

AUGUST, 1950

# Radio-Television SERVICE DEALER



The Professional Radio-TVman's Magazine

**IN THIS ISSUE:**

Servicing FM Detector Systems  
Theory & Practice of Video Detector Circuits  
Horizontal A.F.C. Circuits, Part 2  
High Quality Analyses Series No. 5  
Cycle Inventory Control

**AM-FM-TV-SOUND**

**Paid Circulation Of This Issue: Over: 24,000**  
**Total Distribution Of This Issue: Over: 25,000**

**For Long,  
Trouble-Free  
Service**



## **...You Can Rely On MALLORY VIBRATORS!**

You get long and trouble-free service from Mallory Vibrators because of a three-way combination that can't be beat. The patented tuned mechanism assures slow contact impact, for minimum wear—high contact pressure, for low resistance—fast contact break, for reduced arcing and pitting. That's a Mallory exclusive!

And that's another good reason why more Mallory Vibrators are used in original equipment than all other makes combined.

When you use Mallory Vibrators for replacement, you are sure of long life, dependable starting and high output efficiency. See your Mallory distributor now!

*More Mallory Vibrators Are Used In Original Equipment Than All Other Makes Combined.*



P. R. MALLORY & CO. Inc.  
**MALLORY**

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS  
• RECTIFIERS • VIBRAPACK\* POWER SUPPLIES • FILTERS

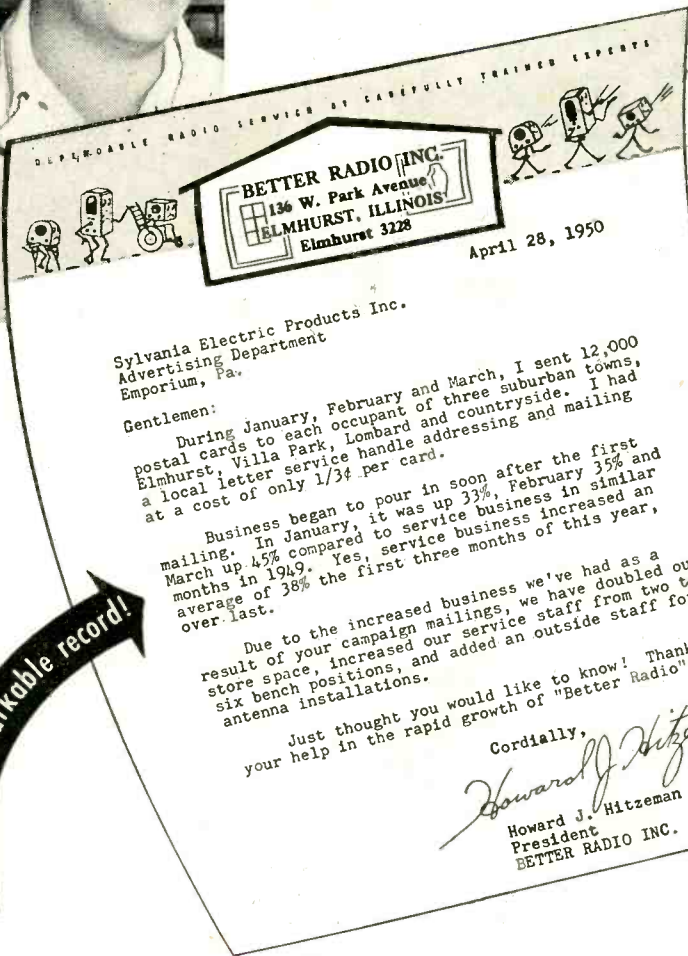
\*Reg. U.S. Pat. Off.

**APPROVED PRECISION PRODUCTS**

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



**"We doubled our  
store space...  
increased our staff"**



**Read this remarkable record!**

**Now let this SYLVANIA DEALER  
CAMPAIGN boost your business!**

The above letter is actual proof of how Sylvania's Service Dealer Campaigns step up sales.

Now the new fall campaign is ready for you. It's tied in with the advertising your customers will be seeing in the Saturday Evening Post, Life, Look, Collier's and Radio and Television Best. It's sure-fire, powerful and complete . . . from colorful window and counter displays to bright, business-pulling postal cards . . . even radio spot announcements and ad mats.

All yours ALL FREE . . . you pay only the postage (1¢ for each card). So don't delay, mail the coupon TODAY!

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

**SYLVANIA  
ELECTRIC**

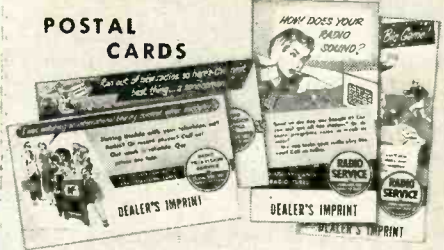
RADIO SERVICE DEALER • AUGUST, 1950



DISPLAYS



WINDOW STREAMERS



POSTAL CARDS



RADIO SPOTS



AD MATS

Sylvania Electric Products Inc.  
Dept. R-1608-A, Emporium, Pa.

Send full details about Sylvania's Fall Advertising Campaign for Radio-TV Service Dealers.

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# EDITORIAL

by S. R. COWAN

## Korean War's Effect

The Korean conflict is going to change the radio-TV industry's pattern of progress. Communications being primary factors in any war-time effort, we can expect: 1) the TV "Freeze" to remain in effect longer than was heretofore anticipated; 2) the allocation of materials and components, which naturally will mean a reduced output of radio and TV sets for civilians; 3) increased manpower shortages, especially of technicians.

