked when servicing, as this cable is subject to much strain and wear. (Color code of the wiring into the plug is: Pin *7*, heavy red lead; pin *8*, heavy black lead; pin *9* small rubber-covered wire (white); pin *10*, small RC wire, (brown); pin *11*, small RC wire (green . . . this is a ground wire); and pin *12*, no connection.)

If the machine is electrically *hot* to the ordinarily very damp floor, the polarity of the *ac* supply plug should be checked to determine which side is grounded. It should be connected this way, and the plug and socket marked with bright nail-polish, scotch tape, or something similiar, so that is may be replaced correctly, if removed for any reason.

2-Way Installation‡

SOME FORM of noise suppression is required whenever a 2-way system is installed in a motor vehicle. Since the receivers in these setups are sensitive to very small electrical disturbances, it is important that unwanted disturbances be eliminated. Such disturbances are produced by the ignition system, electrically-operated accessories, and static discharge (between the front wheels and their bearings, between tie rods, or between other parts of the vehicle which are in intermittent contact). Noise-elimination procedures may vary from installation to installation, and the effectiveness of any procedure can be determined only by trial. A suppressor should always be installed in the high-tension lead to the distributor; by pulling the center lead out of the distributor cap, cutting the lead about ½" from the distributor end, screwing the ends of the suppressor into the cable ends just formed, and then reconnecting the cable to the distributor cap. In operating areas where the signal strength is high, additional noise suppression may not be required.

A high-pitched sound (heard only when the motor is running) can, in most cases, be eliminated by connecting a 1-mfd paper capacitor between the output terminal on the generator and the motor block. If generator noise persists, it is recommended that a filter (made by close winding 22 turns of No. 12 enamel wire on a 1⅛" diameter form) be connected in series with the generator output. Each end of this filter should be bypassed to the motor block through a 1500-mmfd mica capacitor.

Maintenance and Troubleshooting

UNDER FCC regulations, all transmitter tuning adjustments must be

(*Continued on page 77*)

‡Based on RCA engineering department notes.

TV Station Listing: Part 3

*Now on the Air and Authorized to Operate***

City	Call Letters		Channel
OHIO			
Akron	WAKR-TV	Summit Radio Corp., 106 S. Main St.	49*
Ashtabula	WICA-TV	WICA, Inc., 221 Center St.	15
Cincinnati	WCPO-TV	Scripps-Howard Radio, Inc., 2345 Symmes St.	9‡
	WKRC-TV	Radio Cincinnati, Inc.	12‡
	WLWT	Crosley Bcstg Corp., 140 W. 9th St.	5‡
	WCIN-TV	Rounsaville-Clark Tele. Co., 3165 Mathieson Dr., N.E., Atlanta, Ga.	54
Cleveland	WEWS	Scripps-Howard Radio, Inc., 1816 E. 13th St.	5‡
	WNBK	Nat'l Bcstg Co., Inc., 815 Superior Ave.	4 (3)‡'
	WXEL	Empire Coil Co., Inc., 1630 Euclid Ave.	9 (8)‡'
	WERE-TV	Cleveland Bcstg Inc., 1501 Euclid Ave.	65
Columbus	WBNS-TV	Dispatch Printing Co., 34 S. 3d St.	10‡
	WLWC	Crosley Bcstg Corp., 3165 Olentangy River Rd.	3 (4)‡'
	WTVN	WTVN, Inc., LeVogue Lincoln Tower	6‡
Dayton	WHIO-TV	Miami Valley Bcstg Corp., 45 S. Ludlow St.	7‡
	WLWD	Crosley Bcstg Corp., 4595 S. Dixie Highway	2‡
	WIFE	Skyland Bcstg Corp., 5 S. Jefferson St.	22
Lima	WLOK-TV	WLOK, Inc., 1101 Nat'l Bank Bldg.	73*
	WIMA-TV	Northwestern Ohio Bcstg Corp., 223 N. Main St.	35
Massillon	WMAC-TV	Midwest TV Co., 500 Security Bldg., Toledo	23
Sandusky	WLEC-TV	Lake Erie Bcstg Co., Cleveland Rd & Huntington Ave.	42
Toledo	WSPD-TV	Storer Bcstg Co., 136 Huron St.	13‡
Warren	WHHH-TV	The Warren Tribune Radio Sta. Inc., 108 Main St.	67
Youngstown	WFMJ-TV	The Vindicator Printing Co., Vindicator Sq.	73*
	WKBN-TV	WKBN Bcstg Corp., 17 N. Champion St.	27*
	WUTV	Polan Industries, 321 8th St., Huntington, W. Va.	21
Zanesville	WHIZ-TV	Southeastern Ohio Tele. System, 48-52 N. 5th St.	50*
OKLAHOMA			
Lawton	KSWO-TV	Okla. Quality Bcstg Co., Box 699	7*
Miami	KMIV	Miami Tele. Co., Box 420, Wichita Falls, Tex.	58
Oklahoma City	WKY-TV	WKY Radiophone Co., 500 E. Britton Ave.	4‡
	KTVQ	Okla. County Tele. & Bcstg Co., c/o KWCO, Chickasha, Okla.	25
	KMPT	KLPR Tele. Inc., 128½ W. Commerce	19
Tulsa	KOTV	Wrather-Alvarez, Inc., 302 S. Frankfort St.	6‡
	KCEB	Elfred Beck 3302 S. Florence St.	23
OREGON			
Eugene	KTVF	W. Gordon Allen, 260 Henderson Ave., Salem	20
	.....	Eugene Tele. Inc., Box 112	13
Medford	KBES-TV	Southern Oregon Bcstg Co., Box 148, Grants Pass	5
Portland	KPTV	Empire Coil Co., Inc., 85 Beechwood Ave., New Rochelle, N. Y.	27*
Salem	KPIC	Lawrence A. Harvey, 19200 S. Western Ave., Torrance, Calif.	24
PENNSYLVANIA			
Altoona	WFBG-TV	The Gable Co., 1320 11th Ave.	10*
Bethlehem	WLEV-TV	Associated Bcstrs Inc., 516 Northampton St., Easton, Pa.	51*
Chambersburg	WCHA-TV	Chambersburg Bcstg Co., Craft Press Bldg.	46
Easton	WGLV	Easton Publ. Co., 30 N. 4th St.	57
Erie	WICU	Dispatch, Inc., 3514 State St.	12‡
Harrisburg	WTPA	Harrisburg Bcstrs Inc. 11 N. 2nd St.	71*
	WHP-TV	WHP, Inc., 216 Locust St.	55*
Hazleton	WAZL-TV	Hazleton Tele. Corp., Hazleton Nat'l Bank Bldg	63
Johnstown	WJAC-TV	WJAC, Inc., 329 Main St.	6‡
	WARD-TV	Rivoli Realty Co., 502 1st Nat'l Bank Bldg.	56
Lancaster	WGAL-TV	WGAL, Inc., 8 W. King St.	8‡
	WWLA	Harold C. Burke, 306 Southway, Baltimore, Md.	21
Lebanon	.....	Lebanon Tele. Corp., 8th & Cumberland St.	15
Lewiston	WMRF-TV	Lewiston Bcstg Co., 5 W. Market St.	38
New Castle	WKST-TV	WKST, Inc., Cathedral Bldg., E. Lincoln Ave.	45*
Philadelphia	WCAU-TV	WCAU, Inc., City Line & Monument Ave.	10‡
	WFIL-TV	Triangle Publications Inc., 400 N. Broad St.	6‡
	WPTZ	Westinghouse Radio Stations Inc.	3‡
	WIP-TV	Penna. Bcstg Co., 35 S. 9th St.	29
Pittsburgh	WDTV	Allen B. DuMont Labs., Inc., Chamber of Commerce Bldg.	2‡
	WTVQ	Golden Triangle Tele. Corp., 5 S. Jefferson Dr., Dayton, Ohio	47
	WENS	Telecasting Co. of Pittsburgh, Pa., 535 Smithfield St.	16
	WKJF-TV	Agnes J. Reeves Greer, 238 Spruce St., Morgantown, W. Va.	53*
Reading	WHUM-TV	Eastern Radio Corp., Berkshire Hotel	61*
	WEEU-TV	Hawley Bcstg Co., 433 Penn St.	33*
Scranton	WTVU	Appalachian Co., 519 Mulberry St.	73
PENNSYLVANIA			
Wilkes Barre	WGBI-TV	Scranton Bcstrs Inc., 1000 Wyoming Ave.	22*
	WARM-TV	Union Bcstg Co., Bowman Bldg.	16
	WBRE-TV	Louis G. Baltimore, 62 S. Franklin St.	28*
	WILK-TV	Wyoming Valley Bcstg Co., 88 N. Franklin St.	34
Williamsport	WRAK-TV	WRAK, Inc., 244 W. 4th St.	36
York	WNOW-TV	The Helm Coal Co., Box 226	49
	WSBA-TV	Susquehanna Bcstg Co., 53 N. Duke St.	43*
RHODE ISLAND			
Providence	WJAR-TV	The Outlet Co., 176 Weybosset St.	10‡
	WNET	Channel 16 of Rhode Island, Inc., Industrial Trust Bldg.	16
SOUTH CAROLINA			
Camden	WACA-TV	Camden Bcstg Corp., Sta. WACA	14
Charleston	WCSC-TV	WCSC, Inc., Francis Marion Hotel	5*
Columbia	WCOS-TV	Radio Columbia, Cornel Arms Bldg.	25*
	WNOK-TV	Palmetto Radio Corp., Box 5307	67
	WIS-TV	WIS-TV Corp., 1111 Bull St.	10
Greenville	WGVL	Greenville Tele. Co., Calhoun Towers	23
Greenwood	WCRS-TV	Grenco, Inc., Box 868	21
SOUTH DAKOTA			
Sioux Falls	KELO-TV	Midcontinent Bcstg Co., 8th & Phillips Ave.	11*
TENNESSEE			
Chattanooga	WOUC	Chattanooga TV-Inc., 1024 James Bldg.	49
	WTVT	Tom Potter, 1032 Life of America Bldg., Dallas, Tex.	43
Johnson City	WJHL-TV	WJHL, Inc., 145 W. Main st.	11
Knoxville	WCEE-TV	Tele. Services of Knoxville	26
Memphis	WHBQ-TV	Harding College, Gayosa Hotel	13
	WMCT	Memphis Publ. Co., 495 Union Ave.	5‡
Nashville	WSM-TV	WSM, Inc., National Bldg.	4‡
TEXAS			
Abilene	KRBC-TV	The Reporter Bcstg Co., 984 N. 4th St.	9
Amarillo	KGNC-TV	Plains Radio Bcstg Co., 8th & Harrison	4*
	KFDA-TV	Amarillo Bcstg Co., Inc., 800 Hawkins St. Brownsville, Texas	10*
Austin	KTBC-TV	Texas Bcstg Corp., Box 717	7*
Beaumont	KBMT	Television Bcstrs, Box 1592	31
Dallas	KRLD-TV	KRLD Radio Corp., Herald Square	4‡
	KDTX	UHF Tele. Co., Magnolia Bldg.	23

‡Licensed pre-freeze station.

*Operating under special authority since freeze lift.

st—Sharing time.

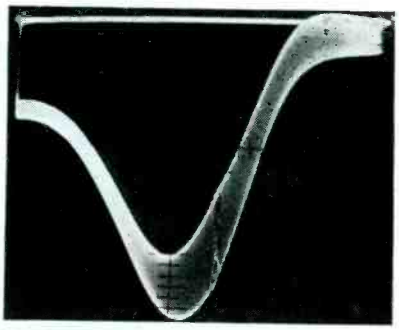
'Old and new channel assignment.

**Stations without superscripts have been authorized to operate, but have not begun to telecast.

(*Continued on page 98*)

In The Field‡

Problem	Analysis
WHY DO ratio-detector *S* curves appear entirely below or above zero-reference lines; and 4.5-mc marker indications not go through nulls?	HALF OF the bleeder resistor across the stabilizing capacitor may be shorted. In addition, AM rejection of the circuit may also be poor. Strong sync buzz may also be passing into the audio circuits.



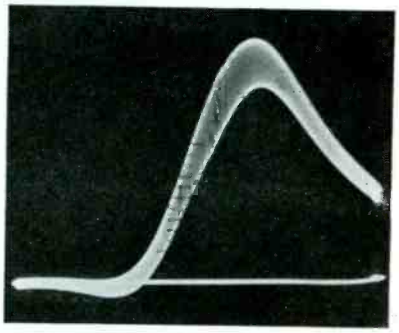


Fig. 1. Waveforms illustrating conditions obtained when strong sync buzz is passed into audio circuits, or half of the bleeder resistor across the stabilizing capacitor is shorted.

WHAT HAPPENS when the horizontal sawtooth reveals very sharp corners and indicates stronger, higher harmonics?	THIS CONDITION can cause interference in radio receivers.

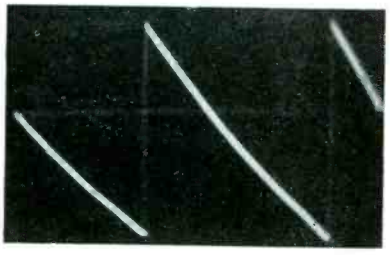


Fig. 2. Horizontal sawtooth with sharp corners which can result in interference to radio sets.

WHAT HAPPENS if the horizontal sawtooth has rounded corners, and also shows weaker higher harmonics?	THIS CONDITION is less likely to produce interference in radio sets.

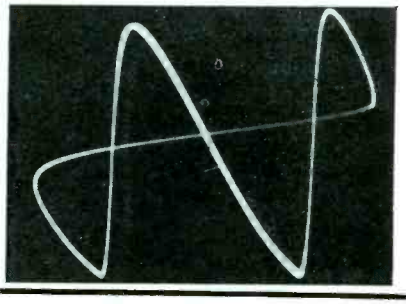


Fig. 3. Rounded-corner horizontal sawtooth waveform which is less likely to produce interference to AM sets.

WHAT DOES spurious *ac* voltage in the *B*+ line cause?	IT PERMITS voltage from one section to back up into other receiver sections, and produces extremely hard-to-find troubles.

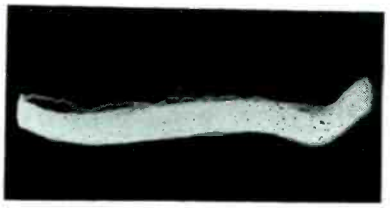
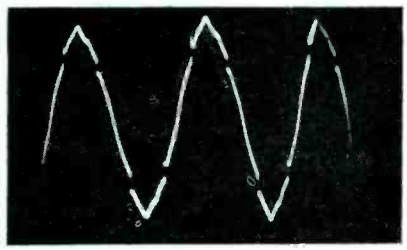
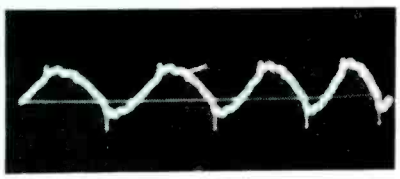
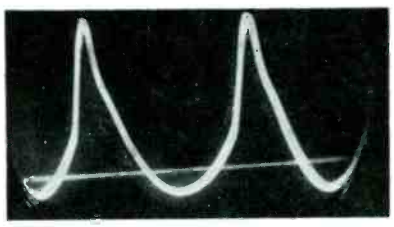
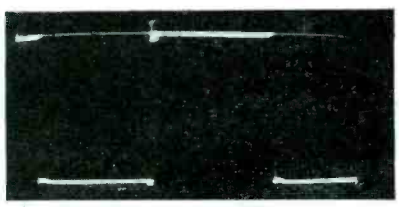
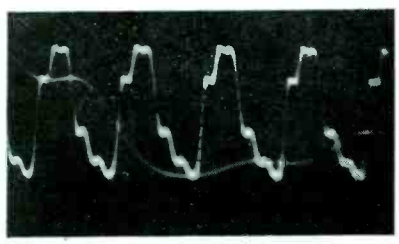
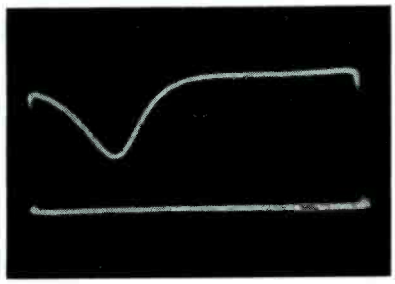


Fig. 4. Spurious ac voltage in B+ line.

Analysis of Ratio-Detector S Curves Appearing Below and Above Zero-Reference Lines . . . Characteristics of Horizontal Sawtooths . . . 60-Cycle Line-Voltage Harmonics . . . Damper Output-Waveforms

Problem	Analysis
WHAT OCCURS when there are harmonics in the 60-cycle line voltage?	SUCH HARMONICS can be disturbing when used to sweep the 'scope in visual-alignment procedures. The harmonics are usually enhanced by small series capacitors.
	 Fig. 5. Waveform which appears when there are harmonics in the 60-cycle line.
	 Fig. 5a. Another example of harmonic trouble, enhanced by passage through capacitor probe. This can cause operator to draw false conclusions if the passage through probe is not recognized.
WHAT WILL HAPPEN if the damper-output waveform has sharp peaks which contain high harmonics?	PICTURE (*spook*) interference will result. This can be trapped out.
	 Fig. 6. Sharp peak damper output waveform with high harmonics which usually indicates picture or spook interference.
WHAT DOES OVERSHOOT in a square-wave test of the video amplifier indicate?	THIS INDICATES an underdamped circuit, and can produce a trailing reversal in the picture.
	 Fig. 7. Overshoot in square-wave test of video amplifier.
WHAT CAUSES ringing and excessively slow rise in a square-wave test of the video amplifier?	A FAULTY high-frequency response of the video amplifier. It produces a smear in the picture.
	 Fig. 8. Waveform produced by a faulty hf response of the video amplifier.
WHAT KIND of a pattern will appear when there is a mismatch of the antenna to the leadin on a swept channel?	SUCH a pattern is shown in Fig. 9. Some video frequencies are attenuated in voltage with respect to other video frequencies, and thus the waveform shown. Extreme mismatch also produces smear.
	 Fig. 9. Waveform obtained on swept channel when antenna is mismatched to a leadin: Video frequencies are attenuated in voltage with respect to other video frequencies.

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

IMPACT IN UHF

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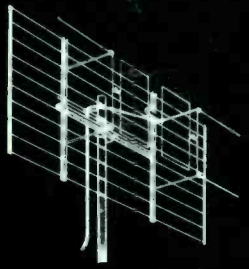
Great UHF ANTENNAS

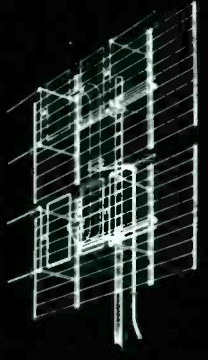
Engineered To Give HIGHEST GAIN and NARROWEST PATTERNS to solve difficult "GHOST" problems in the FRINGE AREA AND IN CLOSE TO THE STATION

This great series once again reaffirms Finco leadership! Model 502 is a 2-bay unit of the colateral* type with a "snap-out" screen for instantaneous installation. Model 504 is the 4-bay version, highly effective in super fringe areas where ultra high gain is consistantly required. Both models feature high front to back ratio and excellent impedance match to 300 OHM line for low signal fringe areas. Completely preassembled — corrosion proof aluminum throughout (including screen) — one antenna, one transmission line!



