OCTOBER, 1953

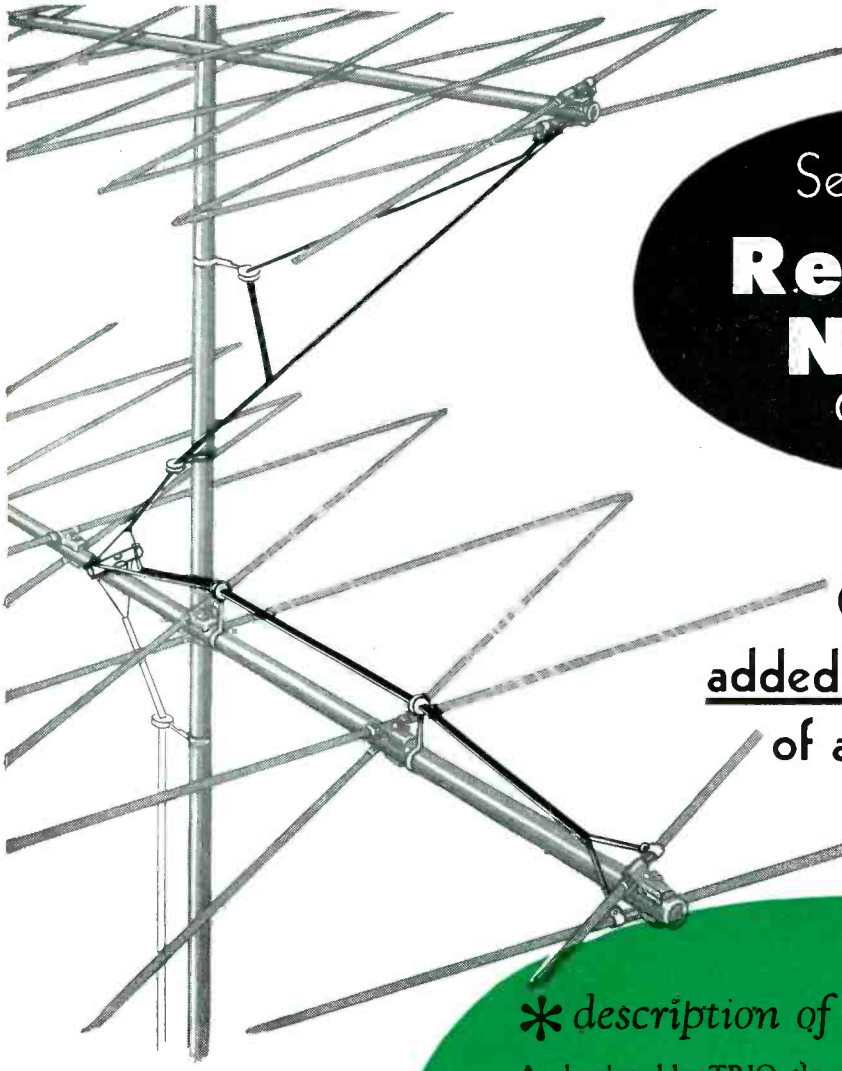
Radio-Television SERVICE DEALER

The Professional Radio-TVman's Magazine

IN THIS ISSUE:

AM-FM-TV-SOUND

TRIO ZIG ZAG ANTENNAS



Sensational NEW

Re-entrant Network

(Using Single Lead-In)

Gives ZIG ZAG added Gain over Best of all other Antennas!

*description of Re-entrant Network

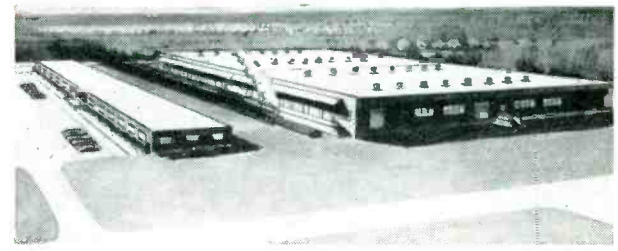
As developed by TRIO, the re-entrant network consists of two paralleled quarter wave transformer sections coupled to each antenna. One transformer provides an efficient impedance match throughout the upper channel coverage of the antenna, the other transformer covers the lower channels. The two transformer sections together offer a practically constant impedance termination to the feed-line, which is not affected by coupling a second antenna and its re-entrant network. Rain or shine, no antenna in America can match the performance of the ZIG-ZAG — on any channel!

ANOTHER NEW TRIO PLANT TO SERVE YOU!

A modern, new addition to TRIO's present facilities adds 24,000 sq. ft. of manufacturing space. A new laboratory, not illustrated, has also been added.

TRIO has on hand, or in the process of shipment from the mills, 60 carloads of aluminum to meet increased production schedules.

Despite these facts, we are not sure we will be able to fill all orders. We suggest you order now.



Outperform on ALL Channels!

Gain that is greater by far than that offered by the best of the collinears, conicals and multi-element Yagis, is now offered by famous TRIO ZIG-ZAG antennas!

A sensational new TRIO development — a new re-entrant type impedance matching network — makes possible this tremendous improvement by providing an almost perfect impedance match to the line on every channel!

Unlike isolation filters, the ZIG-ZAG re-entrant network has NO insertion loss!

A single feed-line is used, even when stacking for all-channel operation!

Extensive tests were made in all sections of the country, in every conceivable type of terrain. Results prove that the ZZ12L, ZZ16H combination, with their associated re-entrant networks, provides the finest all VHF channel, single lead-in operation yet obtained.

Current shipments of TRIO ZIG-ZAG antennas include the complete network.

For channels 2 thru 6 or channels 7 thru 13 separately, or combined for channels 2 thru 13, TRIO ZIG-ZAG antennas are the hottest ever designed.

New descriptive literature available.

HIGH GAIN TRIO UHF ANTENNAS

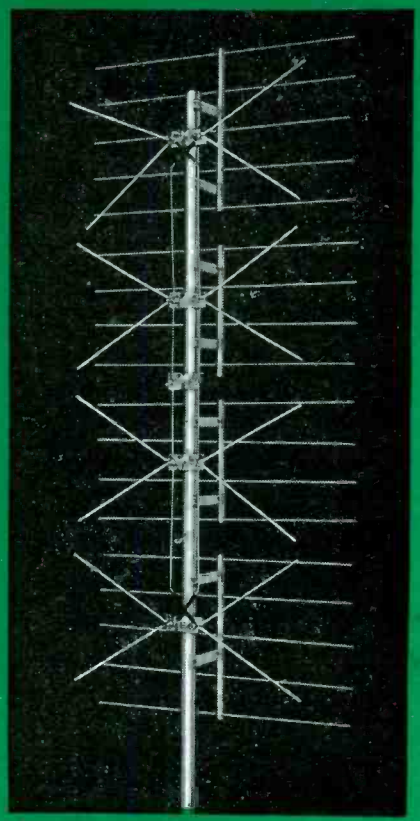
UBT BOW-TIE SERIES

(4-stack, in actual tests, bests all other types)

The popular TRIO 4-stack bow-tie, in actual field tests, outperformed all other types because it takes advantage of the fact that UHF signals are composed of closely spaced layers of different signal strength. Because of its vertical height, the TRIO 4-stack taps one or more of these varying high density layers at all times — offers consistent high gain day in and day out.

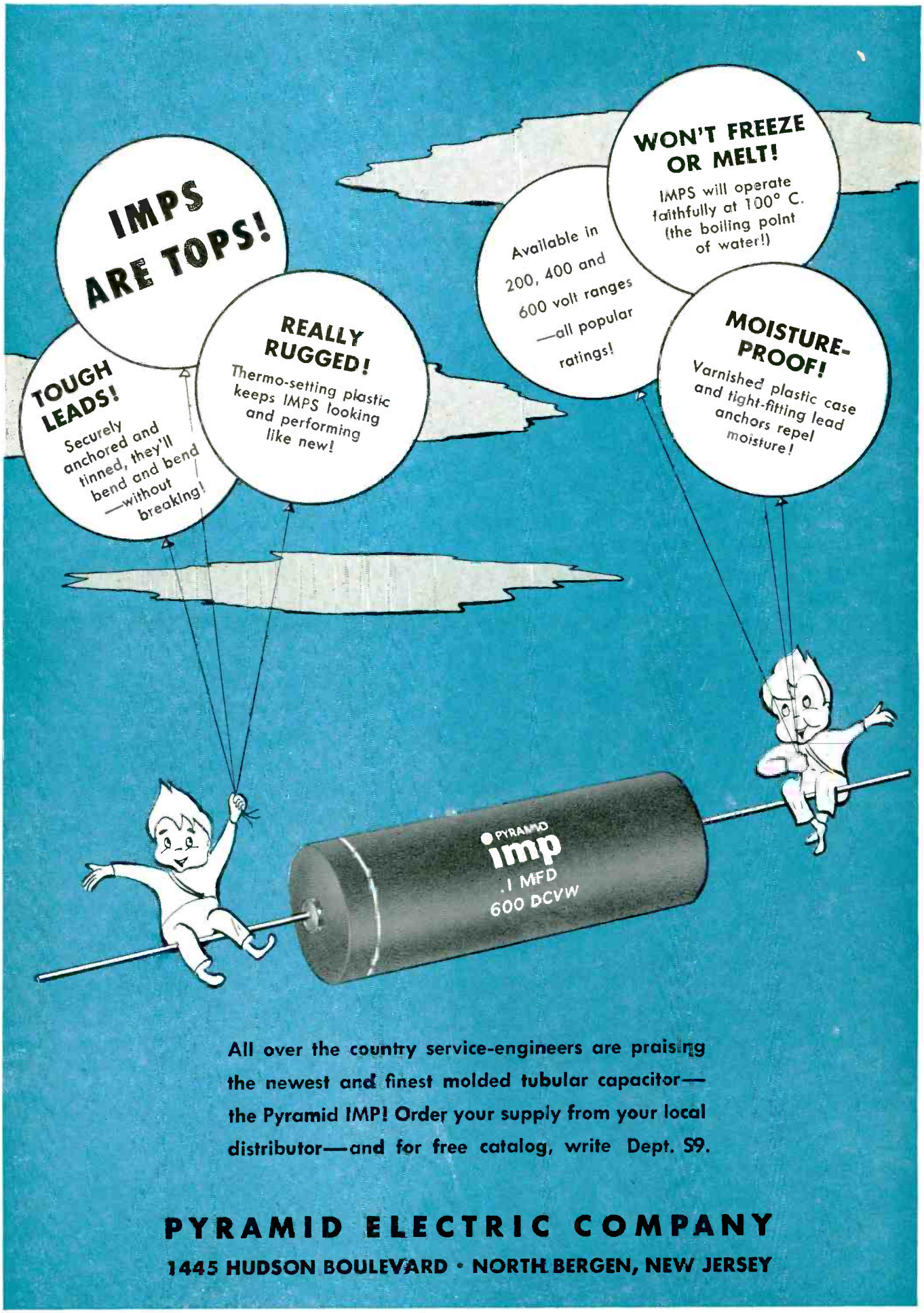
TRIO bow-ties offer high forward gain without sacrificing excellent front-to-back ratio and good line match. Adoption of reflectors using individual horizontal elements eliminates vertically polarized noise pick-up so often encountered with grid, mesh and solid type reflectors.

TRIO bow-ties are also available in 2-stack and single stack models. The 4-stack and two stack come assembled on 4 foot and 3 foot aluminum masts respectively, with phasing harness installed. The single bay model is furnished assembled on a 2 foot aluminum mast.



TRIO Manufacturing Co.

GRIGGSVILLE, ILLINOIS



All over the country service-engineers are praising the newest and finest molded tubular capacitor—the Pyramid IMP! Order your supply from your local distributor—and for free catalog, write Dept. S9.

PYRAMID ELECTRIC COMPANY

1445 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

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MEMBER AUDIT BUREAU OF CIRCULATIONS

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CHANNEL MASTER

introduces a

basically *new type* of VHF antenna

the CHAMPION*

the highest gain all-channel VHF antenna ever developed!

Featuring the unique new "Tri-Pole"

TRIPLE-POWERED DIPOLE

The "Tri-Pole" is a new antenna system in which the Low Band folded dipole also functions as three folded dipoles tied together in phase on the High Band. This is the heart of the Champion, the secret of its phenomenal performance on all 12 VHF channels.

The **CHAMPION** is another great development of the world famous Channel Master laboratories

*Pat. Pending

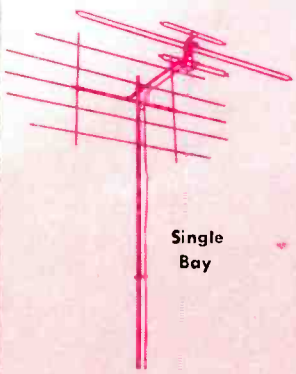
the CHAMPION is the most sensitive all-channel VHF antenna ever designed!

Stacked *CHAMPION* provides:
11-13 D B High Band gain
6½-7½ D B Low Band gain

Here is a totally NEW kind of antenna, completely different — in principal and performance — from any VHF antenna you've ever seen! Since the lifting of the TV freeze means a gradual disappearance of the single-channel VHF area, the VHF antenna of the future will be a *multi-channel* antenna. Prepare now for outstanding reception on *all* VHF channels — present and future — with Channel Master's super-sensitive CHAMPION! Outperforms every all-channel VHF antenna made today — and many Yagis, too!

COMPARE these features with the antenna you are now using:

- Folded dipoles throughout — give close to 300 ohms impedance across the entire band.
- Screen-type reflector provides high uniform gain on every channel, 2 through 13. *Not* frequency sensitive — this reflector provides more than twice as much extra gain as straight bar reflectors.
- Phase-correcting harness is built-in and fully assembled; the only wiring you do is to attach the lead-in.
- All-aluminum construction . . . lightweight, durable, non-corrosive.



MARVEL OF PRE-ASSEMBLY

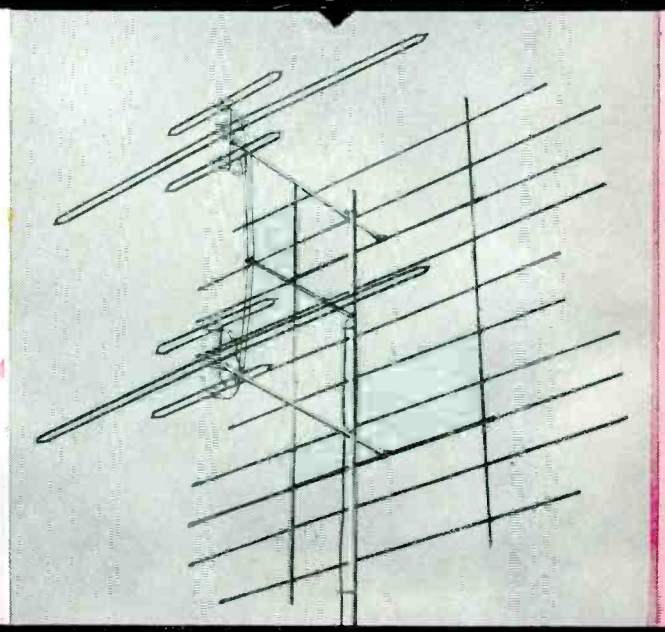
assembles faster than a 5-element yagi!

Collapsed "Pop-Up" screen opens instantly — no loose rods, elements or hardware. "Tri-Pole" assembly features automatic Spring Lock Action — all dipoles snap permanently into place without wing nuts or any other hardware.

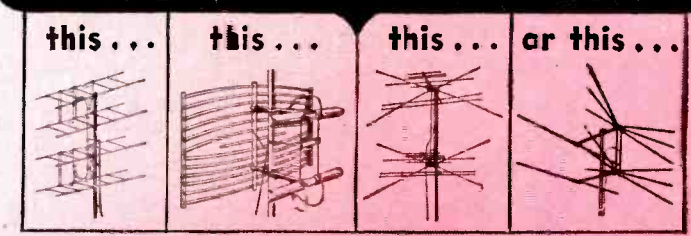
It's a *CHAMPION* in any area!

1-bay—*local areas*
2-bay—*secondary and fringe areas*
4-bay—*super-fringe areas*

THIS ANTENNA...

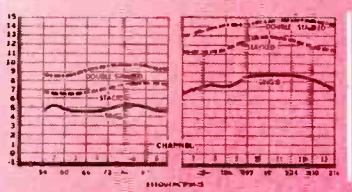


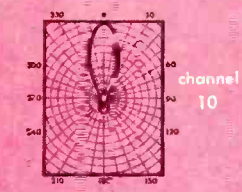
OUT-PERFORMS:



The 2-Bay CHAMPION actually gives you the performance of

- Separate 5-element Yagis for every Low Band channel!
- Separate 10-element Yagis for every High Band channel!



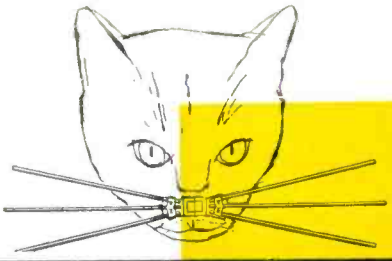


Model No		List Price
325	Single Bay	$20.83
325-2	2-Bay	$42.56
325-4	4-Bay	$88.89
Separate Stacking Harness		
325-3	2-Bay Harness	$ 2.08
325-5	4-Bay Harness	$ 4.75

Send for complete technical literature

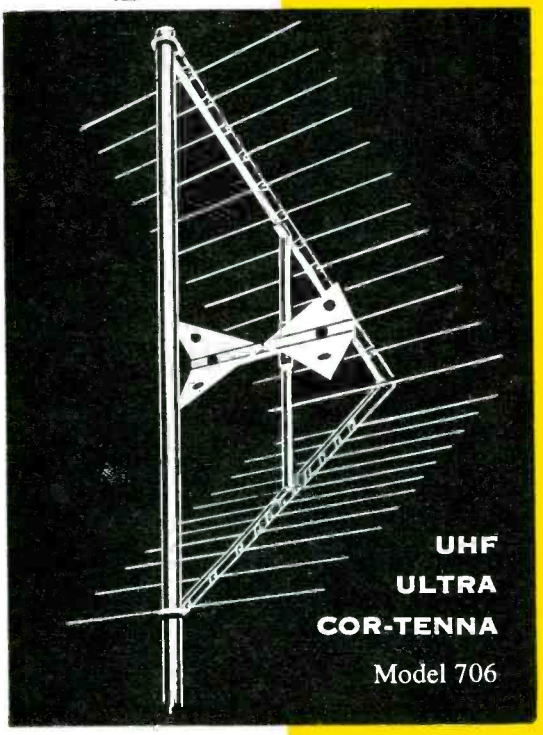
CHANNEL MASTER CORP.
ELLENVILLE, N. Y.

4-Bay



Another First by

TESCO



14.8 db gain! TESCO's Single Bay Corner antenna (Model 706) is one of the most powerful antennas known, with a gain of up to 14.8 db! Model 706 is the *all channel* UHF antenna that minimizes probing . . . gives remarkable performance in UHF fringe areas . . . completely eliminates difficulties in sections where noise or reflection prevail. What's the secret?—TESCO's unique and exclusive engineering principles that are applied in the construction of every antenna offered in this complete line where you see "It's the Cat's Whiskers". . . the slogan that has become the trademark of finest reception, rugged construction, easy "snap-in" assembly, quicker installation and stronger signal.

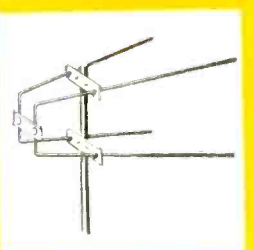
ALSO AVAILABLE STACKED — (Model 706-2)

UHF ULTRA BOW-TENNA (Model 704)

Economical yet highly efficient UHF antenna that delivers high gain from channels 14 to 83. Expanded mesh reflector prevents vibration and eliminates open welds. Antenna is designed for minimum wind resistance. Embossed rib around edge of Dural Dipole Element prevents vibration. Units completely pre-assembled.

UHF-VHF ULTRA V-TENNA (Model 703)

Simplest possible antenna design, built to withstand wind, ice and snow in TV areas about twenty miles from transmitters. Maximum gain up to 11 decibels. Rugged aluminum construction. Receives VHF channels in addition to UHF.



Write TESCO today for literature on the complete line of antennas and mounts for UHF, VHF, and UHF-VHF.

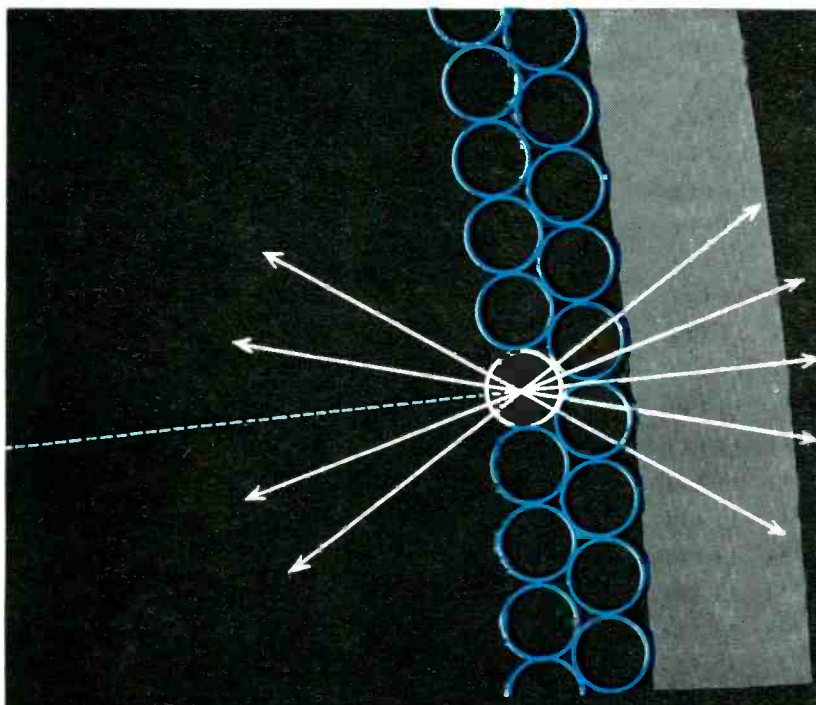
TESCO

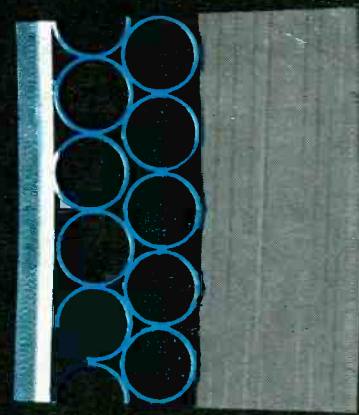
it's the cats whiskers . . . and just as sensitive!

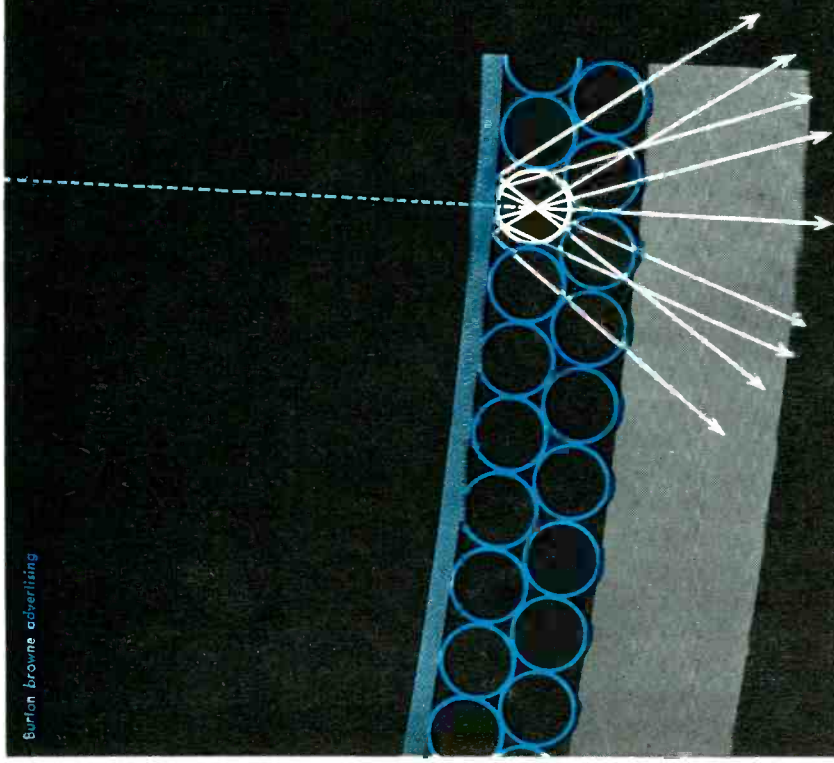
TV PRODUCTS COMPANY

SPRINGFIELD GARDENS 13, NEW YORK

CONTI







what Aluminizing means

Aluminizing means the efficient use of light—light is energy—energy is the pay-off.

Aluminizing means a brighter TV picture, greater contrast, lower beam current, smaller spot size, sharper focus, reduced screen scorch—*all* from the efficient use of light.

On the inside of any TV tube face is a coating of phosphor crystals—the picture screen. As the electron beam—tracing the picture—strikes these crystals, they glow, giving off light in all directions. And there's the problem! Half the light thus generated is *inside* the tube, either lost to usefulness or lighting areas that should be dark. Both brightness and contrast suffer.

But—put a mirror behind the phosphor and "wandering" light is reflected back through the tube face. *Aluminizing creates this desired mirror!*

To aluminize a picture tube, deposit a nitrocellulose film evenly over the phosphor. Over that, deposit a film of aluminum only millionths of an inch thick—just thick enough to reflect the light and just thin enough to let the electrons pass through. Under heat, evaporate the nitrocellulose film to leave a thin smooth coating of aluminum. Result—an efficient light reflecting mirror to specifications.

Simple as it sounds, Rauland research engineers worked for three years to solve the problem and were among the first to do so.

Rauland

Perfection through Research

Zenith Subsidiary

Burton Browne advertising

Trade Flashes

• • • •

Raytheon Service Dealer Meeting Held

Approximately 650 Chicago service dealers attended the Raytheon-Allied Radio Corp. "How to Interpret What You See in UHF" meeting held at the Midwest Athletic Club, Chicago, Ill. on August 12, 1953. Incorporated into this meeting was a presentation of Raytheon's new "Service-Saver" Plan. Sponsoring the meeting were Allied Radio Corp., Raytheon Manufacturing Corpany—Television and Radio and Receiving Tube Divisions, Raytheon Television Distributors, and Television Installation and Service Association. Master of ceremonies for this "instruction clinic" was Mr. C. W. Hoshour, Service Manager of Raytheon's Television and Radio Division. The main speaker of the evening was Mr. William Ashby of Raytheon's *UHF* lecture staff. Mr. Ashby gave a slide-illustrated talk on UHF installations and servicing problems, and introduced the new Raytheon Service-Saver plan, built around the TV Owner's Guide and the dealer's Service Saver manual and wall chart.

"TV Service and Sets Much Better Today"

TV set servicing is much better today than it was a few years ago and so are the receivers, James D. Secrest, Executive Vice President of the Radio-Electronics-Television Manufacturers Association, said in a talk prepared for the Radio & Television Service Clinic and Electronics Fair in Fort Worth, Texas. Mr. Secrest cited a recent statement by the Association of Better Business Bureaus, which has cooperated with the RETMA Service Committee in solving service problems, in support of his statement that great improvements have been made in the service field.

The decrease in the number of service calls per set, which was also partly attributed to the set owner's greater familiarity with his receiver, should in no sense alarm the serviceman, Mr. Secrest said. "The reduction in calls per set will be more than offset by the rapid growth in the number of set owners," he explained. "There is plenty of work today to keep the estimated 50,000 servicemen busy servicing 25 million TV receivers, and many more technicians will be required when we have 50 million television sets in this country, probably less than five years from now."

Tube Data Released By G.E.

If yours is one of the nearly 24 million U.S. homes with TV, you probably have more electronic tubes in your house than electric light bulbes, General Electric Tube Department researchers reported. They figure the average TV home has 21.5 tubes in the TV set, plus 9.5 more in radios. This adds up to 31 tubes, in contrast to the G-E estimate of 19.5 light bulbs in the average home. Even in total numbers in all homes, the tubes come out ahead, the G-E men figure. They estimate the total number of home light bulbs at 905 million, and the total of home tubes at 964 million.

"Wrist Radios Not Far Off"

Wrist radios, frequently featured tongue-in-cheek style in comic strips, will become a reality in the not-too-distant future, predicts Benjamin Abrams, President of Emerson Radio and Phonograph Corporation. Recently, he astounded the world with the introduction of the Emerson "Pocket Radio," the world's smallest personal portable weighing less than a pound and measuring only six inches in width by 1¼ inches in depth. Within two years, Mr. Abrams says, we will have portable radios no larger than a pack of cigarettes and, a few years thereafter, the wrist radio will be an actuality.

Philco Servicemen Attend UHF Conversion Exhibit

More than 500 area radio television servicemen attended a Philco distributors-sponsored and service aid clinic in Philadelphia. The meeting, staffed by factory representatives, was designed to acquaint servicemen with ultra-high frequency, and to introduce new Philco test equipment. Highlight of the 60-

No dust-catchers in Merit's line but complete coverage where it counts!

Keep inventory at a minimum, profits high with Merit's designed-for-action line. Among the new, quick-turnover items recently added: flybacks  for Motorola replacement, a new series of yokes and TV power transformers. Find Merit's complete line listed in John Rider's Tek-File and Howard Sam's Counter Facts and Photo Facts–Tape Marked* to help you.

And! Be sure to get Merit's new, really complete Replacement Guide. 

Forty pages of replacement data and schematics, including IF-RF coils, an exclusive Merit feature.

*originated by Merit

Merit Coil and Transformer Corporation

4425 NORTH CLARK STREET, CHICAGO 40, ILLINOIS

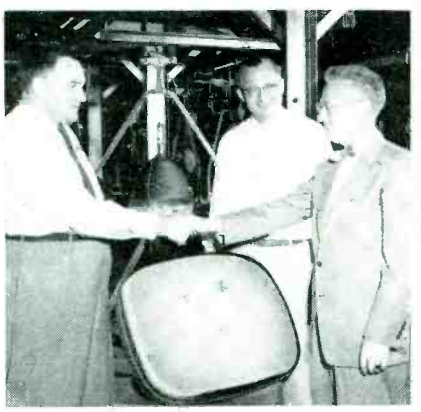
minute program was a special "mock up signal," in which a local *vhf* station was brought in on *uhf*. To accomplish this, Dan Lerner, of Philco's service division, used one of the company's signal generator adapters, Model G8000, which converted the *vhf* signal. Mr Lerner pointed out that although this city does not have a *uhf* station at present, servicemen could check *uhf* tuners, or combination *vhf-uhf* tuners, for their consumer accounts so that the mechanism will be in working order when *uhf* begins here.

RETMA Starts Training Course In N.Y. Area

The Radio-Electronics-Television Manufacturers Association recently started its first pilot training course for television technicians. RETMA member companies have donated about $80,000 in money and equipment for the course which began Sept. 15, at the New York Trade School. Only practising servicemen from the area with at least three years' experience will be eligible for the course which is to run for 16 weeks, two nights per week. The course is geared to meet the needs of practising TV technicians who have a comprehensive knowledge of TV systems and circuitry but whose skills are limited because of inadequate knowledge and use of test equipment.

5,000,000th TV Picture Tube Produced

Sylvania Electric Products, Inc announced that its has produced a total of 5,000,000 television picture tubes at its two picture tube plants, located at Seneca Falls, N. Y. and Ottawa, Ohio.