It would appear as though drastic controls are not to be effected at once. For example, we do not expect to have gasoline rationed, tubes, test equipment and components diverted from civilians to war use only, etc., as we had during the World War. Instead, we do visualize that a reduced output of receivers will require ex-istant sets to take much more use and abuse, and naturally require more maintenance work. That the number of TV sets to be made and sold next year may be held to reasonable limits is not too bad, for even now there is not sufficient trained manpower to install and service what are already available or in use. All in all, we in the service profession can view the future with great optimism. However, let's not get any "fancy ideas." Let's not overbuy or hoard.

## N. Y.'s "Fair Practices Code"

The sponsors of a License Bill, which if adopted would have affected New York's radio-TV technicians, undoubtedly acted on the premise that such regulatory control would eliminate unscrupulous and/or incompetent servicemen and thus benefit the public.

As a matter of fact the great bulk of public complaint was NOT directed against the TV service profession *per se*. Instead, most complaints were lodged against dealers who had promised the set buyers a high range of reception that simply can not be obtained under present conditions in the Art. Basically the complaints were against both retailers and manufacturers themselves, and only a minute fraction of all complaints were lodged against service firms or servicemen for malpractice or incompetence.

The New York Better Business Bureau deserves plaudits for having undertaken its Fair Practices Code project, the pattern and standards of which could and should be adopted by all cities in the country. In this issue our "Trade Flashes" covers the new BBB Standards thoroughly. See page 4.

Meanwhile, the radio-TV service profession can relax just a bit in the knowledge that when the new Fair Practices Code has had a chance to become operative, that very fact itself will negate the need of any License Bill for technicians. In any event, under no circumstances should a licensing bill be proposed or considered until BBB and law enforcement agencies have had an opportunity to learn how effective the Fair Practices Code is.



Sanford R. Cowan  
EDITOR & PUBLISHER

Samuel L. Marshall  
MANAGING EDITOR

COWAN PUBLISHING Corp.  
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# Be Sure of Your Installations — Get the *Aptitude-Tested* RG/U TRANSMISSION LINE CABLES

RG-5/U

APTITUDE RATING No. 8236

Frequency (Mc)	Attenuation per 100 ft
100.	2.65
200.	3.85
300.	4.80
400.	5.60

You know what you are doing when you use Belden RG/U Transmission Line Cables—they're aptitude rated. They are designed from the start to provide desirable electrical characteristics, and rigid manufacturing control assures constant, unwavering quality.

You can safely put Belden Wire to work for you, and know for sure how it will perform. You can know, too, that it will have the stamina to stay loyally on the job for years. For trouble-free installations, specify Belden Radio Wires.

Belden Manufacturing Company  
4639 W. Van Buren Street  
Chicago 44, Illinois

RG-8/U

APTITUDE RATING No. 8237

Frequency (Mc)	Attenuation per 100 ft
100.	2.10
200.	3.30
300.	4.10
400.	4.50

RG-11/U

APTITUDE RATING No. 8238

Frequency (Mc)	Attenuation per 100 ft
100.	1.90
200.	2.85
300.	3.60
400.	4.35

**Belden 8238 RG-11/U**

RG-54A/U

APTITUDE RATING No. 8239

Frequency (Mc)	Attenuation per 100 ft
100.	2.90
200.	4.20
300.	5.50
400.	6.70

**Belden 8239 RG-54A/U**

RG-59/U

APTITUDE RATING No. 8241

Frequency (Mc)	Attenuation per 100 ft
100.	3.75
200.	5.60
300.	7.10
400.	8.30

For use with television antenna.

RG-58/U

APTITUDE RATING No. 8240

Frequency (Mc)	Attenuation per 100 ft
100.	4.10
200.	6.20
300.	8.00
400.	9.50

For use with radio frequency transmission, video, test equipment, and pulse transmission.

**Belden**  
*Radio WIRE*

The *Aptitude-Tested* **LINE**

ATOM®



TWIST-  
LOK®

Every

SPRAGUE  
TV

dry electrolytic  
is processed

FOR **185°F** (85°C.)

**OPERATION!**

Sprague leads again with the largest, most complete line of replacement electrolytic capacitors for television receivers. Each type is engineered especially for tough video applications and will stand up under the high temperatures, high ripple currents and high voltage surges encountered in TV equipment. Every Sprague TV capacitor rated at 450 d-c working voltage or less has been processed for 185°F. (85°C.) operation. Send postcard for special TV Bulletin.

SPRAGUE PRODUCTS CO.  
71 MARSHALL STREET  
NORTH ADAMS • MASS

# TRADE FLASHES

A "press-time" digest of production,  
distribution & merchandising activities

## Better Business Bureau of N. Y. Sets Standards Under Title of: "VOLUNTARY FAIR PRACTICES CODE"

The Better Business Bureau "Voluntary Fair Practices Code" recently adopted by leading manufacturers, distributors, dealers and service companies in the Metropolitan New York area to protect the public against deception in the advertising, selling and servicing of radio and television receivers went into effect July 15th, 1950.

The Bureau alerted advertising media and individual advertisers regarding certain practices which had been allowed but would henceforth be in violation of the new Code. These include misleading or incomplete statements pertaining to such matters as free trials, home demonstrations, exaggerated savings, trade-in allowances, performance claims, guarantees, the number of tubes, etc.

New York's Better Business Bureau has printed and makes available a complete brochure titled: "Standards for Advertising & Selling of Radios, Television Receivers, Television Service & Home Appliances" which every Service Dealer and Service Organization should obtain copies of. For brevity's sake we are reprinting with the Bureau's permission a digest form of the Standard's Part I and Part II. However, as Part III pertains solely to Service, we reprint that portion in full.