Both Units available in 3 models which peak on channel ranges shown below and maintain high gain on balance of frequencies:

#502A — channels 14-32
#502B — channels 29-55
#502C — channels 53-83



#504A — channels 14-32
#504B — channels 29-55
#504C — channels 53-83

Patent No. 2,566,287
*Reg U.S. Pat. Off.

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Leonard R. Smith, TEA president.

Highlights of the Radio and TV Service Clinic and Electronics Fair Held in Fort Worth, Texas

THE SWIFT GROWTH of TV since the freeze lift received a booming tribute in Texas a short while ago, when the Texas Electronic Association held its first Radio and Television Service Clinic and Electronics Fair, a 3-day conclave, in the Texas Hotel, Fort Worth.

Over 500 Service Men, dealers and manufacturer's reps came to see a host of outstanding exhibits, and listen to the nation's best review all phases of TV.

Among those who addressed the boys were *James Secrest,* executive veep of RETMA, who described the tremendous potential in TV; *Forrest L. Baker,* immediate past prexy of TEA, analyzing service costs; *Al Robertson,* an Oklahoma City Service Shop operator, reviewing methods that can be used to merchandise servicing; *William D. Renner* of Howard Sams, covering *uhf*; *Hal Chase,* president of the Television Service Association of Michigan, reporting on business management of service shops; *John F. Rider,* surveying new developments in color TV and transistors; *Mort Farr,* past prexy of NARDA, offering advice to the new TV Service Man; *Clint Walters,* RCA Service Co., explaining transistor operation and application; and *Leonard R. Smith,* prexy of the association, who delivered the keynote address. Also featured was a panel discussion of problems in industry. Among those who participated were *Russel C. Hansen,* manager of the contract service department of Motorola; *R. J. Yeranko,* general service manager of Magnavox; *Bill Satterfield,* national electronics service manager of Philco; and *Dan Creato,* vice prexy of RCA Service Co. *James Palmer,* electronics service manager of the West Texas Appliance Company, acted as panel moderator.

In a bristling talk, Len Smith struck out at those who charged that all Service Men were guilty of malpractice and chicanery.

He said that he refused to believe that there is any large element of service which is not dedicated to the highest standards of operation. "I refuse to condone any contentions from any source," he emphasized, "that our field is peppered with racketeers and dishonest practitioners. Yet it would be blindness not to recognize that there are practices which, if they were destroyed, would better the industry and better the calibre of service we can render the public."

In a review of these problems, it was noted that when manufacturers require that Service Men maintain a special type of in-warranty parts replacement tag for his brand, work is only complicated unnecessarily. Overlong delays and excessive red tape can only handicap Service Men, and when obscure, unknown replacement parts are used to save a few pennies and perhaps force unnecessary added service, a wrong is done, Smith added.

Continuing, the new prexy said that false claims in advertising, books that state the owner can repair his set, distorted statements about the cost of service which compel artificial charges for parts, incompetent men entrusted with advanced technical assignments, installations made with mounting brackets and hardware that are not corrosion-proof and rust-proof, inadequate safety precautions and insurance, hurt every Service Man whether we indulge in them or abhor them.

Hammering away at retail salesmen who give the customer the distinctly false impression that the set does not require service or that the warranty includes service, Smith declared that the customer should be taught at the time he buys the set to expect to pay for service, just as the car purchaser today expects to pay for service when he buys his car. In conclusion, the TEA headman said: "We meet in harmony here. We hope that harmony grows to where our parts jobbers wouldn't think of selling to the consumer—often our customer—at the same prices we pay for our quantity purchases. In turn, we must show them the same kind of loyalty we expect from them, buy from our own suppliers in our own markets rather than from some surplus jobber who may well betray us on any order they ship. . . . Our industry is too big, too constructive, too rich with potential, too needed by the public for us to permit ugly little practices to arise in it. Let's band together, then, for a cause we know is right, and we can have the satisfying knowledge that we will have all right-thinking people with us, working to make a tomorrow we can look forward to with satisfaction, dignity and pride."

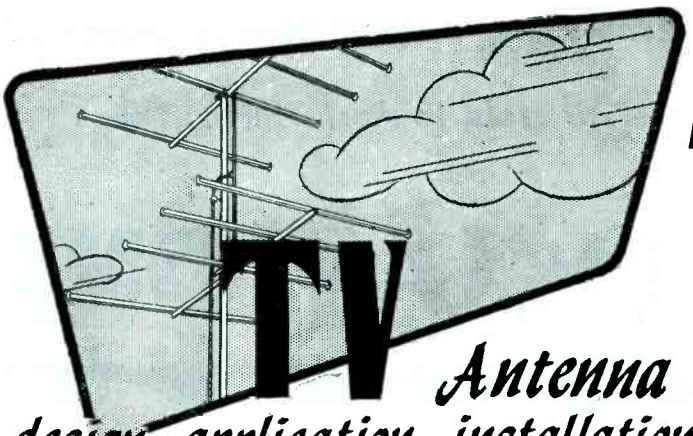
RETMA's spokesman, Jim Secrest, also stressed the import of the Service Man. In his opinion, the Service Man, given a satisfactory product, is probably more often responsible than the manufacturer for the consumer's satisfaction or complaints. In all instances, it was noted, he is closer to the set owner than the manufacturer and therefore in a better position to create good or ill will for the product and the industry.

"The role of the Service Man has become much more important since the advent of television," added Secrest. "In the radio-only days many set owners did their own servicing and some found, like my young son of that day, that a few hard knocks on the plastic cabinet of a table radio produced remarkable results. . . . As for manufacturing, it was a stock joke in the industry—and very nearly true—that anyone with a screwdriver, a pair of pliers, and a soldering iron could get in the business and often did. It was the heyday of the loft operator."

Television, it was emphasized, changed this stiuation from a bonanza for ama-

(*Continued on page 76*)

At recent Service Men meeting in Chicago sponsored by Raytheon and Allied Radio which featured talks by C. W. Hoshour, Raytheon service manager, William Ashby of Raytheon, Jack Lizars of Allied Radio, John F. Rider, and Frank Mock, president of TISA. Left to right: J. Lizars; E. Ralph Haines, Raytheon tube rep in Chicago area; William Ashby; Carroll Hoshour; and F. E. Anderson, distributor sales manager, Raytheon receiving tube division.



Results of UHF Area Survey in Easton-Allentown-Bethlehem, Penna.*

by RALPH G. PETERS

AREA SURVEYS are extremely helpful in predetermining receiving possibilities, providing an accurate gage of locations and the antennas that will work best. With the advent of *uhf*, such surveys have become increasingly important because of the extreme beam-like direction of ultrahigh signals.

On several occasions,[1] the results of surveys conducted in the east and midwest have been published in these columns. A short time ago, the Easton-Allentown-Bethlehem area in Pennsylvania was the scene of a comprehensive area study, prompted by the installation of a new *uhf* station, WGLV.[2]

In planning this survey, six to seven sites were chosen for their relative local importance, in each of the three major cities.

Busy intersections in the downtown areas, as well as central spots in various residental districts, were selected without regard to conditions which might promote favorable reception. Several sites were chosen in nearby communities of importance, and a single representative location was used in a number of outlying towns.

Procedure

Upon arrival at a previously selected site measuring equipment was set up and an antenna moved about and oriented for optimum reception on each channel. During all measurements the antenna was at a height of 12′ above the ground. Since signal strength is commonly discussed in terms of microvolts per meter at an elevation of 30′, the data tabulated was corrected to the 30′ level.

All *uhf* signals were monitored on a standard TV receiver with a builtin *uhf* tuner. In no instance was man-made noise seen to produce interference. In practically all cases, without any antenna connected to the receiver terminal, the picture was found to be completely noise free. It was possible to eliminate completely ghosting or multi-path transmission in all but one or two locations.

In the tests, it was also decided to evaluate *uhf* versus *vhf* picture quality and reception.

Since the physical dimensions of an antenna vary inversely with frequency, the *uhf* antenna intercepts fewer lines of the electromagnetic field than does the larger *vhf* antenna. This means that a greater field intensity is required to produce a picture from *uhf* than from *vhf*.

The *uhf* antenna because of its relatively small dimensions, however, is easily adapted for high gain and may be expected to provide twice the gain which is practical in a comparable situation on *vhf*.

Man-made and atmospheric noise is almost non-existent at *uhf* frequencies. Thus, surplus *uhf* signal is unneces-

(*Continued on page* 93)

Table 1: Measured TV fields in outlying towns.

Site	VHF Station A	VHF Station B	UHF Station A	UHF WGLV
Nazareth				
Town Square	43	205	900	4,400 (8.2 mi.)
Pen Argyle				
Fire House	168	298	330	2,800 (16.5 mi.)
Frenchtown				
Rte 29 downtown	13	140	...	1,350 (12.4 mi.)
Catasaqua				
6th and Chapel	23	173	1,750	10,000 (11.5 mi.)
Northampton				
8th and Dewey	45	130	1,400	12,000 (13 mi.)
Bangor				
Main and Market	23	35	...	950 (16.5 mi)
Bangor				
On Hill S.E. of Center	..	..	130	7,800 (16.4 mi.)

Table 2: Typical results of measured TV fields in Allentown and Bethlehem. Measurements were made at 12′ and corrected to 30′ in accordance with FCC standards. Fields shown are in microvolts-per-meter.

Site	VHF Station A	VHF Station B	UHF Station A	UHF WGLV
Allentown				
Hamilton and 7th	30	65	700	4,400
Route 22 and Schoenersville Rd.	35	123	5,500	10,500
Route 309 and Susquehanna St.	28	100	1,350	
Hamilton and 15th	10	180	700	2,100
Route 22 and 19th	25	198	5,000	5,500
Route 22 at Spanish War Monument	18	138	1,100	3,500
19th and Rath	50	122	1,600	12,500
Bethlehem				
Alt. Rte 22 and Minsi Trail	13	123	3,000	15,500
Alt. Rte 22 and New	10	38	630	3,300
Rte 22 and Nazareth Pike	20	73	2,100	5,000
Center and Illick's Mill Rd.	23	85	2,350	17,500
Rte 22 and 8th	23	58	560	10,000
4th and Cherokee (South Side)	28	38	140	1,100
4th and Lynn (South Side)	20	125	560	25,000

Table 3: Noise-free and usable picture requirements in microvolts-per meter. These data are based on the assumption that a properly installed outdoor antenna is used. Indoor and built-in antennas require considerably more field intensity for equivalent pictures.

Picture Quality	Area	Channels 2-6	7-13	14-83
Noise-free	Urban	500	500	1,000*
Good-Usable	Urban	300	300	500*
Noise-free	Rural	150	300	1,000*
Good-Usable	Rural	75	150	500*

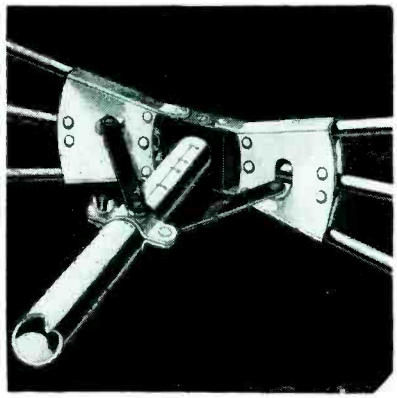
*From a report prepared by *Paul Godley Company*, consulting engineers.

[1]SERVICE; January, June, July, August, 1953.

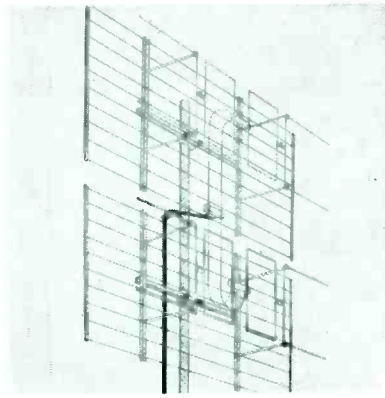
[2]Channel 57, operating at 100,000 watts, effective radiated power from Gaffney Hill with antenna 1,460′ above sea level.

*UHF conversion strips used in *vhf* receivers require approximately twice this signal. Figures are for *uhf* receivers and converters.

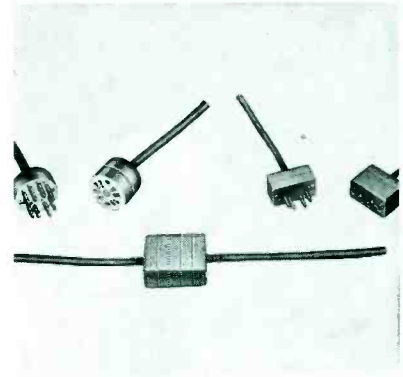
Pictorial Review of Latest in UHF/VHF Antennas . . . Rotators . . . Boosters



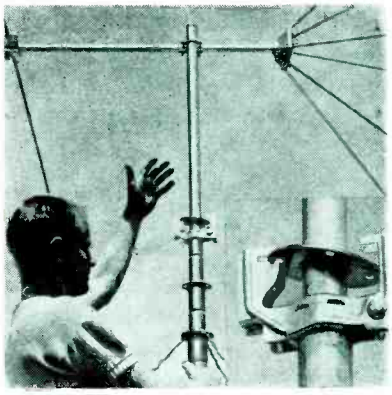
A conical, that's variable, with element heads coupled to a sliding sleeve on the boom. Sliding sleeve is moved to calibration mark on the boom which is said to correspond to the channel peaking desired. Butterfly springs snap elements into position and lock them. (Vari-Con; Falcon Electronics Co., 2003 Cedar St., Quincy, Ill.)



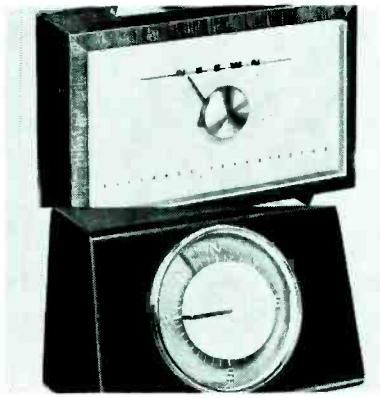
Antenna designed for uhf and constructed on colateral design. Model illustrated is a 4-bay unit. Has a snap-out type screen reflector. Extremely narrow patterns and a high front-to-back ratio are claimed to be features engineered to solve ghost problems due to multiple signals. Variations of setups designed to peak on channels 14 to 32; 29 to 55; 53 to 83. (Model 504; Finney Co., 4612 St. Clair Ave., Cleveland 3, O.)



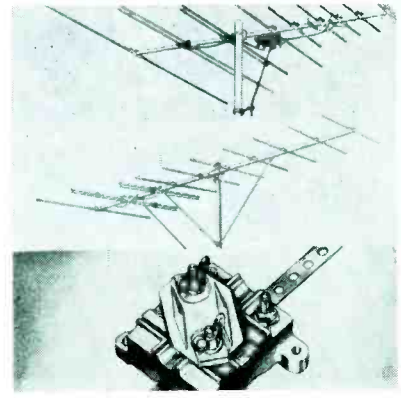
Series of plugs and sockets for connecting 4, 5 and 8-wire rotator cables. Connectors are molded of polystyrene, have phosphor bronze contact strips, and are solderless. Plug pins are plated brass. Base sockets may be mounted on wood or metal. Connectors are designed for either flat or round multi-wire cable. (Mosley Electronics, Inc., 8622 St. Charles, St. Louis 14, Mo.)



Antenna mast, featuring safety device called the third hand, which is said to permit one-hand extension. Major feature of this mast is an automatic, removable locking device that holds mast sections up when one lets go. Another feature is a step-up key, a metal stamping that permits mast indexing; key automatically extends each mast section for elevation. (Strato-Matic lines, series 16 (16-gauge hot dipped galvanized); and series 18 (18-gauge; electroplated with coating of bright zinc); Channel Master Corp., Ellenville, N. Y.)



Antenna rotators, designed for manual and automatic operation. Model at bottom is fully automatic, which supplies fully automatic rotation to any pre-selected stop position. The control case for model above is manually operated with control bar across the top of case. Other improvements include faster rotation; new magnetic brake; and guy wire attachment on clamp plate. (Model U-83—fully automatic, and Model T-10—manually operated; Alliance Manufacturing Co., Alliance, O.)

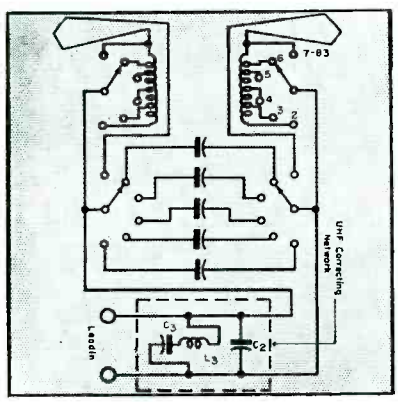


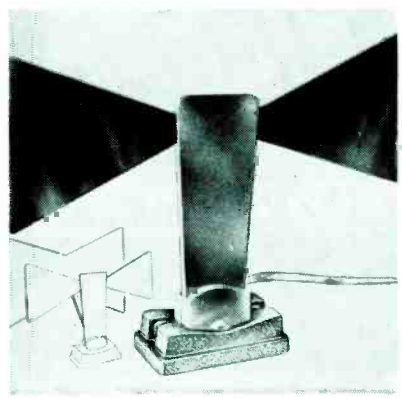
Top: Hi-low yagi phased together with printed circuit isloation filter. There are five elements for high channel reception and four elements for low. Center: broad-band yagi available in both 10- and 5-element models. The 10-element antennas are available for Channels 2, 3, 4, 5 and 6; 4, 5 and 6; and 7 through 13. Bottom: Universal lightning arrester, believed to be the first hermetically sealed model with completely encased electrodes. Unit will accommodate flat, tubular, oval, round and open wire lines. (Vee-D-X models: LaPointe Electronics, Inc., Rockville, Conn.)

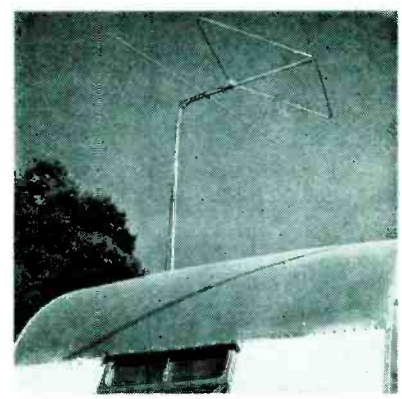
Schematic of switched-tuned uhf-vhf indoor antenna. C_2, a 1-mmfd capacitor, serves to correct for mismatch at uhf caused by selector switch. It is placed 1" from switch terminals and a series-resonant circuit (C_3, L_3) resonant at 400 mc, which is shunted across the lead 7" from C_2. (Model 600; Tricraft Products Co., Chicago 22, Ill.)

Indoor uhf bowtie, with bowtie elements of high-tempered aluminum. Stands about 8½" high in a metal base which it is said cannot be tipped over. In critical areas, gain of the unit, it is claimed, can be doubled by the addition of a reflector, which plugs into fitting at back of the antenna. (Model IBT-500; Radio Merchandise Sales, Inc., 2016 Bronxdale Ave., N. Y. 62.)