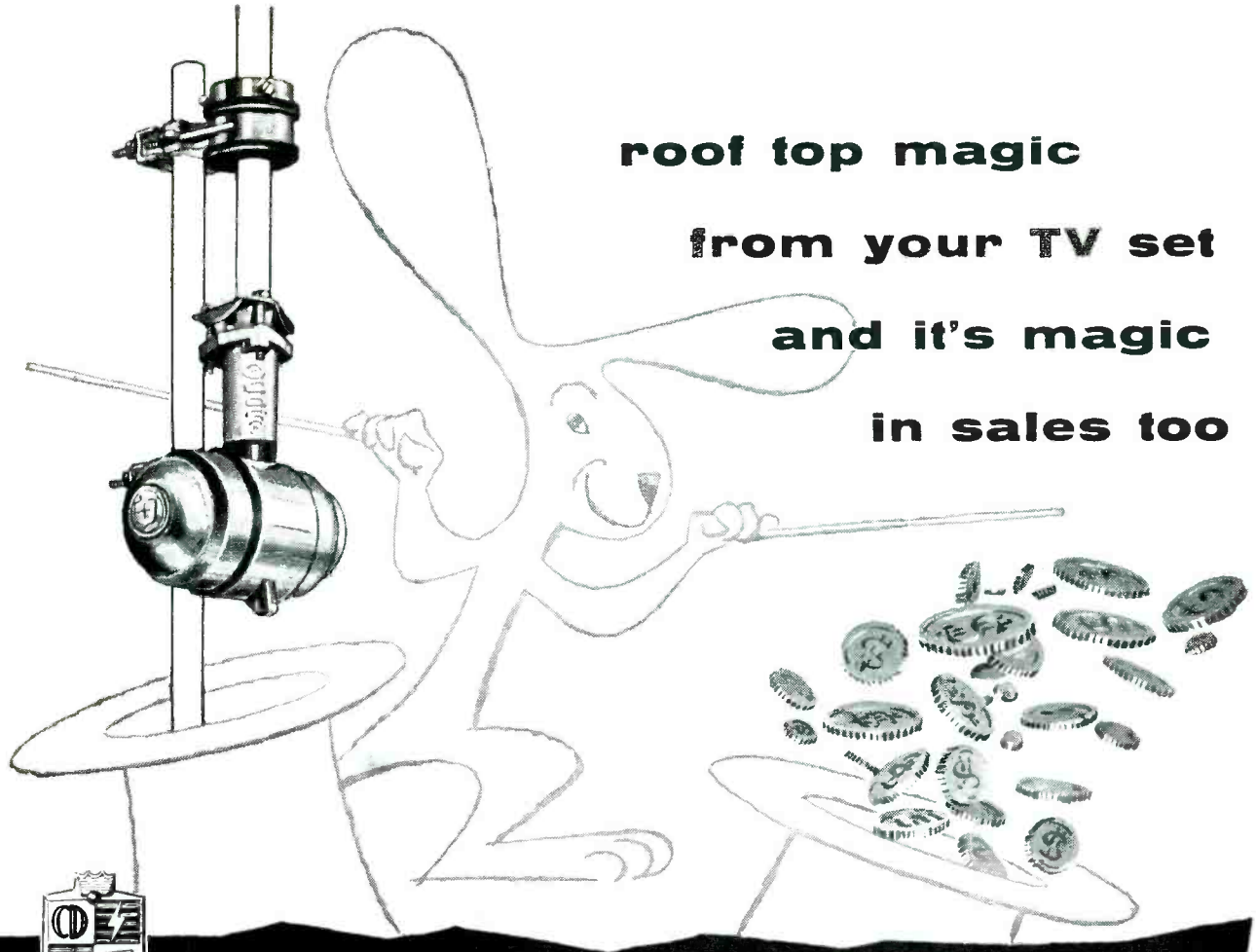


Mayor of Seneca Falls, W. J. Cousin (right) congratulates Sylvania's Division General Manager, W. H. Lamb (left) on his productive achievement. Willis C. Toner, Seneca Falls plant manager (center), stands behind the 5,000,000th TV picture tube.

G.E. Offers Tube Promotion

A new G-E aluminized TV picture

[*Continued on page 66*]



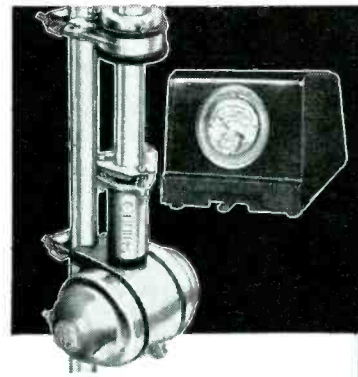
roof top magic from your TV set and it's magic in sales too

the C★D★R Rotors

NATIONALLY PROMOTED IN TELEVISION

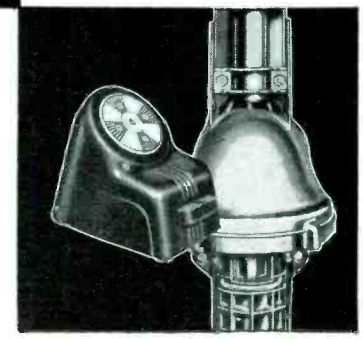
★ There's real MAGIC to the CDR ROTOR! The way it IMPROVES any TV picture is magic ... the way it sells ... is magic! BUT ... the real answer is quality manufacture of a proven design! That adds up to continued dependable performance ... CDR ROTORS ARE BUILT TO LAST ... built to perform under any conditions!

NOW ... MORE IN DEMAND THAN EVER BEFORE with the BIG consumer advertising campaign in full swing ... if you don't have your BIG CDR PROMOTION KIT with selling and advertising aids ... write us for your kit ... to help you sell EVEN MORE!



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

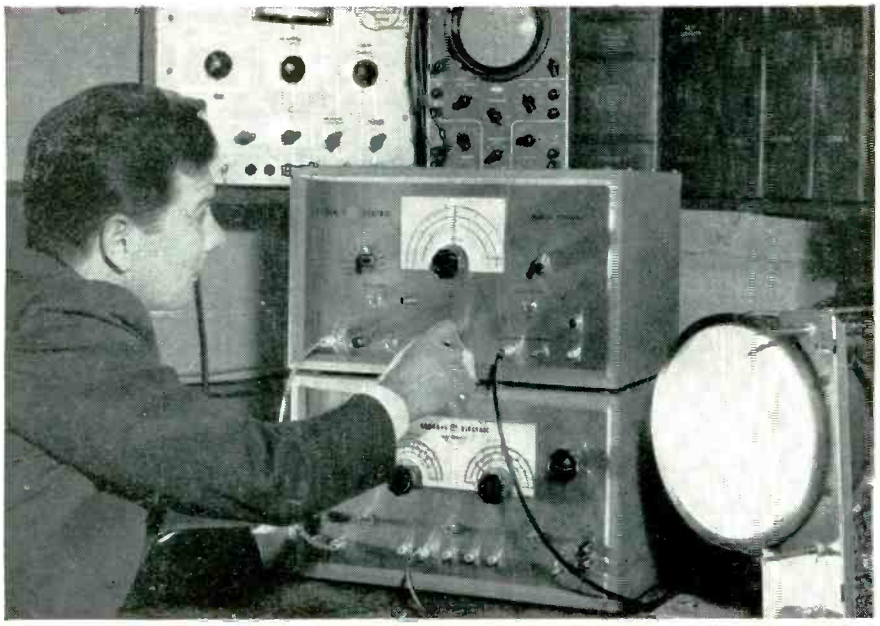
TR-11 ... same as TR-12 without thrust bearing **$44.95**



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

THE RADIART CORPORATION
CLEVELAND 13, OHIO

THE CORNELL-DUBILIER ELECTRIC CORP.
SOUTH PLAINFIELD, N.J.



"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

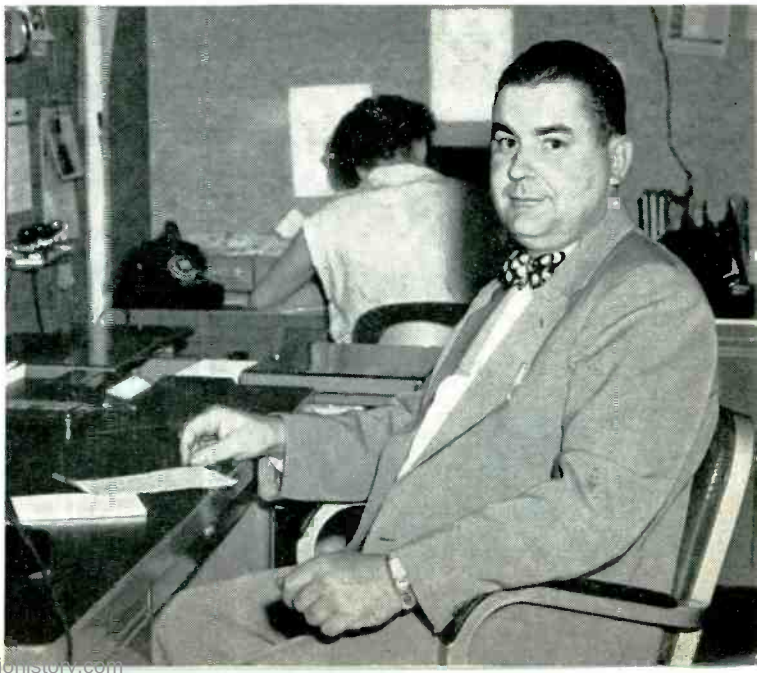
Give your customers TV's finest picture—and make more money!

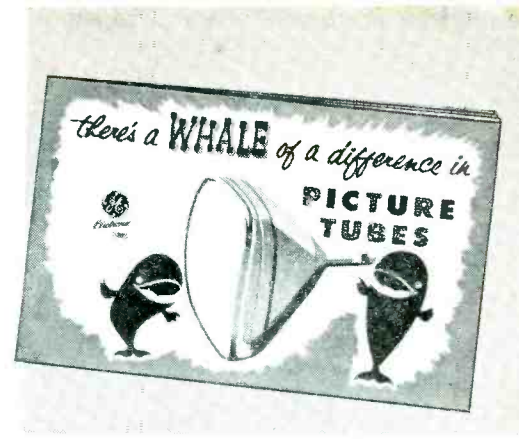
"65% OF OUR PICTURE TUBES SOLD ARE G-E ALUMINIZED. ONE OWNER TELLS ANOTHER."

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.



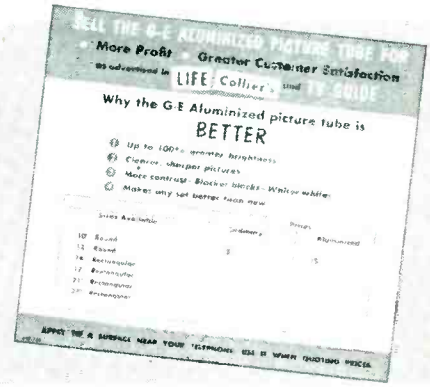


FACT-CRAMMED BOOKLET FOR TV OWNERS

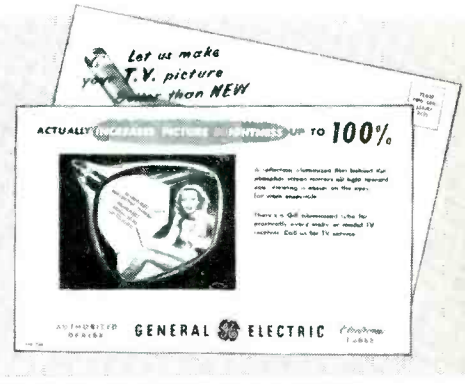
COLORFUL STREAMERS

WE INSTALL PICTURE TUBES!"

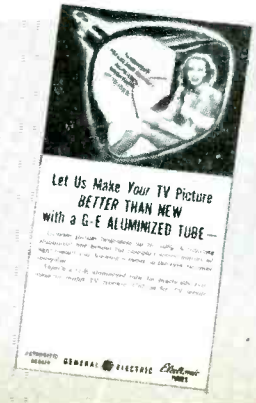
Ask for new 6-piece promotion kit!



PHONE-SELLING PRICE GUIDE



MAIL CARD THAT BUILDS INQUIRIES



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EDITORIAL

by S. R. COWAN

Our New Policy

Our startling new circulation policy outlined on pages 31-32-33-34 in this issue results from several years of cogitation and serious endeavor. Now, for the first time since the very birth of radio, a publication ("Service Dealer") catering solely to servicemen, can boast that it reaches, every month, the owner or manager of every firm in the U. S. A. that does radio and/or TV servicing. Perchance we have left off our mailing list the name of some established Service Organization. If so it was inadvertent. Just get that name to us and it will be our pleasure to add it to our list.

We welcome back to our regular reader audience many thousands of service firms, particularly those in non-TV sections, who since TV's birth have not been subscribing to trade journals because the preponderance of text on TV was of relative disinterest to them. With our new circulation policy change a new editorial policy change too, and hereafter we'll carry some mighty fine articles of non-TV nature that will interest *all* servicemen.

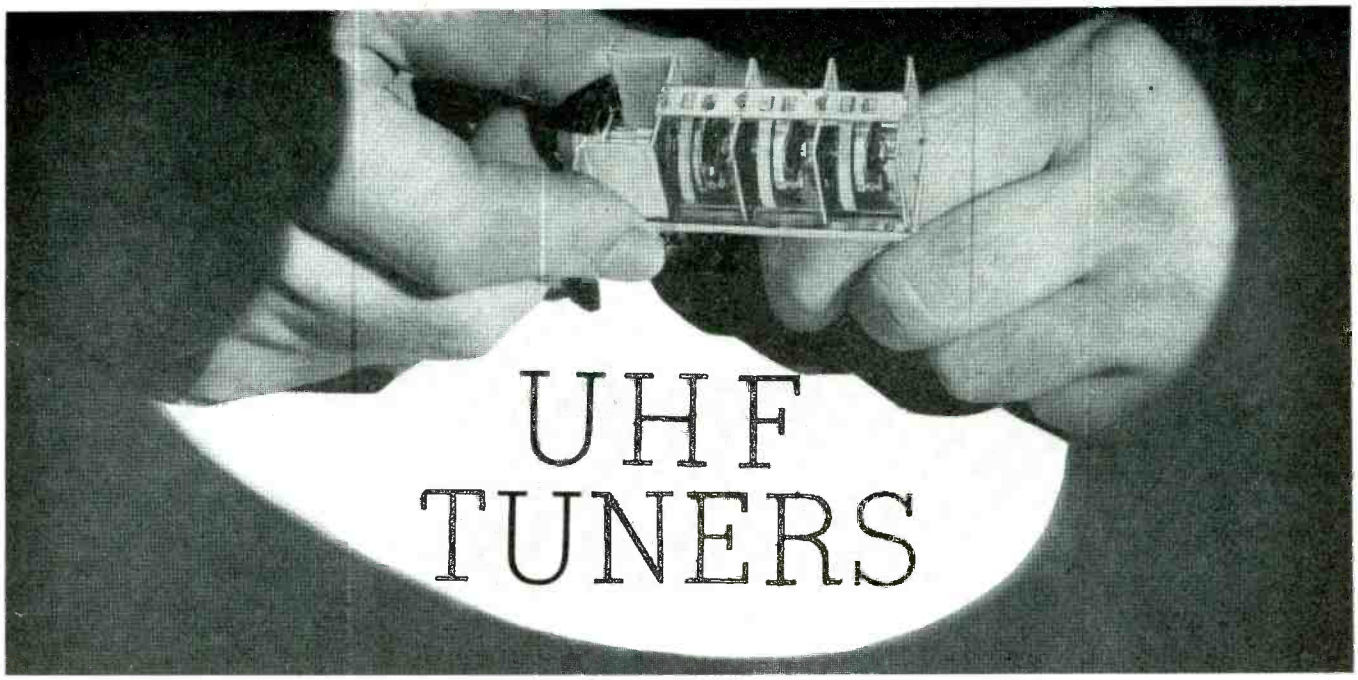
Serving As Liason Medium

We have editorialized with lament on several occasions that the Service Profession is the only segment of the vast electronics industry which has not yet been able to organize itself properly—with local associations having State Federation affiliation which in turn would have a National collaborative tieup. Perhaps that hoped-for goal may be more quickly attained now that this journal will reach all leading servicemen everywhere—providing the means of intercommunication and liason between them. In that capacity our basic aim is to avoid all "political" controversy, for our one goal is to help servicemen to help themselves. By being "organized" the Service Profession can accomplish this more quickly.

Recognition — At Last!

Ask any Serviceman today what he'd ask for if a Fairy Godmother told him he could have three wishes. He would reply without hesitancy: "Grant me 1) More confidence and respect in general from the set-owning public as a whole; 2) More educational cooperation from the industry's "big shots"—meaning receiver manufacturers—who are constantly making production changes which technicians must find out about the "hard way; and 3) The ability to do my work better, in less time, and at greater financial return."

All three of these goals are becoming closer to realization, thank God! For example the program called "Service Saver" by Raytheon is a big step in the right direction. It pulls no punches. It teaches the set-owning public that servicemen are just that—men who can be of service to them. Such a program lines up squarely with the Service Profession's own desires. We hope that other top-notch manufacturers can soon get on the serviceman's bandwagon in some similar fashion.



UHF TUNERS

by **LEONARD LIEBERMAN**

UHF servicing differs from VHF servicing in that certain components of the circuit are radically different in design and construction, and that wiring tolerances are reduced to a point where wire length and position are fixed.

THE lifting of the F.C.C. "freeze" on *uhf* construction permits has produced an extremely active transmitter and station construction race in many parts of the country. This has in turn produced a complementary race by the set manufacturers to make their sets usable in the *uhf* areas. This has resulted in a wide variety of *uhf* front ends, signal and two channel converters, continuously tuned converters for mounting outside the *uhf* cabinet, the same type for mounting inside the cabinet, single-channel tuners, all-channel tuners, etc.

While there seems to be a wide variety of these devices, it might be advisable to go back to basic theory to discover their basis of operation. When we do this, it will be found that all the varieties are based on a few fundamental circuits and are only variations of these circuits.

In fact, the understanding of *uhf* tuners requires a definite knowledge of the *uhf* principles which we are about to discuss, and unless the serviceman sweats it out at this point, *uhf* tuner operation will be meaningless to him. Of course it is realized that the serviceman is a busy person and cannot devote too much time to theory: for this reason we have tried to make the subject matter as simple and as practical as possible.

The 470-890 *mc* band lies just above the region in which traditional components can be used, and extends below the region in which microwave techniques can be applied. The usual methods of tuning are not directly applicable at the high end of the band, and at the low end of the band microwave techniques cannot be applied.

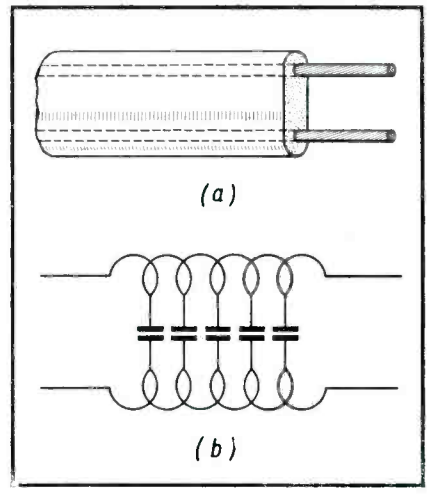


Fig. 1a—Typical 300 ohm line.
Fig. 1b—Electrical equivalent of 300 ohm line.

In general, two types of tuners are used, the first utilizing the conventional turret tuner strip in which each strip is specifically designed for a definite channel, and the second being the continuous tuner type in which use is made of the distributed circuit constants to achieve the desired tuning range.

Items such as impedance matching, standing wave ratios, lead-in attenuation, lead-in dress and so-forth will become part of the serviceman's vocabulary.

Let us examine some of the properties of *distributed constants*. For the purpose of simplified illustration, let us take a transmission line such as the well known 300 ohm twin-lead *(Fig. 1a)*. This line could be looked on as a very large number of small parallel inductors between which are an equally large number of extremely small condensers. *(Fig. 1b)* This transmission line can thus be said to have the properties of a tuned circuit.

It can be proven beyond a reasonable doubt that transmission lines have characteristics such as resonance, inductance, capacity, phase delay, insertion loss which result from the inherent resistance in the wire, and leakage through the dielectric between the two wires.

Some of the other characteristics of transmission lines are worthy of attention. The first of these is the dis-

tribution of current, voltage and impedance along the transmission line, *(Fig. 2)*. For the purposes of illustration the line is assumed to be loss-less, that is the small resistances are ignored and the line is situated in free space. As a result, the physical length of the line and its electrical length are identical for a voltage wave-form at a given frequency.

When the physical length of a transmission line equals an integral multiple of quarter wave-lengths, it is called a matched resonant line. We assume for purposes of illustration, that the line is lossless, and presents a pure inductance to a generator; and the current leads the voltage by 90° as shown in *Fig. 2a*.

The impedance goes from minus infinity to plus infinity as the current goes from null to null at the even quarter wave sections and goes through a maximum at the odd quarter wave sections.

The conditions which exist at the quarter wave points lead to some interesting results which are utilized to the full in practically all present *uhf* devices. Referring to *Fig. 3* it will be noted that at an odd quarter wave length, a open-ended line looks like a series resonant circuit to the generator. On the other hand, if a short is connected across the end of the line, the generated end will look into an infinite impedance. This feature makes the line look like a series resonant circuit for an open ended line and a parallel circuit for a shorted line. Another feature of this arrangement, is that the electrical length of the line can be changed without changing its physical length. To understand this, let us return to the tuned resonant circuit, which we mentioned previously.

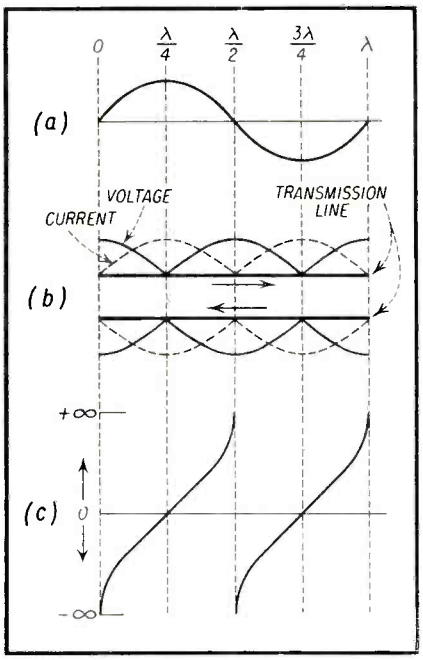


Fig. 2—(a) Input wave form. (b) Current and voltage relations on a tuned line. (c) Impedance of a tuned line, Z = E/I.

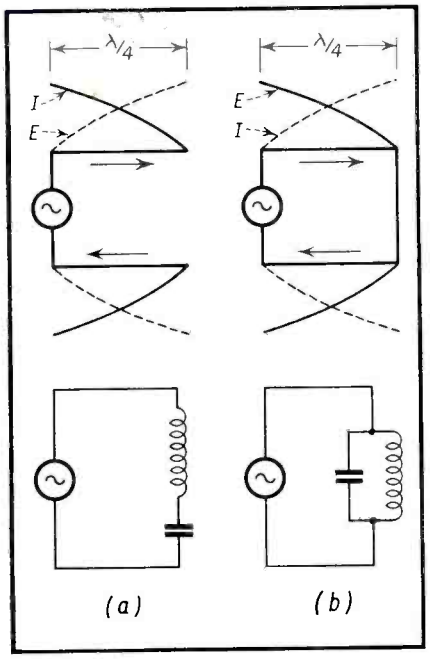


Fig. 3—(a) Quarter wave line open-ended, and equivalent tuned series circuit. (b) Quarter wave line shorted, and equivalent tuned parallel circuit.

To change the frequency of a tuned circuit, we can add additional inductance to the present inductance, or additional capacity to the circuit capacity. This change will alter the circuit frequency. If we reduce the frequency, an electrical wave length *longer* than what we had before the results. Carrying the analogy back to the transmission line, we could either change the inductance or capacitance by changing the line length or we could add a capacitor or inductor between the two lines. By making the physical length of the line equal to a quarter wave length of the highest frequency, we can reduce the frequency by adding a variable capacitor between the parallel lines. Conversely if we make the line equal to a quarter wave length of the lowest frequency desired, by shorting out the line progressively in the direction of the generator, we can reduce the inductance and increase the line frequency. The above two principles plus one other which we will discuss are the basis of operation of all present day *uhf* tuners and converters.

A special form of the parallel wire transmission line is the coaxial line. In this case, the ground braid is one of the lines and the center conductor, the other.

Another development not found in the *vhf* field which is used in *uhf* is the use of the resonant cavity. Its theory of operation is as follows: At the high frequencies, such as in the *uhf* spectrum, a short length of straight wire acts as an inductor. If it is formed in the manner shown in *Fig. 4a*, the capacity between the wires in conjunction with the wire inductance can be resonant at a frequency determined by the length of the wire and the space between the bends. An enclosed cylinder can be considered an infinite number of single wires *(Fig. 4b)*, whose dimensions can determine the highest frequency. If a variable capacity were to be added across the cavity, the result would be a tunable resonant circuit of extremely high "Q."

Some of the features of high frequency techniques are of importance to the practising serviceman. The first of these is that at these frequencies the *rf* current flows on the outside of the conductor. "Skin effect" is therefore a very important factor in design and repair. This effect is the reason for the prevalence of silver and copper plating of the chassis. This plating offers a very low resistance to the *rf* currents.

Practical Considerations

The use of *uhf* results in large circulation *rf* currents flowing in the chassis. As a result when it is desired to bring two points to a common ground point without causing an *rf* difference between them, they are both soldered to the exact same point. This is most notable in the grid return leads.

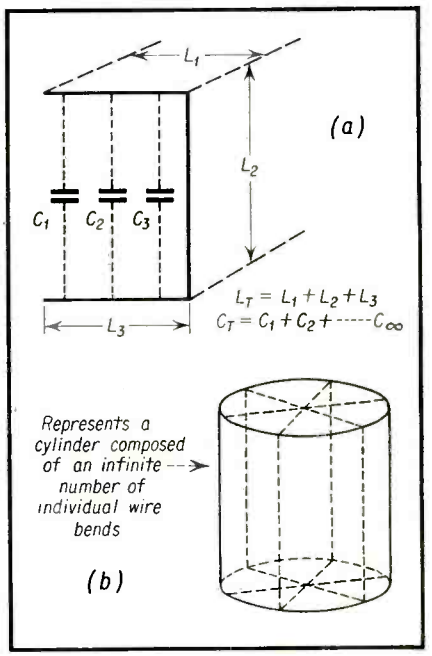


Fig. 4—(a) Single bend of wire at ***uhf***. (b) Equivalent construction of a resonant cavity.

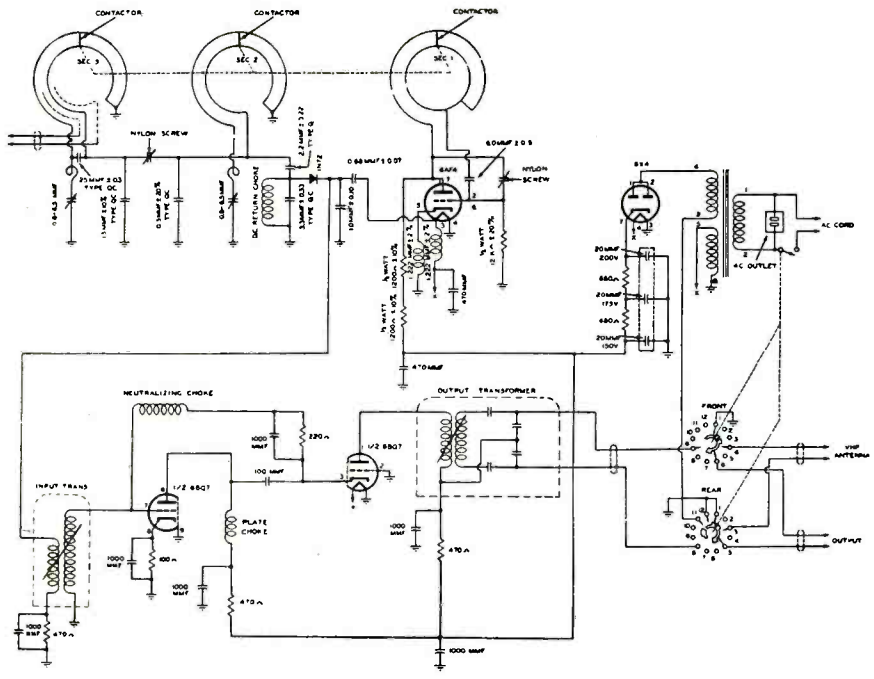


Fig. 5—Schematic of Mallory UHF Converter.

The grid is brought back to the point where the cathode ground return is soldered. If, for any reason, a component is replaced, be sure to reconnect the replacement to the exact same place that the defective unit had been. It is good practice to completely unsolder the defective part when removing it instead of clipping and soldering the replacement to the protruding leads. It is also good practice to replace defective parts with exact replacements. By this is meant that when replacing a component it is not sufficient that the replacement be the same value but should be by the *same manufacturer,* and the lead lengths should be the same as the replaced part. At *uhf* the length of all leads are critical as they add inductance, which may be undesired, to the circuit.

When purchasing antennas or lead-in wire it is advisable to examine the specified characteristics. This is important since the impedance presented to the input circuit of *uhf* circuits are critical. At these frequencies the attenuation resulting from the reflected standing waves caused by a termination mismatch can be quite high. With the low radiated power of the present-day *uhf* transmitters, the greater ground wave absorption, and the higher attenuation from objects in the line of reception make it imperative that as little as possible of the signal power reaching the antenna be lost in transmission to the set input.

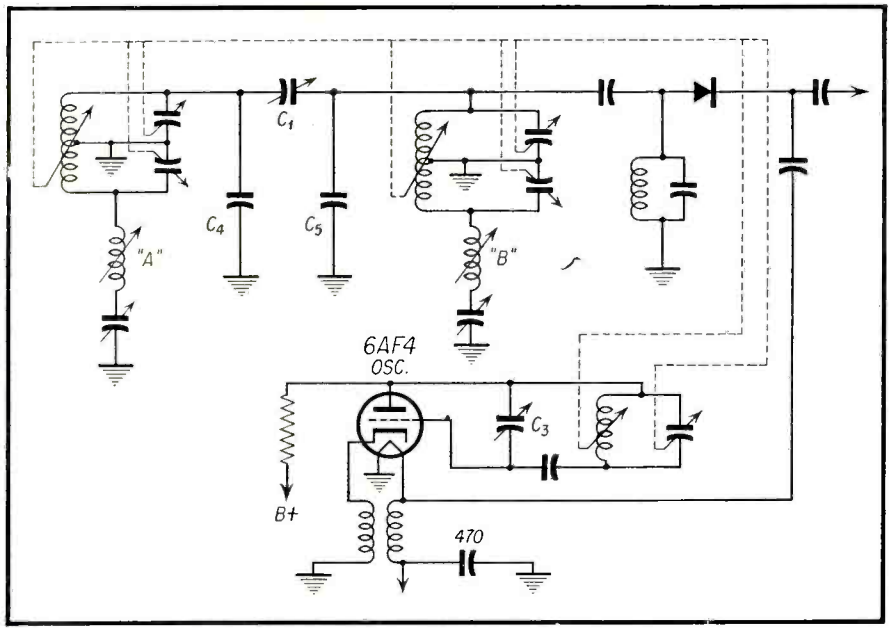


Fig. 6—Tank circuit analogy of Mallory UHF Tuner.