### THE NEW "STANDARDS" Part I and II-For Retailers Only

(merely a digest is given)

The new standards require the following:

1. All trial offers must clearly state the time limitation involved. "Free trial" offers must be used to mean only that there is no obligation on the part of the customers; that such merchandise may be obtained without cost, deposit or other purchase; and that it may be returned within the specified time without cost or other obligation to the customer. If other than a "free trial" offer is made, the conditions of the offer should be plainly stated.

2. A home demonstration in which a radio or television set or a home appliance is not left in the home for trial purposes, should not be described as a "trial offer."

3. Former prices or so-called list prices which are fictitious are not to be used in offering receivers and appliances to the public. No statement or implication should be made that the price of a set or appliance, part or accessory has been reduced, or has been reduced a certain amount, when in fact the price reduction is fictitious, or is otherwise misleading or deceptive.

4. Any trade-in allowance must be an amount deducted from the advertiser's current selling price of the offered merchandise when sold without a trade-in, and must be stated in clear, unmistakable terms.

5. No representations or claims should be made which are not fully justified by actual performances of the set in the locality in which it is advertised, offered or sold.

No representations or claims should be made which deceptively conceal defects or deficiencies inherent in the set or in the current state of the art to which the receiving set is subject, but which are unknown to the buying public.

6. The word "guarantee", if used, must be fully explained. If an advertisement refers to a guarantee or warranty, its exact terms and duration must be stated in readable type.

There should be no statement or implication in a heading or caption that a guarantee is greater than it actually is.

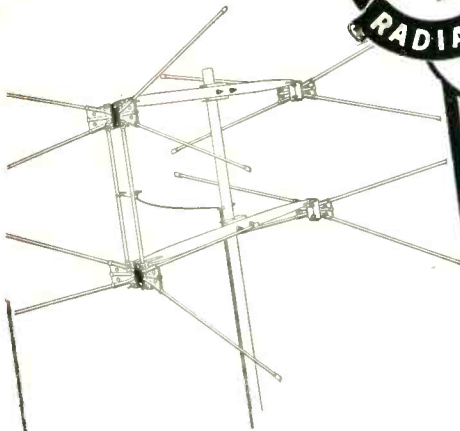
7. No advertising should represent or imply that any radio or television set contains a certain number of tubes or is of a certain tube capacity when one or more such tubes in the set are dummy or fake tubes, or do not perform, or were not placed in the set to perform the recognized, customary function of a receiving set tube in the detection, amplification or reception of radio sig-

[Continued on page 8]

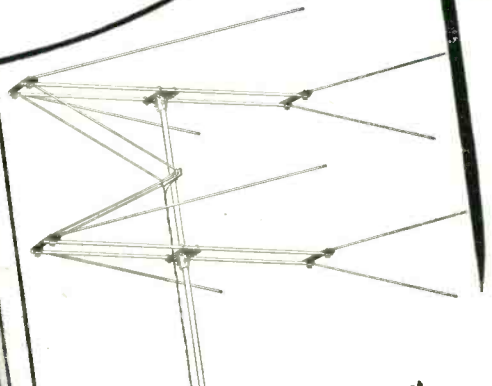
# THE BIG 3 IN TV



By  
**RADIART**



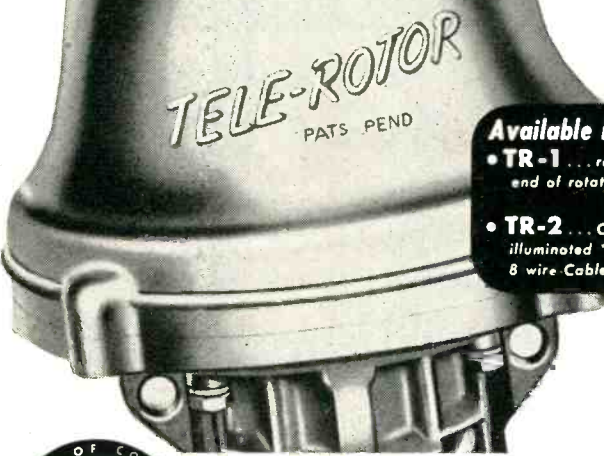
THE "LAZY-X" . . . RADIART engineered for peak performance, making them the most popular everywhere! An all-channel array . . . with the new UNIVERSAL bracket that permits any desired arrangement of the elements.



THE "SUPER-VEE" . . . the newest development in TV antennas. Extra high gain . . . sharp directivity . . . and all channel reception. Available in single and double stacked arrays. Completely PRE-ASSEMBLED with FAST fold-out design for speedy installations.

## THE RADIART **TELE-ROTOR**

Just a few months old in the field . . . but gaining in popularity — zooming to the top in sales! Feature for feature it can't be beat! Most powerful . . . unusually rugged . . . and built to last and perform in a trouble-free manner. Available with the "Perfect Pattern" dial control cabinet with illuminated dial that gives instant indication of antenna position.