TV antenna designed for trailer installation. When traveling, antenna anchors to a position 2" above the roof, mounted on a telescopic pole. When the trailer is parked, antenna can be raised for reception. (Trailer Tenna; Clear Beam, Inc., Burbank, Calif.)







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SILVER ANNIVERSARY

Henry T. Paiste, Jr. (left), vice president of Philco in charge of product performance and service, receiving congratulations from Philco's general service manager, Russell M. Oliver, and a sterling silver bowl commemorating Paiste's 25 years with Philco, presented by Philco's TV and appliance distributor service managers. Inscription on the silver bowl read: "To Uncle Henry, 'Mr. Service, himself,' on his 25th Philco anniversary . . . our heartfelt thanks for making Service a profession."

O'LEARY ADVERTISING NOW G-C AGENCY

O'Leary Advertising, Rockford, Ill., has been appointed by *General Cement Mfg. Co.* to handle ad programs for General Cement and its subsidiaries, Television Hardware, Gee-Lar, and Wood Specialty. *Richard Long* is account executive.

* * *

V-M WINDOW DISPLAY CONTEST

A window display contest, featuring V-M phono and record players, has been announced by *V-M Corp.*, Benton Harbor, Mich.

Both distributor salesmen and retailers will be winners in this contest. First four winning retailers will receive $100, $75, $50 and $25, respectively. A panel of judges will select the four winning displays from photographs or snapshots submitted by contestants. Distributor salesman within each V-M rep's territory, responsible for the greatest number of window displays in the territory, will receive $100 as an award.

* * *

VHF BOOSTER COUNTER DISPLAY

Counter display rack now in use by jobbers to feature the Regency vhf booster. Rack was created by Burton Browne Advertising.

NEWS

BURGESS BATTERY ENGINEERS GRANTED PATENTS

J. J. Coleman and *Milton E. Wilke, Burgess Battery Co.*, Freeport, Ill., have been granted two patents on cell construction developments in deferred-action type batteries.

Batteries of the deferred action type, that are energized or activated by contact with liquids, are said to tend to short circuit because of a local action caused by the activation liquid going into the cells and remaining on the cell surfaces which results in the forming of a bridge between adjoining cells. New-type construction invented by the Burgess engineers is claimed to eliminate substantially local action and short circuits.

* * *

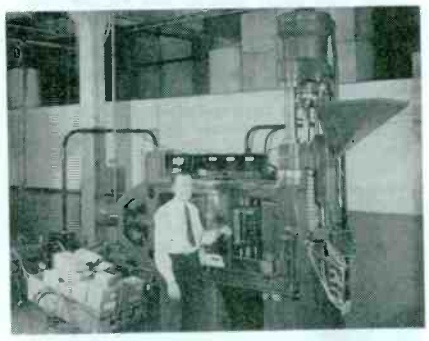
K-G ELECTRONICS MOVES

To provide additional space and facilities, *K-G Electronic Corp.* has moved factory and offices to a new building at 2738 N. Sheffield Ave., Chicago, Ill.

New K-G Electronic Corp. Building

* * *

YESTERYEAR AND TODAY



The oldest and newest pieces of equipment in plant of the Mueller Electric Co., Cleveland. In *the early days* the push cart shown was navigated daily several blocks through down-town Cleveland carrying packages to the post office. The pusher was Al Flynn. A truck to carry parcel-post has replaced the push cart for outdoor use, but it is still serviceable and affectionately known as the Cadillac; each year it is fitted with a new set of discarded auto license plates. Today, Al Flynn is Mueller's superintendent and he is concerned with the operation of many huge machines, one of which is shown above; it is an injection machine for the molding of vinylite insulators. Machine stands about 10' high and weighs nine tons. Four electric heating zones plus 20,000 pounds per square inch pressure plasticize the vinylite and cause it to flow into the molds. With a ten-cavity mold and amolding cycle of about 41 seconds, it can produce over 5,000 medium-sized insulators per day.

NEW PARTS SHOW OFFICERS

Harry A. Ehle, IRC, newly elected president of the Radio Parts & Electronic Equipment Shows, Inc. (second from left), being congratulated by (left) Francis F. Florsheim, Columbia Wire, new secretary; and (right), Bernard L. Cahn, Insuline Corp. of America, Inc., who will serve as treasurer.

EICO DECAL

Three-color decals that can be attached to windows or vehicles are available from Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

* * *

NAME CHANGE

The Grayburne Corp., 4-6 Radford Place, Yonkers, N. Y., has officially changed its name to *Rayburne*.

* * *

NEW GUY WIRE TRADE NAME

Guy Wire, manufactured by Fenton Co., is now being marketed under the new tradename, *Tuf-Guy*.

* * *

TRANSVISION TO CUSTOM-BUILD COILS

A special transformer and coil manufacturing division, devoted to the design, engineering, and manufacture of coils, such as *hf* air core, multi-layer solenoids, peaking, synchro winding, and TV *rf*, *if*, and transformers for audio, power, high voltage and pulse application, has been set up by *Transvision, Inc.*, New Rochelle, N. Y.

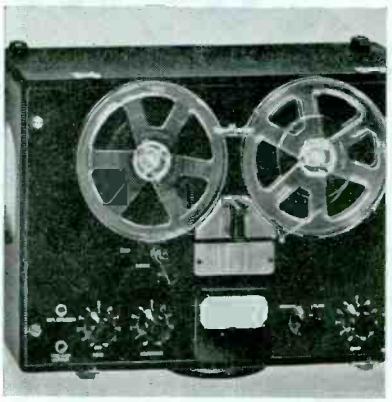
* * *

PHALO PRODUCT DISPLAY

Product exhibit designed to feature special Phalo harness assemblies, wires, cables, etc. Display also features a blowup of the product application chart which is a part of the 46-page catalog recently completed.

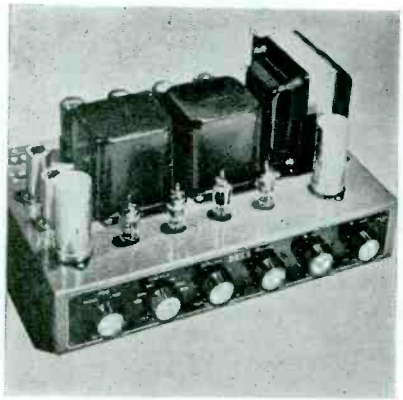
On View at Audio Fairs in San Francisco, Philadelphia, Chicago, and

Right: A huge four-speaker assembly. Left: small apartment size speaker system which measures 11" x 10" x 23¼". Small unit features use of 8" speaker unit, tuned acoustic element enclosed case, and a multicell compression hf driver. (Small model is known as Duette; Jensen Manufacturing Co., 6601 South Laramie Ave., Chicago 38, Illinois.)

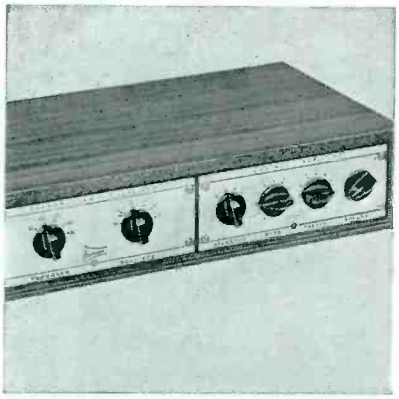


Single-speed tape recorder (7.5 ips), featuring a rear illuminated vu meter which provides level indication in both record and playback positions. Has separate preamp gain control and inputs for microphone and radio-phono. Output 600 ohms; cathode follower. Power output 2 watts (4½ peak). Can be used vertically or horizontally. (Model HF-500; TapeMaster, Inc., 13 W. Hubbard St., Chicago 10, Ill.)

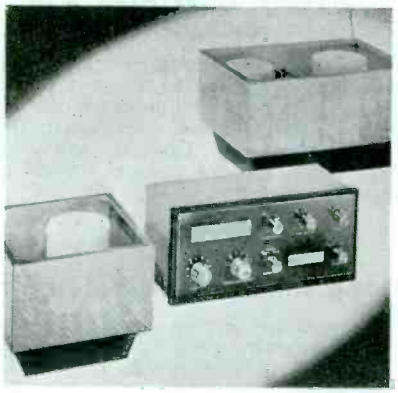
A 25-watt amplifier with four-channel mixer, three mike inputs and a phono input. Socket knockout and input contacts provided to expedite conversion to low impedance mike inputs. Individual tone controls for bass and treble. Multi-stage inverse feedback. Said to employ cellulose-acetate-insulated output transformer. (E-254; Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.)



Binaural amplifier which includes three dual sets of inputs; dual flat inputs for radio and tape, and a pair of dual inputs for phono records (for use of either high or low magnetic pickups). Unit also has six-position function switch to select binaural, monaural, or reverse binaural either with or without loudness control. Power output: 20 watts (10 watts each channel). Dual output impedance: 4, 8, 16 ohms plus dual hi-Z for tape recorders. Tubes: two 12AY7s; two 12AT7s; two 12AX7s; four 6V6GTs; and one 5U4G. (Bell Sound Systems, Inc., Columbus 7, O.)



Audio control center, which consists of a phono preamp-equalizer, with separate turnover and roll-off controls, and control amplifier which provides input selector switch, bass boost and cut control, treble cutoff and boost control, and volume control. Features of the units are step switch controls for permanent calibration; universal pickup compensation; adjustable treble cutoff filter; maximum of 28 db bass boost; adjustable loudness control; low impedance output; tape recorder takeoff jack; and negative feedback. (Model A100-CA2; Brociner Electronics Lab., 344 E. 32 St., N. Y. 16.)

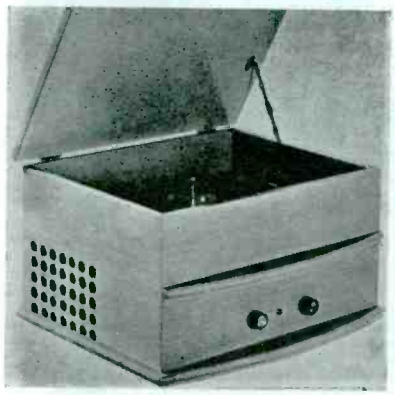


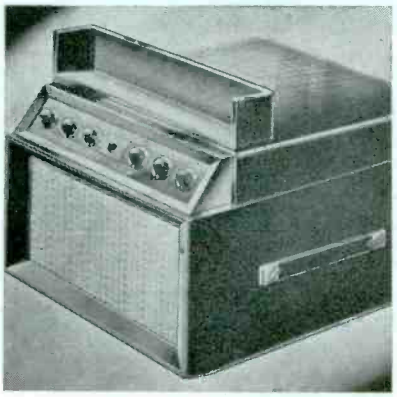
Audio ensemble which consists of three separate units: a preamp-equalizer, power amplifier and power supply. All units are claimed to be non-hygroscopic, providing protection against adverse effects of moisture. Each unit is also said to feature individual calibration and each has an individual response curve. Has a variable crossover compensator. One low and two high-impedance inputs are provided; each with a continuously variable level compensator. Also has a continuous variable loudness control and a six position crossover selector for adjustment to various recording characteristics. (Model 1000; Regency Division (IDEA), 7900 Pendleton Pike, Indianapolis 26, Ind.)

Table model record player with dual speakers, 6 watt amplifier and English 3-speed changer. (Model HF-90; Video Corp. of America.)

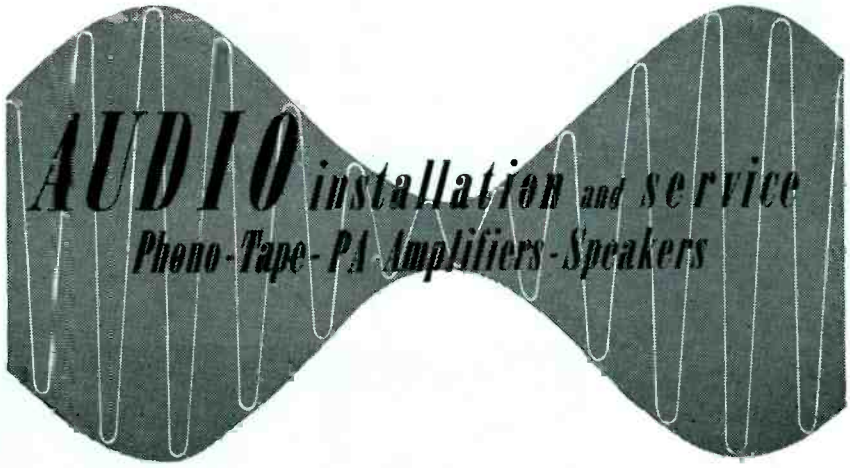
Tape recorder which, it is said, can play for 16 consecutive hours. (Lion Manufacturing Corp., 2640 West Belmont Ave., Chicago, Ill.

A 50 power wide-angle hand microscope for checking phono needles while in cartridge. (Duotone; Keyport, N. J.)





New York‡ . . . Troubleshooting Hum in Audio Amplifiers*. . .



by KENNETH STEWART
and PAUL EDWARDS

HUM has always been a particularly provoking problem in the audio system. Frequently it can be tracked down to the input circuit.

If shorting the grid of the input tube, or turning off the gain control, eliminates the hum, it is obviously coming from some element associated with the input stage. But that only represents a partial diagnosis. There are many ways in which hum can break into the input circuits.

Hum can be induced into different parts of the circuit electrically, magnetically, or electromagnetically. Electrically-induced hum is characterized by its appearance in a high-impedance circuit; hence this is sometimes called an open circuit hum. It is audibly different from other types in that it contains a dominance of higher harmonics, causing it to sound ticky or tizzy. The other forms of induction give rise to a deeper note; almost pure 60 or 120 cps.

To trace hum, the input tube circuit should be checked initially: The input circuit should be disconnected from the grid, and a grid return, in the form of a simple resistor, provided with the shortest possible leads; its value should be the same as the input circuit impedance at the grid, and it should be placed inside of whatever screening is provided for the input stage. If the hum still persists, but disappears when the grid return is shorted, the hum must be in the tube.

If the tube is of the straight heater construction type, probably it is radiating sufficient field to be picked up on the grid, as soon as any impedance at all is inserted in its return. The spiral heater type tube intended to be hum-free, should not introduce noticeable hum; occasionally tubes of this type have been found to cause hum, due to magnetization of some part of the electrode assembly. A permanent magnetic field is produced in the electron path, so that the small residual portions of *ac* field from the heater, which would normally cancel out, form a pattern (interacting with the grid structure) to produce a hum. Demagnetizing will cure this; a demagnetizer similar to that used for demagnetizing clocks and watches should be used.

Having cleared the tube, any hum now picked up must emanate from somewhere in the input circuits. It may be magnetically induced in the transformer core. In this case, shorting either primary or secondary will stop the hum; changing the position of the transformer will alter the hum, but this may not be easy to do. Shorting the windings can also stop hums due to other causes. If, however, the hum is of the deep variety (which means it is of the magnetic or electromagnetic type), stoppage when the primary is shorted offers fairly conclusive evidence that the trouble stems from the transformer core, because shorting the input side increases electromagnetic effects when the actual input is disconnected. One can try reorienting the transformer, taking care to keep the case grounded while making the change. If altering the position varies the hum, a component with better shielding is required.

Open-Circuit Type Hum

If the hum is of the open-circuit type, and the tube has been cleared, the problem is most likely a pick-up type, coming from either the secondary, because the wiring to the grid is not sufficiently screened, or by capacitance transfer from primary to secondary of the input transformer. Connection of one side of the primary to the cold end of the secondary will eliminate the latter possibility. If any hum remains, the hot lead from the transformer case should be screened to the grid, and the screening returned to the cold end of the transformer secondary.

If the hum is due to capacitance transfer between windings, and connection between primary and secondary is not possible as on *ac/dc* chassis, a special screened transformer, or

(*Continued on page* 88)

‡*See detailed reports on new audio developments and equipment displayed at Fairs on pages* 30, 36, 38, 42, *and* 107.

From notes prepared by* ***Norman Crowhurst**, British audio* consultant.

Fig. 1. Minimizing hum through use of twin screened lead.

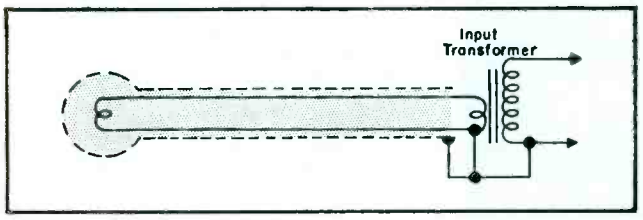
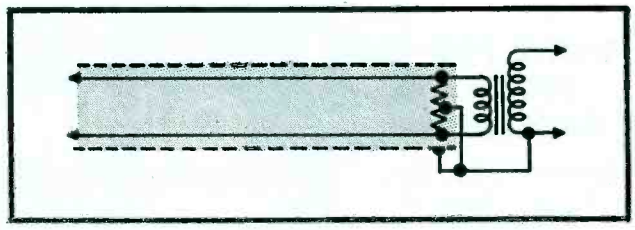
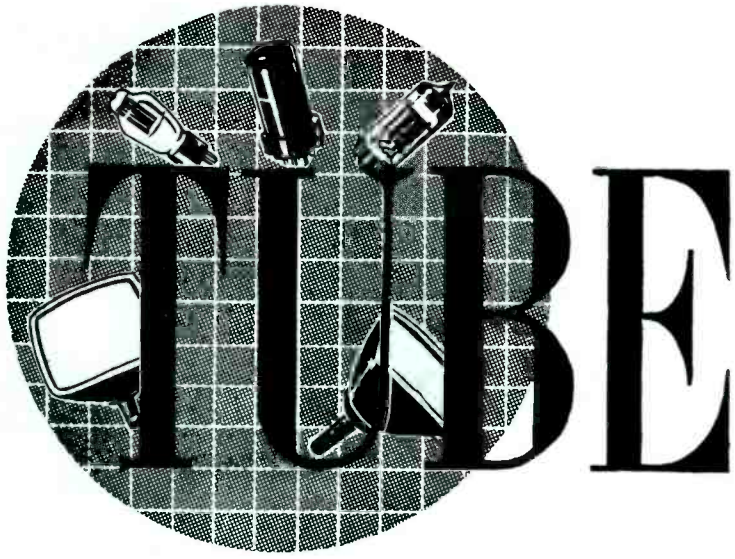


Fig. 2. Balancing or screening input leads at line impedance (500 or 600 ohms) to eliminate hum pickup.





News — by E. A. TEVERSON

Horizontal Deflection and HV Circuits for 27-Inch Picture Tubes* . . . Miniatures and Subminiatures for 12-V Auto, and Mobile and Aircraft Receivers

To PROVIDE adequate deflection voltage for the larger picture tubes, such as the 27MP4, which have horizontal-deflection angles of about 85° and diagonal-deflection angles of about 90°, a horizontal-deflection circuit, with a deflecting yoke,[2] designed to provide the good corner resolution, desirable with large rectangular tubes, is necessary. Such a circuit is illustrated in Fig. 1. It employs a ferrite-core[1] transformer and two ferrite-core coils for linearity and width control. The width control has an inductance range of approximately 3.9 to 22 millihenries. The approximate inductance range of the linearity control[3] is 1.5 to 8.3 millihenries.