Now let us see how the above principles are applied in current *uhf* equipment. An excellent example of the case in which the line is fixed to a maximum length (lowest frequency) and then reduced by means of a shorting bar is seen in the Mallory *uhf* converter *Fig 5.* A detailed diagram of the tuned section is shown in *Fig. 6.* Points "A" and "B" are worthy of note. They are tracking adjustments to lengthen or shorten the lines electrically. Their purpose is to make sure that the pre-selector and mixer circuits change frequency at the same time and at the same rate. *C3* is an adjustable end loading condenser the purpose of which is to regulate the oscillator line length to track with the other circuits.

The choke in the cathode circuit is used as an additional feedback source to maintain oscillation. The choke in the filament circuit is used in conjunction with the cathode to filament capacity to provide a coupling impedance to the mixer circuit. The comparative profusion of bypass condenser results from the fact that at these frequencies small capacities act as excellent bypasses which serve to keep the bypassed point "cool" to *rf.* The bottom end of the filament choke is therefore at *rf* ground with little or no *rf* appearing in the power supply.

The configuration of *C1, C4* and *C5* acts as an impedance matching device which matches the preselector impedance to that of the mixer diode. The matching of impedances is extremely important for the maximum power gain and the minimum unit noise figure.

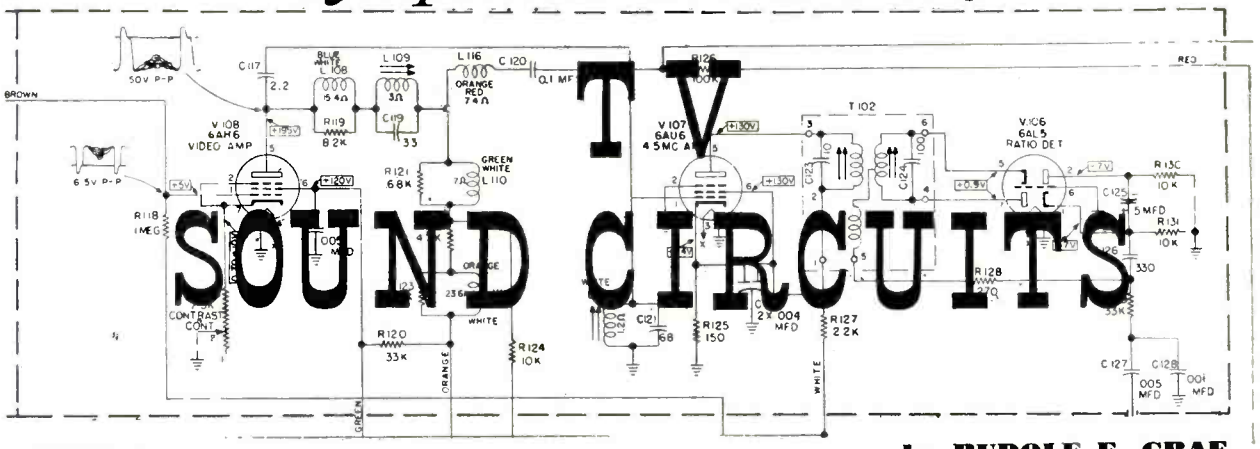
The output of this converter is taken off a 6BQ7 cascode amplifier. This output bandpass is 12 *mc* centered around 82 *mc.* The result is that the output falls on *vhf* Channels 5 and 6. In this way the customer uses his *uhf* unit on that *vhf* channel which is not being used in his locality.

The Stromberg-Carlson converter *(Fig. 7)* is very similar to the Mallory unit just discussed with several interesting variations which are shown in *Fig. 8. Figure 8a* shows the antenna input circuit. This network serves several functions. First it acts to provide a balanced antenna to ground while matching it to an unbalanced input line. Secondly it serves as an impedance device to match the antenna impedance to that of the first tuned preselector section. Lastly it acts as a high

[*Continued on page 62*]

Symposium Series No. 8

TV SOUND CIRCUITS



PART 1

by **RUDOLF F. GRAF**

Part 1 of this article deals with various types of FM detectors used in the sound sections of current TV receivers. Among the detector types discussed are the Gated Beam and Foster-Seeley. Others will follow.

THE sound signal associated with any *vhf* and *uhf* television broadcast is transmitted by frequency modulating the sound carrier at the transmitter and sending out an FM signal. Therefore an FM detector is necessary in the sound system of all television receivers.

Two systems can be employed to get the FM carrier, which is fed to the set from the antenna, over to the FM detector. Both are based on the superheterodyne principle and they are illustrated in block form in *Fig. 1*. In the split sound TV receiver, the incoming sound and video carriers of any particular station are amplified in the *rf* amplifier stage and fed to the mixer where they are heterodyned with the signal from the local oscillator. Thus we get two *if* signals, one sound *if* and one video *if*. They are kept separate, amplified separately and detected separately. Traps are inserted in the sound *if* to keep the video *if* out and vice versa.

In the intercarrier receiver we use only one *if* system for both the video and sound signals which are amplified together. The difference between the sound and video carrier is fixed at 4.5 *mc*. Since the sound carrier is frequency modulated we end up with a 4.5 *mc* frequency modulated sound *if* signal. As far as the sound signal is concerned we have a double superheterodyne circuit. First, the sound carrier is converted to a lower frequency by heterodyning with the local oscillator in the mixer stage. Then we convert again in the video detector stage, with the video carrier beating against the FM sound producing a 4.5 *mc* sound *if*. This system has become into more popular use during recent years and it is now being used almost exclusively in new models of TV receivers.

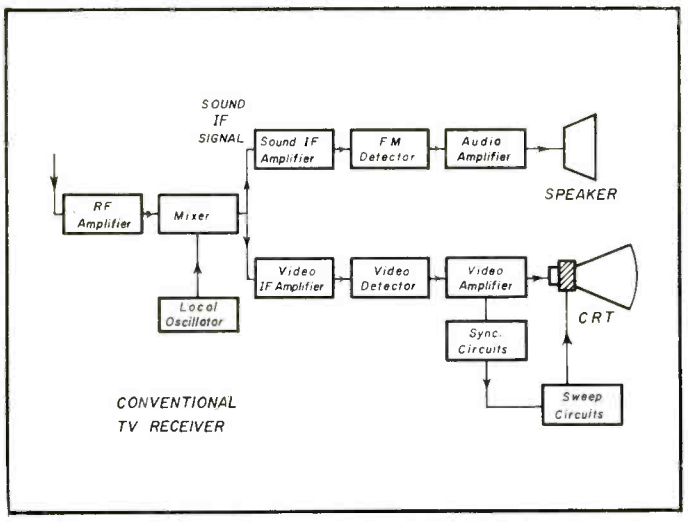


Fig. 1a—Block diagram of conventional set.

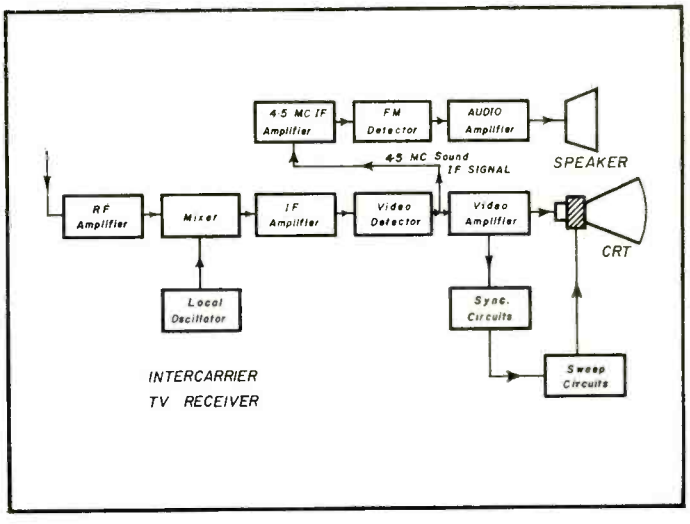


Fig. 1b.—Block diagram of intercarrier set.

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Regardless of whether one or the other system is employed, the rest of the circuitry follows the same general pattern. Sound *if* stages (one, two or three), Detector stage, and Audio Amplifier (one, or two stages). In this article we shall deal specifically with systems employed to detect the FM signal.

In general, five separate and distinct circuits have so far been used to detect an FM signal. They are as follows:

1. Gated Beam detector
2. Foster-Seeley discriminator
3. Ratio detector
4. Philco Locked-in oscillator
5. Fremodyne detector

Of the above five, only the first three types are used in TV receivers. The other two were used in some FM sets but have not reached a high degree of popularity. We shall, therefore, concern ourselves only with the first three types of detectors.

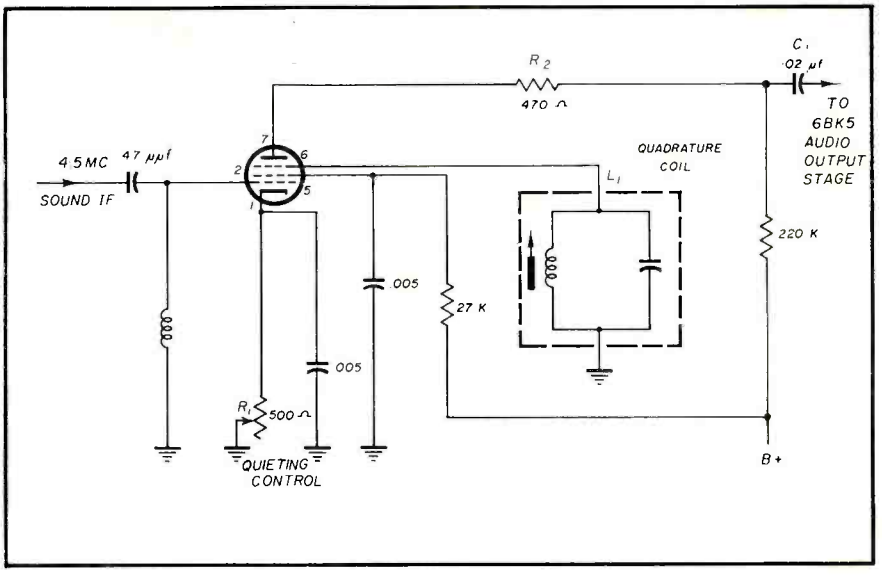

Fig. 3—Gated Beam Detector used in Westinghouse V2233-1.

Gated Beam Detectors

A gated beam detector employs the 6BN6 tube illustrated in *Fig. 2,* and is used among others by Capehart, Westinghouse and Zenith. This tube, has a very special type of construction. It serves as a combination limiter, FM detector and audio amplifier. Beside its ability to detect FM signals, it has the additional very desirable characteristic of being able to reject AM signals without being affected by noise pulses. Comparing the above characteristics with those of the ratio detector and the Foster-Seeley discriminator, we observe that the gated beam detector has some very desirable characteristics combined in one envelope.

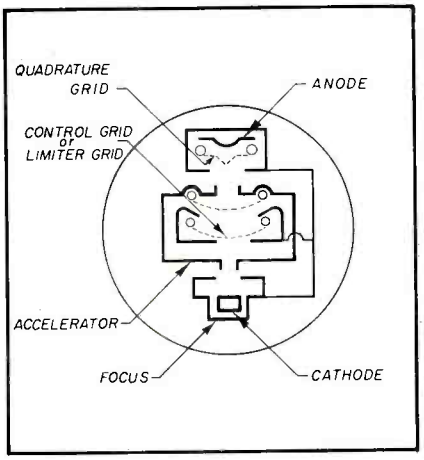

Fig. 2—Internal construction of 6BN6 Gated Beam Tube.

In a schematic the 6BN6 is shown with three grids, a plate or anode, and a cathode. Actually there is a little more to the tube than that. An important part is the focus electrode. It is not shown on the schematic representation of the tube, but it can clearly be seen on the illustration in *Fig. 2.* The purpose of this focus electrode is to gather the electrons that leave the cathode into a narrow beam, and guide them through the opening in the Accelerator.

The first of the three grids is called the control grid. It functions as a limiter grid and receives the modulated *if* signal. Since this tube is now being used in sets with intercarrier circuits, the signal fed into the first grid will be a 4.5 *mc* frequency modulated signal. This signal may come directly from the 4.5 *mc* trap or it may first be amplified by a 4.5 *mc if* amplifier stage.

The second grid is shown schematically as a screen grid. That is, it is connected through a resistor to B+. However, if we look at *Fig. 2* we see that this screen grid is actually a relatively large part of the tube, called the Accelerator. The Accelerator is placed around the control grid and is open at two opposite ends. One opening faces toward the cathode and the focus electrode, and the other toward the second control grid and the anode. This gives us a construction very much similar to that used in the CRT. Thus, we have an electron gun that produces a stream of electrons through the tube. Because of the unique construction of the tube, the cathode current is not affected by the voltage of the first grid. This characteristic helps the tube's function as a limiter.

The third grid is again not what we would expect it to be. Schematically it appears to be a suppressor, however it is another control grid and it is called the Quadrature grid. This grid is connected to the quadrature coil *L,*

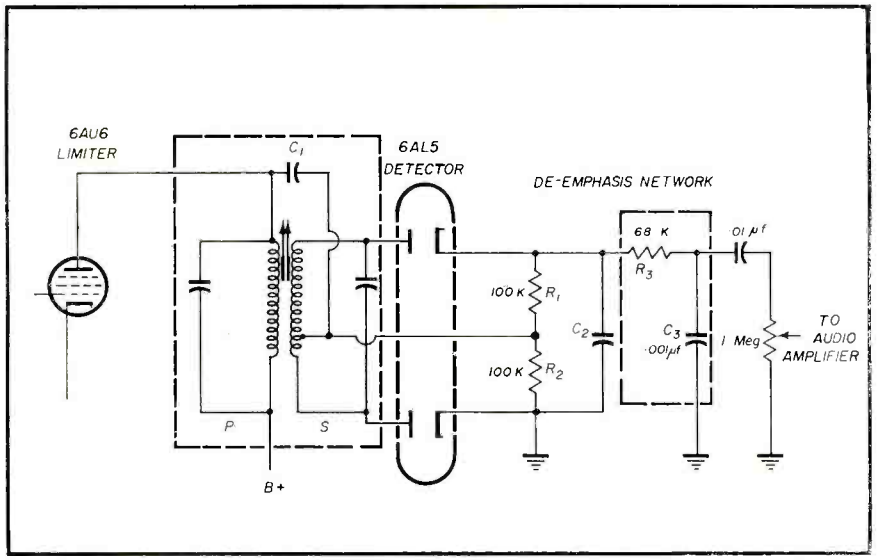

Fig. 4—Foster-Seeley discriminator used in Magnavox 105.

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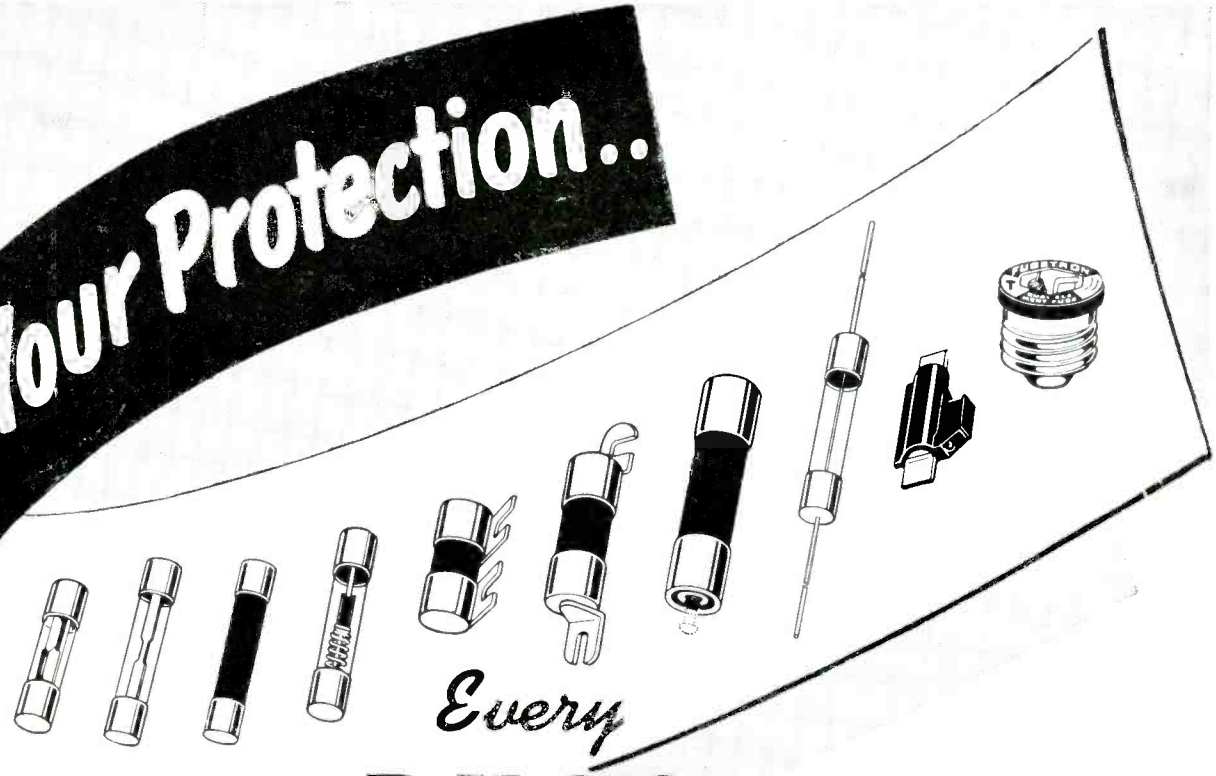

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which is actually a high Q tuned circuit resonant at the same frequency as the signal applied to the first control grid. In this case the quadrature coil is tuned to 4.5 *mc*. The signal from the control grid is coupled to this quadrature coil through the electron stream inside the tube with a lagging phase shift of 90 degrees. Since the signal on the first grid is frequency modulated it will vary in frequency above and below 4.5 *mc*. This frequency variation on either side of the *if* (4.5 mc) will cause the phase shift between the voltages on the limiter grid and on the quadrature grid to be more or less than 90 degrees depending on the frequency swing of the *if*. Now let us see what that accomplishes.

Both the limiter grid and the quadrature grid affect the plate current of the tube. Either of them can cut the tube off, but in order for the electron stream to reach the anode, it must be allowed to pass through the grids. Thus the grids can be considered as gates, and that is how the tube got its name. The amount of plate current is determined by the phase shift variation which, in turn, follows the frequency variation of the *if*. Thus, we see that the frequency modulated *if* signals

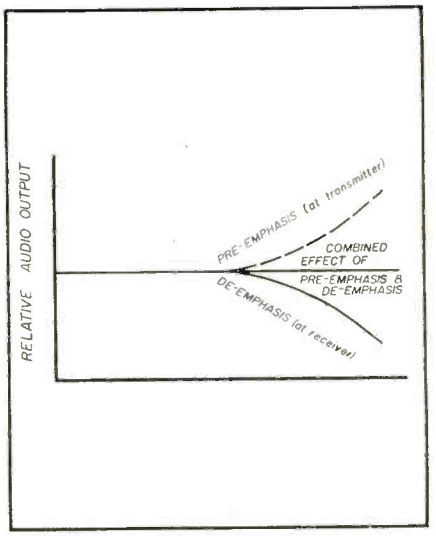


Fig. 5—Curves illustrating the action of Pre-emphasis and de-emphasis networks. They are resigned to be effective for frequencies above 1,500 cycles.

controls the amount of plate current, with the plate current variations being exactly in step with the frequency deviation. By inserting a load resistor *(R2)* in the plate circuit of the 6BN6 coupled through *C1*, to the conventional audio amplifier. See *Fig. 3*.

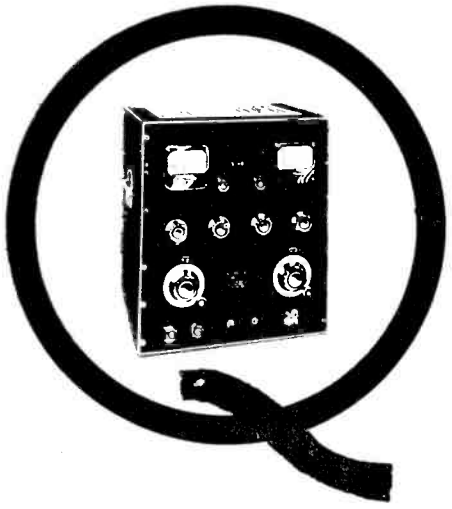
In order to suppress any undesired AM signals, the bias of the tube must be carefully adjusted. This is done by varying the cathode resistor *R1*. This control is called the Noise Rejection control, AM Rejection Control or Quieting Control. Its adjustment is important and will be covered in detail under Alignment Procedure.

Foster-Seeley Discriminator

This circuit requires a dual diode and is used among others by Emerson, Magnavox and Olympic. The most common type of tubes are the 6AL5 dual diode or the 6T8 which, in addition to two diodes, also has a triode in the same envelope.

A representative circuit of a Foster-Seeley discriminator, is shown in *Fig. 4*. The plates of both diodes are connected to opposite ends of a tuned circuit (the secondary of the discriminator transformer) and the cathodes are connected to two equal value resistors. *(R1, R2)* The junction of the two resistors is connected to the center tube, we convert these current variations into audio signals which are then of the secondary of the discriminator transformer which, in turn, connects to the primary through condenser *C1* inside of the transformer. When the circuit is properly aligned and a signal at the intermediate frequency (in this case 4.5 *mc)* is applied to the circuit at the limiter grid, the voltage across both halves of the secondary *S* is the

[*Continued on page 79*]



MEASUREMENTS and METERS

PART 2

by RUFUS P. TURNER

This second and final installment describes the construction, calibration, and use of a Q meter for the measurement of the various constants for which it is designed.

Heathkit Q Meter

This is the Q-voltmeter arrangement employed in the inexpensive Heathkit Model QM-1 Q-Meter which recently has become available for private assembly. The appearance of this kit-type instrument, brings dependable Q measurements for the first time to the serious experimenter having a limited instrument budget.

In the complete circuit (see *Fig 4*), terminals X_1 and X_2 are provided for the connection of either a standard coil or a coil to be tested. Terminals X_3 and X_4 are provided for connection of a capacitor under test.

This circuit is operated in the same manner as the circuit just described using resistor injection of signal voltage. It permits conventional checking of the Q of coils and capacitors by the Q-voltmeter method, and for the checking of inductance and capacitance by the tuned-circuit method, capacitance by the substitution process, and distributed capacitance.

The Q-measuring circuit of this instrument differs from that of the resistor-injection circuit in that the injection capacitor (C_2 in *Fig. 3*; C_9 in *Fig. 4*) is in series with the main-tuning capacitor and consequently reduces the total circuit capacitance. For this reason, two capacitance scales are provided on the dial of the tuning capacitor (C_3 in *Fig. 3*; C_{10} in *Fig. 4*). One of these scales (labelled C_t) reads the actual capacitance setting of the tuning (resonance) capacitor. The other scale (labelled C_e) reads the slightly lower value resulting from the two capacitors in series. The C_t scale is used for normal Q measurements and for substitution capacitance measurements, while the C_e scale must be used whenever effective circuit capacitance is the C value actually required, such as in the direct measurement of inductance by means of Equation (5).

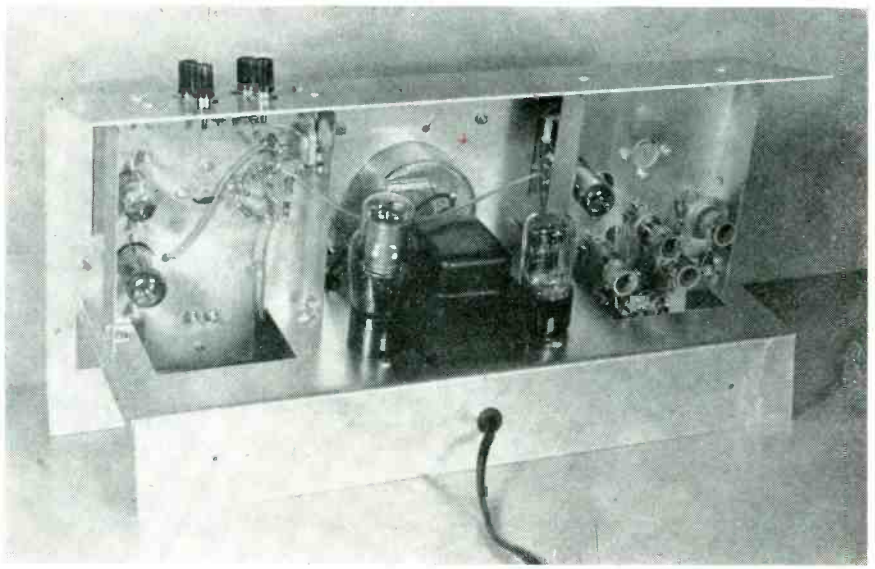


Fig. 5—Inside view of completely assembled Q-Meter. The vertically mounted Q subchassis is seen on the left. The generator subchassis is mounted vertically on the right. Power supply components and Q voltmeter are seen in the center. The complete instrument is 16½ x 8 x 5¾.

For the convenience of the operator, a special inductance scale is provided on the dial of the resonance capacitor. This scale is graduated 1 to 10; and reads 1 to 10 microhenries when the test frequency (f) is set to 7.9 *mc.*, 10-100 μh when f = 2.5 *mc.*, 100-1000 μh when f = 790 *kc.*, and 1-10 millihenries when f = 250 *kc.*

A trimmer capacitor (C_{11} in *Fig. 4*) in parallel with the main tuning capacitor allows reading of small capacitance increments between −3 and +3 $\mu\mu$f.

How Heathkit Q Meter Works

The complete circuit of the instrument is given in *Fig. 4*. The generator section supplies test frequencies in four switched bands from 150 *kc* to 18 *mc*. The cathode follower signal-output stage (V_2) delivers the test-signal voltage, through the calibration trimmer (C_7) and the injection padder, C_9, to the Q-measuring circuit. The v. t. voltmeter consists principally of the input diode (V_3), a balanced *dc* amplifier (V_5-V_6), and meter M. Contact potential of the second

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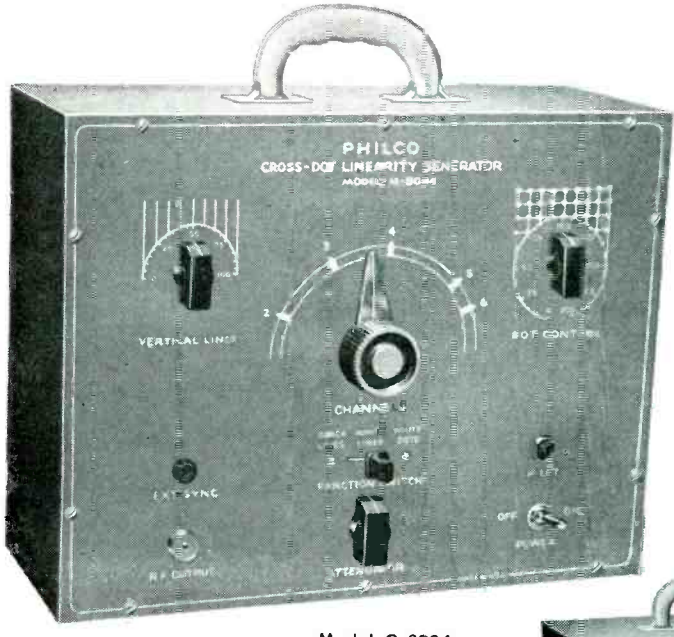

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contact potential effects of the signal diode section, V_4, is used to buck out diode, V_3.

When switch S_4 is in its Q position, the microammeter is connected in the v. t. voltmeter circuit and indicates Q values on a basic range of O to 250. When S_4 is switched to CAL, the meter is connected to the crystal diode circuit to check generator output level. In this position, the generator output may be adjusted (by means of the LEVEL control, R_{14}) to X1 on

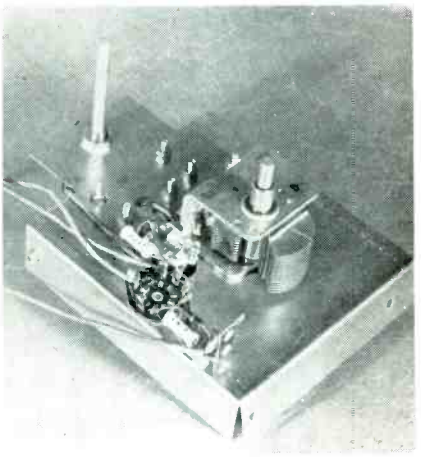

Fig. 6—Front view of the generator subchassis before mounting on the main chassis and panel.

the meter scale (Q range = 0-250), or to X2 (Q range = 0-500).

A standard coil (see in front of Q-meter is *Fig. 1)* is supplied for checking the completed instrument. This coil previously has been checked carefully in the kit manufacturer's laboratory and is labelled with frequency, Q, and capacitance values. In addition, to using this coil initially to set the calibration trimmer, C_7 it may be plugged into the instrument when a standard L value is needed for capacitor Q and capacitance measurements.

The signal generator section is standardized initially by adjusting trimmer C_2 for zero beat with a broadcast station carrier or other radio frequency standard.

The various photographs show constructional details of the Q-meter. It is interesting to note that the Q-measuring section *(Figs. 8* and *9)* and the generator section *(Figs. 6* and *7)* are assembled on separate subchassis and are mounted vertically on the main chassis *(Fig. 5)*. In this way, the shortest possible leads and the "tightest" construction are obtained in each of these sections. The regulated power supply mounted on the main chassis.

Using The Assembled Q-Meter

To Measure Coil Inductance. (1) Set switch S_4 to CAL. (2) Connect the

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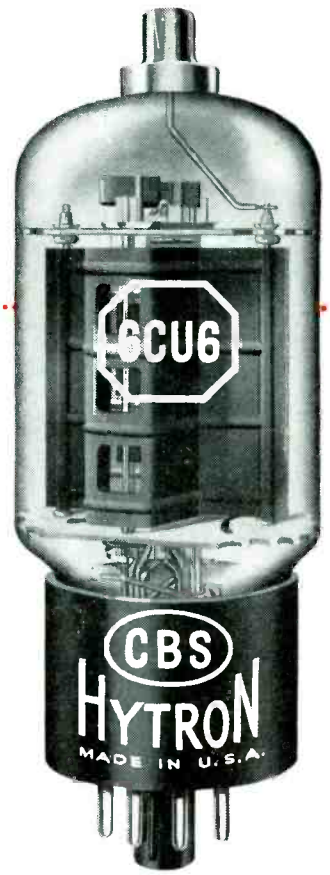
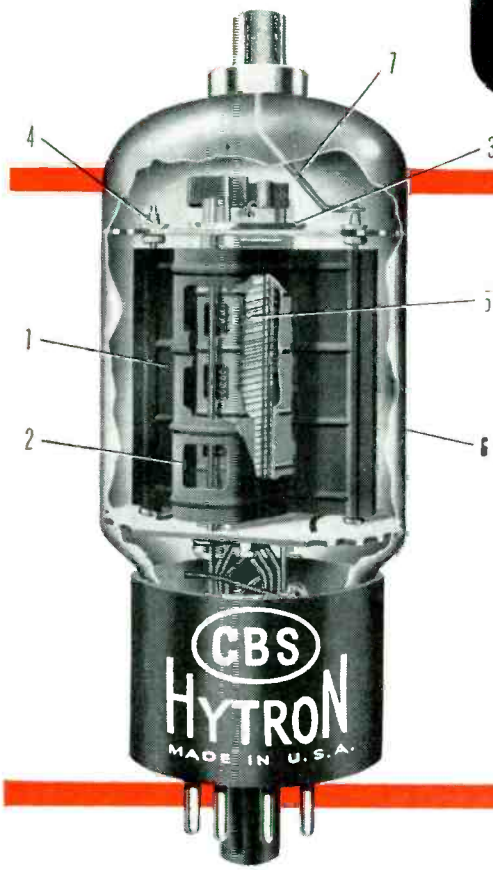
*CTS-RATED: Rated for Continuous Television Service. In TV receivers, five tubes work . . . like transmitting tubes . . . *hard!* You know them: rectifiers, deflection amplifiers, damper diode. Larger-screen sets aggravate the problem. CBS-Hytron recognizes your need for huskier tubes for these sockets. Brand-new designs, not just improved tubes. CTS-Rated 5AW4 already answers your 5U4G low-voltage rectifier problem. Here is your new replacement for the 6BQ6GT: The new CTS-Rated 6CU6. Yes, more CBS-Hytron CTS-Rated tubes are coming. Watch for them.