**Available in the following models:**

- **TR-1** . . . rotator and Control Unit with end of rotation light (uses 4 wire Cable) **\$37.45**
- **TR-2** . . . Compass Control Rotator with illuminated "Perfect Pattern" dial (uses 8 wire Cable) **\$44.95**

**YOU CAN'T BEAT A RADIART ANTENNA ON A TELE-ROTOR . . . IT'S TOPS!**



IT'S RIGHT WHEN IT'S RADIART

**THE RADIART CORPORATION**  
CLEVELAND 2, OHIO



- ROTATORS
- VIBRATORS
- TV ANTENNAS
- AUTO AERIALS
- POWER SUPPLIES



# I TOLD YOU SO

by San D'Arcy

Government Buying. During the early part of this year U.S. Government agencies started to place orders of impressive size for all types of radio-communications equipment. By July 1st probably more than \$500 million worth of parts and equipment was actually on order and in work. Despite this Government purchasing civilian production was not noticeably affected because our industry's manufacturing capacity had grown so large it could absorb the extra volume. However, since the Korean conflict arose, it now becomes apparent that our Government will expend additional sums on radio-communications equipment this year, and for several years to come. It is estimated that another half-billion dollars worth of equipment will be ordered for production during the last half of 1950 making Government radio expenditures exceed a billion dollars for the year 1950. Civilian production of radios and television sets now must be cut into but to what extent is not known just yet. We venture the guess that it will not be to any extent that will upset the industry as a whole. At least, despite what one reads in the papers, we do not foresee for the immediate future any need for extensive Government control of consumer durable goods.

*Decca Adds 45.* The recent announcement by Decca that they and their subsidiaries will henceforth produce all releases in 45 rpm speeds as well as in 33 1/3 and 78 is far-reaching indeed because of Decca's top-ranking sales position in the field. If recording "experts" are upheld in their present-day contention that the slower speed records have inherent advantages not found in the 78 rpm types, it would seem that 78 is already obsolete, except from a technological point of view. So, it is our opinion that while 78 rpm records may still be produced for another decade or two, eventually they will fade into total oblivion.

*FM's Second Chance.* Many people believe Frequency Modulation broadcasting has passed its zenith and from now on must decline. (If the profit and loss records of this country's 111 FM stations for 1949 is a criterion, those who believe FM is dying are quite correct, for not a single FM station showed a profit last year . . . and who willingly supports losing ventures forever?). One New York newspaper, The Times, has long operated FM station WQXR. A recent editorial in the Times is interesting because it states that WQXR is convinced that FM stations can operate profitably (and serve their audiences too, which is a basic FCC requirement for the ownership of a transmitting license). The Times editorial writer contends that experiments prove that the listening public accepts FM readily provided the programs are not simulcasts with either AM or TV broadcasts. In the Rural Radio Network area of New York State, Connecticut, and Pennsylvania which WQXR and its affiliates serves, and which is rapidly being expanded, FM receivers are being sold in larger quantities than ever before. That's a sure sign that WQXR is on the right track, and we wish them every success because we, too, feel that FM should be permitted to survive and thrive.

"Only three minutes on the job and this Amphenol **INLINE** Antenna is fully assembled and going up the ladder!

I save hours of installation time with Amphenol Quick-up antennas, and even more important, because of the sturdy, durable construction of **AMPHENOL** antennas, I know I won't be called back to make repairs.

For quick, easy handling—and above all, durability, there's nothing like the Amphenol **INLINE** Antenna."

**AMPHENOL**

QUICK-UP

**—INLINE\***

ANTENNAS

U. S. PAT. NO. 2,474,480

**AMERICAN PHENOLIC CORPORATION**  
1830 SO. 54TH AVENUE • CHICAGO 50, ILLINOIS

RADIO SERVICE DEALER • AUGUST, 1950



**"MEET  
MY  
ACE  
SALESMAN!"**



**T**HE G-E monogram on the tubes I stock and install—that's Reason No. 1 why I'm doing more business than ever before!" Plenty of radio-TV servicemen are saying this. It pays to handle a winner; public preference for General Electric puts real money in servicemen's pockets, will profit *you* and accent your reputation for first-class repair-work and quality tubes and parts. . . . Reason No. 2 why you'll do more business, is General Electric tube promotion aids! Help to you from G-E headquarters never stops. Stunning new signs and displays; advertising items that crackle and spark; a host of useful serviceman's aids; a continuous flow of up-to-date TV repair tips in Techni-Talk Magazine—these become dollars-and-cents sales figures. Ask your distributor *today* for the full G-E-tube success story!  
*Electronics Dept., General Electric Company, Schenectady 5, N. Y.*

**ONE SOURCE FOR ALL  
YOUR TUBE REQUIREMENTS**

—metal and glass tubes; miniatures; TV picture tubes in a wide range of sizes and types; also germanium diodes and selenium rectifiers. General Electric's line is complete! G.E.'s list of types includes newest tube designs for new radio-TV receivers! . . . Stock G-E 100-per cent, to simplify ordering—benefit from unit deliveries—profit from General Electric tube quality and popularity!

*You can put your confidence in—*

**GENERAL  ELECTRIC**

181-JAB

# Now all ASTATIC cartridges come in these RUGGED, TRANSPARENT PLASTIC BOXES



**T**HERE'S no mistaking which Astatic Cartridge is in this box. You can see and identify the cartridge through the clear, transparent plastic. And there is also an identifying label at each end of the box. Nothing could be more convenient — a real time and mistake saver. Note the uniform size of boxes, regardless of cartridge size.

**T**HE lid comes off the large way, to make the cartridge easier to get at in the new Astatic box. The thickness of plastic is apparent in this view, which assures a rugged container that won't collapse, tear or gap open. Cartridges are kept safer and cleaner.



**C**LEARLY visible through the bottom is a list of the cartridges which the one inside the box replaces. Another convenience to save time and increase efficiency.

**T**HE uniform size and straight, rigid sides of the new plastic boxes make it easy to keep them on shelves in neat, orderly stacks that won't topple.



**THE**  
*Astatic*  
**CORPORATION**  
ASTATIC  
CONNEAUT, OHIO  
IN CANADA: CANADIAN ASTATIC LTD., TORONTO, ONTARIO

## TRADE FLASHES

[from page 4]

nals. For example, Rectifier tubes should not be included in the tube count.