Suppression Capacitor Values

A capacitor, whose value may range from 75 to 200 mmfd, and is connected between terminals *3* and *5* of the hor-deflection output/*hv* transformer affects the natural period of the entire circuit and at the same time aids in suppressing undesirable ripple and interference effects. The specific value of this capacitor must be chosen to provide a retrace pulse having a duration and shape which gives best performance, particularly with respect to scanning amplitude and high-voltage output. When this system is used with picture tubes having slightly different deflection angles, the capacitor must be adjusted to provide the correct ratio of scanning amplitude to high voltage for each tube used. The required value of this capacitor has been found to be affected by the capacitance to ground of the 6W4GT heater winding and the length of the deflecting-yoke leads; thus its exact value is usually determined by trial during development work because the physical arrangement of the parts in the system affects the natural period.

HD Circuit Drivers

The horizontal-deflection circuit may be driven with either a blocking or a multivibrator - type oscillator. Both drive circuits utilize automatic frequency control for better noise immunity and work equally well. Keyed *agc* pulses can be obtained from terminals *3*, *T*, *4*, *5*, or *7* of the transformer, depending upon the magnitude of the desired positive voltage pulse.

Vertical Deflection

The *hd/hv* circuit is used with a vertical-deflection circuit (of the type shown in Fig. 2, which utilizes one triode-connected 6W6GT operating directly from the B– supply with a current drain of approximately 28 ma. A 500-ohm resistor is used between plate and grid *2* to prevent parasitic oscillations. Operation directly from the B– supply permits the use of a lower system B– voltage than would be required if vertical deflection were obtained from the boosted B– supply.

Boosted B Supply

The vertical-deflection circuit can also be operated from the boosted B– supply in a circuit in which a single 6S4 and and a vertical output transformer having a turns ratio of 18:1 are used. In this case, the design-center B– supply voltage must be increased from 265 to 285 volts, and a second damper diode used to handle the increased current which flows in the damper circuit as a result of the load on the boosted B– supply. The cathode of the damper tube must also be connected to terminal *5* instead of terminal *7* of the horizontal output transformer to preserve good horizontal linearity. With this arrangement, the boosted B– supply drain will be approximately 14 ma.

Lead Dress

As noted in earlier *hd* analyses, special attention must be given to wiring techniques utilized with horizontal-deflection and high-voltage circuits to minimize stray capacitance and prevent corona or arc-overs. It is particularly important to dress the 1B3GT plate lead away from other leads and the chassis. Other leads having rela-

Sticker placed on G.E. replacement picture tubes and their cartons to discourage the home handyman from tampering with his set, and also to call attention to the experienced technical service available from his Service Man.

*Based on copyrighted application notes prepared by the tube department of RCA.

[1]RCA 235T1. [2]RCA 219D1. [3]RCA 213R1.

tively high pulse voltages are: 6CD6G plate lead, 6W4GT cathode lead, and leads to transformer terminals *3*, *T*, *4*, and *5*.

Adjustments

Correct adjustment of the ***drive*** control is important for proper circuit performance. The drive should first be increased until a white vertical bar appears near the center of the raster, and then be decreased until this bar just disappears. The linearity control should then be adjusted for best linearity. Because minimum cathode current in the 6CD6G occurs in this circuit very near the optimum setting of the linearity control, a preliminary adjustment of linearity may be made by setting the linearity control for minimum voltage across the 6CD6G cathode resistor. The adjustment of drive is somewhat dependent upon the linearity adjustment and must be rechecked after other adjustments are completed.

New Tube Developments

A beam power amplifier[4] of the 7-pin miniature type, intended primarily for use in the output amplifier of auto radio receivers operating from a 12-volt storage battery, has been announced. Within its maximum ratings, the tube, a 12AQ5, is the performance equivalent of the larger glass--octal type 12V 6GT.

High Power Output

The tube features the application of directed electron beam principles, which it is claimed, makes it capable of producing relatively high power output with high power sensitivity. For example, it is said, a single 12AQ5 operated with a plate and screen voltage of 250 volts can deliver a maximum-signal power output of 4.5 watts with a peak driving voltage of only about 12 volts.

Subminiature Tubes

Also announced for mobile and aircraft receivers is a *premium high-mu* triode[5] of the subminiature type for use primarily as an audio amplifier where dependable performance under shock and vibration is a prime consideration.

Featured in this tube, type 5719, is a pure-tungsten heater designed to give long life under conditions of frequent *on-off* switching.

[4]RCA 12AQ5. [5]RCA 5719.

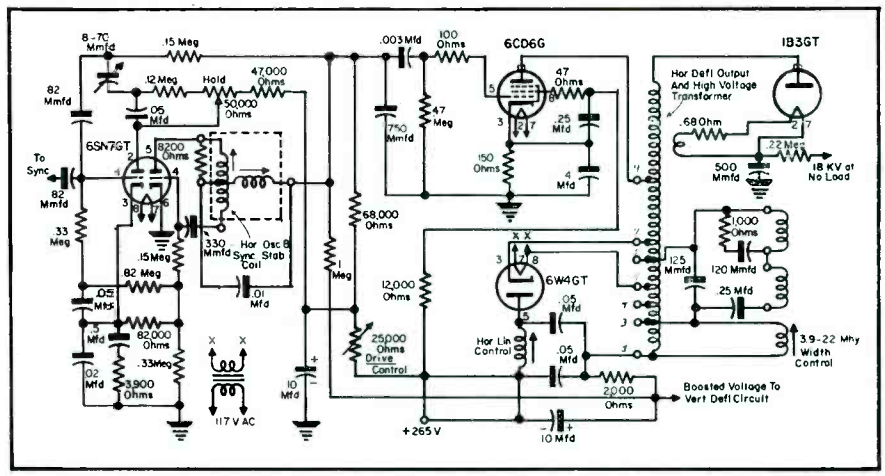
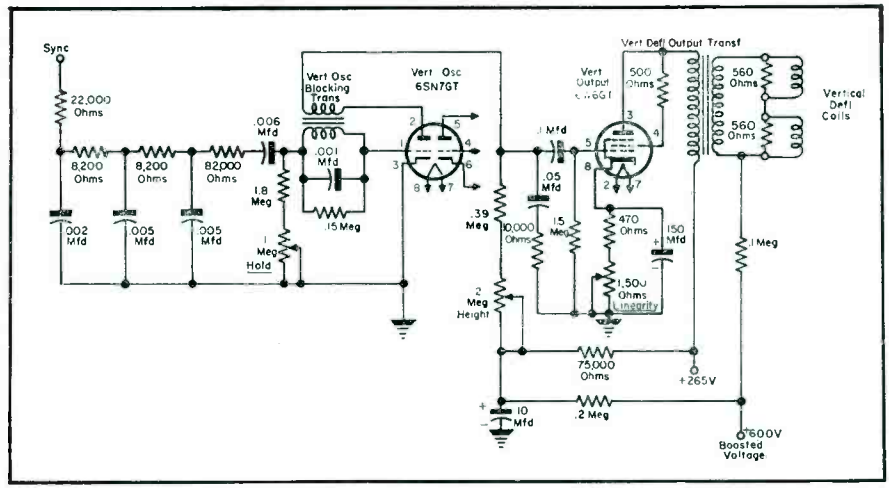


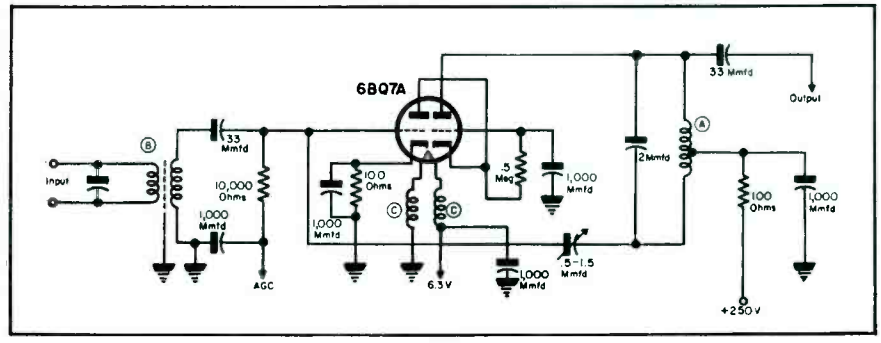
Fig. 1. Horizontal-deflection and hv circuit developed for large-screen picture tubes. System, operating in conjunction with vertical-deflection circuit using a 6W6GT vertical output tube, operates from a 265-v B supply and provides an output of 18 kv.

Fig. 2. Vertical deflection system, which uses a triode-connected 6W6GT, and operates directly from B-supply. Circuit also can be operated from a boosted B-supply, in which instance a 6S4 and a vertical output transformer, having a turns ratio of 18:1, are used.



(Below)

Fig. 3. Medium-mu 6BQ7A twin triode in a driven *rf*-grounded grid amplifier circuit with direct-coupled drive. Tube, a 9-pin miniature type, can be used in a first *rf* amplifier in tuners of *vhf* television receivers or as a low noise *if* preamp in *uhf* television receivers employing a crystal mixer. Tube has high transconductance, low input capacitance, low input loading and low plate-to-cathode capacitance. These features make the tube especially useful in direct-coupled *rf* stage of TV receivers utilizing a driven *rf*-grounded-grid amplifier circuit such as the one shown or the cascode type of circuit. The two triode units of the 6BQ7A are shielded from each other. *A* = tuned circuit element of tuner; value depends on distributed circuit capacitances. *B* = tuned circuit element of tuner; value also depends on distributed circuit capacitances. *C* = bifilar chokes, each 10 turns, No. 18 enamel wire on ¼" coil form. *(Courtesy RCA)*



Service Engineering

(*Continued from page 77*)

test is to replace a suspected tube with one known to be good.

Vibrators should be checked with a 'scope to locate worn contacts. Replacement vibrators should be installed with the same polarity, or orientation, as on the defective item.

Sealed bearings are utilized on the dynamotor, and no periodic lubrication is required. Occasional checks should be made, however, for evidence of excessive brush sparking, pitted commutator surface, or worn brushes, all indicative of need for servicing.

To insure adequate voltage at all times, the battery and generator must be maintained in good operating condition. The battery water level must be kept at the proper height, and the generator output adjusted for the load conditions on the battery.

Faults and Checks

When there is no background noise, the squelch setting should be checked. If there is excessive background noise, antenna connections, ignition and vibrator supply filter should be inspected for faulty operation. In noisy or intermittent conditions, the squelch circuit, loose tubes or wiring, and the vibrator may be the source of the trouble. Weak or fading signals may be caused by tubes, battery or the terrain.

During transmission, low-output may be due to the battery or the *pa* plate tuning and grid drive. When poor modulation exists, the microphone, input transformer or the modulation control may be causing the trouble.

2-Way System Design

THE RECEIVING circuit of some 2-way FM communication systems, such as the RCA CMV-3E1[2], employs a 6BH6 in a Pierce type crystal-oscillator. The two heterodyning frequencies are derived from the oscillator stage; the sixth harmonic being used in the first 6BH6 mixer, and the crystal fundamental in the second 6BH6 mixer. Frequencies in each stage vary; the crystal fundamental ranges from 4.155 to 7.012 mc.

Incoming signals are fed through the contacts of a transfer relay to the 6BH6 *rf* stage. Automatic gain control is incorporated in this stage through grid bias obtained from the 6BH6 first limiter. In the 6BH6 first mixer, the output of the *rf* stage is heterodyned with the sixth crystal harmonic (24.93 to 43.07 mc). The difference frequency is amplified in a 6BH6 first *if* amp, and then heterodyned with the crystal fundamental in the 6BH6 second mixer. Frequencies in the second mixer include the high *if* 5.07 to 7.93 mc, and the crystal frequency, 4.155 to 7.012 mc. Output of the second mixer is the low *if*, whose center frequency is 915 kc.

Two 6BH6 low-*if* stages, and two 6BH6 limiters are utilized before the signal reaches the 6AL5 discriminator tube.

A squelch and noise-amplifier circuit is used to control squelch action in the first *af* stage, elements *6-7-8* of a 12AX7. These elements are used as a noise amplifier, grid *7* being connected to the output of the discriminator. After amplification the noise is rectified in the other half of the duotriode, the grid and plate of this half of the tube being connected together.

In the squelch control section, elements *1-2-3* of the 12AX7 receive the positive output of the noise rectifier. The positive cathode bias on pin *3* permits plate-current flow during no-signal periods, causing a decrease in the potential on grid *7* to a value less

[2]For schematic, see p. 57, SERVICE; June, 1953.

than the positive bias on cathode *8*. Under this condition the first *af* section, elements *6-7-8*, are biased to cutoff, and the receiver silenced during absence of a signal.

When a signal is received, the squelch circuit becomes non-conductive by reduction of the noise-produced bias on pin *2* of the 12AX7. Resultant rise in voltage on plate *1* and, consequently, on grid *7* will permit the first *af* stage to function and pass audio signals.

Plate Voltage Supplies

High voltage for this system is derived from two sources: a vibrator supply and a dynamotor. The vibrator circuit uses a self-rectifying vibrator, to supply plate voltage for the receiver and for all but the last two *rf* stages in the transmitter. This circuit operates continuously while the equipment is on. In the *standby* position, the vibrator supplies plate voltage to the entire receiver, and to the oscillator, modulator, and audio amplifier tubes in the transmitter. During transmission, plate voltage is switched by a relay from the receiver to the first and second tripler, and the screen grid of the oscillator tube in the transmitter. Only the squelch and 12AX7 first *af* tube remain energized during transmission, to insure instantaneous squelch action when the push-to-talk button is released.

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Hi-Fi Audio

(*Continued from page 39*)

working back from the output tubes until a point is found where stimulation of the next grid farther back does not create an increase hum, or does not induce any hum at all. The trouble will be between the no-response grid and the last point from which normal response was obtained.

There are certain procedures that are especially important in high-quality amplifier service. If there is even a suspicion of distortion, the bias voltage on the output tubes should be measured and checked against the manufacturer's specifications or against tube manual data. A leaky or shorted cathode bypass, or leaky coupling capacitors, can change the bias so that the output stage no longer operates properly. Fig. 1 (p. 38) illustrates how a seemingly insignificant *dc* leakage resistance of 5 megohms in a coupling capacitor can place a positive potential of 11 volts on the following grid. The plate voltage is applied to a voltage

(*Continued on page 82*)

Hi-Fi Audio

(*Continued from page* 81)

divider consisting of the coupling capacitor leakage resistance as upper arm, and the grid resistor as lower arm. A *vtvm* must be used to detect the voltage across the grid resistor.

Push-Pull Balance

Another possible cause of increased distortion is lack of balance between the two halves of the push-pull stage, an unbalance which can be created by aging or defective tubes, or circuit components. Where the amplifier does not provide facilities for adjusting push-pull balance, good results have often been obtained simply by changing tubes until a matching pair have been found. One rough indication of the balance of the output stage is in the degree of hum cancellation. With the phase inverter tube removed, various combinations of output tubes should be tried until the quietest pair have been selected.

Figs. 2 and 3 (p. 38) illustrate methods of checking push-pull balance more accurately. Zero or close to zero *dc* voltage (with no signal present) across the whole of the output transformer primary indicates good *dc* balance. To check dynamic or signal balance, a test signal should be applied to the amplifier input—the 400-cycle audio output of the standard signal generator may be used—and the *ac* voltages across each half of the output transformer primary compared. These two signal voltages, referred to the center tap, are opposite in phase, but should be substantially equal in magnitude.

Another method for checking push-pull balance is shown in Fig. 4 (p. 38). This method has been suggested by *D. T. Williamson* (designer of the well-known amplifier circuit bearing his name), and does not require any test

instruments at all, except for some sort of device for detecting *ac* which can be a simple pair of headphones. It does require, however, that the $B+$ lead to the output transformer be unsoldered.

The signals from the two halves of the push-pull output stage combine in-phase across the whole of the output transformer, but they combine out-of-phase when they enter the common $B+$ line. Good signal balance can therefore be indicated by zero or at least minimum signal across the secondary of T_{test} (an inexpensive output transformer of any standard design), while the amplifier is carrying either a test signal or normal program material. The greater the signal input to the amplifier, the more rigorous the test.

Amplifier Oscillation

One amplifier trouble that has on occasion fooled even experienced Service Men is supersonic oscillation. Amplifiers with output tubes connected in push-pull-parallel are especially liable to this defect. The oscillation can be seen without difficulty on the screen, but the operational symptoms may be misleading, especially when the oscillation breaks out only on signal peaks, as illustrated in Fig. 5 (p. 39). In such a case the defect may be diagnosed incorrectly as speaker rattle, which it imitates expertly. With steadier and heavier supersonic oscillation, the amplifier will overload and distort in a more obvious way.

This oscillation can be caused by improper dress of the output stage leads. The plate leads of one-half of the push-pull stage must not be inadvertently coupled capacitively to the grid leads of the other half. If the oscillation cannot be cured by lead dress, stopping resistors should be inserted in series between the output tube grids and the circuit leads connected to them. The resistors should be about 1,000 ohms each, wired close to the socket pins. Plate-stopping resistors of 25 to 50 ohms can also be used to advantage, connected to the plates in the same way. Fig. 6 (p. 39) illustrates the connection of stopping resistors, which do not affect the quality of performance in any way.

Subsonic oscillation, or motorboating, is another type of trouble that may arise in audio amplifiers. The usual loss of filter capacitance should be suspected immediately, and checked by bridging the filters. When the system has low-level stages, such as preamps for magnetic pickups or microphones, the proper functioning of

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Hi-Fi Audio

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filter and decoupling networks will be found especially critical.

One should *never* replace a coupling capacitor with one lower in value, even when the original value seems unusually high. If the stage involved is within a feedback loop, increased phase-shift created by the lower value capacitor can produce motorboating; sounding just like that due to bad filters.

Very low-frequency oscillation appears as a slow, visible but inaudible back-and-forth movement of the speaker cone, sometimes referred to as *breathing*. This should be treated as motorboating.

All capacitors used in low-level stages must be of especially high-quality construction to guard against a very annoying type of crackling noise that can be introduced. Plate resistors in preamps have also been known to cause circuit noise.

The Record Player

Next to tubes, phono needles would probably take second prize as a source of trouble in audio systems. Distortion, noise, and groove skipping are often traced to a worn stylus, although the user may have no idea that his player is ready for a needle change. He may have the wrong impression about how many playing hours his needle is designed for, or he may not realize how much he has used it. In any case the life expectancy of a needle in a *hi-fi* system is far less than in a standard commercial phonograph. Although the actual needle point wear in the *hi-fi* player will very likely be less, due to proper adjustment of tracking force, and the use of high-compliance cartridges, the *effect* of needle wear shows up much more quickly. High-frequency distortion as well as *hf* program material is suppressed by an audio system of limited frequency range. In addition, a blunted needle will not skip grooves as readily when it is mounted in a relatively heavy cartridge and arm.

The diagnosis of distortion, buzzing, and rattling from records should, therefore, always start by suspecting the most probable source—the needle. When on an audio call, in which the complaint is phono trouble, Service Men should try to find out beforehand what type of cartridge and needle are used, and bring spares with him if possible.

In checking to see if the phono is *live*, it has been common practice in the past to stroke the needle with one's finger, while listening for output from the speaker. This procedure must now be revamped, because many record changers have muting switches. These keep the signal cable shorted until the arm has gone through its normal cycle and is dropped onto the record in playing position.