FORGET: RUN-AWAY PLATE CURRENT; HIGH-VOLTAGE ARC-OVERS; SHRINKING TV PICTURES

Replace 6BQ6GT with New Work-Horse

CBS-HYTRON 6CU6



MECHANICAL FEATURES OF 6CU6

1. Heavier-gauge plate with large radiating fins.
2. Vents in beam plates and plate aligned for maximum radiation of heat from grids.
3. Anti-arc rings for uniform distribution of electrostatic field.
4. Anti-arc mica eyelets.
5. Gold-plated control grid to kill primary emission.
6. T-12 transmitting-type bulb.
7. Plate connection: "hard-soldered" and positioned to reduce heat conduction and arcing.

Cut your call-backs by up to 40 per cent with CBS-Hytron 6CU6. It's directly interchangeable with the 6BQ6GT. It's rated the same as the 6BQ6GT. *But* the new CTS-Rated 6CU6 will *live* under 6BQ6GT maximum ratings. How? The 6CU6 has generous *margins of safety* for: plate dissipation . . . plate current . . . high-voltage insulation . . . and high-line protection.

The older 6BQ6GT is a good tube. But remember it was originally designed for 10- and 12-inch TV sets. Today it carries the load in 21-inch sets. Furthermore, it must combat the accumulated dissipation caused by: line-voltage variations . . . faulty receiver adjustment . . . and shifting values of components due to age and overload. Result: the 6BQ6GT may actually be operated well above its maximum ratings in many TV receivers.

In the new CBS-Hytron 6CU6, you have a tube that takes this rough treatment. And continues to ask for more. High voltage and heat meet their match. The weakest link in the TV tube line-up becomes the strongest. And your call-backs plunge downward. Bet you can't wait to try the CTS-Rated 6CU6. We couldn't. It's a honey! Watch for it soon at your CBS-Hytron distributor's.

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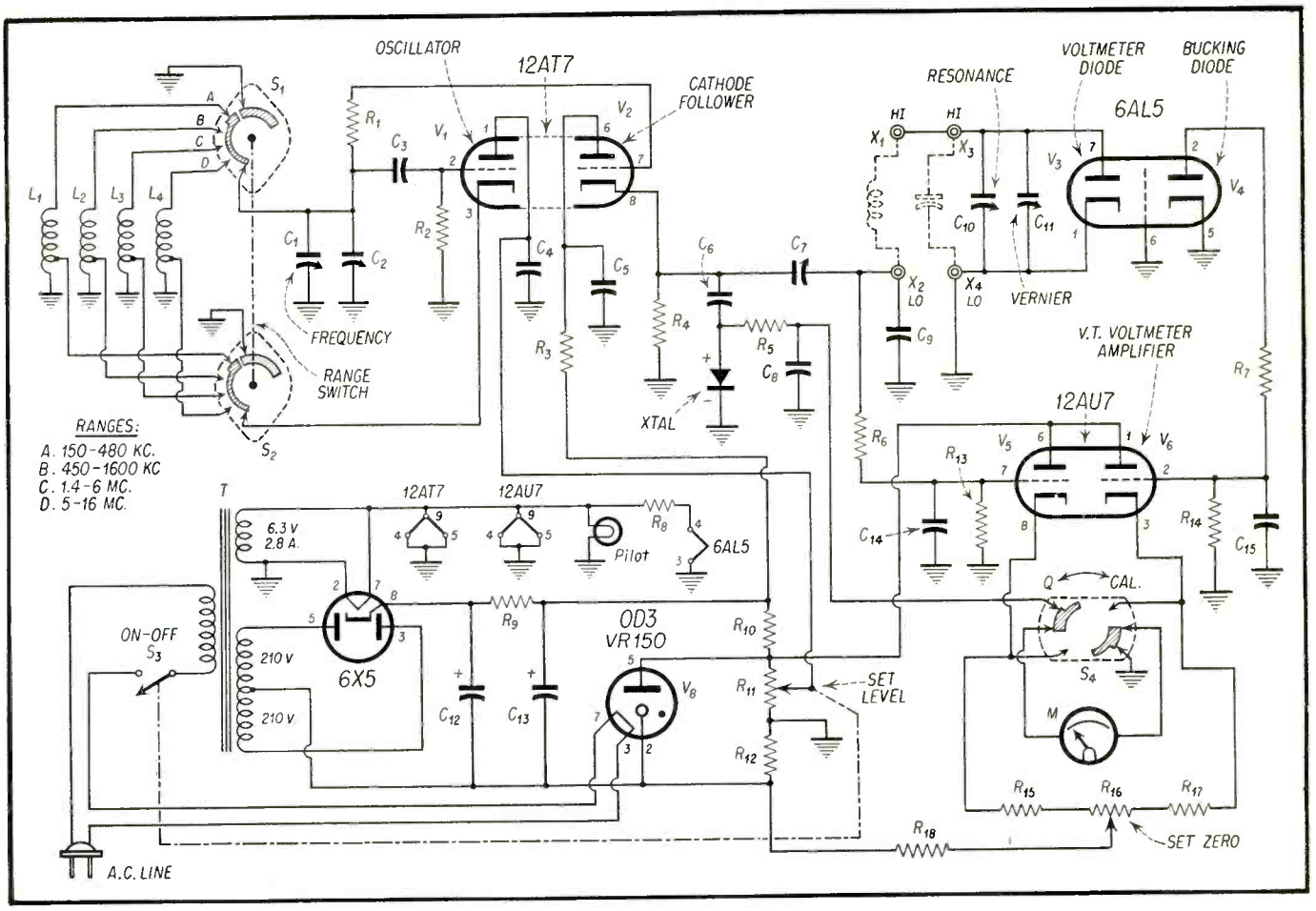


C1—450 $\mu\mu$f generator tuning capacitor
C2—2½ to 6 $\mu\mu$f generator calibration trimmer capacitor
C3—150 $\mu\mu$f ceramic
C4—0.005 μf ceramic
C5—0.005 μf ceramic
C6—0.001 μf ceramic
C7—7-35 $\mu\mu$f Q-circuit calibration trimmer
C8—0.001 μf ceramic
C9—0.005 μf high-Q mica Q-circuit coupling padder
C10—450 $\mu\mu$f Q-circuit resonating capacitor
C11—7 $\mu\mu$f Q-circuit vernier capacitor
C12, C13—Dual 8 μf 450V electrolytic filter
C14—0.001 μf ceramic
C15—0.001 μf ceramic
L1, L2, L3, L4—Special oscillator coils to cover frequency range 150 kc to 18 mc.
M—0-50 dc microammeter
R1—470 ohms ½ watt carbon
R2—22K ½ watt carbon
R3—2200 ohms ½ watt carbon
R4—680 ohms ½ watt carbon
R5—47K ½ watt carbon
R6—3.3 megohms ½ watt carbon
R7—3.3 megohms ½ watt carbon
R8—5.6 ohms 1 watt carbon
R9—1500 ohms 2 watt carbon
R10—2500 ohms 5 watt wirewound
R11—10,000-ohm potentiometer (SET LEVEL control)
R12—4700 ohms 2 watt carbon
R13—3.3 megohms ½ watt carbon
R14—3.3 megohms ½ watt carbon
R15—2200 ohms ½ watt carbon
R16—3000-ohm wirewound potentiometer (SET ZERO control)
R17—2200 ohms ½ watt carbon
R18—100K ½ watt carbon
S1-S2—2-deck, 2-pole, 4-position rotary selector switch (FREQUENCY RANGE selector)
S3—SPST switch on potentiometer R11 (AC POWER ON-OFF)
S4—DPDT rotary switch (METER FUNCTION switch)
T—Power Transformer: 210-0-210 volts, 75-80 ma; 6.3V, 2.8 amp.
XTAL—General-purpose germanium diode (CK705, 1N34, etc.)

Fig. 4—Circuit diagram and component listing of Q meter.

coil to terminals X_1 and X_2. (3) Set switch S_1-S_2 and frequency control C_1 for the proper frequency (250 *kc.*, 790 *kc.*, 2.5 *mc.*, or 7.9 *mc.*, depending upon the direct-reading inductance range desired) and adjust the generator output level to give a deflection to the X1 line on the meter scale. (4) Set the C_{11} dial to zero. (5) Set S_4 to Q. (6) Adjust RESONANCE control C_{10} for peak deflection of the meter. (7) Read the inductance value on the *L* scale of the C_{10} dial, and place the decimal point by referring to the inductance-frequency table printed on the top of the instrument case.

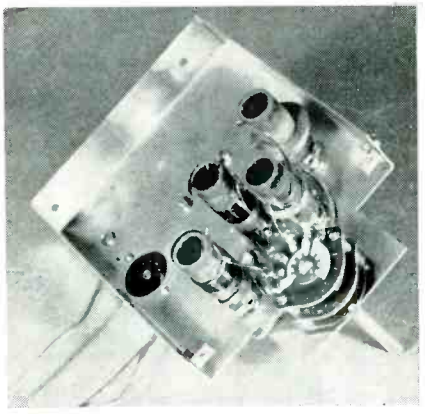


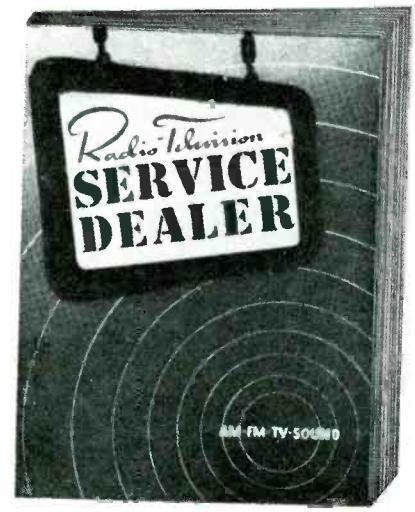
Fig. 7—Coil band-switching unit.

To Measure Coil Q. (1) Set switch S_4 to CAL. (2) Connect the coil under test to terminals X_1 and X_2. (3) Set the generator section to the desired frequency, and adjust R_{11} to give deflection of the meter to X_1. (4) Set S_4 to Q. (5) Adjust C_{10} accurately for peak deflection of the meter. Keep C_{11} at zero. (6) Read the required Q value from the meter. (7) If the meter reads off scale, throw S_4 to CAL and readjust the signal level to X2, return S_4 to Q, read the Q value and multiply it by 2.

To measure Distributed Capacitance of a Coil. (1) Set switch S_4 to CAL.

[*Continued on page 78*]

Our New Publishing Policy Affects YOU!



It has long been our ambition not only to reach every service organization and service dealer in the country, but also to have *SERVICE DEALER* read by every serious-minded employed serviceman.

To that end we have made a master mailing list. On it is the name of every service organization and dealer (having a service department) that has a listing under the "TV Service" classification of Classified Directories issued by the Telephone Companies for every city in the U.S.A. Also on that list are names of thousands of bona-fide service firms who, for one reason or another, are not listed in Telephone Company Classified Directories. Many thousands of dollars, and almost one year of constant research and compilation effort, have gone into this undertaking.

Effective with our November 1953 issue, it will be our policy to send, every month, *and without cost or obligation*, a copy of *SERVICE DEALER* to the owner of *every* established firm and full-time independent serviceman engaged in doing radio-TV service work.

On the other hand, we will continue to seek and we will be happy to accept paid subscriptions from all employed servicemen, part-time independent servicemen, employees of distributors, students and others interested in service work—and, effective in November 1953, such paid subscribers will only be asked to pay the nominal sum of $1.00 for a 2-year (24 issues) subscription. The $1.00 fee required for the 2-year subscription represents just about what it will cost us for postage to send such paid subscribers their 24 copies. Our prime aim is to reach all employed servicemen in the U.S.A. as well as shop owners—and we're making it as painless (financially) as possible—that's why our new 2-year subscription rate is, effective November 1st, 1953, only $1.00. (1-year subs. for 50c will NOT be accepted.)

Service organization owners would be wise to consider buying (or paying part of the cost of) a *SERVICE DEALER* subscription for each employed serviceman so that every technician may maintain his own personal file of time-saving data sheets such as VSSS, TV Field Service Data Sheets, Shop Notes, etc., that appear in every issue.

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Effective with our November issue, we will greatly expand our editorial services. Every issue of *SERVICE DEALER* will consist of many more pages of informative text than heretofore. Every article will be aimed at keeping you abreast of the latest servicing techniques, and our basic publishing policy—that of showing radio-TV servicemen how to do their work more efficiently, in less time, and at greater profit—will remain in effect. Read the next two pages carefully for more pertinent facts in this regard.

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HIGHLIGHTS OF THE NOVEMBER ISSUE:

New Rider TV Field Service Data Sheets

By exclusive arrangement with **John F. Rider, Publisher,** now every issue of **SERVICE DEALER** will carry a complete section of specially prepared service information sheets which were compiled for the use of field TV technicians.

They are a part of a new series of Rider publications which will be titled: **"TV Field Service Manuals."**

Crammed with vital information the prime objective of these data sheets is to enable field service technicians to make light repairs in the set-owners' homes with a minimum expenditure of time.

The TV Field Service data sheets scheduled to appear in **SERVICE DEALER** monthly will always relate to the newest and current TV set models . . . and should prove to be one of the most valuable working aids ever made available to field service technicians.

Video Speed Servicing Systems (VSSS)

Each issue of **SERVICE DEALER** contains 24 new VSSS data sheets. These are troubles, "bugs," and other types of receiver headaches that take up so much of the technician's time, and which are pinpointed for him in such a manner as to enable him to recognize the symptom and effect the cure in the quickest possible time.

Each item is accompanied by a partial schematic, thereby making it so much easier to identify and locate the components involved in the repair.

This material has been obtained from manufacturers' and distributors' service departments, independent servicing organizations, and practising servicing technicians. Before presentation to our readers it is carefully selected, analyzed, and simplified so that optimum benefits are obtained from the material and its presentation.

Servicing Video I-F Systems

by Matthew Mandl

RADIO-TV SERVICE DEALER spares no expense in bringing to its readers authoritative articles by top writers in the field.

This article is one in a series titled, "Symposium," in which each section of the TV receiver is given individual treatment from the point of view of the various types of circuits being used to date. In this manner the practising TV technician knows what to expect in the field.

This feature is presented monthly, and has found widespread acceptance among our readers. Read the Symposium series and keep up to date on TV circuitry.

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For every $1 worth of parts, tubes and accessories bought annually by servicemen for replacement use or for new installations, an average of $2 in labor fees will be charged to set owners. Thus, in 1954 the Nation's radio-TV set owners will pay over $2,400,000,000 to servicemen—servicemen will gross over $1,000,000,000 in salaries—Parts Distributors will sell servicemen over $1,000,000,000 worth of merchandise for new installations and replacement use.

Statistics Compiled by Radio-TV Service Dealer—August 11, 1953

I. Facts and Figures:

1941—80,000,000 receivers in use. (No TV)
Replacement Market in $:

$ 44,000,000	replacement parts
42,000,000	replacement tubes
$ 86,000,000	Total*

*In all cases these are net $ values received by mfrs., not retail list prices.

Bulk of this $ volume was done by:

14,000	service organizations
16,000	service dealers
30,000	Total

10-12,000 independent servicemen were relatively unimportant factors.

1946—90,000,000 receivers in use. (No TV)
Replacement Market in $:

$ 60,000,000	replacement parts
51,000,000	replacement tubes
$111,000,000	Total

Bulk of this $ volume done by:

17,000	service organizations
8,000	service dealers*
25,000	Total

*War (shortages had depleted the ranks of service dealers.)

1950—96,000,000 receivers and 5,000,000 TV sets in use.
Replacement Market in $:

$100,000,000	replacement parts
62,000,000	associated equipment such as TV accessories, rotors, antennas, boosters, etc.
270,000,000	replacement tubes*
$432,000,000	Total

*Includes picture tubes.

Note that a radical change took place, accounted for by the advent of TV, i.e.: 1) through the GI training many independent servicemen came into the field, 2) TV specialty service contractors obtained a very large share of $ billing.

Bulk of this $ volume done by:

20,000	service organizations who did	$120,000,000
17,000	service dealers " "	175,000,000
970	TV specialty contractors "	95,000,000
15,000	independent servicemen "	42,000,000
52,970	firms and individuals	$432,000,000

1953—98,000,000 receivers and 27,000,000 TV sets in use.

Replacement Market in $:

$265,000,000	replacement parts
86,000,000	associated equipment, antennas, boosters, etc.
320,000,000	replacement receiver tubes
220,000,000	replacement picture tubes
$891,000,000	Total*

*Remember these are net prices by mfrs., not retail list prices. Associated equipment such as antennas, boosters, etc., while for new installations, are called part of the "replacement market," because Parts Distributors sold them to servicemen.

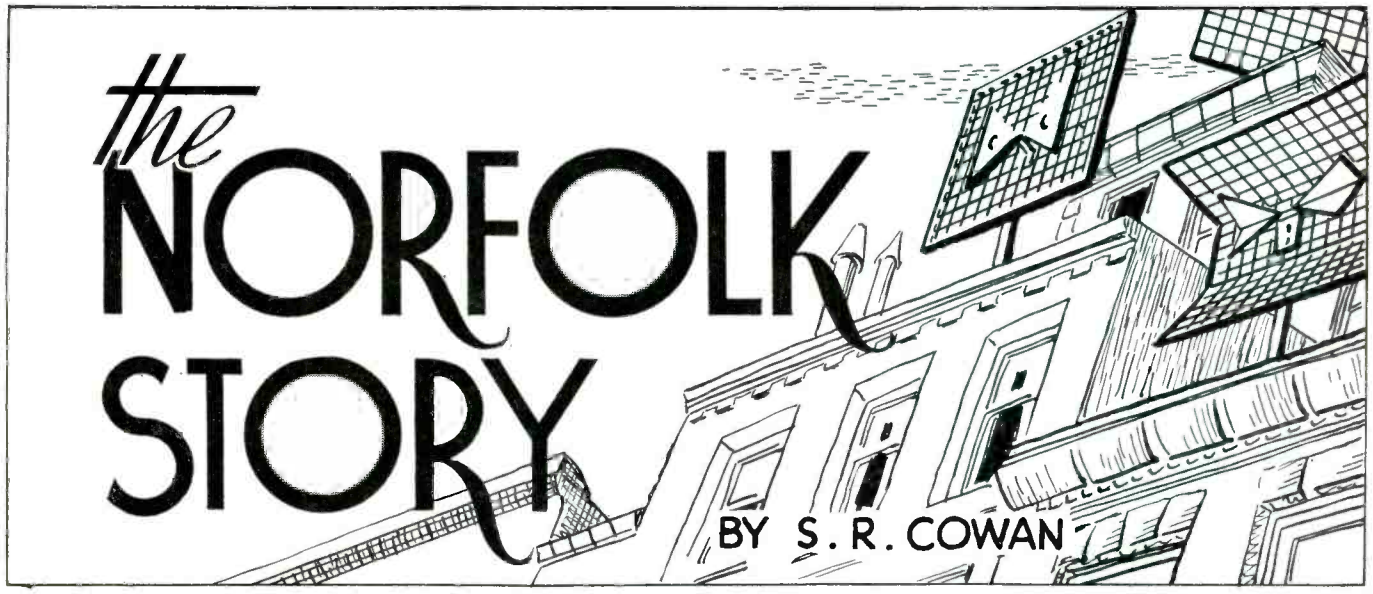
Bulk of this $ volume done by:

32,000	service organizations who did	$273,000,000
23,000	service dealers " "	410,000,000
2,450	TV specialty service contractors	165,000,000
30,000	independent servicemen	43,000,000
87,450	firms and individuals	$891,000,000

II. Conclusion:

A. The vast increase in replacement $ volume is primarily accounted for by the increased number of TV sets being used, and conversions being done.

B. Every time 5,000,000 additional TV sets go into regular use, the annual replacement market $ volume increases by approximately $140,000,000. In other words, statistics given above indicate that the average TV set in use requires $27 worth of replacement tubes and/or parts per year, while the average radio receiver requires $1.80 worth of replacement and/or tubes per year for maintenance outlay.



The advent of UHF has brought with it many problems and headaches to technicians and dealers in various communities ready to be served by this new service. To compensate for this, however, the amount of money being spent, and about to be spent by the public is fantastic as evidenced by this article.

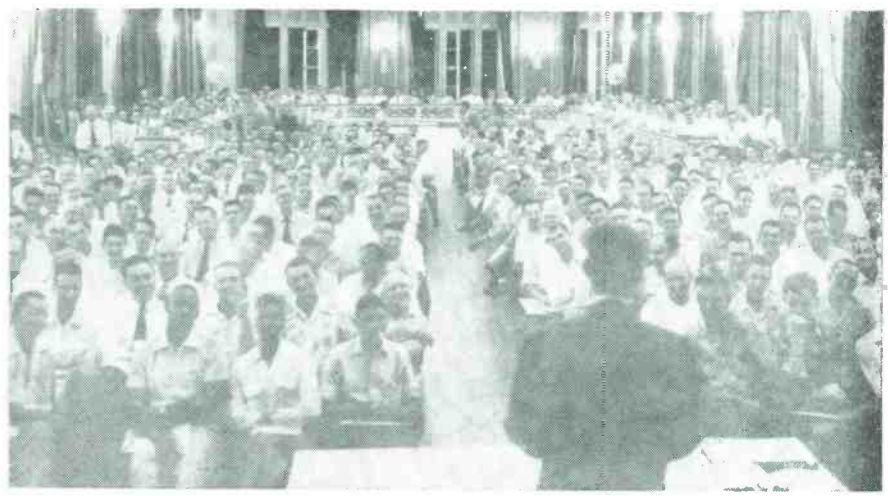
HERE for the first time is a factual story showing how the starting of operations of a new *uhf* TV station affects the earning capacity of, and poses problems for, the servicemen within its range.

Norfolk, Virginia, has enjoyed the programs of *vhf* TV station, (WTAR-TV), for almost two years. It is estimated that upwards of 175,000 TVsets in 150,00 homes function within its signal area, and that approximately 820 TV service organizations with a total manpower of 2,400 technicians have handled the original installations and now account for the maintenance of these receivers. We have, on reliable information, ascertained that during the past twelve months the service business in the Norfolk area approximated $11,000,000. Thus, if each of the 820 service organizations got its share of the total business, its dollar volume approximated $134,000 or just under $12,000 per shop a month. Broken down further, each shop charged about $8,000 for labor and required, at net distributor prices, around $4,000 worth of replacement tubes, parts and accessories, etc., on the average each month.

Early in August came the "big news!" —that Norfolk, as of September 19th, 1953, would have a new *uhf* station, (WVEC-TV, Channel 15), operating, with the transmitter located just outside of Norfolk, in Hampton, Va. And the report was that soon thereafter two other new *uhf* stations would also begin to serve the area.

It so happens that all the new stations have transmitters situated at widely spaced localities not in line with each other and thus practically none of the receiving antennas now being used are oriented so they can receive at optimum all the signals soon to be transmitted. Naturally this posed a problem for the Norfolk service fraternity and for Norfolk's TVset owners. Right from the outset, because the new *uhf* station is located in a different direction from the present *vhf* station, one knew that Norfolk would need almost 100% antenna servicing.

Recognizing the many problems attendant upon launching a new *uhf* station, the new *uhf* telecast station management overlooked no angles which would deter their venture from immediate acceptance and success. Their survey even disclosed that many homes in the Norfolk area did not own at present any TVset because potential buyers had not been completely sold on accepting a single program source, and especially because there was



This overflowing crowd of dealers and technicians are listening to Publisher S. R. Cowan deliver his address.

Some of the sponsors and company representatives responsible for the Norfolk Forum. Left to right are (back row) Bill Turner, Bill Shumate and Richard Hyer, and (front row) Fred N. Dodge, John Triplett, Sam Schussel, Miss Bailey, Gordon Dougherty, and H. F. Rieth.

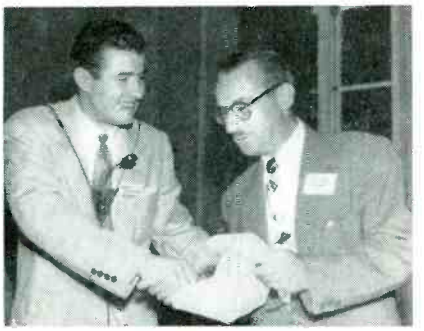
resistance to the present *vhf* station program policy of offering a high percentage of re-telecasts by means of kinescope recordings. One of the prime policies of the new *uhf* station is to be that of offering original and simultaneous live talent programs of popular rating.

So it was apparent that with the advent of the new *uhf* station would come the problem of: "How could Norfolk's present 820 service dealers handle the many new original installations besides the huge volume of conversion-to-*uhf* of the 150,000 or more receivers already in use?"

Broadcast station management wasted no time. Norfolk's three leading radio parts distributing firms (Radio Supply Co., Inc., and Radio Parts Distributing Co., of Norfolk and General Supply Co., of Newport News), collaborated with the new station in a two-fold educational program. One was to "sell" TVset owners on the advantages that would acrue from the new *uhf* station, by convincing them that the high cost of conversion would be a justifiable investment; and the other a technical educational program that would qualify the local servicemen for the colossal job they had facing them. NBC, represented by Fred Dodge, and Tom Cheisman, owner of one of the new *uhf* stations, had marvelous cooperation from the local newspapers which carried the story on the soon-to-be-operating station. The public was well informed. Servicemen got fine cooperation from their distributors.

Simultaneously the three distributing firms collaborated and their first move was to engage the Grand Ball Room of the famous Norfolk Monticello Hotel where on Monday evening, August 10th, the first of a series of technical forums was held. Every serviceman who could be reached was invited to attend, and the record-shattering attendance of almost 900 service dealers and servicemen who were present attested to the success of the venture. The preceding page shows a picture of most of the audience listening to the talk delivered by S. R. (Sandy) Cowan, Publisher of "Service Dealer."

The technical program included: Tom Cheisman, (owner WVEC-TV), "The problems of putting a UHF station on the air"; Fred Dodge (National Broadcasting Co.), "What 150,000 fast conversions to UHF mean to Norfolk's set-owners and servicemen"; Harold Rieth (Regency Div. of IDEA, Inc.), "UHF Converters"; Sam Schlussel, (Channel Master Corp.), "UHF-VHF Antennas"; Richard Hyer, Federal Telephone & Radio Corp.), "UHF Cable"; and S. R. Cowan ("Service Dealer" Magazine), "How to determine what prices must be charged for your services." The program began at 8 p.m. sharp and was concluded at 11:30. To add a bit of glamour to the evening's doing's Dorothy Bailey, "Miss Virginia of 1953" acted as hostess and handed to each serviceman present at the forum a package kit containing the literature of manufacturers of TV parts and equipment handled by the parts distributors who sponsored the event.



Shown from left to right are Gordon Dougherty of Regency, and S. R. Cowan, Publisher of Radio TV Service Dealer.

Highlights Worth Considering

As the advent of new *uhf* station coming to Norfolk is merely typical of what is happening regularly in all other parts of the country where new stations are going into operation either on *uhf* or *vhf*, it behooves a technical publication such as this to report to its servicemen readers just what effect any new station can have on their pocketbooks and available time.

To begin with, the average *vhf* TVset owner will have to pay from $90 to $175 for a *uhf* conversion job, and sometimes even more depending upon the local circumstances, such as the location of the new transmitter, etc. In Norfolk, the serviceman's job obviously was to make the conversion itself and also see to it that the set-owner's outlay was protected by having the antenna installation so pre-planned that it would be able to afford peak efficiency not only now with one *uhf* and one *vhf* station, but also when the other stations also begin operations.

So, a combination *uhf-vhf* antenna, a properly positioned and guyed mast, an antenna rotating device or its equivalent in the selection of antenna array, a *uhf* converter and necessary cable were basic and mandatory requirements. Yes, the average Norfolk conversion job is estimated to be in the neighborhood of $125-$150 with fringe area installations requiring boosters running $30 higher. Broken down dollarwise, a $150 conversion job represents a $100 outlay for parts and accessories at the parts distributor's store with the $50 balance going to servicemen for labor charges.

The Time Factor

Studying conversion jobs from locales having prior experience with the problem it is accepted that the average team of two servicemen working together can handle an average of four complete conversions in an 8-hour day. Translated into round figures, the advent of *uhf* to Norfolk meant that the 820 service firms there with 2,400 technicians available, working at maximum speed and doing nothing but conversion jobs could handle about 4,800 conversions daily. In 10 working days they could do 48,000 jobs or in about six weeks they could handle all of the 150,000 potential conversion jobs.

Of course it was realized that not all the servicemen would be able to

[*Continued on page 77*]

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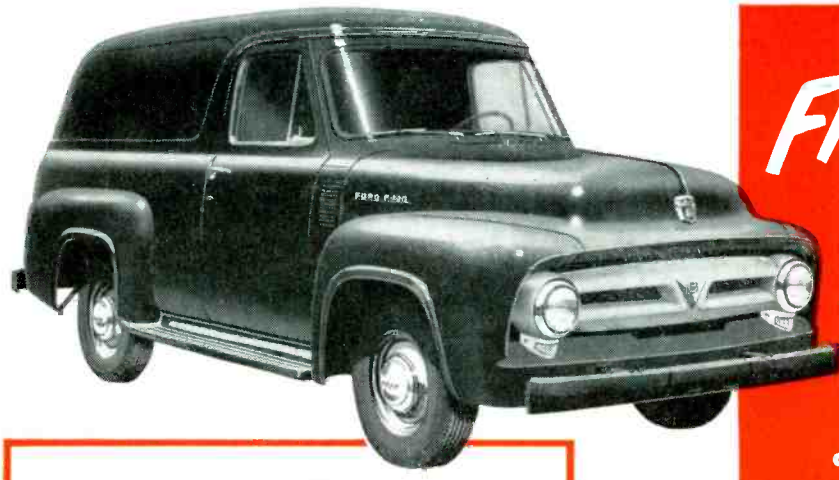

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TRANSISTOR PARAMETERS

by RUFUS P. TURNER

The use of transistors in electronic circuits is finding ever increasing applications. This article is a follow-up on, "Germanium and Radio-Electronics" by the same author in the May, 1953 issue of RTSD. Technicians with an eye to the future would do well to digest its contents.

THE input and output terminals of a transistor are in definite ohmic relationship with each other. Because of this fact, voltages and currents in the output circuit have important effects upon voltages and currents in the input circuit. This is not true, to any great extent, of the vacuum tube. The newcomer to transistor technology accordingly must become familiar with these relationships before attempting to apply the transistor correctly to circuits.

At *dc* and low frequencies, the transistor impedances may be regarded as essentially resistive, and the transistor may be considered as a simple 3-terminal network with internal resistances arranged as shown in *Fig. 1*. Resistance r_e is that component associated with the emitter, r_c is the internal collector resistance, and r_b the base resistance.