8. Claims for efficiency of indoor and outdoor or roof antennae should be made with due consideration for the type of radio or television set to be operated, distance from transmitters, location of antennae, etc. False or misleading representations should not be made that antennae or aerial eliminators will improve selectivity or tone, remove electrical disturbances, give volume and distance equal to outdoor aeriels, remove danger of lightning, storms and short circuits. Statements or implications that "no aerial" or "no roof antennae" is necessary should not be made unless any limitations of such claims are made clear.

9. When any reference is made to the picture size of a television receiver, the diameter of a circular picture tube, or the longest dimension of a rectangular surface tube should be given, except that where a projection system is used it is necessary only to prominently mention this fact. Picture tube size should not be confused with picture size. Any enlarging device that is sold as part of a set or as a permanent attachment to a picture tube should be prominently identified by a caption and in any illustration, and the enlarged size should not be mentioned without, or more prominently displayed than, the proper description of the size of the tube itself. A device that enlarges part of a picture shall not be so described or illustrated as to imply that the whole picture or screen size can or will be made larger.

### PART II

#### APPLIES TO SERVICE

(reprinted in full from  
BBB "Standards")

#### 1. Service Offered

No statement or implication shall be made in an advertisement or otherwise that the service offered is greater or other than is actually included in the contract to be sold to the customer.

#### 2. Explanation of "Service"

The word "service," or words of similar meaning shall be construed to include inspection, any adjustment of parts and replacement of all parts necessitated by normal usage, at no extra charge above the advertised and/or service contract charge. If such complete service is not included in the contract itself, what is offered shall be clearly and specifically described. If a contract is advertised or offered which does not include replacement of parts, a specific statement shall be made that parts are not included or that an extra charge will be made for parts replacement. If inspection and adjustment of existing antennae are not included, this shall be stated.

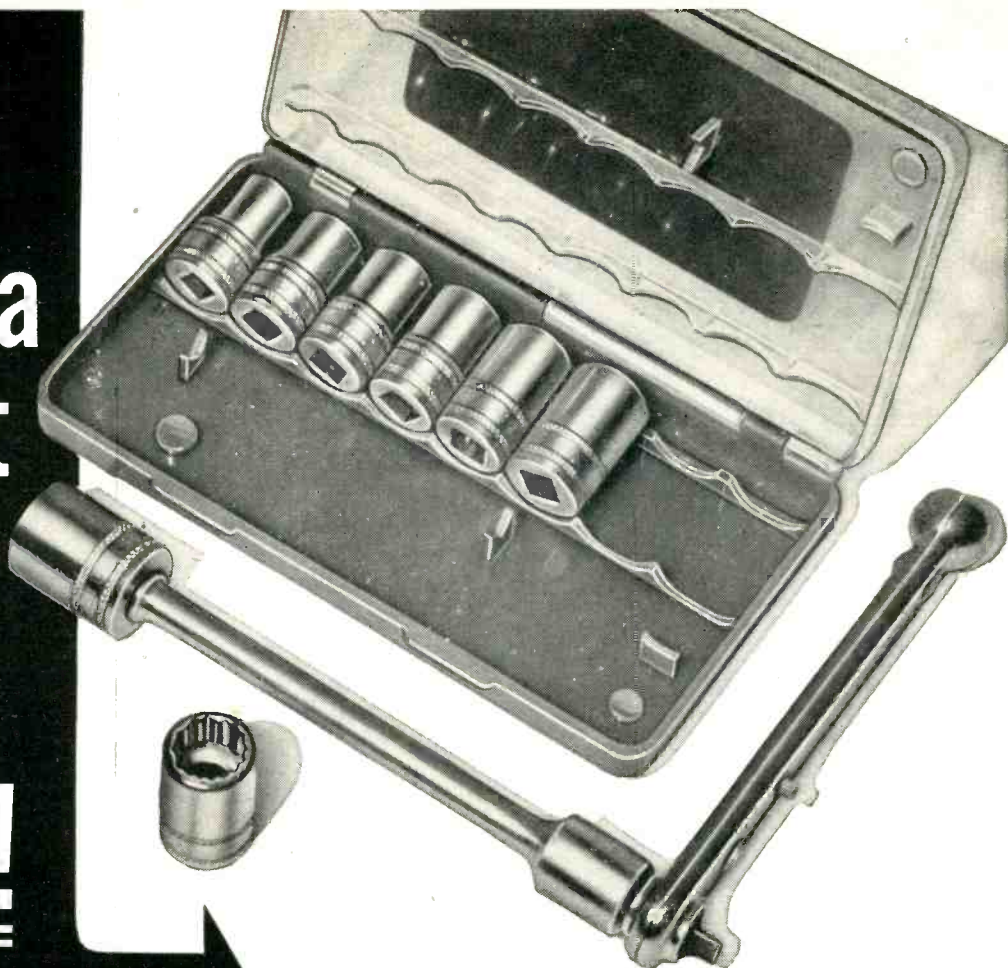
#### 3. Prices

Advertised or offered prices shall include complete servicing of set, existing

# THIS Sylvania Socket Wrench Kit FREE!

When you purchase

100 Sylvania receiving tubes  
or 3 Sylvania picture tubes



## Note these outstanding features!

1. 8 chrome-plated steel interchangeable sockets, 3/16" to 7/16"
2. Either clockwise or counter-clockwise ratchet action . . . finger-tip selector
3. Convenient 4-inch socket extension for hard-to-reach screws and nuts
4. Incorporates offset screwdriver with 2-way ratchet action
5. 3 3/4", easy-to-hold handle, convenient for tight spots
6. Good-looking, plastic case . . . pocket-size

Your Sylvania Distributor is giving away this new Socket Wrench Kit free with every purchase of either 100 Sylvania Receiving Tubes OR 3 Sylvania Picture Tubes. This offer begins August 1st and is good for a limited time only!