"Better make sure first that it's equipped with a Jensen needle."

An amplifying channel with a preamp for magnetic pickups may have as much as one hundred times more gain than the most sensitive of amplifiers designed for radio or crystal cartridges. A particular tube may thus introduce unacceptable noise or hum, but may operate normally in other positions.

It is possible for phono distortion to originate in the playing mechanism itself, due to a mechanical vibration of the phonomotor called rumble. The phono cartridge is protected, to a certain extent, from picking up this rumble by the spring mounting of the changer plate, and by the rubber suspensions of the motor hanging from the plate. The effect of the spring mounting can be reduced by allowing any part of the changer to touch the cabinet, but the most serious danger lies in possible hardening of the motor suspensions. When this occurs the reproduced rumble may become very great. Over and above the annoy-

(*Continued on page* 85)

Donald M. McNicol

DONALD MONROE MCNICOL, who served as editor of RADIO ENGINEERING, published by the *Bryan Davis Publishing Co., Inc.*, in the early 30's, died recently at his home in Roselle Park, N. J. His age was 78.

He was extremely active until his final illness as a writer of communication and electronic technical papers, acting, too, as a technical consultant to *Wire and Radio Communications*. He was the author of *Radio Telegraphy*, an early work and many major texts on radio transmission.

DM, as he was known to everyone, was elected Mayor of Roselle Park in '28 and served for two terms.

Early in his career he was a Western railroad telegrapher. He became a Postal Telegraph engineer early in 1900. In 1922 he became editor of *Telegraph and Telephone Age* in New York. Subsequently he joined RCA as assistant to the president.

For many years, DM taught at many universities. He was an instructor in Teachers College of Columbia University, lecturer in the Sheffield Scientific School of Yale University and Cooper Union in New York.

In 1926 he was elected president of the IRE. For over a score of years he was active on a number of key IRE committees. For six years he was a member of the board of directors. He also had been chairman of the publication committee of the AIEE.

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ance created by the low-frequency noise, rumble intermodulation can create large amounts of distortion, of a type similar in nature to that caused by open filters. The motor mounts and changer springs should be checked and necessary corrections or replacements made. If the rumble persists, the rim drive mechanism should be checked. The rubber idler wheel coupling the turntable rim to the motor bushing should be replaced if there seems to be the least bit of uneven wear. When this, too, fails to cure the trouble, the motor itself may be faulty and may require replacement.

[**To Be Continued**]

DC Restorer

(*Continued from page 33*)

object as shown by e_g. (It will be noted here that the bottom of the sync pulses does not remain at a constant negative voltage level.)

Enter the DC Restorer

In the detection of sound modulation in AM radio, as represented by Fig. 2 (p. 32) there is no significance to the *dc* component of the signal. The *ac* component represents the audio signal, and the time constant of the circuit is made large enough so that the lowest desired audio frequency is passed by the circuit. In television, however, as shown by Fig. 4 (p. 33), the *dc* component is actually part of the transmitted signal in that it represents the average brightness level of the televised scene. The elimination of the *dc* level, as resulted in e_g of Fig. 4*b*, eliminates some of the transmitted information, for it is no longer apparent that there has been a large change from a light to a dark background. Of even grater practical significance is the fact that the sync pulse tips do not remain at the same level with changing background level. The significance of the elimination of the *dc* component of e_g in Fig. 4*b*, when it is amplified and applied to the picture tube, is shown in Fig. 5 (p. 33). The curve represents the grid voltage versus beam-current or brightness characteristic of a picture tube. Signal *1* represents a signal with a bright background level. The picture brightness control has been adjusted so that the blanking level of the applied signal coincides with the cutoff point on the picture-tube characteristic as desired, to allow maximum contrast range while at the same time providing retrace blanking. The picture-tube beam current is cut off for the duration of the blanking pedestal, so that the electron beam will not be visible as it returns to start each new horizontal and vertical scan. Signal *2a* represents a signal which has shifted to a dark background level as it should be with the *dc* component present. The top of the blanking pedestal still coincides with the picture tube cutoff and the output from the video portion of the signal has moved down toward the black end of the tube characteristic. In *2b* we have a signal with a dark background as it appears with the *dc* component removed. The average value of this signal is now at the zero applied signal level, so that the resulting picture has essentially the same background level as signal *1*; and since the blank-

ing pedestal does not reach picture-tube cutoff the scanning retrace lines will be visible on the picture.

One way to overcome the difficulty just described is to use direct-coupled amplifiers from the video detector to the picture tube grid (or cathode). In this way, since the coupling capacitors are eliminated between each stage, the entire video signal including the *dc* component will be amplified and applied to the picture-tube signal element. While this method is probably the most straightforward to understand it becomes difficult in practice; first, because direct-coupled amplifiers are subject to drift, and second, since the *dc* output level of each stage is directly connected to the grid of the following stage, it is difficult to obtain proper plate, grid and cathode-voltage relationships. The trick for overcoming these difficulties which became generally accepted was, of course, the use of *dc* restoration.

Fig. 6 (p. 90) shows a simplified schematic of a commonly used *dc* restorer circuit. The *dc* restorer is a rectifier to obtain a picture-tube compensating bias from the sync-pulse tips. The *ac* output of the video amplfier is applied to the diode detector through C_1. In the circuit shown the sync pulses are negative, and the signal is applied to the cathode of the diode, so that the negative pulses cause C_1 to charge rapidly. The charge leaks off slowly through R_1. Since the time constant of R_1C_1 is sufficiently long so that the charge on C_1 is maintained over several sync pulses, the circuit is effectively a peak-reading voltmeter, the output of which is proportional to the peak value of sync pulses. The bias developed prevents current from flowing except on sync pulse tips; no current flows on any video signal peaks because they are never greater than the blanking level, which is a constant value below the sync pulse tips.

As indicated in Fig. 5, the peak value of the sync pulses is a measure of the average brightness of the picture. For instance, signal *1* in Fig. 5 has a large peak value of sync pulses. Its average value falls high upon the picture-tube characteristic curve and it therefore produces a high value of average brightness. Signal *2a* on the other hand has a low peak value of sync pulse; its average value falls far down on the curve and it produces a low value of average brightness. The bias developed across R_1 applied to the picture-tube grid through R_2, as shown in Fig. 6, therefore accomplishes *dc* restoration. That is, it com-

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Audio

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an input isolating transformer may be necessary.

Hum can, of course, also be picked up in the input circuit, by the leads from the microphone or pickup, or in the microphone or pickup head itself. Care in placement will take care of the latter.

Inductive hum in a low-impedance circuit is due to a loop in an alternating field. To avoid this possibility, the whole length of the lead, both inside and outside of the amplifier, should be run with as little space as possible between the pair, and they should be twisted together throughout their length.

In checking where pickup occurs, the line may be disconnected at any stage and a resistor equal to the working impedance connected to the open input at that point. If the hum disappears, its origin is further from the amplifier; if the hum doesn't vanish, it is nearer to the source.

Low-impedance circuits often do not need screening, but where the line is long, it may sometimes reduce hum pickup; in this case, twin screened lead should be used. The internal lead should be used for the signal circuit, and the outer screen should be connected to the signal circuit at one point.

In some equipment lines are run at 500 or 600 ohms; in these instances it is always a good precaution to use twin screened cable. If successive lengths of line are coupled together, the screening and two inner conductors should be kept separate, except at the amplifier input. The best plan in this case is to use a balanced circuit. If the screening is quite complete (there is no point at which the line is exposed), the center tapped resistor can be omitted, as the symmetrical capacitance of the line will insure balance.

The foregoing data applies to low-impedance circuits using a transformer to step up to the grid circuit. High-

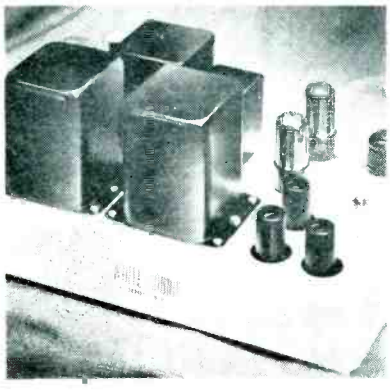
Hi-Fi Flexo-Rack, of wood construction and secured by thumbscrews and bolts, which it is said can be adapted to accommodate any audio system to its best advantage. Rack, available in kit form, can aid in deciding on final cabinet design. (Model 730; River Edge Industries, River Edge, N. J.)

Amplifier with loudness contour selector; seven magnetic phono equalization positions for all types of records; separate bass and treble tone controls; built-in preamp with dc heated filaments for minimum hum; five feedback loops; and partial cathode loaded output circuit. Preamp for G.E., Pickering, Audax and similar magnetic pickups. This is not in the circuit when a high level pickup or a tuner is fed into amp. Power output said to be 20 watts at 0.3%; peak, 30 watts. (DB-20 David Bogen Co., Inc., 29 Ninth Ave. N. Y. 14).

Sky hook universal clamp designed to fasten to almost every type of surface ledge, round pipe or irregularly shaped stanchion. Microphone can be attached directly to 5/8"-27 tube supplied with clamp. Casting is finished in gun metal shrivel; chrome tube is 3" long. (Model SK-1; Atlas Sound Corp., 1451 39th St., Brooklyn 18, N. Y.)

impedance inputs from crystal or condenser microphones require quite different treatment. As stated earlier, the impedance loading must be kept very high, and the grid circuit impedance is highest of all at the low, hum frequencies. This means extreme care must be taken to prevent electric pick-up. Screening must be absolutely complete. Even a hole in the screening can let hum in. The screened return virtually requires plumbing from the head right to the grid of the input tube. If any connecting plugs or sockets are used, they must maintain concentric screening throughout; otherwise trouble can arise.

A 25-watt amplifier featuring a balanced impedance phase inverter; balanced impedance drive; balanced drive; zero phase shift through dc phase inverter and voltage amplifier; plate degeneration as well as cathode degeneration; voltage amplifier; carbon brush volume pot and feedback of 20 db around four stages of amplification. (Model 1020; White Sound, Inc., 105 W. Madison St., Chicago 2.)



DC Restorer

(*Continued from page 87*)

bines on the picture-tube grid a signal proportional to the *dc* level of the video-detector output with the *ac* signal from the video amplifier. More explicitly, if the brightness control is adjusted to provide retrace blanking on very dark (low peak-to-peak values) pictures, any brighter picture will have a larger peak-to-peak value, which will cause an increased positive diode bias to be applied to the picture tube grid, thus causing the average of the signal to move up on the tube characteristic to provide a bright picture as it should. A signal of any value develops the proper amount of bias to place it automatically on the portion of the tube characteristic which corresponds to its proper *dc* value, so as to provide the correct level of average brightness.

Another DC Restorer Method

Another way to obtain *dc* restoration, which found some acceptance, was to develop the picture-tube compensating bias by grid rectification in one of the video amplifiers. Since it is necessary to develop the grid-leak bias on sync pulses, it must be developed in a stage preceding the picture tube where the polarity of the pulses can be positive. The last video amplifier must therefore be direct coupled to the picture tube grid. Grid-leak restoration is therefore probably only an advantage over complete direct coupling, where more than one video amplifier stage is used. Some receiver designs attempted to obtain a measure of *dc* restoration by the use of a grid rectification in the picture tube itself, by allowing the positive peaks of video signal to draw current and develop a negative bias on the picture tube grid. This method was not too satisfactory since, to develop grid current, the video peaks had to be at a high level where saturation and blooming was encountered.

Exit the DC Restorer

Even with *dc* restoration, it proved difficult to hold blanking levels constant enough to prevent vertical retrace lines from becoming visible in the presence of large variations in average picture brightness levels. In practice, the point at which retrace lines became visible was in some cases a limitation on the maximum brightness setting. Also, as the larger tube sizes put more demands on the horizontal deflection system it became increasingly difficult to keep the horizontal retrace time sufficiently short

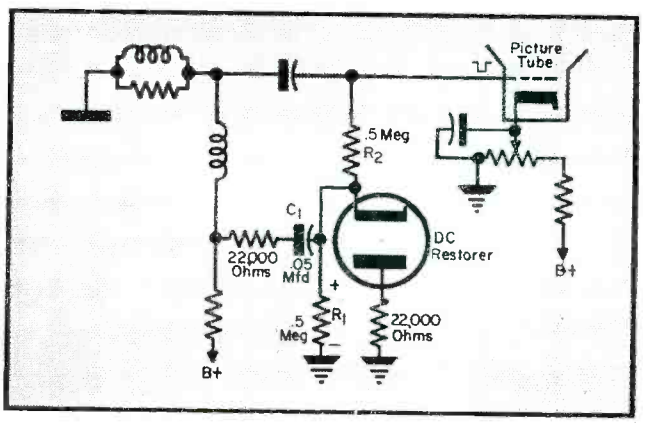


Fig. 6
Simplified schematic of commonly-used dc restorer circuit.

to prevent horizontal foldover. Vertical and horizontal retrace blanking has come into general use to overcome these two difficulties. Service Men have become generally familiar with the operation of these circuits, one form of which is shown in a simplified schematic in Fig. 7. In these retrace-blanking circuits a pulse is derived from the retrace kick of both the horizontal and vertical-deflection systems and applied to the picture grid or cathode (depending on pulse polarity), so as to cut off the beam current during the entire retrace time. In this way horizontal foldover is prevented and the vertical retrace lines are not visible regardless of the setting of the brightness control.

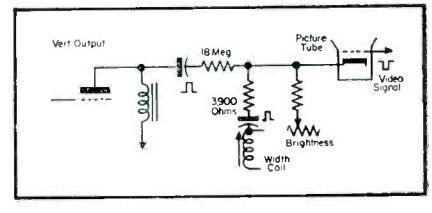
With the general use of vertical retrace blanking one of the uses of the *dc* restorer disappeared; it was no longer necessary to clamp the sync pulses at a constant level to prevent vertical retrace lines from becoming visible in the picture. It now became possible to review the need for *dc* restoration on the basis of *picture tone quality* alone.

Some information on the results of omitting *dc* restoration may be obtained from further inspection of Fig. 5 (p. 33). Since all signals will operate with their average value at the point set by the brightness control, operation will be in the linear range of the tube characteristic regardless of transmitted average brightness level. There will be less tendency for dark pictures to lose contrast. The reason for this improvement is shown by the two methods of operation with signal *2*. Signal *2a* is held at its transmitted *dc* level and the video portion of the signal is operating in the non-linear region of the tube characteristic near cutoff. The contrast range of the resulting picture is therefore compressed by the curvature of the characteristic in this region.

There are, on the other hand, two apparent disadvantages to utilizing only the *ac* components of the television signal. First, of course, the average brightness levels are not faithfully reproduced. Second, the brightness range available for dark pictures is decreased. For instance, in signal *2b* very bright highlights will reach into the saturated white portion of the picture-tube characteristic much before highlights in signal *2a*. In practice, operation without *dc* restoration seems to have provided good results. The eye is more sensitive to relative brightness (contrast) than to absolute brightness (average brightness). Therefore, the viewer does not recognize the lack of faithful reproduction of average brightness levels, and in fact finds pictures generally improved because good contrast is maintained. The decrease in brightness range for dark pictures has proved to be no serious disadvantage. Furthermore, since the *dc* voltage applied to the picture tube remains constant there is no interaction between the brightness and contrast controls, as is the case with receivers employing *dc* restoration. In one experience with an older receiver using *dc* restoration and no retrace blanking, there was a tendency to readjust continually the brightness control for program or sometimes even scene changes. On a newer receiver incorporating retrace blanking, but without *dc* restoration, there is no such tendency. In fact, the brightness control is a covered shaft adjustment

(*Continued on page 92*)

Fig. 7. A vertical and horizontal retrace blanking circuit.



DC Restorer

(*Continued from page* 91)

and there is no need to know of its existence.

If two TV receivers, one with, and one without *dc* restoration are observed simultaneously the difference in average brightness levels can be observed, particularly if the two sets are switched back and forth between channels carrying programs of quite different brightness. However, when observing one without restoration alone no particular deficiency will be recognized. An interesting way to observe the results of the lack of the *dc* component in the video signal is to adjust the vertical hold control until the vertical blanking bar appears on the picture. The lighter portion of this bar, which represents the vertical blanking pedestal, will be seen to vary in brightness as the televised scenes change. On a receiver incorporating *dc* restoration, the blanking bar will maintain a constant brightness on all but the most drastic scene brightness changes. A measurement of the picture-tube *dc* grid-cathode voltage will, of course, show a constant value without restoration, and a voltage which varies with scene changes if restoration is present.

Thus, in answer to the original question: The *dc* restorer has been eliminated in most receivers because faithful reproduction of average brightness levels has been found secondary to ease of adjustment, maintenance of good contrast and a small step toward circuit simplicity. Some designs continue to use a single video amplifier with direct coupling to provide true *dc* brightness levels. However, it is common in late models to find both horizontal and vertical retrace, blanking, *ac* video coupling and no *dc* restoration.

Another interesting by-product of eliminating the *dc* restorer is a decrease in airplane flutter. Airplane reflections result in fluttering ghosts and alternating variations in signal level. The lack of a *dc* restorer has no effect on the presence of ghosts. However, the visible signal-level flutter is in the frequecy range below about 10 cps; so, if *ac* coupling is used (no *dc* restorer), these low frequencies will not be passed to the picture tube and one annoying aspect of flutter will not be present.

Color TV

Our old friend, the *dc* restorer, may, however, return to work in *color TV* receivers. Since the eye does not have an equal sensitivity range for all colors, reproducing the picture at a

brightness level different from that at which it is televised may appear to the eye as actual color distortion. In other words, color may appear unnatural if faithful reproduction of brightness levels is not maintained.

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TV Antennas

(*Continued from page 70*)

sary for overcoming the ignition, neon light, electric motor noises, etc., often seen on *vhf*.

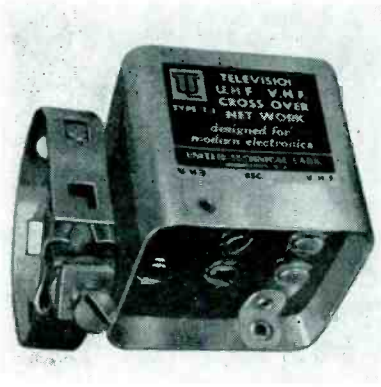
Measuring Equipment

For all *vhf* measurements, an instrument covering 50 to 220 mc and utilizing a half-wave dipole was used.

This instrument contains a builtin calibrating oscillator and is supplied with correction factors for antenna, attenuator, transmission line, etc., which render the instrument direct reading.

For *uhf* a 2-stacked bowtie antenna with reflector was used. Signals were fed into the set and replaced by direct substitution with a calibrated *uhf* signal generator. The signal generator output was then adjusted to give the same reading on the receiver output meter as noted with the antenna connected. Voltage at the receiver terminals could then be read directly from the signal generator.

Dick Morris (right), sales manager of Snyder Manufacturing Co., presenting Frank Corbin of M. V. Mansfield Co., Pittsburgh, with the first of the Snyder bowtie reflector antennas. Antenna features diamond embossed aircraft aluminum elements, an all welded reflector screen and single U-bolt installation. (Model UHF-5.)