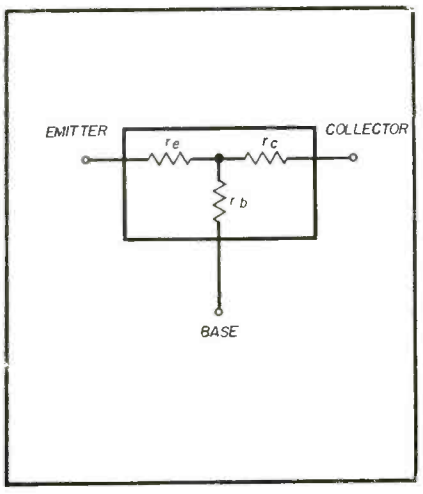

Fig. 1—Transistor internal resistance components.

In the point contact transistor, these three resistances are inherent in the whisker contacts, the germanium wafer, and the electrical connection to the latter. In the junction transistor, they are inherent in the three separate conduction areas and in the electrical connections thereto.

Note that r_e, r_c, and r_b actually are internal and are not the lumped resistances in the external circuit of the transistor. Thus, an emitter resistance R_e (note capital-letter designation) *in an amplifier circuit* would be in series with the internal resistance r_e, a collector load resistance R_c (or R_L) in series with r_c, and a base resistor R_b in series with r_b.

In point contact and PNP junction transistors, the emitter resistance is low because the emitter electrode is positive-biased with respect to the base and, like a positive-biased point contact diode, passes a relatively large current. The collector resistance, r_c, on the other hand, is high, since the collector electrode is negative-biased with respect to the base and, like a negative-biased point contact diode, passes only a small reverse current. In the NPN junction transistor, emitter resistance also is low and collector resistance high, although the emitter is biased with a negative voltage and the collector with a positive polarity. In this case, current is carried in directions opposite to those in the previously-discussed transistors, but the resistances are similar. The rule of high input conductance and low output conductance still holds. These effects account for the low input impedance and high output impedance of the transistor. By careful control of the resistivity of the germanium and of the technique of attaching conductors to the base, the base resistance (r_b) is kept low in transistors intended for amplifier and general-purpose use, since a high value of

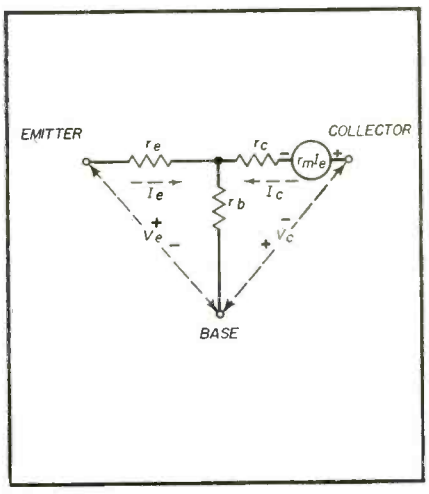

Fig. 2—Equivalent 3-terminal network of transistor.

base resistance favors negative resistance and attendant instability. In transistors designed especially for trigger, switching, and counting applications, negative resistance usually is desirable and r_b need not be low.

From the equivalent network in *Fig. 1*, it is evident that a portion of the voltage applied to the collector terminal might also be "felt" at the emitter terminal, and vice versa.

The following input, output, and transfer resistances are characteristic of the transistor triode. The symbols used in this listing now are standard in transistor practice:

$R11 = r_e + r_b$

$R12 = r_b$

$R21 = r_b + r_m$ (For the grounded-base type of circuit.)

$R22 = r_c + r_b$

The term r_m is defined as the *transfer impedance* of the network or the *net mutual resistance* of the transistor.

Figure 2 is a complete equivalent 3-terminal network of the transistor triode in the grounded-base arrangement, with electrode voltages and currents indicated. The polarities shown apply to point contact and PNP junction transistors and would be reversed for NPN junction transistors. Here, V_c is the applied collector voltage, and I_c the resulting collector current. The symbol $r_m I_e$ represents an apparent internal generator which is analogous to uE_g in a vacuum tube.

Checking Characteristics

Figure 3 is a test setup for taking point-by-point data on transistor characteristics. Two separate adjustable *dc* power supplies (*A* and *B*) are required, one to furnish the emitter voltage and the other for the collector voltage. Emitter supply *A* is adjustable from zero to 2 volts; collector supply *B* from zero to 50 volts. Constant-current supplies are desirable for operating transistors, but since these are not too readily available, conventional power supplies having low output impedance may be used.

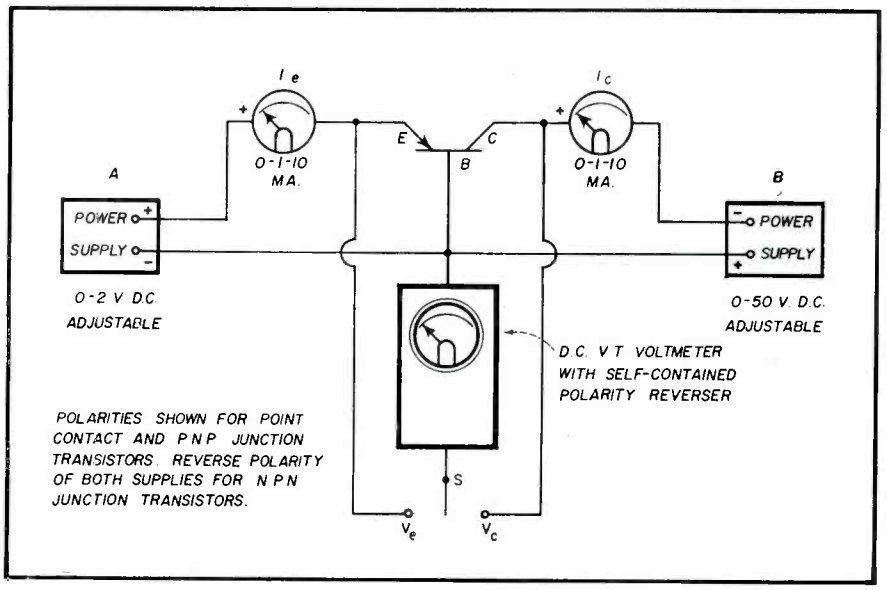

Fig. 3—Test set-up for transistor curve data.

Two 0-1-10 *dc* milliammeters are provided. Meter I_e checks emitter current; I_c collector current. Emitter and collector voltages, with respect to the grounded base, are measured with a high-impedance-input *dc* vacuum-tube voltmeter. When the voltmeter changeover switch, *S*, is in its V_e position, the emitter voltage is measured. When *S* is in its V_c position, the collector voltage is measured. The voltmeter must have a polarity switch, in order that the polarity might be changed when switching between emitter and collector.

The setup will enable the operator to take point-by-point data for plotting curves of transistor performance, or for checking the static characteristics of transistors. Polarities of bias voltages shown in *Fig. 3* are for point contact and PNP junction transistors. Each power supply polarity must be reversed when checking NPN junction transistors.

Vacuum-tube curves show one electrode current plotted as a function of the voltage of that electrode at various selected voltages of another electrode. These are so-called constant voltage curves. For example, plate current is plotted against plate voltage to give a curve for each of several selected grid voltage values. In transistor practice, however, because the transistor is a current-operated device, current is plotted against voltage for various constant *current* levels. Thus, emitter current is plotted against emitter voltage to give a separate curve for each of several selected constant collector current levels. The reason for this procedure, aside from the transistor being current-operated, is the fact that the various internally evident resistances are mutually related and the magnitude of voltage or current in one portion of the transistor circuit will be affected by voltage and current levels in the other portion.

The following paragraphs discuss the nature of the various transistor performance curves and the procedure to be followed in plotting them.

Curve 1. A curve may be plotted to show emitter current, I_e versus emitter voltage V_e for a constant value of collector current I_c. A family of such curves may be made corresponding to various selected values of I_c.

To take these data, throw switch *S* to its V_e position, and adjust power

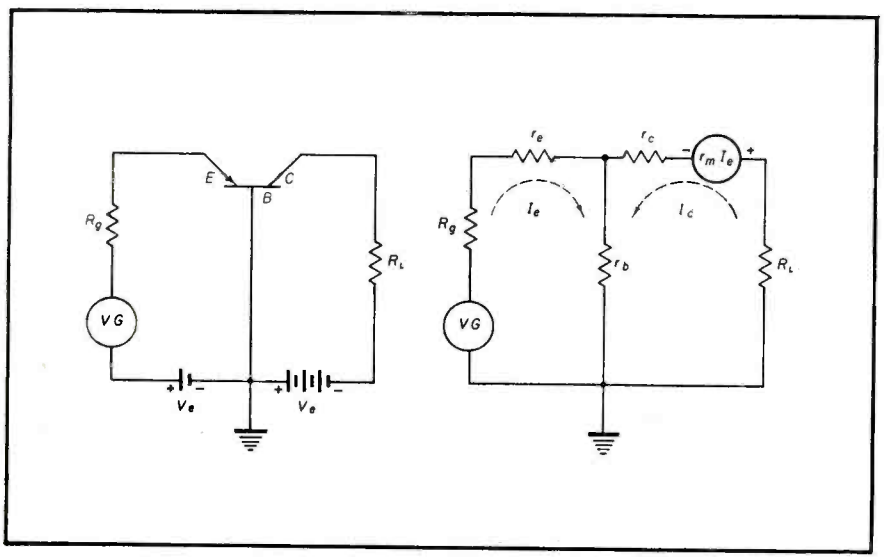

Fig. 4—Grounded-base amplifier and equivalent circuit.

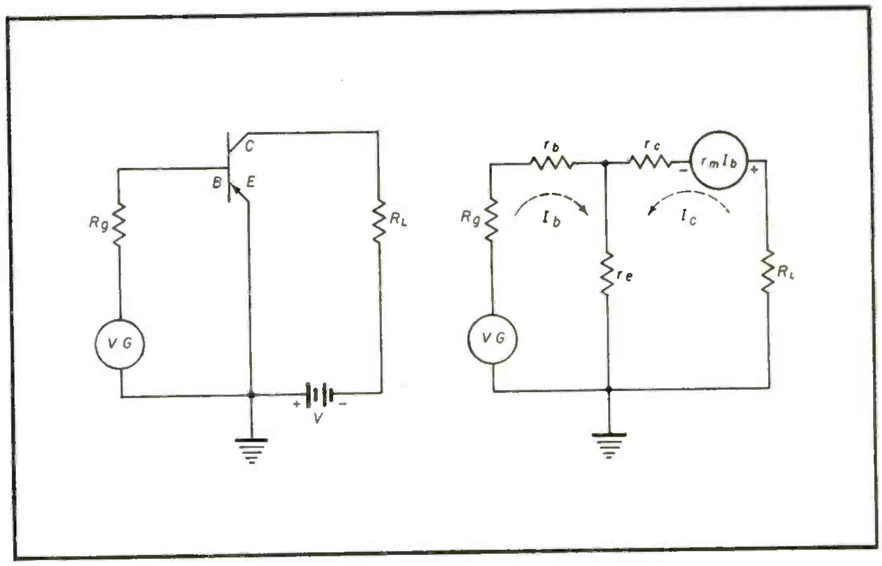

Fig. 5—Grounded-emitter amplifier and equivalent circuit.

supply *A* for the desired step value of V_e. Adjust power supply *B* until I_e is selected constant value. Read the corresponding I_e value.

The dynamic value of transistor resistance *R11* may be determined as the slope of this curve.

Curve 2. Collector current I_c is plotted against emitter voltage V_e for a constant value of emitter current I_e. A stant value of collector value of collector current I_c. A family of such curves may be made, corresponding to various selected values of I_c.

To take these data, throw switch *S* to its V_c position. Adjust power supply *B* for the desired step value of V_c. Adjust power supply *A* until I_c is the desired constant value. Read the corresponding I_e value.

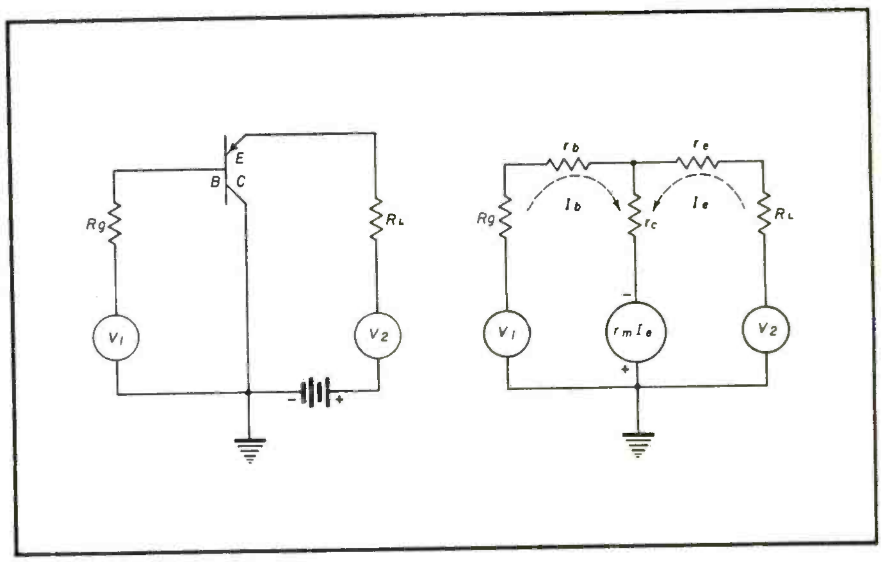

Fig. 6—Grounded-collector amplifier and equivalent circuit.

family of such curves may be made, corresponding to various selected values of I_e.

To take these data, throw switch *S* to its V_e position, and adjust power supply *A* for the desired step value of V_e. Adjust power supply *B* until I_c is the desired constant value. Read the corresponding I_c value.

The dynamic value of transistor resistance *R12* may be determined as the slope of this curve.

Curve 3. Emitter current I_e is plotted against collector voltage V_c for a constant value of emitter current I_e.

The dynamic value of transistor resistance *R21* may be determined as the slope of this curve.

Curve 4. Collector current I_c is plotted against collector voltage V_c for a constant value of emitter current I_e. A family of such curves may be made, corresponding to various selected values of I_e.

To take these data, throw switch *S* to its V_c position, and adjust power supply *B* for the desired step value of V_c. Then adjust power supply *A* until

[*Continued on page 74*]

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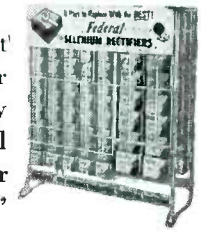

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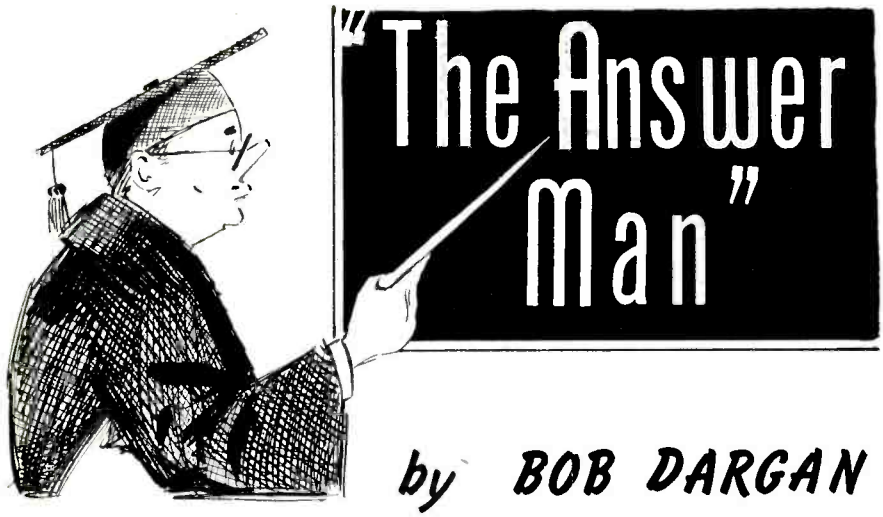


Beginning with this issue RTSD institutes a service to its readers under the department heading, "The Answer Man."

In the past we have answered inquiries and questions directly. However, many of these questions find universal application and we feel that our readers should benefit by the replies.

Henceforth, certain questions of universal appeal, relating to the servicing of TV receivers which are sent in by our readers will be answered by Bob Dargan, our Answer Man, as soon as possible, and will appear on these pages. Answers to many other technical questions that are submitted will not appear in print. However, as heretofore, all questions will be acknowledged and answered. Therefore, if you have a novel or serious problem, address questions as follows: "Answer Man," Radio-Television Service Dealer magazine, 67 W. 44th Street, New York 36, N.Y.

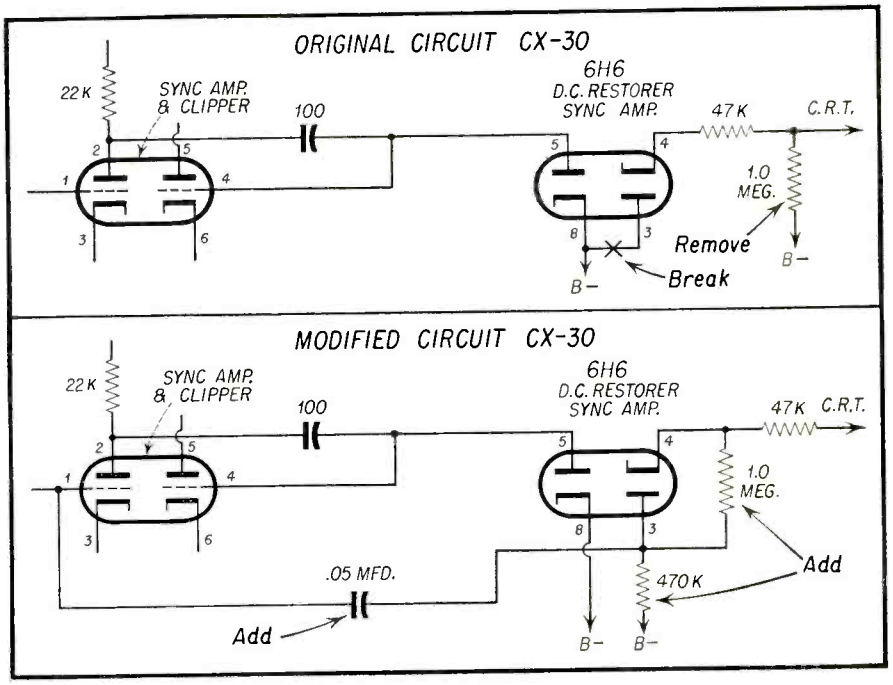
Dear Answer Man:

I have a Capehart Farnsworth receiver in the shop, model #3007-M, Serial #A665709. It is Chassis CX-30, Series A and uses a 16" picture tube. This set, I understand, has been using a 6H6 for a sync separator and *dc* restorer. I am told that the company later issued a revised drawing showing how to change from a 6H6 to a 12SN7 tube in this application, including circuit changes, etc. So far I have been unable to get hold of any. I have looked through the Video Speed Servicing Systems and I notice you haven't printed anything on this trouble. Can you help me out on this problem. That's #1.

#2 is I'd like to obtain a schematic on an Air Marshall 17" television receiver, Serial #12040, Code 26.

This set is made by Air Marshal Corporation, 12 East 44th Street, New York 17, N.Y. I am having a tough time with audio hum that I can't filter out. I wrote them and have never received an answer. It's an *ac dc* type of power supply..

R. M. D.
Baltimore, Md.



Dear R. M. D.

Concerning a modification in the Capehart Farnsworth CX-30 chassis, changing the 6H6 tube to a 12SN7 tube for the sync amplifier, *dc* restorer, your information is incorrect. In fact the reverse is true. The early CX-30 chassis employed the 12SN7 tube for this function and the circuit was

[*Continued on page 68*]

FIELD STRENGTH METER

by **WYN STARKS and DAN LERNER**

(Test Equipment Section, Philco Corp.)

AN accurate direct reading field strength meter has many practical uses in the electronics field. Among these are antenna measurements and booster gain tests. A commercial unit of this type for use on *vhf* TV channels 2 thru 13 is shown in *Fig. 1*.

The Field Strength Meter is a very versatile instrument, the uses of which have not been fully taken advantage of by the servicing technician. This article indicates a number of valuable applications of this servicing aid.

APPLICATIONS

Antenna Installations:

With the field-strength meter connected to the leadin of an antenna, various locations, adjustments, and changes may be tried, while observing the output indication of the instrument. Where there is more than one station it may be necessary to select a compromise position for the antenna. The field-strength meter is first used to take a relative reading on the best condition for each station. A compromise position of the antenna may then be determined which will give, as nearly as possible, equal performance on the desired stations. In some cases it will be necessary to adjust for best performance on a weaker station while sacrificing some signal level from the strong ones. In all cases the results should be checked on the screen of the television receiver for ghosts and general performance.

Antenna Distribution Systems

In checking signals along a distribution system which uses 75-ohm coaxial lines, the field-strength meter should be used with a *vhf* 75-to-300 ohm matching transformer. Allowance must be made for the 6 db increase in gain due to impedance stepup.

Fig. 1—Physical appearance of the Philco Field Strength Meter, Model M8104. Note sturdy construction and accessibility of controls.

Precise db level can be made by using the field-strength meter in conjunction with a matching transformer and a calibrated step attenuator, as illustrated in *Fig. 2*. This arrangement permits quick checking of the level and the gain or loss of line amplifiers in antenna distribution systems. To check a line amplifier, the test cable of the field-strength meter is first connected to the input line (which is removed from the line amplifier) and the step attenuator is set for zero attenuation. The field-strength meter is then adjusted to center the meter pointer on the scale and thus calibrate a standard level for the input (low) side of the amplifier. The input cable is replaced on the input of the amplifier, and the field-strength meter test cable is connected to the output of the amplifier. The step attenuator is adjusted to bring the field-strength meter reading back to the standard center-scale indication, after which the db gain of the amplifier is read from the step attenuator, the gain being equal to the number of db added to re-establish the signal level. Amplifier gains can thereby be set to maintain correct signal levels all along the system. For more exact results, the signal can be produced by a generator at the head of the line, the input signal strength being set to simulate the average signal level expected from the antenna. Measurements can be made in a large system by setting up the equipment in a truck,

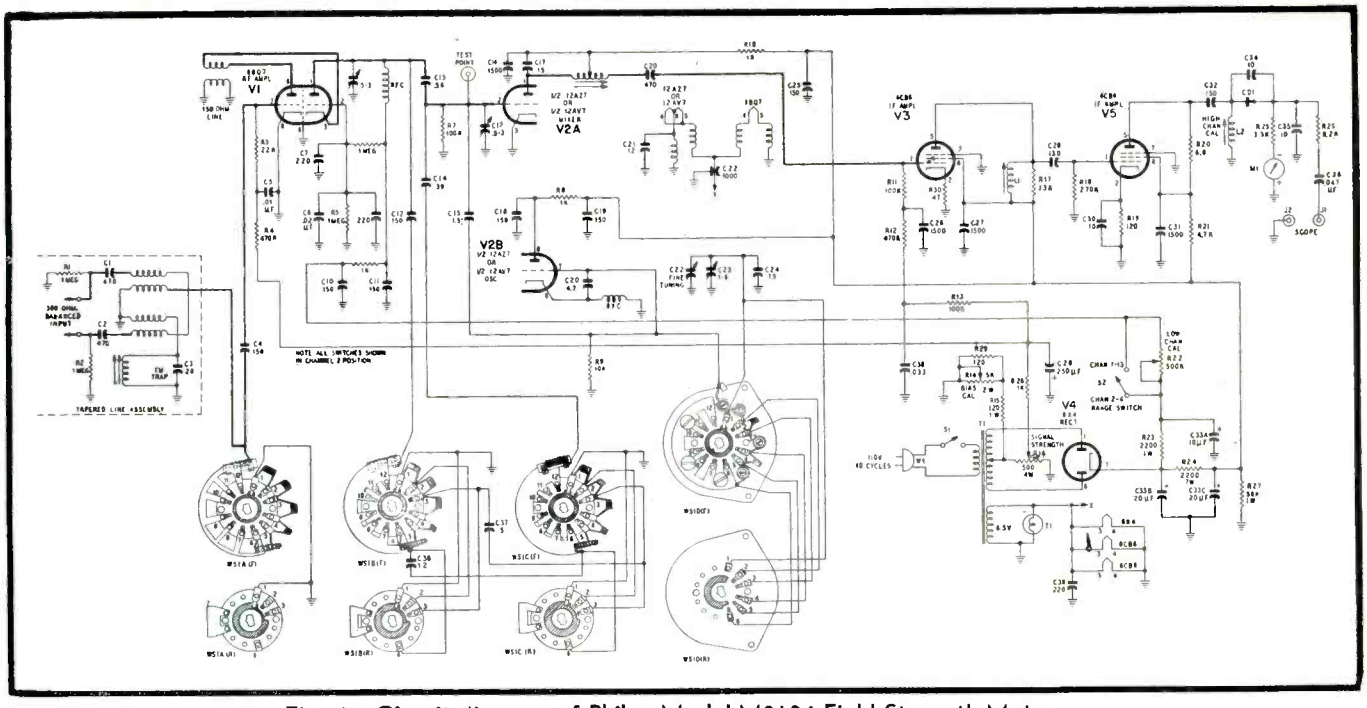


Fig. 4—Circuit diagram of Philco Model M8104 Field Strength Meter.

the test cables being connected to the amplifier on the line pole.

Comparison Checks of Booster Amplifiers

The field-strength meter is useful for making gain checks on boosters and other *vhf* amplifiers. This type of amplifier usually operates at such low signal levels that it is not practical to use probes and oscilloscopes for dynamic testing. However, the field-strength meter, because of its great sensitivity, is ideal for making this type of test. When used with a scope to check *rf* levels and gain it becomes, in effect, a super-sensitive detector and scope amplifier.

To make this type of test, the field-strength meter is connected to the input of the amplifier, and a signal-strength reading is taken. Then the instrument is switched to the output leads of the amplifier or booster, and another reading is taken. From the two readings it will be evident whether the amplifier is working properly, and the ratio between the two readings will provide an approximate check on the gain of the amplifier. Accurate gain checks can be made by using the step attenuator and setup shown in *Fig. 2*.

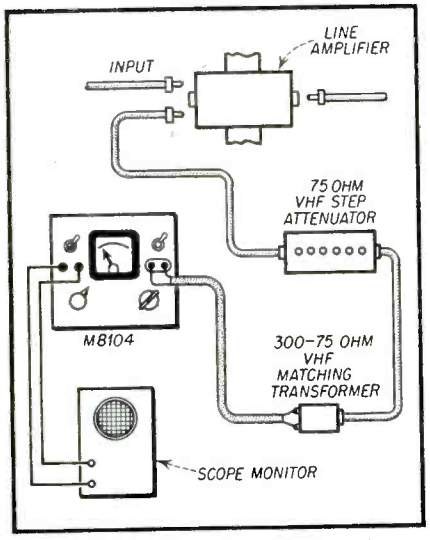


Fig. 2—Meter hookup with matching transformer and attenuator.

MEASUREMENT TECHNIQUES

Whenever signal-level measurements are made using the field-strength meter, it is always desirable to observe the following precautions:

1. Connecting cables or lines carrying *rf* signals should not run parallel to each other, and should not cross, unless unavoidable.

2. RF cables and lines should always be properly terminated in their characteristic impedance. Since in practice this is not always possible, it may be necessary to insert a resistance matching pad in the line. See *Fig. 3*. While this will "cool off" the line by reducing standing waves, it will also cause some loss in signal strength. In the case of a 6 db pad it will cause the signal to drop two times down from the original level.

3. Any connections in the cables and lines should be carefully made to avoid changing the spacing or size of the wire at any point. If precise measurements are to be made, the connectors which are used should be rated for use with the impedance of the line.

4. "Hot" cables are usually caused by either poor line matching or excessive leakage around the lines when checking at low signal levels. Proper termination, shielding, and grounding with heavy straps should minimize this difficulty.

5. Where standing waves on an *rf* line are unavoidable, the line should be tuned for maximum indication on the field-strength meter. This can be done satisfactorily by running the hand or a piece of tinfoil along the line to the point which gives the maximum reading.

CIRCUIT DESCRIPTION

The Philco Model M8104 *vhf* field strength meter is an example of the type of instrument suitable for making the measurements described. This instrument is designed around the highly efficient, low-noise Philco *vhf* television

[*Continued on page 74*]

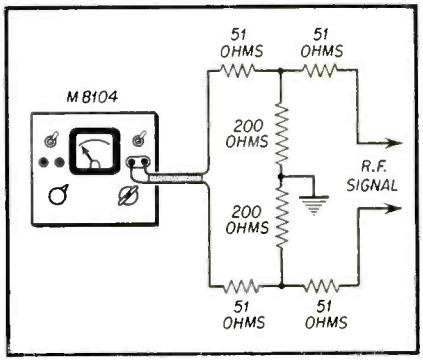


Fig. 3—Use of resistance pad with Field Strength Meter.

ASSOCIATION NEWS

Sylvania Wins NATESA Award Second Year In Row

For the second year in a row Sylvania has received a NATESA Friends or Service Management Award for "outstanding service to service management in creating better customer relations."

Frank Moch (right), president of the National Alliance of Television and Electronic Service Associations, is shown above giving the award to Frank W. Mansfield, Sylvania's Director of Sales Research.

NATESA

The independent TV-Radio-Electronic service people across the entire nation who have done so much to make a brand new giant industry, TV, possible by doing such a remarkable job of installing and maintaining about 20 million TV sets practically without help from any other segment of the industry, met at a convention in Chicago's Morrison Hotel, October 9th to 11th. A really packed three day official schedule of discussions, seminars, demonstrations and lecturers had been set up to bring servicemen up to date on latest developments. New products were viewed and new circuits and features such as color TV, *UHF* and transistors were discussed. Eminent industry experts and educational big wigs such as Professor Hazelhurst of Northwestern University spoke. This was the latest in a series of meetings to better prepare independent service people to do an even better job of service on TV and radio sets.

The meeting was hosted by Television Installation Service Association (TISA), the Illinois affiliate of NATESA. To honor the occasion, Mayor Kennelley proclaimed the days of the Convention, October 9th through 11th inclusive, as TV-Radio-Electronic Service Days in Chicago.

Long Island Electronic Technicians Association, Inc.

Vol. 1 No. 2, of the LIETA News has recently been published with the following information that a "Get Acquainted Open House" was held on Sept .16th in the main ballroom and dining room of the Masonic Club, Williston Park, N.Y.

The following is the LIETA Code of Ethics: As a member in good standing, I agree To employ qualified personnel to assure proper service; No student shall be employed as a master technician; To avoid trick advertising which offers to service or deliver materials under conditions which are objectionable or unfair to the set owner or to fellow-members; To issue a standard guarantee for a minimum of not less than 90 days on all work that has been authorized and paid for, and to give each customer an itemized bill; To use, whenever practicable, original factory replacement parts; and in all other cases, to use replacement parts to be known to be equal or superior in quality; To render prompt and efficient service; To treat each client in a professional manner and to observe the Golden Rule and To abide by the decisions of duly constituted authority in the Long Island Electronic Technicians Association, Inc.

Utah Association of Radio and Television Servicemen

Members of the new Utah Association of Radio and Television Servicemen meeting recently discussed the plan of establishing a credit reporting service for association members.

John F. Burns, president of the association, said the service would be of vital help to shop owners, technicians and electronic specialists.

At the meeting, the radio and television repairmen discussed major problems confronting the small radio and television shop owner in the difficulty of controlling credit.

Mr. Burns brought out that credit is one of the great preblems of the individual independent servicemen because he usually doesn't have the facilities to check the credit rating of his customers.