You'll find this new kit an indispensable aid in your work . . . gives you 8 different size sockets in one box . . . fits easily in your pocket. Exclusive with Sylvania, this kit is valued at \$3.25 . . . but will not be sold anywhere for any price during this special offer. Get your kit without delay!

**Remember**—This Socket Wrench Kit is not for sale—it's free! Take advantage of this wonderful opportunity while the limited offer lasts! Inquire at your Sylvania distributor's today.

# SYLVANIA ELECTRIC

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

RADIO SERVICE DEALER • AUGUST, 1950

# WE MAKE LOUDSPEAKERS ...not apologies!

If you could see the way we make RACON Paging and Talk-Back Speakers—as so many sound men do, at our invitation—you'd know why they return for more RACON Speakers . . . why they don't come back with complaints—or we with excuses.

**POWER** Only RACON Paging Speakers—no other—have continuous power capacities of 20 watts (peak 35 watts) and 10 watts (peak 15 watts). The proof of their ability to take punishment is that they are guaranteed for 18 months.  
**Does your loudspeaker line have this?**

**DESIGN** Every part of a RACON Paging Speaker is exponentially flared. Why? Because an exponential flare is the most efficient method of coupling a diaphragm to the moving air. More costly for us, of course—but it results in greater sound output and better low frequency response.  
**Does your loudspeaker line have this?**

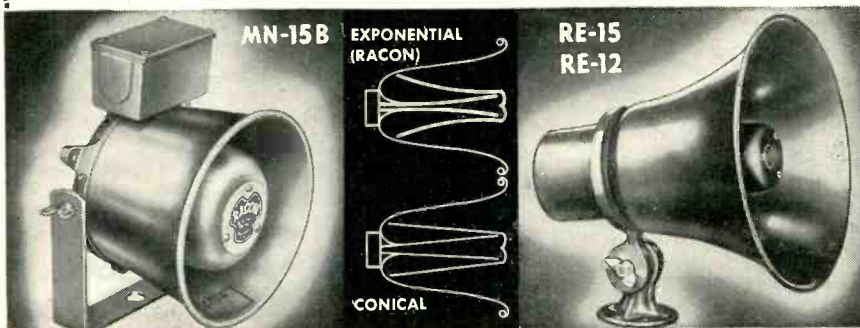
**CONSTRUCTION** The response of a RACON Paging Speaker is smooth, clean and free from vibration and resonant peaks. This is primarily due to the fact that, in place of the usual thin tin tone arm, RACON uses a 1/4" wall aluminum casting for the tone arm.  
**Does your loudspeaker line have this?**

**IMPEDANCE** Every RACON Paging Speaker is available in 8, 15 or 45 ohms—at the same price.  
**Does your loudspeaker line have this?**

**MOUNTING** RACON mounting brackets are designed for life. Instead of zinc or thin sheet metal brackets which give way under vibration, only husky rib-reinforced aluminum castings are employed.  
**Does your loudspeaker line have this?**

**VOICE COIL** Aluminum-wound voice coils are usually associated with the most expensive types of loudspeakers. Yet in RACON Paging Speakers they are standard—to provide greater efficiency and better response characteristics.  
**Does your loudspeaker line have this?**

**PRICE** The price tag on RACON Paging Speakers might be a little higher. Why? Because of the extra care and quality we put into every speaker. The price reflects honest engineering, skilled craftsmanship and top performance . . . these are constant, and so are the prices. We like to say, "RACON Paging Speakers are always for sale—never on sale."  
**Does your loudspeaker line have this?**



Model RE-15 (20 watts; 8, 15 or 45 ohms) . . . . .	\$34.00
Model MN-15B (20 watts; 8, 15 or 45 ohms) . . . . .	\$34.00
Model RE-12 (10 watts; 8, 15 or 45 ohms) . . . . .	\$26.00

**The proof** of all these facts is in putting RACON Paging Speakers to work for yourself. Connect one to an amplifier and give it the roughest, toughest test you want. You'll be coming back—not to complain—but for more.

ACOUSTICAL  EXCELLENCE

SINCE 1922  
**Racon Electric Co., inc.**

Sound  
Equipment  
Manufacturers

52 East 19 St.  
New York 3,  
N. Y.

In Canada: Dominion Sound Equipments Limited, Montreal, Que.

antenna, and all working parts thereof, unless clearly and conspicuously described otherwise. There shall be no implication that a featured or quoted price includes more than it actually does.

#### 4. Price Applied to Size

If the cost of a service depends on the size of a set (picture tube size), the exact price of a particular size shall be clearly indicated when prices are quoted in an advertisement.

#### 5. Price Applied to Duration

When prices are advertised or quoted, the exact duration of the contract to which they apply shall be given.

#### 6. Extended Payments

When extended payments are available, and any terms of such payments are actually quoted in an advertisement, such quoted terms shall be so expressed as to avoid any confusion as to the full amount to be paid or the number of payments to be made.

#### 7. Advance Information

Service companies shall furnish to advertising media to which copy is submitted, and to prospective customers, on request, adequate information as to coverage of offered contracts, and the extent of the protection offered to customers (i.e., whether through an escrow account or a bond, in which case the bank or bonding company shall be identified, and whether the replacement of parts, when required by Insurance Laws, is covered by an insurance policy, identifying the insurance company). If requested in advance, service companies shall make available to customers and to advertising media exact sample copies of the service contracts offered.