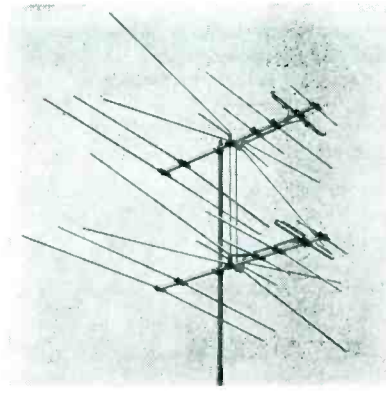


(Left)

Crossover network designed to permit the use of uhf and vhf antennas from a single leadin and elimination of antenna controls or switches for all-channel TV reception. (United Technical Labs., Morristown, N. J.)

(Right)

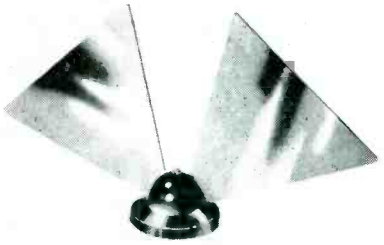
VHF conical featuring use of extended conical type driven element. Full gain is claimed to be realized from this type of construction. High channel section consists of 2 driven elements and 2 directors. The receiving element for the low end of the high channels is located in the center of the flat plane conical assembly. Transformer type receiving element is used to sustain the gain level at the higher end. (Model Jet 213; JFD Mfg. Co., Inc., Brooklyn 4, N. Y.)



TV Antennas

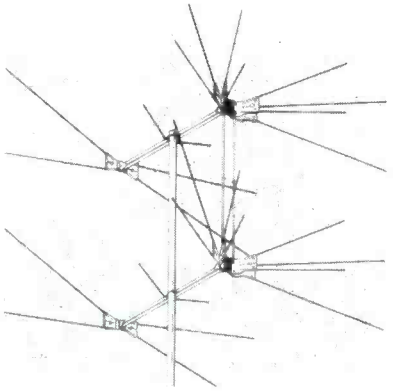
(Continued from page 93)

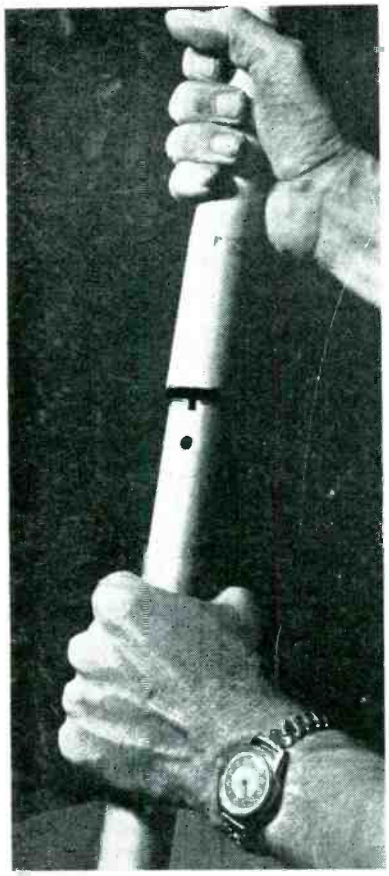
(Above)
A uhf booster, featuring a bandwith of 5-12 mc. Gain said to be 14 db. (Model UH-14-83; Tele-matic Industries, Inc., 1 Joralemon St., Brooklyn 1, N. Y.)



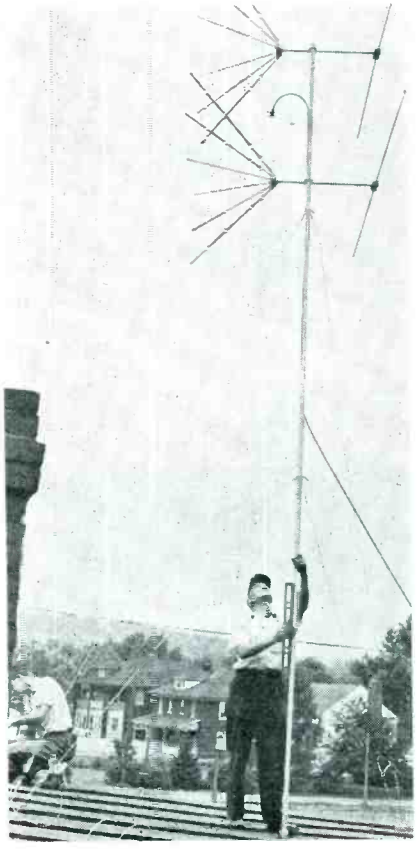
(Above)
UHF indoor butterfly antenna made of aluminum and mounted in a walnut plastic base. The wings are gold anodized and adjustable. (Model 8990; Television Hardware Mfg. Co., division of General Cement Mfg. Co., 919 Taylor Avenue, Rockford, Ill.)

(Below)
A uhf-vhf conical array with, it is said, one major in-line lobe. Array can be stacked up to four bays. Extension of the conical-v-beam theory, it is claimed, is effected by the mounting onto the standard head of two additional splines with decreased vortex, to compact and add-in-phase the ultrahigh voltages into one major lobe. A hi-v-reflector is mounted on the same cross arm in back of the vhf dipoles, to reinforce the pattern and increase the forward gain, while increasing the front-to-back ratio from channels 7 to 83. (Models 520, 540, 580; Telrex, Inc., Asbury Park, N. J.)



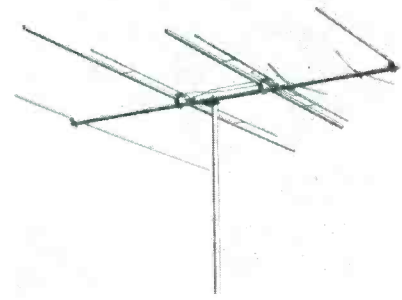


Assembling two sections of Perma-Tube. Here expanded end of the upper mast section is about to be slipped over the reduced end of the lower section to form a machine-tight fit. The positioning device is said to prevent the mast from turning at the joint once it is oriented.



(Left)

Installing 20' antenna mast mounted on a roof bracket, supported by 18-gage wires in York, Pa. Mast is electricwelded steel tubing, coated inside and out with plastic to prevent corrosion. (Photos courtesy Jones and McLaughlin Steel Corp. and George Cooper, TV Specialist in York, Pa.)



(Right)

Fringe area antenna engineered for coverage of all vhf channels. Said to have one major forward lobe, narrow beam to reduce ghosts and noise pickup and high signal-to-noise ratio. (Model CP-1; Wells and Winegard, Television Accessory Mfg., Burlington, Ia.)

TV Antennas

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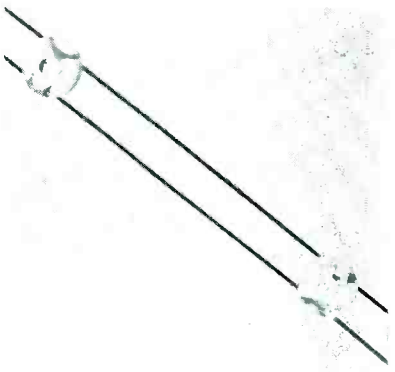
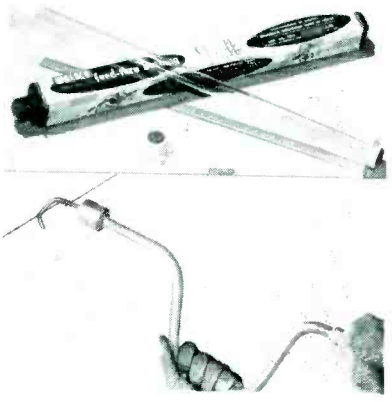


Open wire transmission line for uhf and vhf. Insulator (polythemalyne) is said to be designed for minimum signal loss. The impedance of the wire is 300 ohms. No standoffs are necessary, it is claimed, or if preferred regular standoffs can be used. (Saucerline;‡ Fretco, Inc., 406 N. Craig St., Pittsburgh, Pa.)

‡Pat. Pending.

(Below)

Feed-thru bushing that, it is said, can accommodate all popular TV leadin wires; coax or twin-lead wires including shielded and tubular, as well as rotator control cable. Also has provision for terminating to open line. Bushing is 15" over-all and fits walls up to 14" thick. It requires a ¾" hole. (Walsco.)



(Above)

Guy-wire tightener, which looks much like a typical drill bit, except that the end is curved to hook around the guy-wire. By revolving the handle included in the kit, guy-wire can be coiled and tightened evenly. (Guy-Tite; Walsco.)

(Below)

Continuously tunable uhf booster. Uses a 6AJ4 low noise uhf triode. (Model IT-133; Industrial Television, Inc., 369 Lexington Ave., Clifton, N. J.)

Tools . . . Parts Instruments . . .

[See page 100 for additional new product news.]

MALLORY DUAL-OUTPUT POWER SUPPLY

A dual-output service bench power supply, *Rectopower 12RS6D*, designed to test 12-volt auto radios, as well as the standard 6-volt sets, has been introduced by *P. R. Mallory and Co., Inc.*, 3029 E. Washington St., Indianapolis 6, Ind.

Unit is equipped with both a *dc* voltmeter and ammeter for the measurement of current drawn by the equipment as well as the voltage applied to it. An infinitely variable output-voltage control is featured, and is said to be valuable in duplicating voltage fluctuations encountered under actual operating conditions. Has fuse in *ac* line and a self-reclosing overload circuit-breaker in the dc circuit.

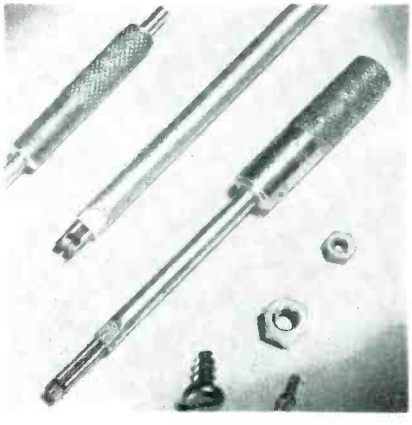
Specifications: 0-8 volts at 10 amperes or 0-16 volts at 6 amperes, variable, continuous duty; 20 amperes on low range or 14 amperes on high range, intermittent duty; filtered *dc* output to less than .8 volt *rms*; and 12,000 mfd filter capacitor.

* * *

ASSCO NUT AND SCREW STARTER

A nut and screw starter, to aid in starting small nuts as well as screws in difficult, hard-to-reach places, has been developed by Aviation Service Supply Co., Stapleton Field, Denver, Colorado. Tool has a lever-mechanism in the handle which controls movable blades and adjusts them for gripping all standard sizes of small nuts and screws.

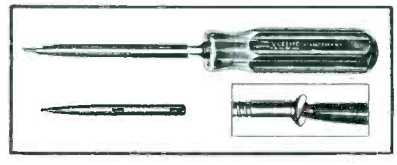
Starter has a pair of movable blades projecting from a sleeve attached to the handle. As these blades are pushed into the sleeve, mechanism inside the handle causes them to rotate inward, thus forming a *V*-shaped end, which grips the screw head and maintains the necessary tension to hold it until the screw is started. Available with lightweight aluminum handle and body, and blades of specially tempered drill-rod steel in six different sizes designed to accommodate all standard sizes of small nuts and screws from a 6 to a ¼" nut, and from a 4 to a 10 screw.



XCELITE SCREWHOLDER

A screwholding device, that is claimed to have sufficient holding power to start and loosen screws even when they are too small for the screwdriver, and fits any round-bladed screwdriver in its range, has been developed by Xcelite, Inc., Dept. V, Orchard Park, N. Y. Tool slips up and out of the way when not in use.

Screwholder features *wedge-grip* tempered spring steel holders that prevent dropping of screws. Available in 3/16".



INTERNATIONAL INSTRUMENTS MINIATURE MULTITESTER

A miniature multitester combination volt-ohmmeter, for testing resistances and *ac* or *dc* voltages, has been announced by *International Instruments, Inc.*, P.O. Box 2954, New Haven 15, Conn.

Tester, which is 4¼" x 3" x 1½", has four *dc* voltage ranges reading to 300 *v*, four *ac* voltage ranges reading to 600 *v*, and four resistance ranges reading to 2,000,000 ohms. A sensitivity of 10,000 ohms-per-volt with accuracy of ±2% of full-scale deflection for *dc* voltages is claimed and for *ac* voltages, a sensitivity of 8,000 ohms-per-volt with accuracy of ±5% of full-scale deflection. Power for resistance measurements comes from self-contained batteries.

TV Stations

(Continued from page 64)

City	Call Letters		Channel
		TEXAS	
	KLIF	Trinity Bcstg Corp., 2104 Jackson St.	29
	WFAA-TV	A. H. Belo Corp., Young & Houston Streets	8‡
El Paso	KROD-TV	Roderick Bcstg Corp., Wyo. & Walnut Sts.	4*
	KTSM-TV	Tri-State Bcstg Co., Inc., 801 N. Oregon St.	9*
	KEPO-TV	KEPO, Inc., 706 Capital Nat'l Bank Bldg., Austin	13
Fort Worth	WBAP-TV	Carter Publications Inc., 400 W. 7th St.	5‡
	KTCO	Tarrant County Tele. Co., 1101 W. 7th	20
Galveston	.....	Rudman Tele. Co., c/o M. E. Rudman	41
	KGUL-TV	Gulf Tele. Co., 801 Union Station Bldg.	11*
Harlingen	KGBS-TV	The Magic Triangle Televisors, Inc., Box 711	4
Houston	KPRC-TV	Houston Post Co., 2318 Polk Ave.	2‡
	KTVP	UHF Tele. Co., Magnolia Bldg., Dallas	23
	KNUZ-TV	KNUZ Tele. Co., Box 2135	39
	KXYZ-TV	Shamrock Bcstg Co., Gulf Bldg.	29
Longview	KTVE	E. Texas Tele. c/o James Henry, Rt. 3	32
Lubbock	KFYO-TV	Plains Radio Bcstg Co., 914 Ave. J	5
	KLBD-TV	Bryant Radio & Tele. Inc., 1805 Broadway	11*
	KBUD-TV	Texas Telecstg Inc., 3601 Ave. H	13*
Lufkin	KTRE-TV	Forest Capital Bcstg Co., Box 701	9
Marshall	.....	Marshall Tele. Corp., 270 Park Ave., New York 17, N. Y.	16
San Angelo	KTXL-TV	Westex Tele. Co., 1901 W. Bureaugard St.	8
San Antonio	KEYL	San Antonio Tele. Co., Transit Tower Bldg.	5‡
	WOAI-TV	Southland Industries, Inc., 1031 Navarro St.	4‡
	.....	Alamo Tele. Co., Kirby Bldg.	35
Sherman	KSHM	Sherman Tele. Co., Life of America Bldg., Dallas, Tex.	46
Temple	KCEN-TV	Bell Publishing Co., Box 419	6
Tyler	KETX	Jacob A. Newborn, Jr., Box 1572, Beaumont, Tex.	19
Texarkana	KCMC-TV	KCMC, Inc., 317 Pine St.	6
Victoria	KNAL-TV	KNAL-Tele. Co., Victoria Band & Trust Bldg.	19
Waco	KANG-TV	Central Texas c/o Clyde Weatherby	34
Wichita Falls	KTVW	White Tele. Co., 1507 Lamar	22
	KFDX-TV	Wichita Radio & Tele. Co., 801 Scott St., City Nat'l Bank Bldg.	3*
	KWFT-TV	Wichita Falls, Tele. Inc., c/o Kenyon Brown, Box 420	6*
		UTAH	
Salt Lake City	KDYL-TV	TLF Bcstg Corp., 143 S. Main St.	4‡
	KSL-TV	Radio Service Corp. of Utah, 10 S. Main St.	5‡
	KUTV	Utah Bcstg & Tele. Corp., 29 S. State St.	2
		VIRGINIA	
Charlottesville	WCHV-TV	Barham & Barham, Box 631	64
Danville	WBTM-TV	Piedmont Bcstg Corp., Hotel Danville	24

City	Letters Call		Channel
VIRGINIA			
Harrisonburg	WSAV-TV	Shenandoah Valley Bcstg Corp., Rawley Pike	3
Lynchburg	WWOD-TV	Old Dominion Bcstg Corp., Box 918	16
	WLVA-TV	Lynchburg Bcstg Corp., 925 Church St.	13*
Marion	WMEV-TV	Mountain Empire Bcstg Corp., Park Blvd.	50
Newport News	WACH	Eastern Bcstg Corp., 114 24th St.	33
Norfolk	WTAR-TV	WTAR Radio Corp., 720 Boush St.	4 (3)‡¹
Hampton (area) Norfolk	WVEC-TV	Peninsula Bcstg Corp., Box 481	15
Richmond	WTVR	Havens & Martin, Inc., 3301 W. Broad St.	6‡
Roanoke	WROV-TV	Radio Roanoke, Inc., Mountain Trust Bldg.	27*
	WSLS-TV	Shenandoah Life Stations, Inc., Shenandoah Bldg., 301 1st St. S.W.	10*
WASHINGTON			
Bellingham	KVOS-TV	KVOS, Inc., 1321 Commercial St.	12*
Seattle	KING-TV	King Bcstg Co., 301 Galer St.	5‡
	KOMO-TV	Fisher's Blend Stations, Inc., 100 4th Ave. N	4
Spokane	KXLY-TV	KXLY-TV, 315 W. Sprague	4*
	KHQ-TV	KHQ, Inc., 700 Radio Central Bldg.	6*
Tacoma	KTNT-TV	Tribune Publ. Co., 711 S. Helena Ave.	11*
	KMO-TV	KMO, Inc., 914½ Broadway	13
Yakima	KIMA-TV	Cascade Bcstg Co., Inc., Box 702	29
	KIT-TV	KIT, Inc., Box 1651 Tacoma	23
WEST VIRGINIA			
Beckley	.....	Appalachian Tele. Corp., 270 Park Ave., New York, N. Y.	21
Charleston	WKNA-TV	Joe L. Smith, Jr., Inc., Main and Kanawha St., Beckley, W. Va.	49
Huntington	WSAZ-TV	WSAZ, Inc., 912½ 3rd Ave.	3‡
Parkersburg	WTAP	W. Va. Enterprises, 309 Charleston Nat'l Bank Bldg.	15
Wheeling	WLTV	Polan Industries, 321 8th St., Huntington, W. Va.	51
	.....	Tri-City Bcstg Co., Box 767, Bellaire, Ohio	7
WISCONSIN			
Beloit	WRBJ	Beloit Bcstg Co., Hotel Hilton	57
Eau Claire	WEAU-TV	Central Bcstg Co., 203 Barstow St.	13
Green Bay	WBAY-TV	Norbertine Fathers, P. O. Box 633	2*
Madison	WKOW-TV	Monona Bcstg Co., 215 W. Washington Ave.	27*
	WMTV	Bartell Tele. Corp., 710 N. Plankington Ave., Milwaukee	33
Milwaukee	WTMJ-TV	The Journal Co., 333 W. State St.	3 (4)‡¹
	WCAN-TV	Midwest Bcstg Co., 723 N. 3rd St.	25
	WOKY-TV	Bartell Bcstrs, Inc., 710 N. Plankington Ave.	19
Neenah	WNAM-TV	Neenah-Menasha Bcstg Co., 101 E. Wis. Ave.	42
Oshkosh	WOSH-TV	Oshkosh Bcstg Co., 1235 Bowen St.	48*
WYOMING			
Casper	KSPR-TV	Donald Lewis Hathaway, Box 930	2
Cheyenne	KFBC-TV	Frontier Bcstg Co., Plains Hotel	5

HAWAII			
Honolulu	KGMB-TV	Hawaiian Bcstg System, Ltd., 1534 Kapiolani Blvd.	9*
	KONA	Radio Honolulu, Ltd., P. O. Box 2727	11*
	.....	American Bcstg Stations, Inc., Barr Bldg., Washington, D. C.	4
PUERTO RICO			
San Juan	WKAQ-TV	El Mundo Bcstg Corp., Box 1072	2

[Revisions and Additions, Next Month]

(Right)

Careful examination of needle diamonds with a binocular stereoscopic microscope. This is one of many inspections conducted in grading diamonds. *(Photo courtesy Tetrad)*

Tools . . . Instruments Parts . . .