TRT

The Television and Radio Technicians group of the Electric Association of Kansas City, has informed the City Plan Commission that it opposed any ordinance governing the erection of television antennas.. Reasons given by the TRT executive committee in support of its action were the following: Kansas City has enjoyed less TV service repair difficulty than any other major city in America; The Better Business Bureau has received very few complaints on television installations; No complaints, damage suits or injuries caused by antennas have been registered in Kansas City: All manufacturers of television receivers are rapidly moving in the direction of improving built-in antennas and tuners. Within a few months there will be even less need for outdoor antennas in Kansas City than at the present time; All present TV stations and proposed stations will be increasing their power within a very short time. Thus, the need of antennas for reception will decrease as that increased power becomes available; Qualified servicemen in the television field in Kansas City are, and have been, vitally interested in the safety factor. Antennas have been checked for safety on being erected, lightning arrestors have been installed, and all other factors of safety have been considered; The TV serviceman, in order to make a reasonable profit, cannot afford "call backs" to previous installations. Therefore, it is imperative that the original installation be in working order and safe in every respect.

The first color television course to be offered in Kansas City has been approved by the executive committee of the Television and Radio Technicians. It will be a lecture course consisting of two and a half hour sessions at Central Radio and Television Schools, and will be open to TRT members only. Subjects to be covered during the sessions will be color fundamentals, a description of the CBS color TV system and its limitations, color kinescopes, principles of the NTSC color television system, theory of the subcarrier system of transmitting color information, the composite NTSC color video waveform, NTSC color receiver circuits for the NTSC signal.

EITSA

A new organization, to be known as the Eastern Idaho Television Servicemen's Association, has been working with Idaho Falls city officials in drawing up a TV code for the city. Frank

Rabou of Idaho Falls said that the proposed code will be presented to the City Council and if approved, it will set up standards for dealers and servicemen. He said the tentative code calls for bonding and insuring of all television installers. Permits would be required for installing antennas under 15 feet high and separate permits would be required for each antenna 15 feet hight or more. Reports from areas where television has been in operation a few years show that various "shady practices" have been carried on at a loss to the public. He pointed out that some organizations travel through the country installing inferior equipment and then leave the area. A spokesman for the embryo association said that any reliable company will offer good electronic equipment and will provide good service. The main object of the association, the spokesman said, is to protect the public and to keep the television industry from getting a "black eye" from poor practices.

PRSMA

Representatives of all local groups have joined forces, combining their efforts in a move to improve the service industry, it was disclosed recently. According to Sam Brenner, president of the Philadelphia Radio Service Men's Association, sponsor of the movement, the representatives decided after a series of meetings, to join forces in mapping out programs, in both consumer and educational drives. "The aim is to make the TV technician a respected profession in this area," he said.

The combined membership of dealers and technicians in the four cooperating groups totals more than 500, it was said. Groups participating in the drive are: PRSMA, the Television Contractors Association, Northeast Television Service Dealers Association and the Television Service Dealers Association of Philadelphia. Mr. Brenner stressed that the aims of the combined group would be the same as those of the individual organizations. At present, the members of the local service groups in the program call themselves the Council of Radio and Television Service Associations of Philadelphia.

A resolution was passed by the representatives at a meeting recently stating that: "We recognize a need for the formation of a committee in order that efforts of individual groups can be combined, so that ways and means of furthering the TV service industry can be planned and executed." The groups also resolved to achieve unification of aims and purposes of television radio service organizations here, and to set up an educational program for both service work and business operations. By the combined effort, it was said, the servicemen could present a stronger front in asking the TV industry's assistance in alleviating existing service problems. In addition, full cooperation would be given local authorities, such as the Better Business Bureau, district attorney's office, Chamber of Commerce and other municipal groups to eliminate the unethical operations in the industry.

Albert M. Haas and William Weill represented the TCA in the combined meetings, while Sam Brenner and James Daly were the PRSMA agents. Ray Cherrill and Henry Whelan acted in behalf of the NETSDA, while Lou Smith and Dave Krantz were the TSDA of Philadelphia delegates.

TEA

Speaking before some 500 servicemen, dealers and manufacturers' representatives at the Texas Radio and Service Clinic and Electronics Fair in Houston, Texas, John Rider of Rider Publications, warned that servicemen must be prepared for the advent of color, which he predicts will spread more rapidly than did black and white TV. He reminded the group that stations and networks are ready to switch to the new field and they should do likewise. He foresaw TV sets having units hermetically sealed within the picture tube and although several years away, this possibility is something for service groups to keep in mind.

William D. Renner, of Howard W. Sams & Co. spoke on *UHF*, which he declared was a successful service requiring little more care and technical knowledge for servicemen. Servicemen were urged to read all publications and factual matter to avoid the necessity of personal research on *UHF* and reminded that where shop personnel is encouraged to become familiar with *UHF*, they are the ones doing the best job.

The Value of Business Ethics in TV Service was the topic discussed by Duffield Smith, managing director of Dallas Better Business Bureau. Service as a whole and its position as an industry depends upon the individuals in it and their standards of action in advertising, sales, and type of service rendered, he said. He noted that servicemen have difficulty in making money servicing TV, mainly because the public is not accustomed to the higher charges incident to TV, rather they are familiar with radio and its repair charges. Since the consumer is not aware of the problems besetting TV servicemen, the project is to educate him, help promote better public relations and help offset the fear instilled in the customer by those customers who have been victimized by unethical persons.

CIRCUIT COURT

Admiral 21W1 — Contrast Control Action

The Admiral 21W1 has several interesting circuits. *Figure 1* shows an unusual biasing method for the sync stripper. The cathode of the video amplifier and the cathode of the stripper are both connected to opposite sides of the contrast control. The arm of the control is grounded. As the contrast control is varied the bias on both the video amplifier and the sync stripper are changed in opposite directions.

The composite signal is fed to the grid of the 12AU7 stripper tube from the plate of the video amplifier. The plate of the 12AU7 is at approximately 40 volts due to the voltage divider action of *R74* and *R75*.

The video amplifier is a 6AC7 whose plate is *d-c* coupled to the cathode of the CRT. The sync is taken off the video amplifier plate load through the network consisting of *L14* and *R44*. The signal is coupled to the grid of the stripper through *R37* and *R38* paralleled by *C80* acting as a double time constant noise discriminating circuit. The plate voltage of the stripper is so low that its output will compress the top of the sync pulse and any noise whose amplitude is greater than that of the sync pulse.

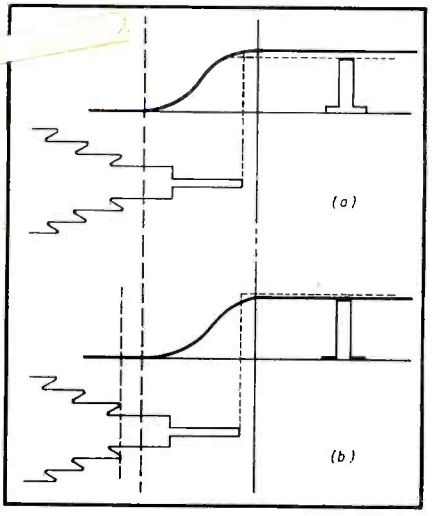


Fig. 2—(a) Cutoff obtained by contrast control setting. (b) Cutoff obtained by bias built up across 2.2 meg grid resistor.

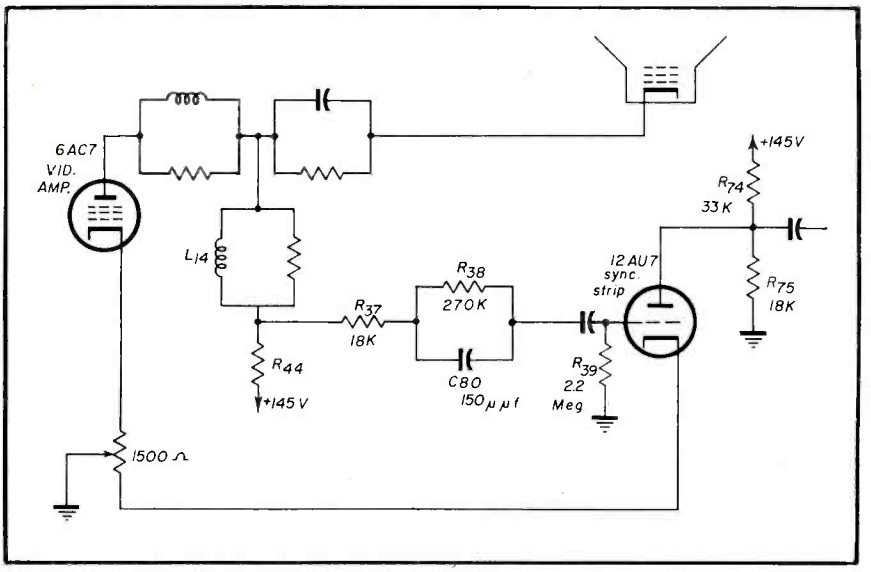


Fig. 1—Partial schematic of Admiral 21W1 sync stripper.

Now let us see how the contrast control works. In a weak signal area the contrast control is set for minimum video amplifier bias. This sets the stripper at a high bias. The signal input is set so that the video information falls in the cut-off region. See *Fig. 2a*.

In a strong signal area the video contrast control is set for maximum resistance. This places the cathode of the stripper at or near ground potential. Under these conditions the grid resistor (2.2 meg.) draws grid current. The bias set up by this current flow cuts the tube off. The RC time constant of the coupling condenser and the grid leak condenser keeps the tube cut-off such that only the sync pulse amplitude is sufficient to bring it back into conduction.

Another aid in noise suppression is the design of the third video *if* amplifier *(Fig. 3)*. Usually the coupling transformer load resistor is in the grid circuit. In this case it is in the primary circuit and the grid of the following stage goes to ground through the secondary only. The purpose of this is to present a low *dc* impedance to any noise which might have been generated in the previous stages. This stage does not go back to the *agc* line. The bias of the stage is derived from the cathode resistor which is by-passed for *rf*.

Philco RF-71 Chassis — Noise Suppression and Sync Gating

The Philco RF-71 Chassis *(Fig. 4)* has a noise suppression and sync gating system which is very unusual. The operation of this circuit depends largely on a well known but infrequently used fact. This is that sharp random noise pulses have a very large high frequency content.

In the circuit under examination

[*Continued on page 72*]

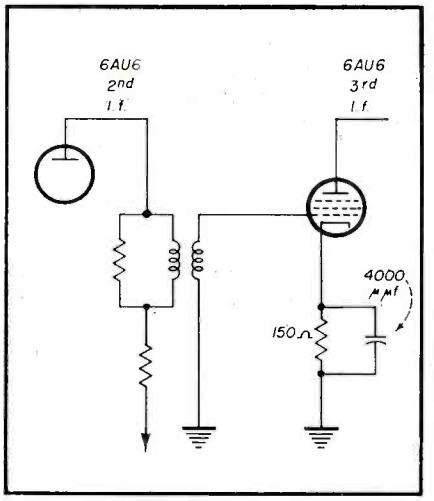


Fig. 3—Partial schematic of 3rd video *if* amplifier.

TRADE LITERATURE

Filling a definite need is a down-to-earth, comprehensive, *8-page transistor manual* being offered free by CBS-Hytron, of Danvers, Mass., electronic tube division of the Columbia Broadcasting System, Inc. Profusely illustrated, the CBS-Hytron Transistor Manual is in three parts; theory, data, and application. Contained are nine different basic transistor applications. Both point-contact and junction transistor operation are explained by vacuum-tube analogy. Also clearly described are conduction by "holes," and P-N-P and N-P-N transistors.

* * *

Allied Radio Corporation, Chicago, distributors of electronic parts and equipment, announce the release of their 1954 general catalog. Allied's new catalog contains 268 pages listing over 20,000 items. The new *Catalog (No. 135)* is available free on request. Write to Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Illinois.

* * *

A new *4-page brochure* on Piston type variable trimmer capacitors for industrial, military, experimental and radio trade requirements—form No. 220, is available to engineers, purchasing agents and electronic parts jobbers simply by writing the JFD Electronics Division of the JFD Manufacturing Company, Inc., 6101 16th Avenue, Brooklyn 4, New York.

* * *

A brand new *30-page illustrated booklet* describing the entire VEE-D-X line of *uhf* and *vhf* antennas and accessories is now available from La-Pointe Electronics, Inc., Rockville, Ill. Some thirty-six different products, including the company's new Antenna Rotator, are pictured and comprehensively described in this handy, wallet-size guide to the VEE-D-X line.

* * *

Ram has published its *1954 Replacement Components Manual*. For further details, write directly to Ram Electronics Sales Co., Irvington-on-Hudson, N. Y.

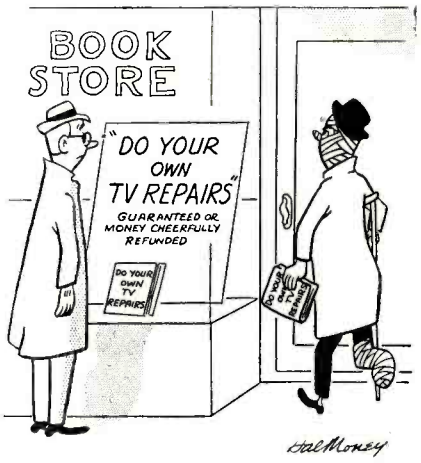
* * *

Workman TV, Teaneck, New Jersey, issuing *Bulletin 5-716-C and 5-717-C*, giving information application and operating data of their new Model 5TV4 "B" Plus Booster.

A new *TV capacitor replacement supplement* designed especially for use in new TV areas is now offered as an invaluable aid to service technicians in locations where TV is just opening up. This handy card is punched for easy wall hanging and has a large area for Sprague distributor's imprint. The new free TV capacitor supplement C-451 is available from Sprague distributors everywhere—further information may be obtained from Sprague Products Company, 71 Marshall Street, North Adams, Mass.

* * *

G.E. is making the widest possible distribution of a 17-page pamphlet entitled *"Quick Facts About Color Television."* Almost every question which may be asked by the consumer about



color television is answered in this pocket-size booklet. It deals with cost and picture size of color TV. It explains, thoroughly, what is meant by a compatible color TV system and how the NTSC color system works. It outlines changes which may be expected in TV programs and answers the question: "Are The Broadcasters Ready For Color?" The booklet concludes with a discussion of why the color tube is a major problem and delves into the question of color converters.

* * *

The latest *Federal Television Picture Tube Data Book* is available upon request by writing to the Vacuum Tube Department, Federal Telephone and Radio Company, 100 Kingsland Road, Clifton, New Jersey.

* * *

The first edition of the 1953 *Stancor TV Transformer Replacement Guide* is now available.

Transformer replacement information on over 5,600 TV models and chassis, including many 1953 models, has been compiled for this edition. It covers 101 brands of TV sets in alphabetical order, by model and chassis number. This useful guide is available without charge from the Chicago Standard Transformer Corporation, Standard Division, Addison and Elston, Chicago 18, Illinois.

* * *

TV Picture Tube Components are described in a four-page booklet. Also included is a description of stranded tungsten coils and filaments for vacuum metallizing. They are used in the aluminizing of picture tube screens. The booklet is available on request from the Tungsten and Chemical Division, Sylvania Electric Products Inc., Towanda, Pa.

* * *

Astron Corporation announced the availability of its new *catalog supplement, AC-3A* for its expanded line of twist-prong electrolytic capacitors. The new supplement provides complete listings of catalog numbers, capacitance and voltage ratings, case sizes, and list prices of all standard twist-prong capacitors to fulfill every radio and television replacement need. Copies may be obtained by writing Astron Corporation, 255 Grant Avenue, East Newark, New Jersey.

* * *

This new fourth edition of *"Radiotron Designer's Handbook"* thoroughly covers the design of radio and audio circuits and discusses in detail, from the viewpoints of theory and practice, the design considerations necessary for the proper use of electron tubes and circuit components. It includes 1,000 illustrations, bibliographies and references totaling more than 2,500 items, and an extensive 50-page index containing 7,000 entries. 1522 pages, 8¾ x 5½ inches. $7.00. Edited by F. Langford-Smith this book is printed in U.S.A. (1953) by Radio Corporation of America, Harrison, New Jersey.

* * *

Channel Master Corp., Ellenville, New York, has announced publication of its *"TV Antenna Handbook for VHF and UHF."* The "Antenna Handbook" is a 12 page manual illustrating

[*Continued on page 72*]

PERSONNEL NOTES

Meet the key men responsible for the manufacture and distribution of servicemen's products.

Commander R. H. G. Mathews has been named executive vice president of Burton Browne Advertising, Dr. Burton Browne, head of the agency, announced. The agency serves many clients in the electronics industry. A pioneer in the field of radio and electronics, Comdr. Mathews was one of the founders and directors of the American Radio Relay League and, with K. E. Hassel, formed the Chicago Radio Laboratories, which subsequently became the Zenith Radio Corp.

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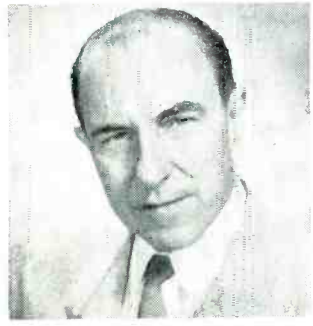

The appointment of **Isadore Waber** as Vice President in charge of sales was announced by C-B-C Electronics Co. Inc., manufacturers of Picboost Television Picture Tube Brighteners. Before joining the C-B-C organization, Mr. Waber was Advertising and Sales Promotion Manager for the Radio Electric Service Co., distributors of electronic parts and equipment in Philadelphia. In his new post he will have charge of the company's sales and advertising program.

←

Paul G. Mathes has joined the staff of Trio Manufacturing Company, Griggsville, Illinois, as Advertising Manager, according to an announcement by J. L. Wade, General Manager. Mr. Mathes, comes to Trio from the Industrial Design section of International Harvester's Refrigeration Division, Evansville, Indiana. Mr. Mathes attended Illinois University where he was graduated with honors in 1951 with a Bachelors Degree in Industrial Design.

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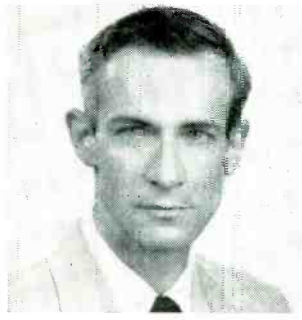

Mr. Webster E. Barth, General Sales Manager of LaPointe Electronics Inc., manufacturers of the Vee-D-X line of TV antennas and accessories, announces the appointment of **W. Ward Willett** as Advertising Manager. Mr. Willett was formerly Sales Promotion Manager of the Piax Corporation. At the same time, Lincoln N. Kinnicutt, formerly director of advertising and public relations, was named Assistant to the General Sales Manager.

←

Transvision, Inc., New Rochelle, New York announces the designation of David Gnessin as Educational Director. Mr. Gnessin has had many years of experience in this field, being the editor of the current Transvision Television Kit Instructions. Mr. Gnessin's greatest popularity is due to his editorship of Television Notes magazine for the past 4 years, circulated among television servicemen.

→

Howard W. Sams has announced the appointment of **Joseph H. Morin** as Sales Promotion Manager of Howard W. Sams & Co., Inc., Indianapolis, publishers of Photofact service, electronic technical manuals and books. "Mr. Morin's wealth of experience and wide acquantanceships in the electronics distribution, sales and sales promotion fields qualify him admirably for the new assignment he is undertaking with Howard W. Sams & Co., Inc.," Sams said.

→

Sheldon Rutter, one of the country's foremost designers, has been retained by Channel Master Corporation to do all product design and will also serve as a packaging and art consultant. In announcing Mr. Rutter's appointment, Harold Harris, Channel Master's Vice President in Charge of Sales and Engineering, stated, the appearance of a product and the nature of its package must be considered to make them more appealing to the ultimate consumer.

→

Martin W. Krenske has been named assistant sales manager for the Edwin I. Gutham Company of Chicago. Mr. Krenske formerly was the industrial sales manager of the Standard Transformer Corporation of Chicago. Following his graduation from Northwestern University in 1949, Mr. Krenske joined Standard as a member of the sales staff. A year later he was promoted to industrial sales manager, a position he held until his recent resignation.

→

Frank J. Powers has been named head of the Industrial Engineering Department of CBS-Columbia Inc., it was announced recently. Mr. Powers held a similar post at the Burndy Engineering Company and also has had managerial posts with Federal Radio & Telephone Co., and the Sperry Gyroscope Co. A graduate of Union College in electrical engineering, Mr. Powers also attended N.Y.U.

←

Harry N. Reizes, Managing Director of Audio Fairs, and Advertising Manager of Service Dealer magazine predicts that "Audiorama—1953" held Oct. 14 thru 17 at the Hotel New Yorker will be a revelation to hi-fi enthusiasts and servicemen. The Audio Fairs in New York and Los Angeles have introduced to the public better listening habits—and from this step onward the servicemen will be called upon to keep equipment in better shape, audio and soundwise.

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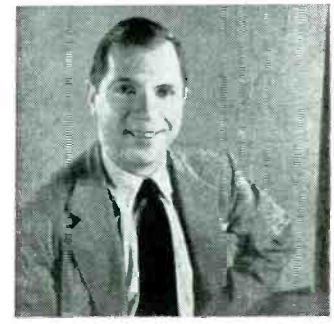

Pyramid Electric Company, capacitor manufacturers of North Bergen, New Jersey, announces the appointment of Joe Starr as Assistant Sales Manager, Manufacturers Division. Mr. Starr who has been intimately associated with the capacitor industry since 1939, brings to Pyramid Electric Company considerable experience in both engineering and sales.

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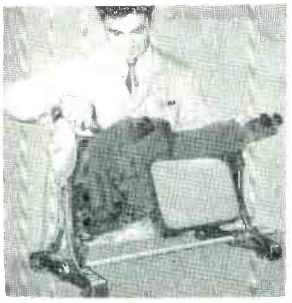
New Products

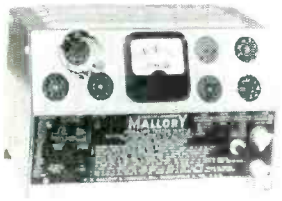


Repairack

JFD Manufacturing Co., Inc. has introduced a practical tool for the servicing bench. Some of the outstanding features of "Repairack" are that it holds television, radio and phono turntable chassis up to 200 lbs. securely in place; pivots freely to permit easy access to farthest corners of set; fully adjustable up to 32" in length for accommodating practically every size chassis; protects tubes and components from damage while being serviced.

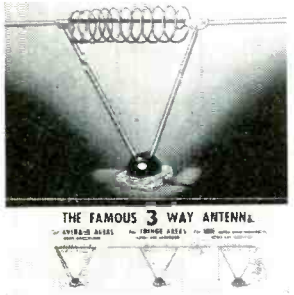
Picture Tube Extension Cord

C-B-C Electronic Co. Inc., 1310 Callowhill Street, Phila., Pa. is now in production on their new Picboost TV Picture Tube Extension Cord. This cord permits the service dealer to test picture tubes or chassis when either is outside the TV cabinet. It is also used for TV conversion work, and for hi-fi installations incorporating a TV receiver. The list price has been established at $2.25.



Vibrator Tester

An important addition to the auto radio serviceman's work bench is the new Mallory 12VT1D Vibrator Tester now being produced by P. R. Mallory & Co. Inc. of Indianapolis. The 12VT1D will test directly, without adaptors, either 6 or 12 volt vibrators of the most popular types and all auto radio vibrators used since 1940. Overall dimensions of the 12VT1D are: 6¾" high, 10⅜" wide and 5½" deep. Shipping weight is approximately eight pounds.



"Flash-Beam" Indoor Antenna

Brooklyn Television Co., Inc. has announced production of their new 1953 "Flashbeam" antenna designed for use in average or fringe areas. Its beautiful heavy swivel cut-glass base revolves 180° for easy orientation and compliments the decor of any home. For full details, write directly to the manufacturer, 72 Steuben Street, Brooklyn 5, N.Y.

Cathode Ray Oscilloscope

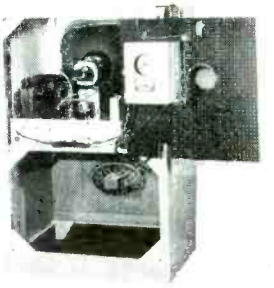
A new 5" television cathode ray oscilloscope has been announced by The Hickok Electrical Instrument Co. Priced at only $129.50, this scope features a frequency range from 0.5 cycles to 700 KC, down 3 db. It has excellent stability, no drift, less than 1% tilt, and less than 2% overshoot. A unique feature of the scope is that a dual fuse is provided so that the B-plus line is entirely fused.

Full-Focus Deflection Yokes

The Rogers Full-Focus Deflection Yoke is a product of Rogers Electronic Corp., and is individually tested electrically and mechanically. Each coil is precision-wound, impregnated and baked to insure top performance and extra long life. The use of a ferrite core assures maximum high voltage efficiency and reduced operating temperature. Each yoke is supplied with color coded leads, circuit diagram, and matched network.

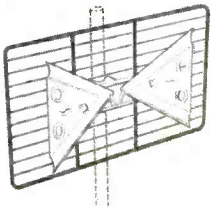
Coin-TV Set

Transvision, Inc. of New Rochelle, N.Y. has just released its new model C-1 Coin-TV Set. The set has 26 tubes with oversize chassis on straight A. C. operation. Picture size is straight 17" rectangular, black-faced screen. No hodge-podge hay-wire connection on bolting a coin-box to any set, this is a specifically designed unit built to bear the brunt of coin-box abuse. The coin-boxes are durable and easy to operate, providing ½ hour entertainment for 25 cents.



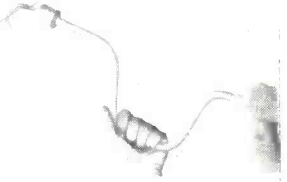
New UHF Antenna

A new bow-tie with reflector uhf antenna has been introduced by Snyder Manufacturing Co., of Phila., Pa. Covering channels 14 to 83, coded the UHF-5, the antenna is of collapsable space-saver design and is factory preassembled. The Snyder UHF antenna has diamond embossed aircraft aluminum elements, an all welded heavy duty reflector screen and single U-bolt installation.



Guy-Wire Tightener

The "Guy-Tite," a new guy-wire tightener, introduced by the Walsco Electronics Corporation. By revolving the handle included in the kit, the serviceman coils and tightens the guy-wire evenly with very little effort. This is especially valuable where long guy-wires make fast and easy tightening essential. The Guy-Tite is easy to remove, loosen, or tighten at any time.



Finco UHF Antennas

The Finney Company, 4612 St. Clair Avenue, Cleveland 3, Ohio, are now in the introduction campaign on their Series 500 antennas, designed specifically for uhf and constructed on the basic co-lateral design. Model features a "snap-out" type screen reflector for ease of installation. Extremely narrow patterns and a high front-to-back ratio are features engineered to solve difficult ghost problems due to multiple signals, both in the fringe area and in close to the station.

Build Your Service-Sales Future on a Firm Foundation with . . .

PRECISION
TEST EQUIPMENT
Standard of Accuracy

. . . These 5 Matched "PRECISION" Instruments provide a Complete MODERN SERVICE LABORATORY for TV-FM-AM at only moderate cost.

SERIES E-200-C
SIGNAL and MARKING GENERATOR for A.M., F.M., and TV alignment.

Exceptional Accuracy and Stability • 1000 pt. vernier calibrating scale • 0-100% Modulation • A.V.C. — A.G.C. substitution-override network • Direct reading 88KC to 120 MC • Complete with Coaxial output cable and technical manual • In matched, heavy gauge steel case 10½ x 12 x 6".

Net Price: $78.50

SERIES E-400
SWEEP SIGNAL GENERATOR Direct Reading from 2 to 480 MC.

Narrow and Wide Band Sweep for F.M. and TV, 0-1MC and 0-15MC • 1500 pt. vernier calibrating scale • Multiple Crystal Marker • 8 tubes including V.R. and rectifier • RG/62U Coaxial Terminated Output cable • Complete with 2 crystals • In matched copper-plated case 10½ x 12 x 6".

Net Price: $139.75

SERIES ES-500A
High Sensitivity, Wide Range 5" C.R. OSCILLOGRAPH

Push-Pull "V" and "H" amplifiers • 1 MC Band Width • High impedance, compensated "V" input Step Attenuator • Z axis modulation • 12 tubes incl. V.R. and 2 rect. • Light Shield and Mask • Heavy Steel Case. 8¼x14½x18".

Net Price: $173.70

SERIES EV-10A
True Zero-Center VTVM—MEGOHMMETER with large 7" meter.

58 ranges to 6000 Volts, 2000 Megs, +70DB, 12 Amps • Direct Reading R.F. VTVM scales via optional RF-10A High Freq. probe • Voltage Regulated bridge type circuit • Constant 13⅓ Megs input resistance to 600 V., 133⅓ Megs at 6000V • Complete with test cables • In matched steel cabinet 10½ x 12 x 6".

Net Price: $99.75

SERIES 612
Modern Free-point TUBE TESTER, and dynamic A-B-C Battery Tester.

Incorporates RTMA recommended circuit principles • 10 lever free-point element selection • Built-in roller chart • Dual short-check sensitivity • Noise, Ballast and Pilot Tests • Free replacement tube test data chart service • Complete, ready to operate • In matched heavy gauge steel cabinet 10½ x 12 x 6".

Net Price: $76.75

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PRECISION **PERFORMANCE, ACCURACY, WORKMANSHIP and VALUE have been setting a world-wide standard of comparison for over 20 years.**

Every *PRECISION* instrument is guaranteed for one full year against mechanical or electrical defects.

OTHER MATCHED COMBINATIONS

The instruments shown above illustrate one of many possible MATCHED COMBINATIONS of *PRECISION* Test Equipment for the modern TV-FM-AM service bench. Each combination provides a selected, basic and efficient Laboratory at moderate cost.

SERIES TV-4—Super-High Voltage Safety Test Probe.

Extends range of Series EV-10A (above) to 60 KV direct reading, with full safety to operator and equipment. Multiplier cartridges also available to match most VTVM's and 20,000 ohms per volt test sets.

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Net Price: $14.75

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PRECISION Performance-Engineered Instruments are on display at leading radio parts and equipment distributors.

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pass filter to reject signals below the *uhf* band.

The last item is important since the "Q" of the preselector must be low to keep this stage a broadband affair for tracking purposes. In all double conversion operations the oscillator is *below* the desired *rf* frequency. There is a possibility at the low end of the band that the oscillator will combine with an unwanted signal which is the *if* frequency difference *below it*. A broadband preselector would permit these unwanted frequencies to appear at the mixer input. They would then mix with the oscillator and completely upset the desired picture. A high-pass filter which sharply attenuates all signals below 470 *mc* therefore acts to keep these undesired signals out.

Figure 8b shows the output section of the 6BQ7 tube. The switch, M-3, tunes the output stage or circuit to either Channel 5 or 6. This method of output tuning has several advantages over the fixed 12 *mc* or 2 channel output, since with only half of the band-

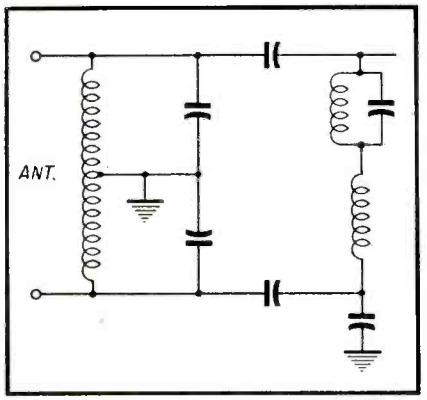


Fig. 8a—Stromberg-Carlson antenna input circuit.

width being used the gain can be just about doubled. In the 12 *mc* approach the gain in the unwanted half is not used and therefore wasted. The switching arrangement is straightforward. The circuit with the switch open (channel 6) is tuned for a 6 *mc* bandpass centered at 85 *mc*. With the switch closed the frequency of the tuned circuit is lowered to a 6 *mc* signal centered on 81 *mc*.