#### 8. Make

Service companies which are prepared to service only certain makes and models shall not imply that they service others.

#### 9. Extra Charges

If any extra charges may be made in some circumstances for inspection, for adjustment of any kind, or for necessary replacement of any parts, including the picture tube and existing antenna, above the advertised or quoted price of a service contract, in order to obtain an offered contract or during the lifetime of the contract, this fact shall be made entirely clear in any advertisements and/or in advance to all prospective customers. This shall not be interpreted to include extra costs due to other than normal usage or to outside causes, such as fire, presuming that these exceptions are adequately covered in the contract itself. In all cases, however, extra charges shall be made known to the customer prior to the acceptance of the contract or any payment therefor.

#### 10. Speed of Service

No unqualified statement as to the speed of service to be expected shall be made. If a term such as "Service within 24 hours" is used, a customer should expect to get exactly that, a complete adjustment, in all circumstances, on any day of the week, and without extra cost. A term such as "24 hour service," unexplained, shall not be used, since it can mean either service within 24 hours or immediate service during the whole 24 hours of the day. Example of correct usage, when invariably capable of ful-

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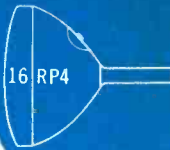


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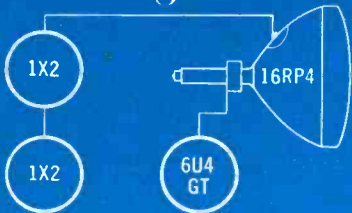
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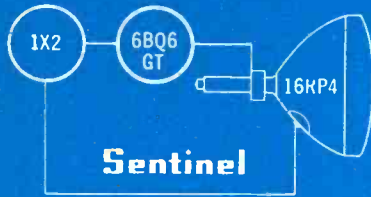
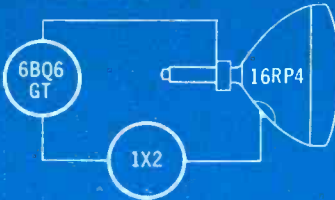
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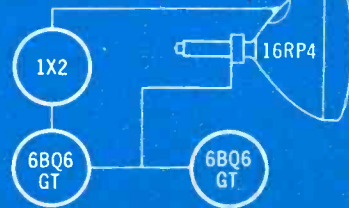
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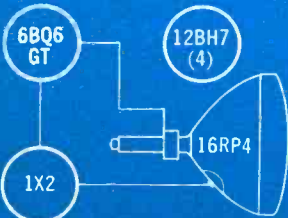
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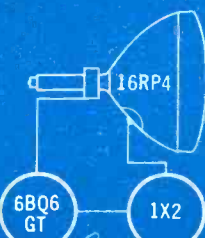
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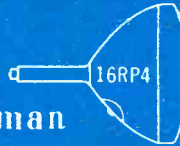


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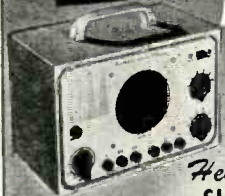
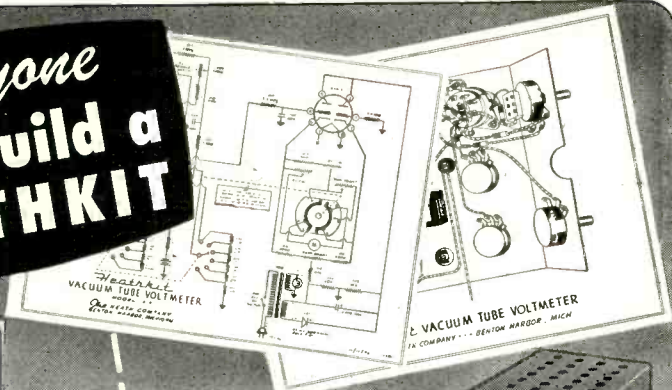


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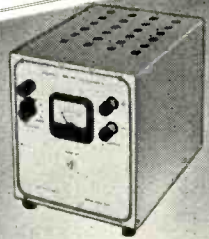
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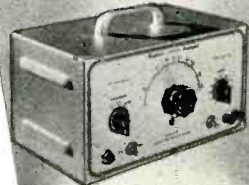
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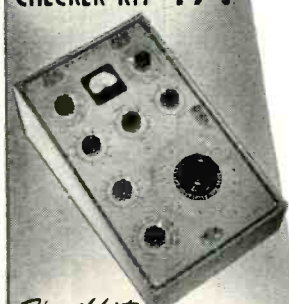
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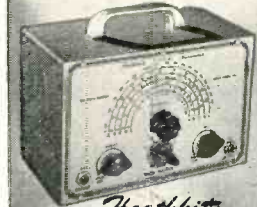
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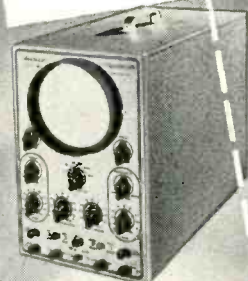
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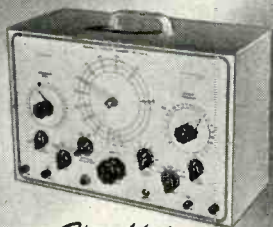
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**11. "Free" Offers**

The terms "Free" or "Gratis" or similar expressions must not be used when the offer of an article is dependent upon the purchase of other merchandise or services. The expression "included with" is acceptable.