ERIE CERAMIC DISC CAPACITORS

A line of ceramic disc capacitors, *K-Lok*, available in four styles, with a capacitance range from 220 to 4500 mmfd. are now available from the *Erie Resistor Corp.*, Erie, Pa.

Units are said to undergo a maximum decrease in capacitance value of only 1% per decade; greatest capacitance change from 25° C value is ±5% from —55° C, to +105° C and +5%, —10% from —55° C to +125° C.

In linear circuit operation, both voltage coefficient of capacitance and piezoelectric effect are low. Life rating is up to 1000 *vdcw at* 85° C and 500 *vdcw* at 125° C. Other features are: power factor, 1% maximum; insulation resistance, 10,000 megohms.

* * *

NATIONAL BANANA PLUGS

A banana-type plug, *FWT*, molded of mica-filled bakelite in accordance with JAN specifications, and styled for easy gripping, is now available from the *Components Division, National Company, Inc.*, 61 Sherman St., Malden, Mass.

Leads can be brought directly from the base of the prongs or through a hole at the bottom of the plug. Top has been designed to accept additional plugs. All contacts and screws are nickel-plated brass.

* * *

RCP PEAK-TO-PEAK VTVM

A peak-to-peak *vtvm, 655*, that provides for *ac* measurements of from .2 to 4200 volts, *ac rms* measurements of .1 to 1500 *v*, *dc* measurements of from .02 to 1500 *v*, and resistance measurements of from .2 ohm to 1000 megohms, all on 7 ranges, has been announced by *Radio City Products Co., Inc.*, 152 W. 25th St., New York 1, N. Y.

Measuring circuit uses a balanced bridge-type *dc* amplifier and meter together with a high-impedance voltage divider. A 1-megohm isolation resistor provides an input impedance of 11 megohms on *dc*. An additional peak-to-peak rectifier together with compensated attenuator are used for the *ac* measurements.

WILLIAMS CLOSE-QUARTER DRILLING BIT

A drilling bit, *Close-Quarter*, for boring a hole through the upper plate of a building wall, under a hip roof, has been introduced by the Williams Electric Co., 1010 S.E. 39th Ave., Portland 15, Oregon.

Bit is provided with a special head and a ratchet drive, with the entire assembly short enough, it is said, to get under the ordinary hip roof. Available in two sizes: 1" and 12/16".

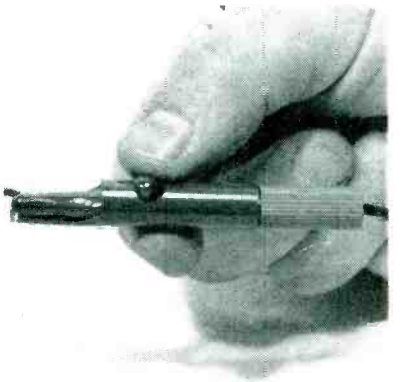
* * *

INSULINE ALLIGATOR CLIP AND SCREWDRIVER COMBINATION

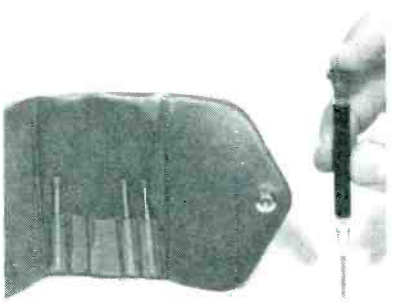
A fully-insulated alligator clip, designed to facilitate the testing of live circuits in TV and radio receivers, has been announced by the *Insuline Corporation of America*, 3602-35th Ave., Long Island City 1, N. Y.

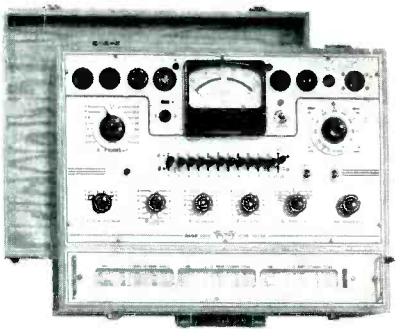
Spring-loaded jaws, which are acuated by a thumb button in the body of the clip, hold on conductors up to ¼" in diameter. Connection to the clip is made with standard banana plugs. Available in two body colors: *524B* black and *524R* red.

A screwdriver combination, *Mini-Kit 989*, for precision work on miniaturized electronic equipment using tiny screws, has also been introduced. Consists of a swivel-top handle into which can be fitted any of four hardened steel blades measuring .100", .080", .070" and .055".



Above: Insuline Alligator Clip
Below: Insuline Screwdriver Combination





TRIPLETT MUTUAL CONDUCTANCE TUBE TESTER

A mutual conductance tube tester, *3423*, that tests tubes by applying a *hf* signal to the grid and measuring the signal component in the output, has been developed by the *Triplett Electrical Instrument Co.*, Bluffton, Ohio.

In the plate circuit, a high *Q* tuned circuit which responds only to 4 kc is used to extract the amplified signal. Thus, it is said, hum and ripple, and tubes with open grids, present no problem to the tester, and cannot give false readings. Tubes with widely varying characteristics can be checked, it is claimed, without overloading or other damage to the tube because of a wide selection of tube parameters.

* * *

C-D STEATITE-CASED TUBULAR CAPACITORS

Steatite-cased paper tubular capacitors, *Budroc*, available in a capacity range from .0005 to 1 mfd at voltage ratings of 200, 400, 600, 1000 and 1600 *vdcw*, have been introduced by *Cornell-Dubilier Electric Corp.*, Industrial Division, 333 Hamilton Blvd., South Plainfield, N. J.

Tubular capacitor is of non-inductive construction and housed in a ceramic (steatite) tube with Polykane end seals.

* * *

MALLORY LINE VOLTAGE ADJUSTER AND ISOLATION TRANSFORMER

A line voltage adjuster and isolation transformer, *LT-12*, that provides infinitely variable *ac*-line adjustment from 90 to 130 *v* at 1200 watts; infinitely variable low voltage from 0 to 40 *v ac* at 4 amperes in the isolation position, or 0 to 40 *v ac* at 8 amperes in the common line position, and an isolated, infinitely variable 90 to 130 *v ac* output at 350 watts, is now available from *P. R. Mallory and Co. Inc., Distributor Division, P.O. Box* 1558, Indianapolis, Ind.

Metal case dimensions are 7⅞" high x 5¾" deep x 6½" wide. Supplied with a 6' rubber-covered line cord.

TV Parts . . . Accessories

GONSET REMOTE TUNER-BOOSTER-UHF CONVERTER

A universal TV remote control unit, which it is said may be attached to any conventional TV receiver, is now available from the *Gonset Company,* 801 South Main St., Burbank, Calif.

Featuring a Standard Coil cascode tuner ahead of a booster amplifier, unit permits channel selection from the viewing position (including volume, contrast, and fine tuning adjustments). Remote Control takes the place of both a booster and a *uhf* converter, as the turret tuner has provision for snap-in coil strips. A sound output connection is provided for headphones, to permit silent viewing. Unit is available for either 21 or 40 mc *if.*

* * *

LION MOBILE TV CART

A mobile cart, for use with a remote control TV set, has been designed by the *Lion Manufacturing Corp.,* 2640 West Belmont Ave., Chicago, Ill.

TV cart facilitates the movement of the set from room to room.

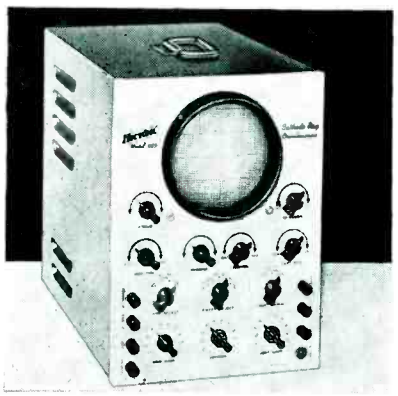
* * *

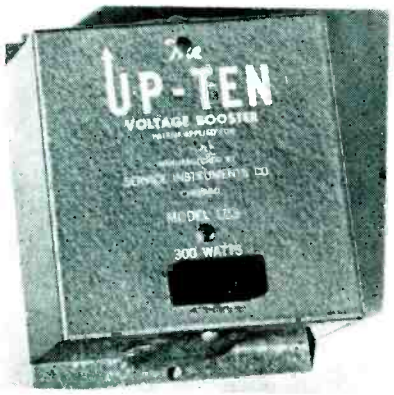
HICKOK 5-INCH 'SCOPE

A 5" 'scope, *665,* with a frequency range from .5 cycle to 700 kc, down 3 db has been announced by *The Hickok Electrical Instrument Co.,* 10521 Dupont Ave., Cleveland 8, Ohio.

Instrument is said to have no drift, less than 1% tilt, and less than 2% overshoot; accelerating potential is 1775 v, power consumption 35 watts. Square wave response is claimed to be flat from 60 cps to 100 kc.

A feature of the 'scope is a fusing arrangement for the *B+* line; a dual fuse is provided so that the *B+* line is entirely fused. 'Scope has been designed with push-pull amplifiers with a vertical sensitivity of .020 millivolt per inch; horizontal sensitivity is .030 millivolt per inch. Vertical input impedance is 15 mmfd, 2.2 megohms; horizontal impedance, 52 mmfd, .1 megohm.





SERVICE INSTRUMENTS 10-VOLT LINE BOOSTER

A voltage booster, *Up-Ten,* designed to add ten volts to the existing line voltage when used with TV set or electrical appliance, up to 300 watts, is available from *Service Instruments Co.,* 422 S. Dearborn St., Chicago, Ill.

* * *

RAM VERTICAL SWEEP COMPONENTS

Twelve types of vertical scanning output transformers and five vertical blocking oscillator transformers, have been added to the line of Ram flyback transformers.

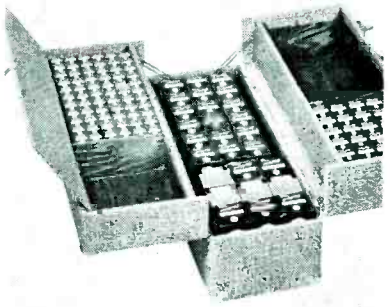
Available in five basic mountings. Further details available from *Ram Electronics Sales Co.,* Irvington-on-Hudson, N.Y.

* * *

MAGNE-PULSE INTERMITTENT RECORDER

An intermittent recorder, *202,* that is said to be capable of automatically detecting and locating intermittent troubles, has been developed by *Magne-Pulse Corp.,* 140 Nassau St., New York 38, N. Y.

Instrument consists, in effect, of three *vtvms* which monitor as many as three separate voltages in a chassis. With the set operating normally, each of the three voltages being monitored are *zero set* in the recorder so that meter pointer is at *0* for all three circuits. If any of the three voltages deviates beyond preset limits from the normal value, the voltage change is detected by the associated *vtvm,* a relay is actuated causing the appropriate lamp to light and a buzzer is sounded.



ARGOS CARRY-ALL TUBE CADDY

A carrying case, *Carry-all Tube Caddy,* that opens from the top in spread eagle fashion, has been announced by *Argos Products Co.,* Genoa, Ill.

Tube caddy can carry up to 262 receiving-type tubes in the various sizes normally needed. Compartments are said to be large enough to accommodate a soldering gun, meter, or other equipment. Size: 21" x 15" x 8".

* * *

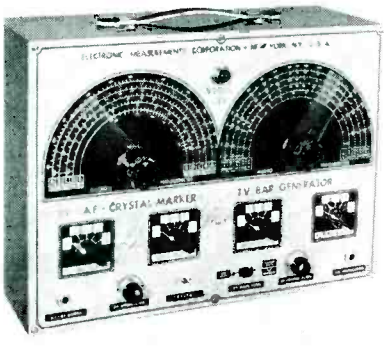
[See page 104 for additional new product news]

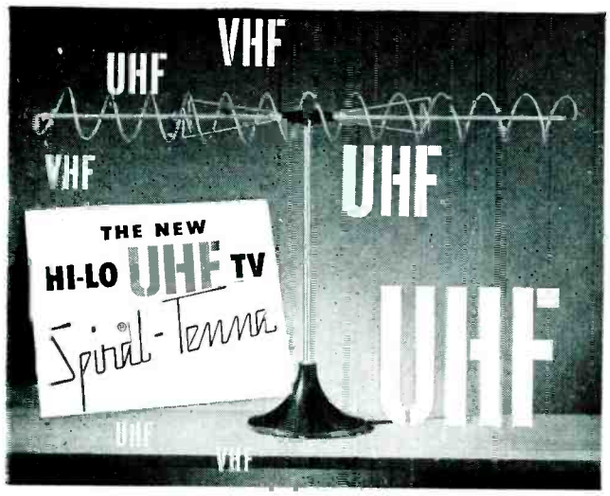
* * *

E-M RF-AF-CRYSTAL MARKER-TV BAR GENERATOR

A *rf-af* crystal marker-TV bar generator, *700,* that is said to provide complete coverage from 18 cycles to 108 mc on fundamentals, has been introduced by the *Electronic Measurements Corp.,* 280 Lafayette St., New York, N. Y.

Unit provides a bar generator for TV adjustment with a variable number of bars available for horizontal or vertical alignment. Included is a Wien-bridge *af* oscillator with sinewave output from 18 cycles to 300-kc, and crystal marker and amplitude control. Other features include individually tuned coils, constant *rf* output impedance, stepped *rf* attenuator, electrostatically shielded transformer, Colpitts *rf* oscillator from 300 kc to 108 mc on fundamentals; up to 216 mc on second harmonic and variable percentage of modulation.





Peak Performance for Indoor UHF and VHF Television Reception

Model 202 U-V

Now — the nationally advertised, consumer accepted HI-LO TV Indoor Spiral-Tenna is applicable for both VHF and UHF with our exclusive UHF antenna adapter from channels 2-83. But, you still get the volume by selling at the same low, low price.

The Hi-Lo UHF antenna adapter is available separately for all previous HI-LO antennas. List Price $2.00.

Sold by recognized jobbers

at the same low list price!

U. S. Patent No. 2,495,579 Canadian patents 1951 — other patents pending

ORDER HI-LO UHF-VHF TV Spiral-Tenna TODAY!

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Replace with **Seletron**

SELENIUM RECTIFIERS

and be safe!

No arc-over, short circuits or excessive heating when you replace with SELETRON. Proof? Millions are giving top performance as original equipment in many famous make radio and TV sets right now!

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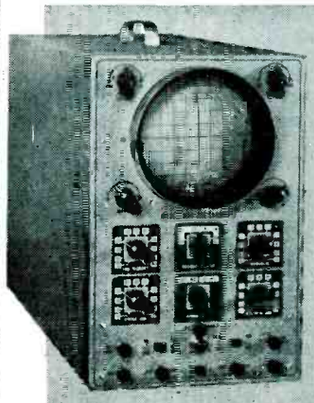

model 600

EMC MODEL 600 SCOPE features the use of a 5UP1 new 5 inch scope tube. The 2-stage, push pull, vertical amplifier has a sensitivity of .02 volts per inch and can be used up to 5 megacycles. A two step attenuator input is available. Synchronization is available on either positive or negative phase of input voltage through the vertical amplifier or from an external source. A multivibrator type of sweep from 15 cycles to 75 kilocycles is incorporated. Direct connections to scope plate available.

MODEL 600 (completely wired and tested) **$99.50**

model 106
VACUUM TUBE VOLTMETER

Check these features

SPECIFICATIONS

All functions completely electronic — meter cannot burn out.

DC VOLTAGE: Input resistance 16.5 megs or 1⅔ megohms per volt. Ranges 0 to 1.5, 10, 100, 300, 1000 up to 30,000 volts (with accessory probe).

AC VOLTAGE: Input resistance 2 megohms. Ranges 0 to 1.5, 10, 100, 300, 1000. Frequency response flat from: 25-100,000 cycles.

OHMS: 1000 — 10,000 — 100,000 —10 megohms, 1000 megohms.

COMPACT, portable bakelite case measures 4¼ x 5¼ x 2⅞".

MODEL 106 (complete with 1 meg isolating probe) **$35.90**
IN KIT FORM **23.90**
MODEL HVP, 30,000 Volt Probe for Model 106 ..... **8.75**
MODEL RFP, High Frequency Probe (useful to 200 megacycles) **6.95**

— See them at your Jobbers —

EMC

Write Dept. S-10 for free complete catalogue of these and other instruments.

ELECTRONIC MEASUREMENTS CORPORATION
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EXPORT DEPARTMENT 136 LIBERTY STREET, N.Y.C. 6, N.Y.

☐ Years in business. ☐ No. of mechanics employed.

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using a single 6SC7.

and TV Service Men, displayed by G.E.'s Addie Chandler.

4055 Redwood Ave., Venice, Calif.

VINETA TV TURNTABLE

Ren Talk

Sales Co., 530 Gough St., San Francisco, Calif. (northern California and Nevada), and Edward Dimond, 14315 Mil...

PERSONNEL

ROBERT S. WINDT, formerly vice president of David O. Alber Associates, has been appointed publicity and promotion manager for CBS-Columbia Inc. He will make his headquarters at 3400—47th Ave., Long Island City, N. Y.

* * *

ALFRED E. BOURASSA, formerly assistant advertising manager of Carter's Ink Co., has been appointed assistant to the advertising manager of CBS-Hytron, Danvers, Mass.

* * *

PAUL G. MATHES is now advertising manager of Trio Manufacturing Co., Griggsville, Ill.

Paul G. Mathes

Robert A. Elliot

ROBERT A. ELLIOT is now manager of the distributor sales division for Erie Resistor Corp., Erie, Pa.

W. O. SPINK is now assistant equipment sales manager of the electronic product sales department of Sylvania Electric Products Inc.

* * *

M. L. FINNEBURGH has become vice president of The Finney Co., 4612 St. Clair Ave., Cleveland, O., joining his brother, L. H. Finneburgh, Jr., president of the firm. Finneburgh recently retired as general sales manager of the Liquid Carbonic Corp.

M. L. Finneburgh

Larry H. Kline

LARRY H. KLINE has been named general sales and merchandise manager of the Ward Products Co., Division of The Gabriel Co., 1148 Euclid Ave., Cleveland, Ohio.

K. L. BISHOP has been named general sales manager of V-M Corp.

* * *

ELWOOD W. SCHAFER, former vice president of the National Union Radio Corp., has been named assistant to Charles F. Stromeyer, CBS-Hytron vice president in charge of manufacturing and engineering.