Before we leave this discussion on the shorted line type of tuner it would be of some interest to examine one other circuit design which appears in other units of this type. *Fig. 9* shows partial schematics of the tuning elements of the GE and Regency converters. *R1* and *R2* in the GE and *R1* in the Regency serve to damp out the unused portion of the line. If this is not done there exists the possibility that when the shorting bar is close to the tube (the high frequency portion of

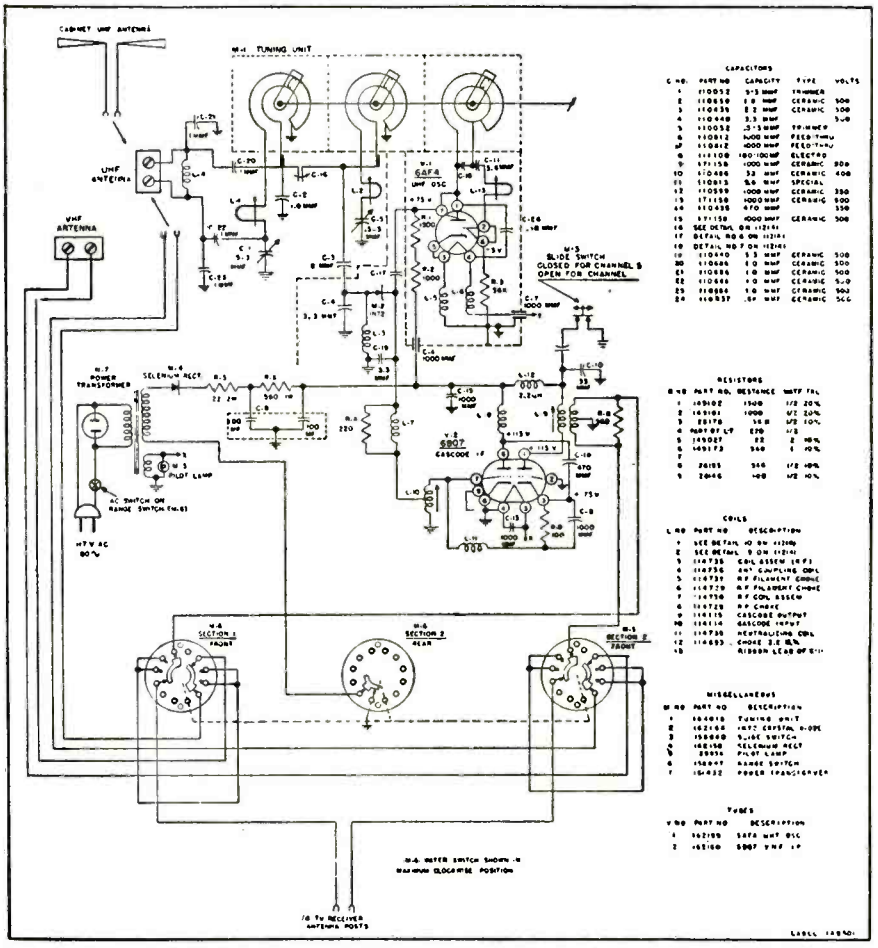


Fig. 7—Schematic of Stromberg-Carlson Converter.

the band), the unused portion of the line if not damped might become resonant. This could result in a loss of energy which could cause the oscillator to stop operating at this frequency (suck-outs).

One of the examples of a capacity end tuned converter is the Motorola TC 101 *(Fig. 10)*. While there are several tuning units of the capacity tuning type, the Motorola is the most interesting because in contrast to the others the tuning capacity is not of the lumped constants type. Note in *Fig. 10* that in the oscillator circuit we find that the tank is a series tuned Colpitts type circuit. This circuit consists of a coil *L13*, a fixed condenser C_L and a vari-

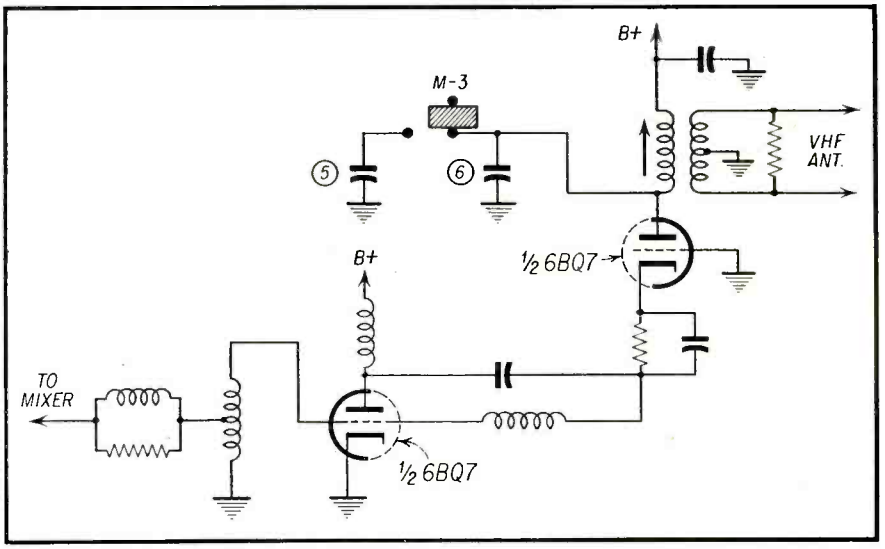


Fig. 8b—Stromberg-Carlson output circuit.

able condenser C_s. To find out how this circuit works let us look at *Fig. 11*.

In *Fig. 11* we note that *L13* consists of a number of turns of metal on a glass wall tube with a brass rod through it. At its minimum inductance (highest frequency), C_L consists of the capacity of the turns to the brass rod through the glass and the capacity between turns. C_s consists of the end capacity between *L13* and section B made of metallized glass, plus the capacity of this second section to tuner core B. Note that C_s is at a point of minimum capacity (highest frequency) with the second core out. As the tuning core is moved in the direction of f_L the amount of *L13* short-circuited by the core "A" is decreased causing the inductance of *L* to increase and the frequency to decrease. At the same time by introducing the heavier section of core "B", C_s is increased due to the smaller space between section B and core B. C_L does not decrease because the distributed capacities remain practically constant. The effective capacity of C_L therefore, is not changed significantly. In fact over the tuning range C_L can be regarded as constant. We effectively have a tuned line whose electrical length is changed by means of the change in end capacity C_s and inductance *L13*.

The preselector is an even clearer example of end loading. *Fig. 12* very roughly shows how this works. The area change produced as the tuning core is moved in the glass tube acts as a variable inductance. At the higher frequency, the position of the tuning core can reduce the inductance sufficiently to obtain the desired high frequency. At the mid range the wall of the tube and the rod are shaped so that the capacity is increased by bringing the wall and rod closer. At the low end the face of the core adds capacity to the end wall.

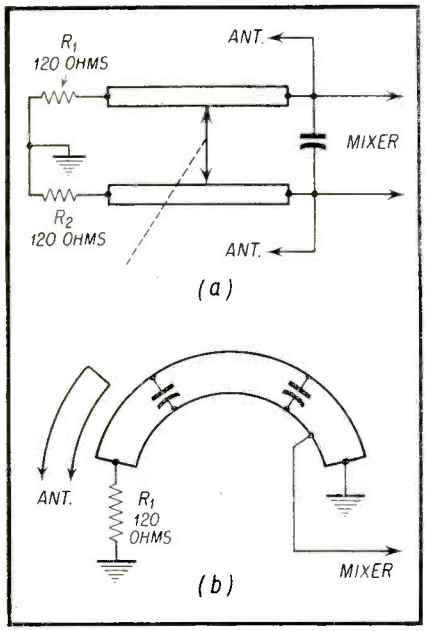


Fig. 9—(a) G.E. Converter preselector damping resistors. (b) Regency converter simplified.

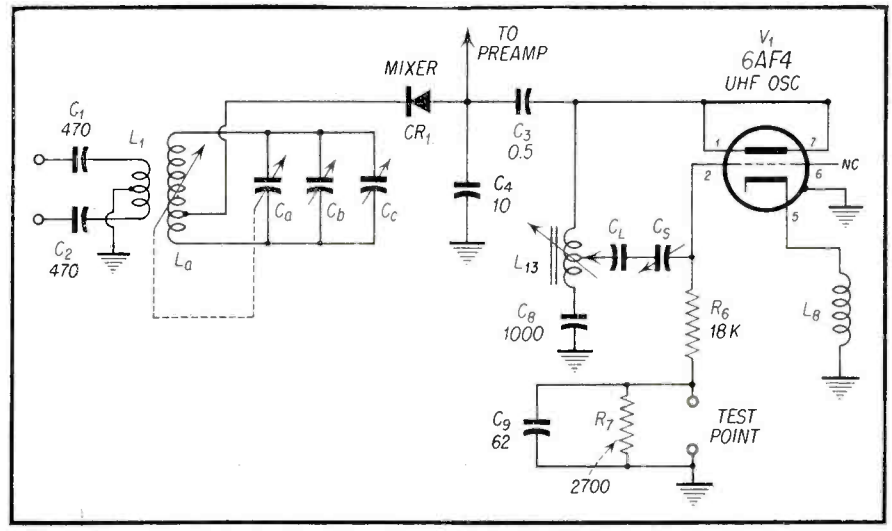


Fig. 10—Partial schematic of Motorola TC 101 Converter.

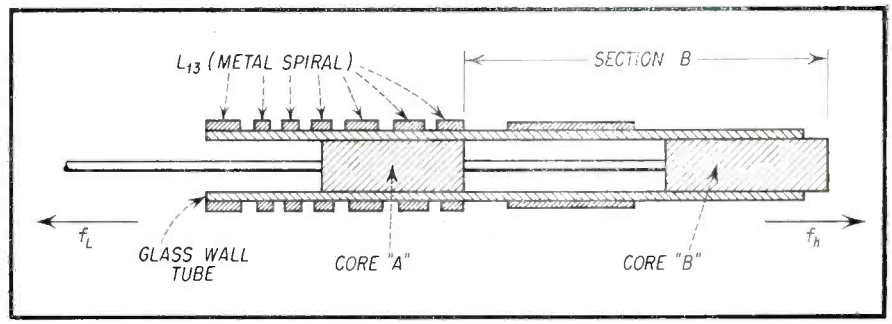


Fig. 11—Physical construction of TC 101 converter oscillator coil.

The converters made by the Radio Receptor and Granco Companies *(Fig. 13)*, are excellent examples of the resonant cavity type of tuning unit. As explained previously, the dimensions of the cavity are designed so that the cavity resonates above the highest frequency needed. A loading capacitor is added across the inside of the cavity bringing the cavity resonance close to the high end of the *uhf* band. A plunger rod which can vary the amount of capacitive coupling between the two "plates" of this capacitor is the tuning device. *C1* and *C2* are air gap mica trimmers which adjust the tracking of the three tuned circuits. Coupling between cavities is accomplished by means of coupling loops. The shape and depth of penetration of these loops

[*Continued on page 74*]

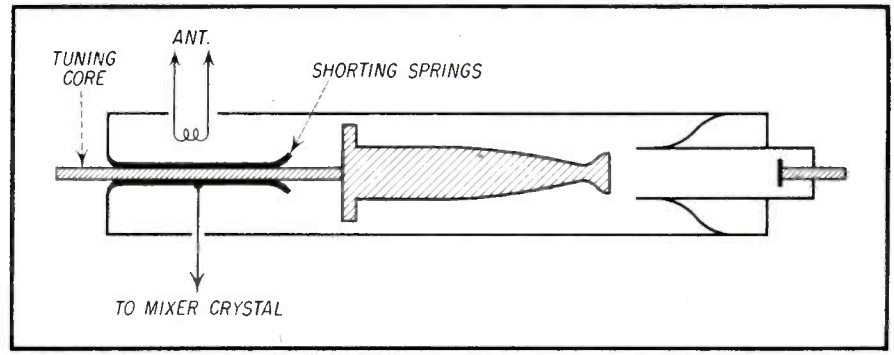
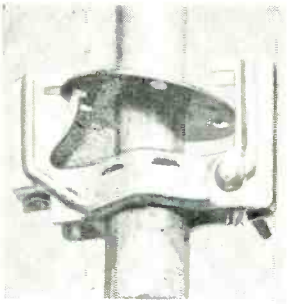
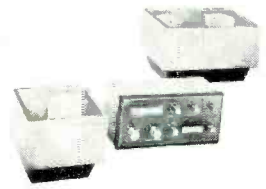


Fig. 12—Motorola TC 101 Preselector.



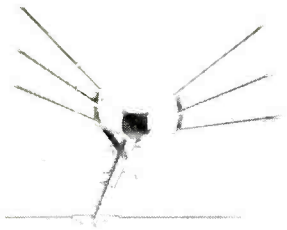
New Antenna Mast

An all-new antenna mast, featuring a unique safety device called the "Third Hand," which permits one-hand extension, has been developed by **Channel Master Corporation**. Another feature is the Step-Up Key, a metal stamping that makes for fast, simple mast indexing. This key automatically extends each mast section for elevation. Beaded safety rings keep the mast sections completely inter-locked and concentric at all times.



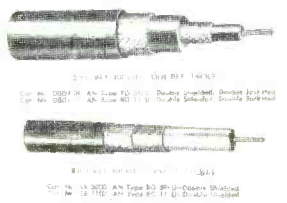
New Hi-Fi Ensemble

Regency has introduced a new professional high fidelity ensemble that consists of three separate units: a pre-amp-equalizer, a power amplifier and the power supply. All units are non-hygroscopic, providing complete protection against all adverse effects of moisture. Each unit is individually calibrated and each has an individual response curve which is supplied with the ensemble.



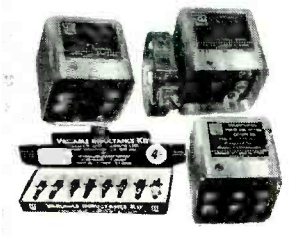
"Vari-Con" TV Antenna

Falcon Electronics, Co., 2003 Cedar Street, Quincy, Ill., announces a antenna so constructed that it provides all channel coverage, yet is easily peaked for top performance on any channel range, **vhf** or **uhf**. Easy to essemble, one need only open the antenna like an umbrella and tighten the wing nuts. Butterfly springs snap the elements into position and lock them securely.



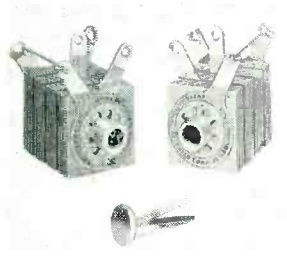
"Rotaxial" Cables

Community TV systems require cables which give exceedingly low radiation losses and consistent peak performance over the entire **vhf** range. Rotaxial cables are constructed for this use in both Double Braid—Single Jacket, and Double Braid—Double Jacketed Types. For advice on how to properly use "Rotaxial" cables, and prices, write to **U.S. Wire and Cable Corp.**, Progress & Monroe Streets, Union, New Jersey.



UTL Products For Radio-TV

United Technical Laboratories introduces a TV Cross Over Network designed to permit the use of **uhf** and **vhf** antenas with a single lead-in; an Interference Filter of the 3-section high pass type for use between the transmission line and a TV receiver. A 2 receiver coupler for operation of 2 TV receivers from a single antenna; and a variable Inductance Kit, consisting of 8 permeability tuned coils, calibrated within 5% limits.



Rectifier-Magnetic Devices

A small, compact and inexpensive single phase bridge rectifier, Type D-3575, has been developed by **International Rectifier Corporation**, El Segundo, California, for the operation of magnetic devices such as relays, solenoids, and electric counters. The unit is designed for use directly from 117 volt AC systems and is rated to deliver an output of 9 watts at 90 volts DC, continuous duty.

New Front End Chassis

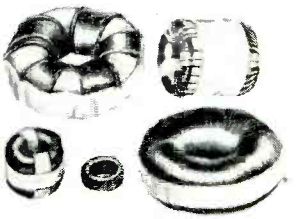
Granco Products, Inc. announces the production of new front end chassis for all-channel **uhf** reception. Termed "Hideaway" unit, it is adaptable to any TV chassis for the purpose of obtaining built-in **uhf** reception. The Model UJ5, is recommended for fringe area reception, tunes the entire **uhf** band utilizing three coaxial tuned cavity elements, two as preselectors and one controlling the local oscillator.

Reversing Polarity Switch

Pomona Electronics Company has introduced the Peco Model MS-1 Meter Reversing Polarity Switch to assist the radio and electronics technician. It is designed to reverse polarity when making circuit tests without removing test lead to meter and can be instantly attached by plugging into test lead holes on Simpson Tester Model 260 for which it is exclusively designed.

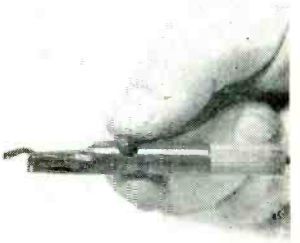
Production Of Toroids

F. W. Sickles announces that their long experience in coil production techniques are now being applied to toroidal winding problems. Sickles facilities are offered to industry for high volume winding of toroidal coils to tight inductance, balance and "Q" tolerances: precision wave filters on communication networks; pulse transformers; magnetic memory units and magnetic amplifiers.



Circuit Testing Clip

A fully-insulated alligator clip that greatly facilitates the testing of live circuits in television and radio receivers has been brought out by the **Insuline Corporation of America**, 3602—35th Avenue, L.I.C. 1, N.Y. The spring-loaded jaws, which are actuated by a thumb button in the body of the clip, hold firmly on conductors up to ¼ inch in diameter. Connection to the clip is made with standard banana plugs.

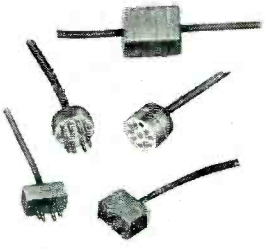


All-Purpose Microphone

Shure Brothers announces the new, all-purpose Model 777 "Slim-X" Crystal Microphone. Designed to provide good-quality voice and music reproduction, it can be used: on desk or floor stand, mounted on a swivel adapter; in the hand; around the neck, with a lavalier. Technical information: smooth frequency response—60 to 10,000 c.p.s.; special-sealed crystal element—for long operating life; high impedance; 7' single-conductor cable, disconnect type.

New Rotator Connectors

A new series of plugs and sockets for connecting 4, 5 and 8-wire rotator cables is now offered the trade by **Mosley Electronics, Inc.** The rotator connectors are precision molded of polystyrene and are solderless and, in addition, the line plugs and sockets possess a unique design feature that eliminates the need for individual set screws. Connectors are designed for either flat or round multi-wire cable.

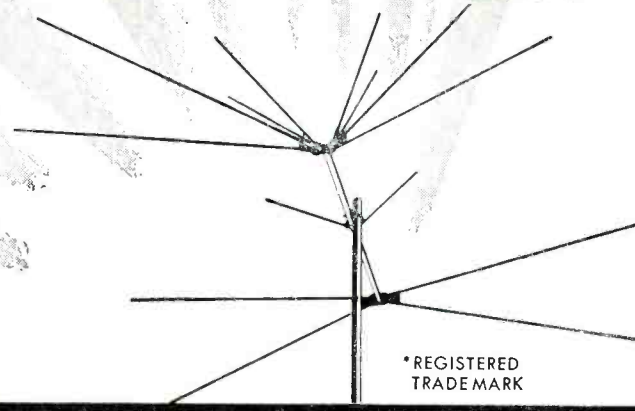


Your BEST antenna buy for channels 2 to 83!

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 TRADEMARK

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"
ASBURY PARK 5, N. J.

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.

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

TRADE FLASHES

[from page 10]

tube promotion package, developed for service dealers to tie in closely with national advertising for the tubes, was recently announced by the G-E Tube Department. "This package will enable the service dealer to take advantage of the growing consumer demand for aluminized tubes," said G. A. Bradford, manager of advertising and sales promotion for the Tube Department.

TV Sales Increase In June

Retail sales of television sets in June increased substantially from the level of May while radio sales declined between the two months, the Radio-Electronics-Television Manufacturers Association reported. During June, 431,089 television receivers were sold at retail while 449,116 radios, excluding automobile receivers, moved through retail outlets. In May RETMA had reported that 244,191 TV sets and 716,407 radios were sold through retail stores. For the first six months of this year, the RETMA retail report showed sales of 2,775,900 television receivers and 3,017,196 radios.

Trio Adds New Addition

A modern addition to the Trio Manufacturing Company plant at Griggsville, Illinois, has just been completed. These new facilities add 24,000 square feet of manufacturing space.

Also added was a new laboratory which will be devoted to product research, testing, development and improvement.

Schulman Heads RETMA Service Committee

H. J. Schulman of the Allen B. DuMont Laboratories, Inc., has been appointed Chairman of the RETMA Service Committee, according to an announcement by the Radio-Electronics-Television Manufacturers Association. Mr. Schulman succeeds R. J. Yeranko, of The Magnavox Co., as Chairman of one of RETMA's most active and progressive groups. The Service Committee, through cooperation with Better Business Bureaus, has done much to improve relations between television set owners and servicemen. The new Vice Chairman of the Committee is John F. Rider, of John F. Rider Publisher Inc., who succeeds F. B. Ostman, Capehart-Farnsworth Corp.

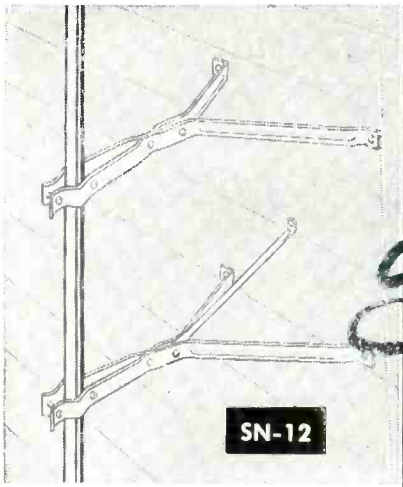
ELI Reports Success In TV Service Campaign

Albert L. Maillard, President of the Electric League of Indianapolis, Inc., revealed recently the city's successful campaign for television servicing. Starting about two months ago with a nucleus of five major television service companies who were anxious to raise the standards of television service in Indianapolis, the ELI engaged the cooperation of utility companies, distributors, television stations, and dealers in an educational program. Service managers of distributor organizations have been induced to join the television servicing committee to act as unofficial policemen in the group that now numbers 20 service companies.

An intensified program combining window exhibits, a television program, and newspaper advertising publicized the training and financial investment reliable companies needed as well as a list of ethical standards they practised. This educational approach has helped consumers understand the reason for the high cost of TV maintenance.

Robot Tube Used To Extend TV Tube Life

An electronic "guinea pig" is being employed in RCA's Lancaster (Pa.)



In addition to its extensive regular line, *here are illustrated*

South River's

great new products, from the one company that gives you the most complete quality line of antenna mounting accessories:

- GR-1—Guy Ring
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- PM-10—Saddle Mount
- SN-50—"Snap-in" Type Chimney Mount *
- SN-12—"Snap-in" Wall Bracket. Also available in 6", 15", 18", 24".
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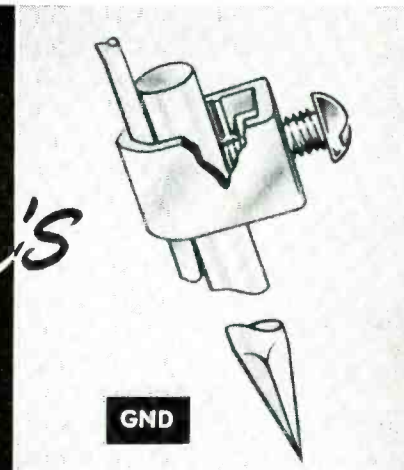
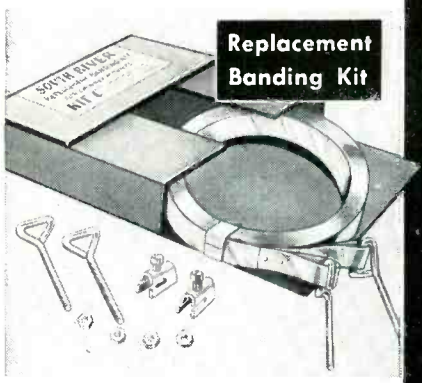
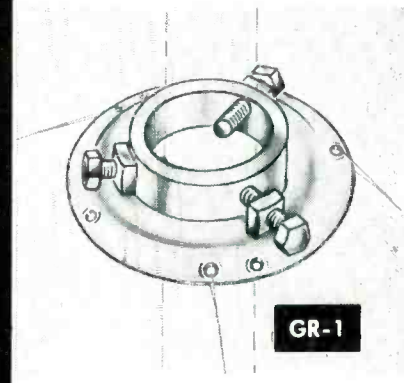
- EM-1—Eave Mount
- Replacement Banding Kits (3 standard kits to fit all chimney mounts)





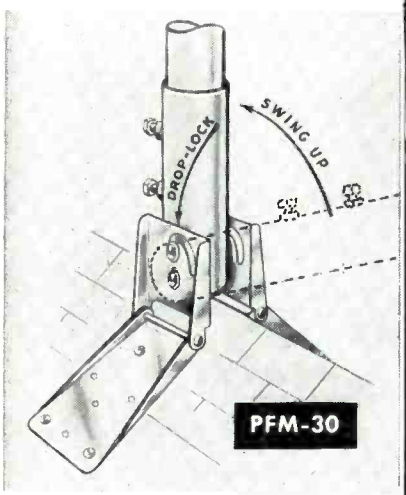


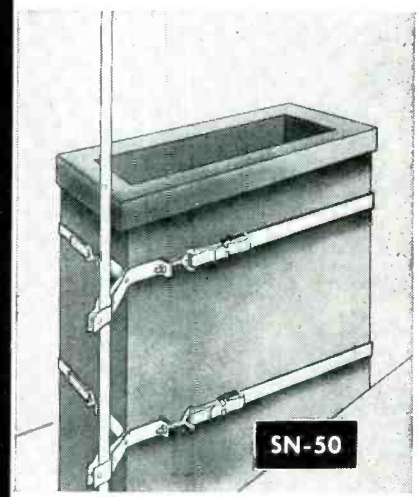
South River Also Makes:

Chimney Mounts *	Large Mast Adapters
Wall Brackets	Screw Eyes
Universal Roof Mounts	Mast Stand-offs, Snap-ons
Swivel Flat Roof Mounts	Guy Clamps—Guy Rings
Chimney Mount Extensions (for extra large crown chimneys)	Banding
Eave Mounts	Electronic Hardware

All South River Chimney Mounts are Available in Stainless Steel Banding

*U. S. Pat. 2482575





Write immediately for your copy of South River's new 1953 catalog, just off the press. Illustrated is the most complete line of the most ingenious and the easiest to install antenna mounts in the industry.

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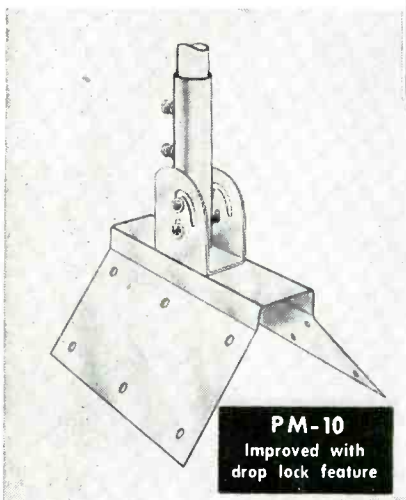

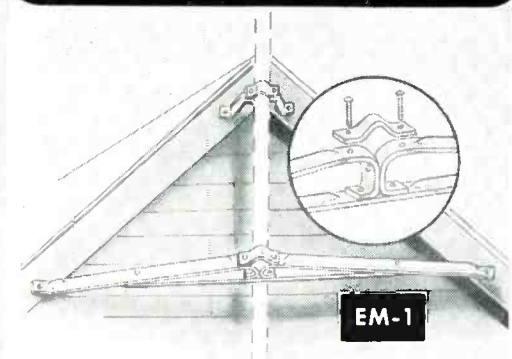

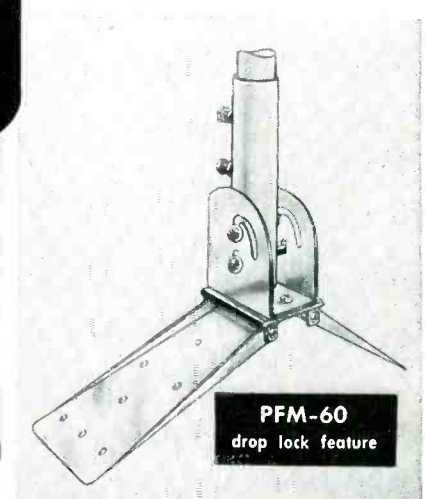

IN CANADA—A. T. R. ARMSTRONG CO., TORONTO

picture-tube plant to help produce a new video tube that will provide a sharper picture and longer life than those made by conventional methods. The "guinea pig" consists of a sample tube with five thermocouples attached outside. These are, in turn, attached to an electronic potentiometer—a temperature measuring instrument developed by Honeywell.

Western Market Study On Tubes Completed

In a few years, the western market will have upwards of a 4,000,000 TV set saturation and a picture tube replacement business of approximately 1,000,000 annually, according to a study completed recently by Pioneer Electronics Corp. A 6-year study of the replacement market shows that the life of the average picture tube is in excess of 2 years. This means, conservatively speaking, a 4,000,000 tube replacement market every 2 to 4 years.

THE ANSWER MAN

[from page 42]

changed in later runs to make use of a 6H6 tube.

The improvement by incorporating the 6H6 circuit is shown on the schematic for the A-2 series, for Model 3007 and consists of the following changes:

a. Remove the 1 megohm grid resistor from between the grid and B minus.
b. Disconnect the junction of pin #3 and #8, the plate and cathode, of the 6H6 tube.
c. Install from pin #3 of the 6H6 tube a 470K resistor to B minus.
d. Connect a 1 megohm resistor from pin #3 to pin #4 of the 6H6 tube.
e. Connect a .05 μf condenser from pin #3 of the 6H6 tube to pin #1 of the 12SN7 sync amplifier.

In reference to the second problem, the Air Marshall Corporation is no longer in operation. However, the schematic for the Air Marshal 17" television receiver is available from John F. Rider Publisher Inc., 480 Canal Street, New York 13, N.Y. in either the Tek-File for $2.00 or individually for $1.50. The Tek-File is number 43A.

It would have been very helpful if your letter had mentioned whether the hum being experienced occurs on station or off station or both. Also if you had stated whether the hum was present in the minimum volume position of the volume control. It is even important to know whether the hum is present in the picture, raster or both.

The first step would be to replace the FM detector tube, 6BN6, as this tube is very likely to be the cause of the hum.

The possibility exists that the local oscillator is out of adjustment if the hum is present on only one channel.

However, if the hum is tuneable, on channel, investigate the local oscillator tube and replace it. In fact it is most important that all the tubes be substituted for in the circuits that the FM signal passes through.

Always realize that hum can be due to alignment also and if only present when a picture is being received the FM detector circuit, the sound *if* amplifiers and the *if* strip can be the cause.

Consider the power supply if the hum is present when the volume control is in the minimum volume position and it is more than likely due to poor filtering of the B plus voltages. Check the electrolytic condensers to determine if one of them is open.