* * *

STANLEY NICIEJEWSKI has been appointed sales manager of the rectifier division of Sarkes Tarzian, Inc.

* * *

ALFRED D'URSO is now assistant sales manager of distributor sales at Sarkes Tarzian, Inc.

* * *

JOE STARR has been appointed assistant sales manager, manufacturers division, of the Pyramid Electric Co., North Bergen, N. J.

Sheldon Rutter

Joe Starr

SHELDON RUTTER, Evanston, Ill., has been retained by the Channel Master Corp., Ellenville, N. Y., to create all product design, and to serve as packaging and art consultant.

CHRISTIAN J. REIMULLER, formerly vice president in charge of engineering and sales at the Studebaker plant in Maywood, Ill., has been named publicity-public relations head of Javex, Redlands, Calif.

* * *

G. MILTON EHLERS is now chief research engineer of the Aerovox Corp., New Bedford, Mass.

* * *

HAROLD BLUMENTHAL has been appointed sales manager, manufacturers division, for Shure Brothers, Inc., Chicago, Ill.

* * *

COMMANDER R. H. G. MATHEWS, formerly general sales manager of the Honan-Crane Corp., has been named executive vice president of Burton Browne Advertising, Chicago, Ill.

Jerry B. Minter

R. H G. Mathews

JERRY B. MINTER, vice president, Measurement Corp., Boonton, N. J., and president, Components Corp., Denville, N. J. has been elected president of the Audio Engineering Society.

A. L. CHAMPIGNY has been appointed manager of advertising and sales promotion for the General Electric tube department. . . . G. A. BRADFORD, former manager, has been named manager of advertising and sales promotion for the G.E. radio and TV department.

* * *

C. J. STEVENS has been appointed sales coordinator for the jobber sales division of the V-M Corp.

Richard L. Grose (right), sales and ad manager of V-M, and **C. J. Stevens**, recently appointed sales coordinator for jobber sales at V-M.

J. C. VAN ARSDELL, formerly manager of sales engineering, electronics division, has been appointed assistant general manager of the division, at Erie Resistor Corp. . . . WILLIAMS KLEVANS, field sales engineer, has been promoted to manager of sales engineering, succeeding Van Arsdell. . . . WILLIAM J. WERVEY succeeds Klevans as electronics sales rep in Indiana and southern Ohio. . . . MALCOLM YOUNG, formerly manager of quality control, has been made assistant general manager of the plastics division. . . . RALPH L. HATHAWAY has been promoted from superintendent to works manager of the electronics division. . . . PHILIP B. EHRMAN has been named assistant superintendent . . . . HORACE S. HERRICK is now manager of quality control, electronics division.

* * *

Joseph H. Morin

JOSEPH H. MORIN, who was distributor sales manager of Shure Brothers, Inc., has been named sales promotion manager of Howard W. Sams, Inc., Indianapolis, Inc.

On Book Row

TELEVISION FUNDAMENTALS: THEORY, CIRCUITS AND SERVICING. . . . BY KENNETH FOWLER AND HAROLD B. LIPPERT: An excellent discourse on the basic principles that should be known by Service Men who install and service TV chassis. Book describes each of the elements of the receiver system—from the antenna to the picture tube—leading to the more complex circuitry and theory of television. Treatment omits the use of mathematical and engineering analyses. Includes practical installation procedure for receivers and antennas, detailing how to make up antennas for varying receiving conditions, and how to use typical test equipment, and troubleshoot TV receivers by picture analysis.—*524 pages, priced at $7.00; McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y.*

* * *

MOST-OFTEN-NEEDED 1953 RADIO DIAGRAMS AND SERVICING INFORMATION. . . . COMPILED BY M. N. BEITMAN: Volume 13, this service manual includes material on home and auto sets, portables, clock radios, combinations and automatic changers. Accompanying schematics are voltage data, alignment procedures, tube and trimmer locations, service hints and parts lists.—*192 pages, 8½" x 10½", paper bound, priced at $2.50; Supreme Publications, 3727 W. 13th St., Chicago 23, Ill.*

* * *

TELEVISION AND FM RECEIVER SERVICING (THIRD EDITION). . . . BY MILTON S. KIVER: A revised edition, this text includes information on alignment and servicing instructions, cascode tuners, keyed *agc* systems, keyed sync separators, direct-drive horizontal output systems, vertical retrace suppression circuits, *uhf* TV, reducing and eliminating interference, test instruments, integrated system of coordinating troubles with circuits, and locating defects in horizontal *afc* systems.—*320 pages, 8½" x 11" paper bound, priced at $4.20; D. Van Nostrand Co., Inc., 250-4th Ave., New York 3, N. Y.*

* * *

UHF TELEVISION ANTENNAS AND CONVERTERS. . . . BY ALLEN LYTEL: Book covers *uhf* TV antennas, transmission lines, converters and tuners. Diagrams, performance charts and photographs of all types of *uhf* TV antennas now on the market are included. Described are assorted types of transmission lines, their application and operation; analysis revolves about use of lines as antenna leadin and circuit element. UHF TV converter circuits are broken down stage by stage with schematics, and the purpose, function and layout of each stage is discussed. UHF all-channel tuners are also described.—*128 pages, paper binding; John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y.*

* * *

NARDA TV BLUE BOOK: A 1954 edition, book features suggested trade-in values on over 4000 TV sets produced since '46, the products of over 50 manufacturers. Also featured are reports on the market in '54, selling in '54 and the servicing and selling of trade-ins.—*Priced at $5.00; National Appliance Trade-In Guide Co. 2132 Fordem Ave., Madison 1, Wis.*

JOTS AND FLASHES

THERE ARE MORE electronic tubes in every TV-radio home than electric light bulbs, according to a recent survey. Specifically, it was reported that the average TV home has 21.5 tubes in the TV set, plus 9.5 more in radios or 31 tubes, in contrast to an estimate of 19.5 light bulbs in the average home. Even in total numbers in all homes, it was noted that the tubes come out ahead. It was estimated that the total number of home light bulbs add up to 905 million, and the total of home tubes at 964 million. . . . Top award of $2,500 in the G. E. tube department's *Write Your Own Ticket* contest for radio and TV Service Men will go to *George Champlin,* 106-B N. Tower, Centralia, Wash. Four $500 winners are: *Albert N. Giddis,* 145 Bellevue St., Lowell, Mass.; *Russell A. Vogt,* 16930 Plymouth, Detroit, Mich.; *Ben Chew,* 2205 S. Carmona, Los Angeles, Calif., and *Thomas Radio and Electric,* 208 Oley St., Reading, Pa. . . . A West Coast office has been opened by the Radio-Electronics-Television Manufacturers Association. Office is located in the Ambassador Hotel, Los Angeles; telephone number is Dunkirk 5-2179. *Joseph J. Peterson* will serve as manager of the office. . . . Opening of the first class of the pilot training course for TV Service Men sponsored by RETMA at the New York Trade School, featured talks by *Harold J. Schulman,* chairman of the RETMA Service Committee and service manager of the Allen B. DuMont Laboratories, Inc., *John F. Rider,* chairman of the local industry advisory committee to the New York Trade School, and *G. E. McLaughlin,* superintendent of the New York Trade School. . . . *Dr. William L. Everett,* Dean of the College of Engineering, University of Illinois, has been named the recipient of the IRE Medal of Honor for 1954. . . . *Brociner Electronics Lab* are now located at 344 East 32nd Street, N. Y. 16. . . . A carload of Raytheon picture tubes were delivered to Allied Radio recently, coincident with the opening of Allied's new home in Chicago. . . . *Javex,* Box 646, Redlands, Calif., has released an 8-page catalog, *252,* describing 28 new electronic items.

ADVERTISERS IN SERVICE, OCTOBER, 1953

Industrial Television Inc.

TECHNI-TOPICS

By WALTER V. TYMINSKI

AN EVALUATION OF PASSIVE TELEVISION RECEIVER COUPLERS

The general characteristics of two set couplers were discussed in parts one and two. Included in this evaluation were resistive decouplers, the IT-117A transmission line coupler, the IT-131A VHF transformer coupler, and the IT-135A UHF wide band hybrid ring coupler.

PART III

The techniques developed for two set couplers are also applicable for signal distribution to a greater number of receivers. For example, all I.T.I. two set couplers can be used to feed additional couplers, with the number of couplers limited only by the signal strength and sensitivity of the receivers.

For resistive decouplers, using a resistive terminated transmission line, the lead-in is tapped with an additional coupler unit for each receiver. If four receivers were operated in this manner the system would have the following characteristics:

Loss Ant. to Set = 14.3db (P/27)
Loss Set to Set = 24.6db (P/288)
Directivity = 10.3db (11)
Freq. Range = VHF and UHF

If the terminating resistor is omitted the performance becomes:

Loss Ant. to Set = 11.1db (P/13)
Loss Set to Set = 21.5db (P/140)
Directivity = 10.2db (11)
Freq. Range = VHF and UHF

Since the use of several units results in a relatively high cost, even four resistive couplers list at approx. $8.00, I.T.I. has developed four set couplers featuring good performance at low cost.

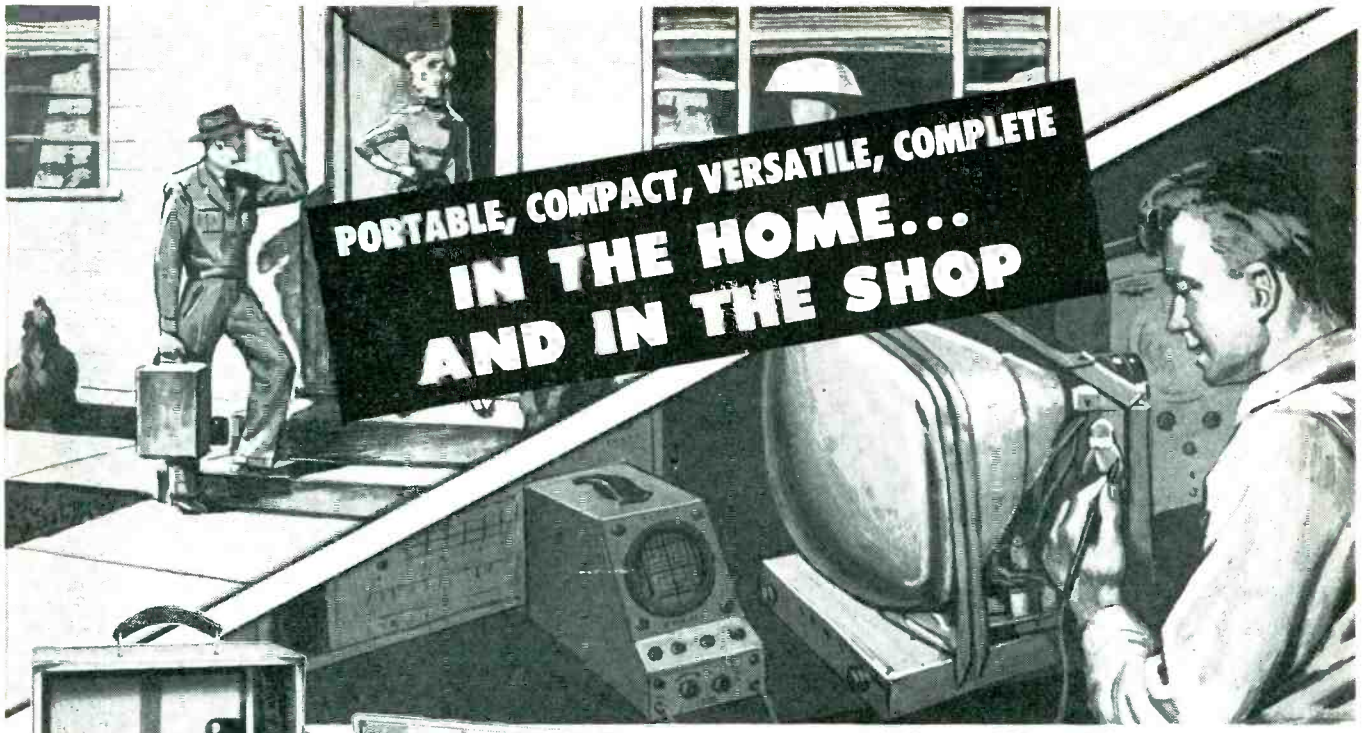
The IT-118A Four Set AutoCoupler utilizes the same transmission line principles found in the IT-117A Two Set AutoCoupler. However, in the IT-118A two 300 ohm TV receivers are connected in parallel to terminate the 150 ohm lumped transmission lines. The characteristics of this arrangement are:

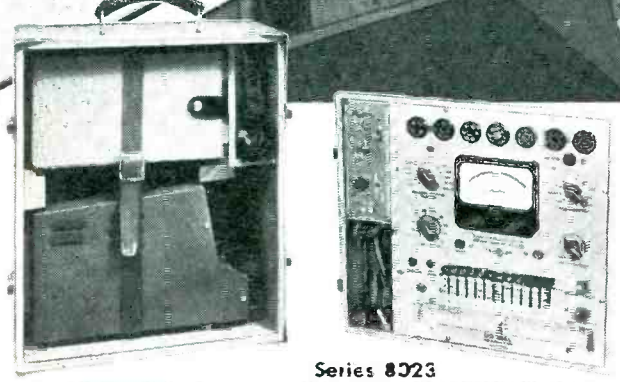
Loss Ant. to Set = 6.0db (P/4)
Min. Loss Set to Set = 12.0db (P/16)
Min. Directivity = 6.0db (4.0)
Freq. Range = VHF

If, for comparison to the resistive decoupler arrangement, 8.5db pads are used at each of the outputs, the characteristics become:

Loss Ant. to Set = 14.5db (P/28)
Min. Loss Set to Set = 29.0db (P/790)
Min. Directivity = 14.5db (28)
Freq. Range = VHF and UHF

(To be continued)





Series 8023

RCP

"DO-ALL" Servishop Sets You Up In Business

Rapidly and efficiently services the 75 out of 100 TV sets which can be serviced at home . . . all the measurements at your fingertips.

With the RCP Servishop you can check, test and align set from antenna to picture tube. Whether it be AM-FM or TV—UHF or VHF—there is nothing that does the complete job as expertly and professionally as the RCP Servishop.

Series 8023 includes:

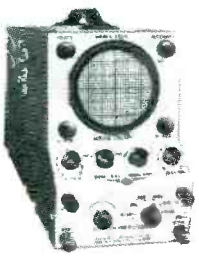
1. **Model 750**—for UHF and VHF . . . serves as signal, marker and pattern generator.
2. **Model 533M**—a portable 3" scope with high sensitivity and wide band response.
3. **Model 808A**—a tube and set tester which also serves as cathode ray tube tester and reactivator plus a vacuum tube voltmeter with ohmmeter.
4. **Model 730**—AF-AM (RF) FM signal generator—easily aligns and checks all circuits in AM and FM receivers.
5. **Model HVMP-1**—Hi-Voltage Multiplier Probe.

Complete, including all necessary leads. **$341.00** Net.

Series 8020—Same as the 8023 less Model 730 Signaligner. Complete **$310.00** Net.

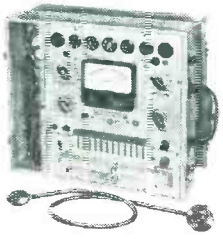
Model 8873A—Servishop—A compact, convenient service package to meet your AM-FM, and TV test needs . . . includes 808A "DO-ALL" Tube and Set Tester and Model 730 Signaligner AF-AM (RF) FM Signal Generator. Complete with tubes, batteries and leads. $139.95 Net.

Model 750
"DO-ALL" TV Signal Generctor



Model 533M
The Midgetscope

Model 730
Universal Signaligner



Model 808A
"DO-ALL" Tube and Set Tester

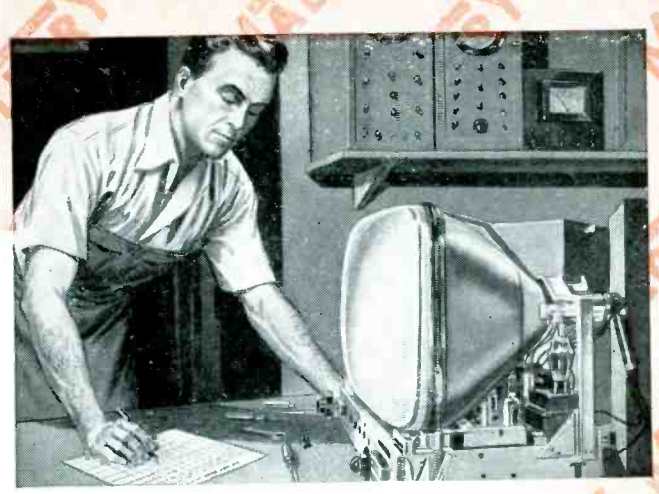
TIME PAYMENT PLAN

Ask your local distributor about the new RCP Finance Plan . . . Gives you 1 year to pay and allows you to buy the equipment package you need to do the complete job.

See Your Local Parts Distributor Or Write For New RCP Catalog Department S-10.

RADIO CITY PRODUCTS CO., Inc.
152 WEST 25th STREET • NEW YORK 1, N. Y.

Depend on Mallory
for
Approved Precision Quality



Put More Service Life Into All Your Jobs

Whenever Mallory FP Capacitors go into a service job, your customers can be sure of more hours of entertainment . . . you can be sure the job is done right . . . once and for all. For all your service work, you'll get better results with Mallory Capacitors. They are engineered to meet the electrical requirements of any TV or radio set. They'll give performance that is equal to . . . and often better than . . . the original equipment.

What's more, Mallory FP Capacitors are the only fabricated plate capacitors available to the replacement market. You can depend on them to give longer life at higher temperatures and greater ripple currents. They will give trouble-free performance at 185° F. (85° C.).

Any way you look at it, dependable service work builds satisfied customers. The next time you order capacitors, ask for Mallory FP's. They will put an end to call-backs due to capacitor failure . . . yet they cost no more.

For plastic tubular replacements, specify Mallory Plascaps®. Their improved moisture proofing will put an end to shorts. No off-center cartridges . . . leads are permanently secured.

P.R. MALLORY & CO. Inc.

MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
RECTIFIERS • POWER SUPPLIES • FILTERS • MERCURY BATTERIES

APPROVED PRECISION PRODUCTS

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

A serviceman's *"best friend"* is an RCA Tube

An RCA Tube starts working for you from the instant the customer first sees the familiar red, black, and white carton. You have her confidence from the start, because she knows and respects the RCA trademark.

But the big payoff to you begins when the tube goes to work. For, experience has proven that the superior quality of RCA Receiving Tubes and Kinescopes is your best measure of protection against premature tube failures. With RCA Tubes, you can be sure the job is well done.

Helping you to safeguard your reputation is a vital, everyday service of RCA Tubes. And that protection is yours at no extra cost.

UNLOCK THE DOOR TO BIGGER PROFITS

Here's *your* key to better business... RCA's dynamic Dealer Identification Program. Ask your **RCA Tube Distributor** for your copy of the colorful, 16-page booklet "A Magic Pass-Key to Customer Confidence." It tells you how you can become a Registered Dealer... and get *extra* sales benefits.

RADIO CORPORATION of AMERICA
ELECTRON TUBES
HARRISON, N. J.