Another possible cause of hum in some receivers is the positioning of leads near the audio amplifier grid circuit. This circuit usually employs

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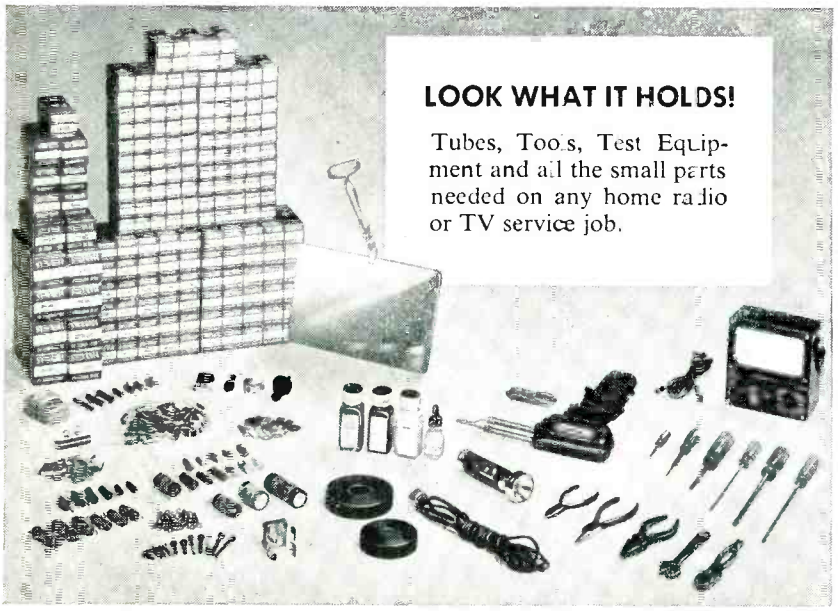

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STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF Radio-Television Service Dealer, published monthly at New York, N. Y. for October 1, 1953.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Sanford R. Cowan, 6 Embassy Court, Great Neck, N. Y.; Editor, Sanford R. Cowan, 6 Embassy Court, Great Neck, N. Y.; Managing Editor, Samuel L. Marshall, 262 Sullivan Place, Brooklyn 25, N. Y.; Business Manager, Sanford R. Cowan, 6 Embassy Court, Great Neck, N. Y.

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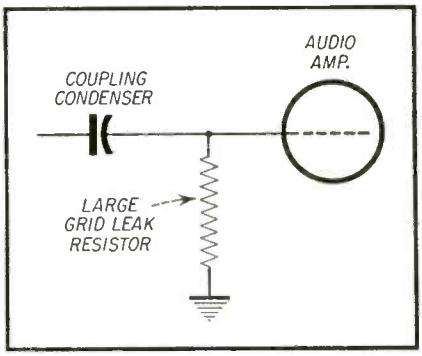
(Signed) S. R. COWAN, Publisher

Sworn to and subscribed before me, this 28th day of September, 1953.
HARRY N. REIZES, Notary Public

a very large grid leak resistor. Any leads with heavy magnetic fields associated with them can induce into the grid circuit, if positioned near the coupling capacitor and grid leak resistor, a voltage which will be heard in the speaker if it is of audible frequency. This would be very important to consider if any leads carrying 60 cycle voltages, vertical deflection



Audio input circuit.

voltages or even composite video signals are near the grid circuit of the audio amplifier.

There even exists the possibility that the AM filtering condenser in the FM detector circuit is open. This will cause hum when audio signals are being detected in the FM detector circuit.

* * *

Dear Answer Man:

I have a little trouble with horizontal circuits and drive controls and I would appreciate it if you will tell me in what back issues these circuits have been covered.

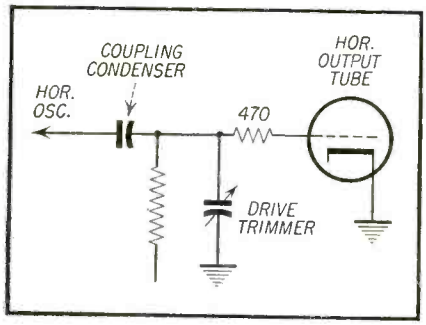
Can you also tell me about front end adjustments in the house?

Thank you,
N. R.
Brooklyn, N.Y.

Dear N. R.

Horizontal deflection circuits are delved into very thoroughly by Leonard Lieberman in the April, May and June issues of Radio Television Service Dealer magazine, and by Frank De Fina in the July issue. These articles very thoroughly cover the horizontal deflection system and should certainly prove well worth the time to read.

In reference to the inquiry concerning horizontal drive controls they basically set the amplitude of the horizontal waveform applied to the horizontal output tube grid. This is usually accomplished in a capacity voltage divider network as shown in the drawing.



Horizontal drive circuit.

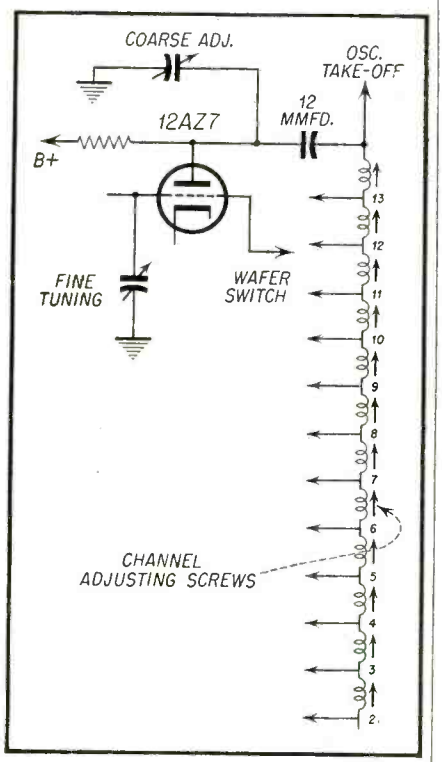
If it is misadjusted, drive lines will appear as a bright vertical line down the approximate center of the picture.

In other cases insufficient drive will narrow the picture width. This would be the result of the trimmer screw being turned clockwise so that too much capacity is introduced into the circuit. This will bypass a large portion of the signal to ground from the control grid thereby reducing the drive on the horizontal output tube.

It is even possible to adjust the trimmer screws down tight, short circuiting most of the signal from the control grid with the result that no raster and insufficient high voltage is present.

The proper adjustment of the drive control is where the drive line just disappears.

In reference to front end adjustments, most current receivers have arrived at either of two types of tuners.



Typical wafer-switch circuit.

The first is the wafer switch type which is quite popular in many manufacturer's receivers. In this tuner the coils are usually of the incremental inductance type. This means that small amounts of inductance are added for each channel starting at the highest channel and adding a small coil for each channel lower in frequency. In other words a small inductance is taken for the highest channel, #13 and to it another small inductance is added to it to cause the local oscillator to tune to Channel 12. This is because in resonant circuits frequency is inversely proportional to inductance.

The other type of tuner is the turret type where coils are inserted in a drum. A separate set of coils is employed for each channel and it tunes independently of the other coils. They have very little effect on each other.

Both types have a course adjustment on the top of the tuner which permits tracking of the oscillator over the television channels. However, it is seldom that this trimmer need be touched. Most tuners of this type may be adjusted on any channel by varying the position of the slugs (channel adjusting screws)

• • •

TRADE LIT.

[*from page 58*]

and describing more than 60 different *vhf* and *uhf* antennas currently produced by Channel Master, and is designed to assist the installation man in selecting the proper antennas for all types of reception areas and conditions. Full technical data, including gain curves and directivity patterns are included on most of the models. The "TV Antenna Handbook" is available, free of charge.

* * *

A new and up-to-date TV *Fuse* Guide containing the very latest information on fuse usage in modern television sets has been prepared by Littelfuse, Inc. The Guide is in booklet form and is perforated so that service men can hang it on the wall conveniently and easily. For your copy write directly to Littelfuse, Inc., 1865 Miner St., Des Plaines, Ill.

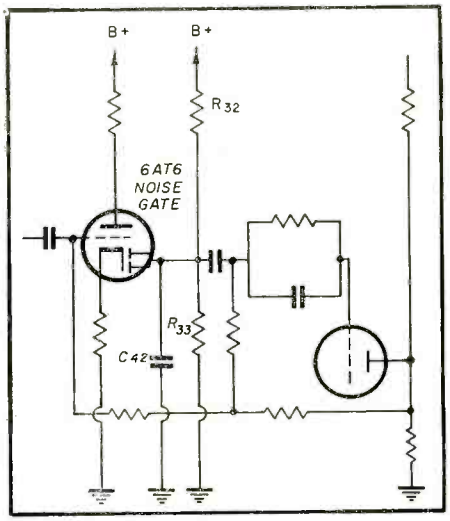
* * *

Descriptive catalog sheets just off the printing press, covering the new ATR *dc-ac* line of inverters for television, radio, and industrial usage; also, "A" battery eliminators including several models for 6 and 12 volt DC combination output are now available. Write directly to American Television & Radio Co., 300 East Fourth St., St. Paul 1, Minnesota.

CIRCUIT COURT

[*from page 57*]

we find the following conditions. The triode section of a 6AT6 is connected as a cath. follower. The diode section plates are connected to a point on a B+ bleeder. The cathode of the tube is common to both sections. The diode plates conduct because their potential is B+. As a result of the current



chassis.

Fig. 4—Partial schematic Philco RF-71

through *R32*, the voltage at the diode plates is less than the supply voltage.

The composite video signal is coupled to the grid of the triode sync phase positive. This signal then appears at the top of the cathode resistor still sync phase positive. As the sync pulse appears at the resistor its instantaneous voltage approaches the voltage on the diode plates.

When a noise pulse comes in greater in amplitude than the sync pulse, the diode is cut off. As far as the rise and fall of the sync pulse is concerned, at the end of the sync pulse the voltage on the cathode resistor drops. When this occurs, the diode again starts conducting and the diode plate voltage drops. The result of this action is a pulse identical with the sync pulse. This pulse fed to another sync stage by a coupling condenser where it is further clipped and compressed to present a clean sharp pulse to the sweep oscillators.

By operating in this manner, the circuit eliminates any noise pulse which might be riding on the sync pulse. To eliminate any noise pulse which might have enough amplitude to cut off the diode at other times, a capacitor *C12* is connected across the diode plate. The high frequency content of the noise pulse sees this as a short and does not develop enough voltage to cut the diode off.

In order to vary the diode sensitivity to allow for different signal strengths, the diode B+ is connected to the *if* B+. This B+ varies with signal strength. A strong signal will develop a high *agc* bias for the *if* grids. This bias drops the *if* plate current which raises the *if* B+ voltage. In a strong signal area therefore the diode plate voltage is high and the cathode has to go higher in voltage before the diode is cut-off.

In a weak signal area, the opposite is true. The *agc* voltage is reduced, the *if* plate current is increased and the *if* B+ is increased. This reduces the diode plate voltage and enables the diode to be cut-off much quicker.

FIELD STRENGTH METER

[*from page 44*]

tuner. This tuner, together with a high-gain *if* amplifier and crystal detector, is used in conjunction with a sensitive indicating meter to produce an instrument of exceptional sensitivity and usefulness.

The Model M8104 is designed primarily for use in checking relative field strength or signal levels. It has a wide range of applications for television service, antenna installation, community antenna systems, and laboratory tests. Front panel controls have been carefully arranged for convenience of operation.

The circuit used is similar to the front end and video *if* system of a television receiver. The tuner portion of the instrument operates into a two-stage, high-gain *if* amplifier. The output of this amplifier is then rectified by a crystal, the rectified signal being used to operate the sensitivity meter. External monitoring jacks are provided, and permit the use of an oscilloscope for visual monitoring of the composite video signal. The circuit incorporates a new type of electronic sensitivity control which permits the checking of signal levels all the way from 10, to 100,000 microvolts. The indicating meter is calibrated from 10 to 100 microvolts, for reading low signal levels.

Above 100 microvolts, the relative signal levels are obtained directly from the calibrated Signal Strength dial. This control is simply rotated to make the pointer of the indicating meter coincide with the red line at the center of its scale. At this control setting the

field strength is then indicated in microvolts on the calibrated scale of the control. The adjustment of the Signal Strength control also adjusts the operating voltages on the tubes to reduce the overload effects from strong signals. This built-in electronic compensation produces a constant output level at the crystal detector and meter for all signal levels within the range of the instrument. The "reference level" calibration system is one which has long been successful in expensive laboratory equipment. It is the use of this system which permits the checking of strong as well as weak signals without overload. Specifications are as follows:

Frequency Coverage

Television Channels 2 through 13. Additional coverage of all *uhf* channels is possible when the instrument is used with the Philco Model G8000 VHF-to-UHF Signal Generator Adapter, and the Philco Matching Transformer, Part No. 45-1736.

Sensitivity Calibration

The indicating meter is calibrated in microvolts, from 10 to 100, and the Signal Strength control is calibrated from 100 to 100,000 microvolts.

Special Calibration Scales

In addition to its calibrated microvolt scale, the meter also has a scale marked in units from 0 to 100. The Signal Strength control also has an additional scale marked in units form 0 to 100. These extra scales make is possible for the user to construct special calibration tables or curves.

Oscilloscope Monitoring Jacks

Jacks are provided on the front of the instrument as a means for connecting an oscilloscope when it is desired to obtain visual monitoring of the signal.

UHF TUNERS

[*from page 63*]

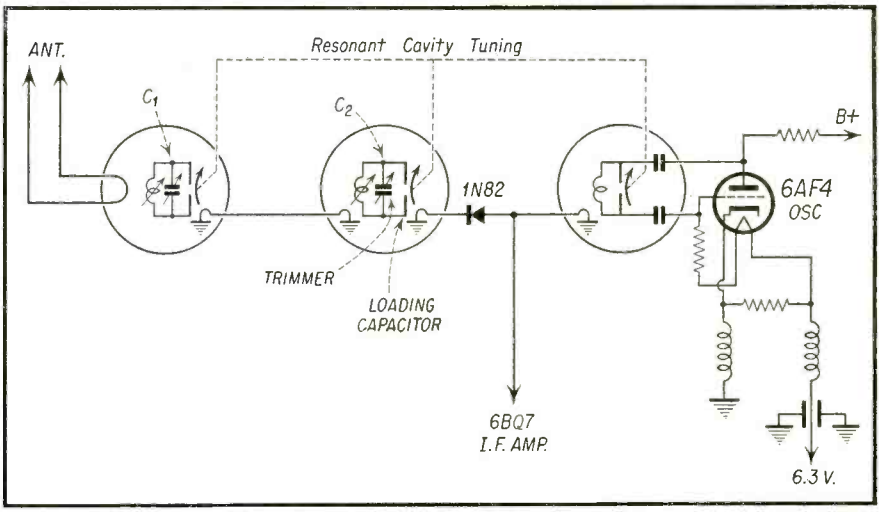


Fig. 13—Partial schematic of Granco Converter.

determine the impedance and bandpass characteristics of the different cavities.

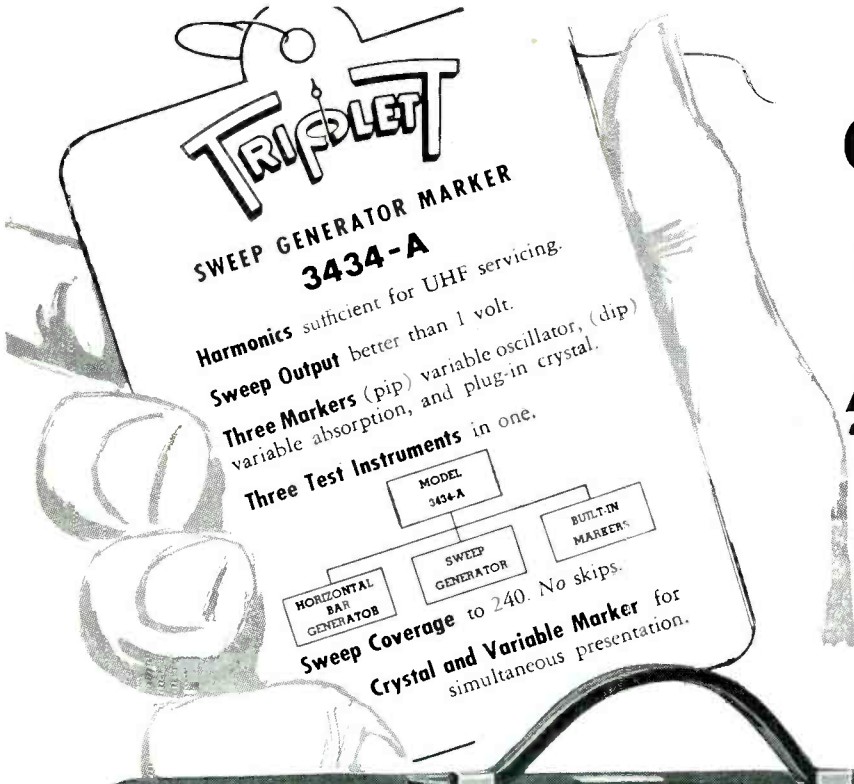
In conclusion, it should be repeated that servicing work on *uhf* units, calls for a great deal more care, neatness and precision in the work than is usually done in *vhf* work. In replacing oscillator tubes, it may be necessary to try several tubes in order to find one which operates properly at the required frequencies. These tubes may not be defective and may function properly in another unit. It cannot be too strongly emphasized that replacement parts should be *exact* replicas of the defective parts. An intensive study of basic *uhf* principles and theory should be made in order to understand the new designs which are popping up with the tremendous expansion of this new phase of the art.

TRANSISTOR PARAMETERS

[*from page 40*]

I_e is the desired constant value. Read the corresponding I_c value.

Power Supply Adjustment. Unless constant-current power supplies are used at A and B, it will be necessary to follow each adjustment of one supply with a compensating adjustment of the opposite supply, in order to obtain the



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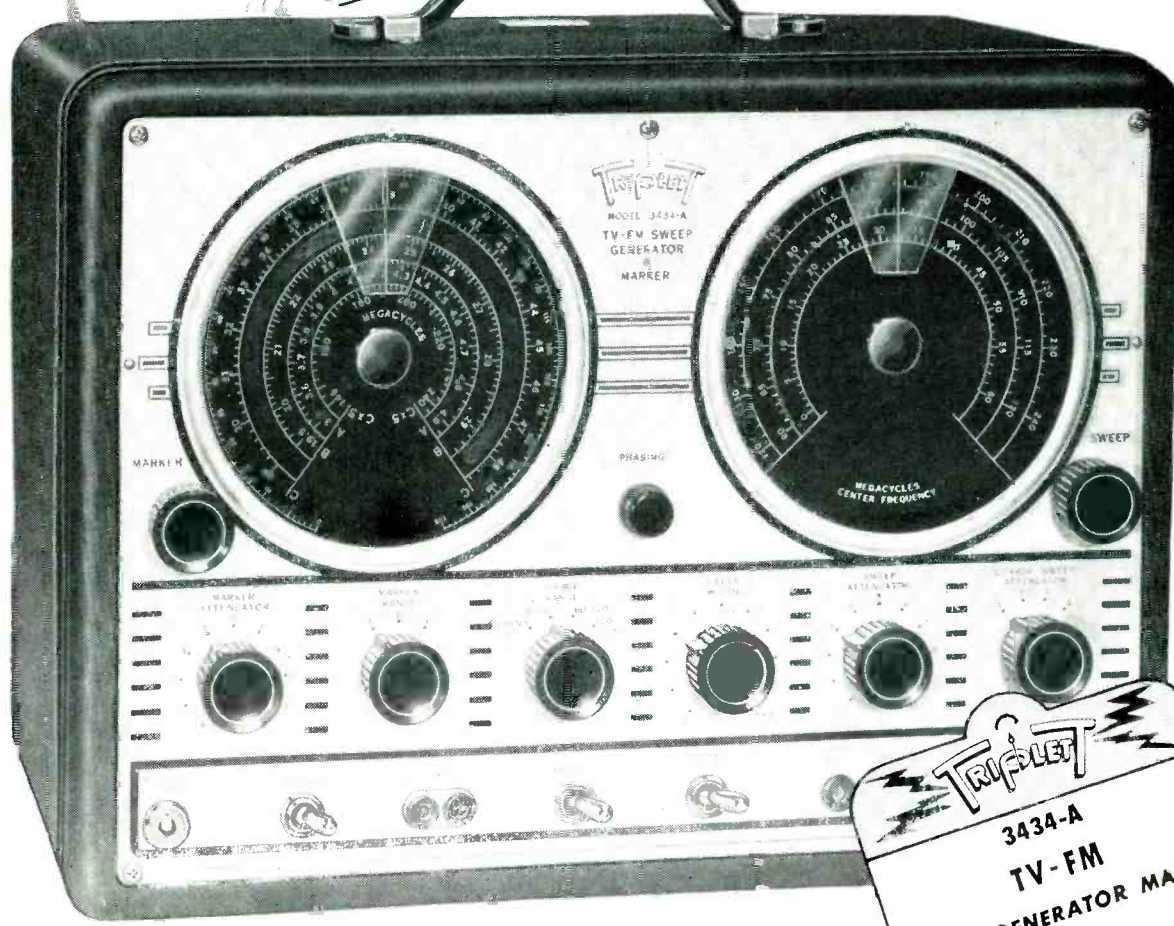

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required currents and voltages for the various curves.

Current Amplification. The current amplification factor, *alpha,* is an important transistor characteristic. Current amplification may be measured with the setup shown in *Fig. 3* in the following manner:

(1) Apply rated collector operating voltage to the transistor, as read with the *vtvm* switch to its V_c position.

(2) Set the emitter current to a value within the I_e rating of the transistor under test.

(3) Record this emitter current value as I_{e1}.

(4) Read the corresponding collector current and record as I_{c1}.

(5) Raise the emitter current by a small amount, recording the new value as I_{e2}.

(6) Read the corresponding new collector current value and record it as Ic^2. From these data:

$$\text{Alpha} = \frac{dI_c}{dI_e} = \frac{I_{c2} - I_{c1}}{I_{e2} - I_{e1}}$$

In terms of transistor resistances, alpha equals:

$$\frac{R_{21}}{R_{22}} = \frac{r_b + r_c}{r_b + r_m}$$

Static Measurement of Transistor Resistances. The foregoing discussion dealt with the determination of transistor resistances dynamically as the slopes of plotted curves. These resistance values may be determined statically for the *zero value of the constant-current component* on the basis of open-circuited input or open-circuited output of the transistor. The following procedures are followed.

1. Open the collector circuit. Apply rated emitter voltage V_e, as measured with a high-resistance *dc vtvm.* Measure the corresponding emitter current I_e. Then:

$R_{11} = V_e/I_e$ output circuit open (zero I_c).

2. Open the emitter circuit. Connect the high-resistance *dc vtvm* between emitter and base (equivalent to an open circuit because of the high resistance of the instrument). Adjust the collector current, I_c, to rated value. Read emitter voltage V_e. Then:

$R_{12} = V_e/I_c$ input circuit open (zero I_c).

3. Open the collector circuit. Connect the high-resistance *dc vtvm* between collector and base equivalent to an open circuit because of the high resistance of the instrument). Adjust the emitter current, I_e, to its rated value. Read the corresponding collector voltage V_c. Then

$R_{21} = V_c/I_e$ output circuit open (zero I_c).

4. Open the emitter circuit. Apply rated collector voltage V_c. Read the corresponding collector current I_c. Then:

$R_{22} = V_c/I_c$ input circuit open (zero I_e).

1. For the Grounded-Base Circuit.

Input Impedance = $R_{11} = r_e + r_b - \frac{r_b(r_b + r_m)}{R_L + r_b + r_c}$

Output Impedance = $R_{22} = r_b + r_c - \frac{r_b(r_b + r_m)}{R_G + r_b + r_e}$

2. For the Grounded-Emitter Circuit.

Input Impedance = $R_{11} = r_b + r_e + \frac{r_e(r_m - r_e)}{R_L + r_e + r_c - r_m}$

Output Impedance = $R_{22} = r_c + r_e - r_m + \frac{r_e(r_m - r_e)}{R_G + r_b + r_e}$

3. For the Grounded-Collector Circuit.

Input Impedance = $R_{11} = r_b + r_c + \frac{r_c(r_m - r_c)}{R_L + r_e + r_c - r_m}$

Output Impedance = $R_{22} = r_e + r_c - r_m + \frac{r_c(r_m - r_c)}{R_G + r_b + r_c}$

Equivalent circuit formulas for grounded-base circuit shown in Fig. 4, grounded-emitter circuit shown in Fig. 5, and grounded-collector circuit shown in Fig. 6.

Amplifier Equivalent Circuits

Figures 4, 5, and *6* show circuits and equivalent networks of the grounded-base, grounded-emitter, and grounded-collector transistor amplifiers, respectively. The circuits of these amplifiers now are well known, having received extensive treatment in the literature.

NORFOLK STORY

[*from page 36*]

spend all of their time solely on conversions, for the new set installations would have to be attended to besides. Thus upwards of 3 months of solid work was ahead of Norfolk's servicemen.

From an earning point of view, as each conversion represents close to $150 for the service contractor—with between 150,000 and 200,000 conversions plus new set installations awaiting the doings in the next 90 days—it spells upwards of $30,000,000 in TVset owner spending—$10,000,000 of that total being gross earnings for the service fraternity, or close to $120,000 additional billing per service firm in the September-November period. Any way you look at it, any new TV station launching means big business for all parties concerned, the equipment manufacturers, the wholesalers and the servicemen. From the latter's angle, doing an installation or conversion job properly, in the fastest possible time, and with a legitimate profit markup for services rendered is the key to healthy growth.

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Q METER

[from page 30]

(2) Set C_{11} to zero. (3) Connect the coil to terminals X_1 and X_2. (4) Set RESONATING capacitor C_{10} to a convenient low value such as 100 $\mu\mu$f on the C_e scale, reading this value as C_1. (5) Set S_4 to Q and adjust FREQUENCY control C_1 for peak deflection of the meter. Note the generator frequency. (6) Set the generator to ½ of this frequency. (7) Set S_4 to CAL and readjust the signal level, if necessary. (8) Throw S_4 back to Q, and adjust C_{10} for peak deflection of the meter. Record the reading of the C_e scale as C_2. (9) Calculated the distributed capacitance value from the equation:

$C_d = (C_2 - 4C_1)/3$. Use this value with Equation (10) to correct the inductance value previously obtained.

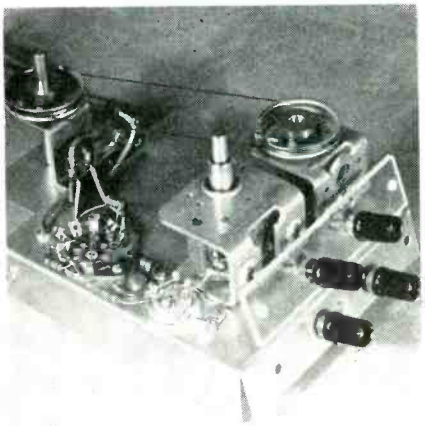

Fig. 8—Main resonating capacitor, vernier capacitor, binding post terminals, and 6AL5 socket are visible on front view of the Q subchassis.

Capacitance Checking. Values of 425 $\mu\mu$f or less may be checked by the substitution method, using the scheme explained in connection with Equation (7). The unknown capacitor is connected to terminals X_3 and X_4, and C values are read on the C_e scale of the C_{10} dial. Capacitances higher than 425 may be checked directly, using a coil of accurately-known inductance plugged into terminals X_1 and X_2, and employing the scheme explained in connection with Equation (6). The frequency is varied to obtain resonance. The unknown capacitor is connected to terminals X_3 and X_4, and capacitor C_{10} adjusted to its lowest-capacitance setting. This latter setting must be substracted from any value obtained by this measurement.

To Check Q of a Capacitor. (1) Plug a high-Q coil into terminals X_1 and

X_2. (2) Set switch S_1 to CAL. (3) Set the generator section to the desired frequency. (4) Adjust LEVEL control R_{11} for X1 deflection of the meter. (5) Switch S_1 to Q. (6) Resonate the circuit by tuning C_{10} for peak deflection of the meter. Keep C_{11} at zero. (7) Check level by switching S_1 to CAL, readjusting the generator output, if necessary. Return S_1 to Q. (8) Record the setting of C_{10} as C_1, and the Q-meter reading as Q_1. (9) Connect the test capacitor to terminals X_3 and X_4. (10) Retune C_{10} for peak deflection of the meter. Check the signal level with S_1 temporarily at CAL. (11) Record the new setting of C_{10} as C_2, and the new meter reading as Q_2. (12) Using the four readings obtained, calculate the capacitor Q by means of Equation (9).

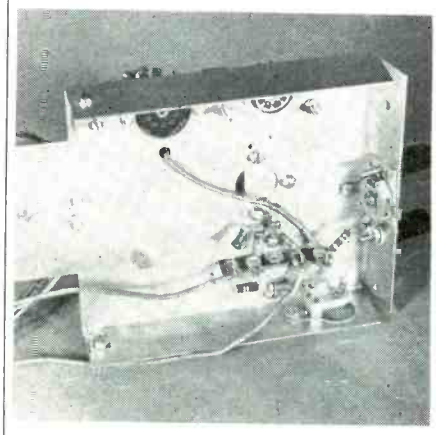

Fig. 9—Rear view of the Q subchassis before mounting. The trimmer capacitor seen directly under the binding posts is the signal coupling capacitor (C_9) in Fig. 4.

Measurement of Small Capacitances. Small capacitances, between ¼ and 6 $\mu\mu$f may be checked, by the substitution process, previously described, by using the trimmer (VERNIER) capacitor, C_{11}, exclusively for resonating (after the Q-measuring circuit initially has been resonated with the main capacitor, C_{10}).

SOUND CIRCUITS

[*from page 24*]

same. The voltage across both tubes is then the same and the currents in both tubes are the same. Since the currents in *R1* and *R2* are in opposite directions and equal, the combined voltage, which is the voltage across *C2*, will be zero.

Besides coupling by mutual induction between the primary and the sec-

[from page 79]

ondary, we also couple the signal to the detector by means of *C1*. As the frequency of the *if* varies about the center frequency, the voltage coupled through the transformer and that coupled by *C1* add in such a manner as to make voltages applied to each of the diodes no longer equal. Thus, the tube currents are not equal any more and the voltages across *R1* and *R2* do not cancel each other.

The amount of output voltage, which is the difference between the voltage across the two resistors, depends directly upon the deviation from the center frequency. The greater the deviation, the more the output. The output will be positive or negative with respect to ground, depending on whether the deviation is above or below the center *if* frequency.

This detector is sensitive to both amplitude and frequency modulation, and since we want it to respond only to frequency modulated signals, we must remove all traces of amplitude modulation, such as static and the effects of fading. This is done by the limiter which is the last, and sometimes only, stage of amplification before the discriminator. This stage works somewhat like a clipper where all signals above a certain minimum amplitude are removed. This clipping action does not affect the frequency modulation, but effectively removes all traces of noise, etc.

R3 and *C3* make up a so-called de-emphasis network. This little circuit has the opposite effect of a pre-emphasis network that is used at the transmitter and the effect of both networks is illustrated in *Fig. 5*. The principle operation of this circuit is as follows.

We know that most of the noise in any audio signal is found at the higher frequencies. We also know that the high frequencies audio signals of an average broadcast are much weaker than the lower frequencies. Now, by using pre-emphasis at the transmitter we can send out the weaker high frequency signals at a stronger level. In order to bring the overall signal down to its normal level at the receiver, we must use of a de-emphasis network so as to restore the original balance of highs and lows. By using this little trick, we can increase the signal-to-noise ratio by an appreciable amount and are able to obtain higher fidelity reception. The time constants of both networks must be the same and is usually between 50 and 100 microseconds. The de-emphasis network need not always be at the detector output. It may be found inserted anywhere between the detector and the speaker.

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