**12. Advanced Replacements**

No advertisement shall offer advance replacement of parts as an inducement to sign a service contract, unless the replacement of necessary parts is included in the contract itself (or such replacement is covered by an insurance policy when required), or unless the advertisement states that such parts replacement is not included in the contract.

**13 Kind of Replacements**

All replacement shall be made with parts of equal value and equal performance capability to the parts replaced, except with the advance knowledge and consent of the customer. It is the intent of this standard that cheap or inferior or second-hand substitutions shall not be made.

**14. Choice of Service**

In the selling of installation and service contracts in connection with the sale of new sets, the seller shall not state or imply that the only service obtainable is his own or that of a service company designated by him, when in fact service may also be obtained on the offered set from the manufacturer thereof or from a service company the customer may select.

**15. Conversions**

Any concern advertising or offering conversions from a smaller to a larger picture tube shall be prepared to assume full responsibility for the performance of the converted set as relating to the new size, and for the possible abrogation of any existing service contract by such conversion, and shall inform customers in advance that it will be responsible therefor.

**PART III  
PUBLIC EDUCATIONAL PLAN**

The final phase of the BBB television standardization drive basically consists of an educational program for the public and has as a feature a most ingenious booklet which must be seen to be appreciated, it is that fine. Were these booklets available from the inception of TV the public would not have permitted unscrupulous retailers or manufacturers to "get away with" the misrepresentation that has been so rampant. This booklet explains clearly just how much to expect from any TV set in the way of performance—what should be incorporated in service "contracts"—what a TV set buyer should not expect from the service contractor, etc. As stated before, the booklet is fine. The Better Business Bureau is offering the booklets to all dealers and service companies at cost for free distribution to the public. However for only ten cents, which covers cost of mailing, the Bureau will send copies to anyone.

Finally, it has been made clear by the executives that head up the BBB that although that agency is not a law enforcement body they intend to see to it that the Standards set up as the Fair

[Continued on page 29]

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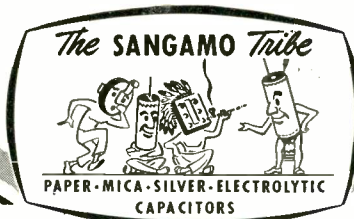
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# Servicing

# FM DETECTOR

# Systems

by MATTHEW MANDL

In this article the two basic systems of FM detection are discussed. In addition many valuable servicing procedures are pointed out with specific methods of testing, which should appeal to many service technicians.

WHILE there are relatively few tubes used in the detector systems of frequency modulation receivers, the complexity of the circuits involved contribute to many of the troubles encountered in the sound sections. This, of course, also holds true for the FM detection stages of television receivers, and the types of trouble indications which are usually encountered are as follows:

1. Total absence of sound from the speaker
2. Sound output very weak
3. Sound output distorted
4. Noise and static
5. Excessive high frequency response—high frequency hiss

Inasmuch as some of these troubles may be due to faults in the i-f or audio amplifier stages, the technician must resort to special checks in order to find whether these, or the detector circuits are causing the poor reception. Servicing procedures for detector stages differ somewhat from those which would be employed in i-f or audio amplifiers and a basic understanding of the detector and its associated circuits will help in fully utilizing such techniques.

The majority of FM receivers and television sets on the market today use two basic FM detection systems. One of these is the discriminator and the other the ratio detector; each of which differs from the other in circuit make-up and the manner in which detection is accomplished.

The discriminator will detect AM as well as FM signals, and for this reason a "limiter" stage is always used before the discriminator so that static and other AM type noise pulses are clipped off. The ratio detector, on the other hand, needs no limiter, for it responds only to frequency modulation signals. Both circuits employ "de-

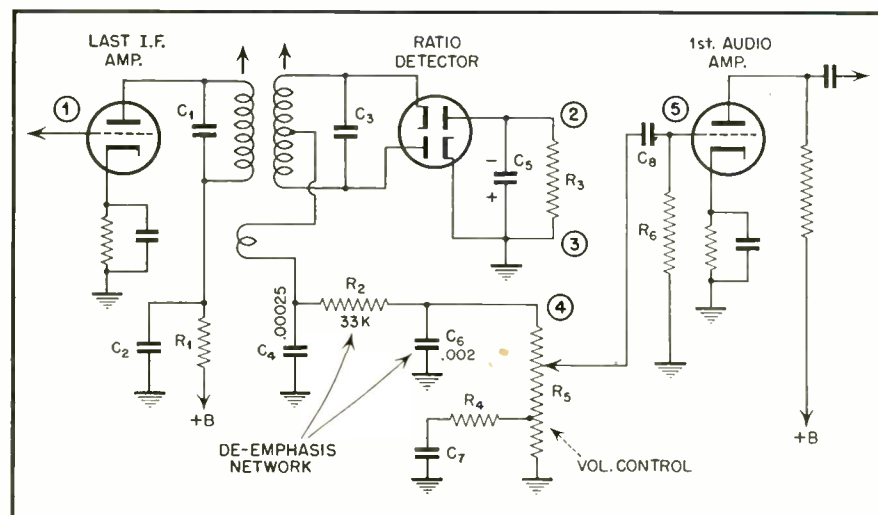


Fig. 1. Typical ratio detector circuit.

emphasis" networks, because in FM transmission the higher audio frequencies are "pre-emphasized" in order to increase the signal to noise ratio. This boosting of the high audio frequencies at the transmitting station means that they would have to be diminished at the receiver or excessive high frequency response will result. Without de-emphasis all high frequency sounds are louder than normal, and such sharp sounds as an "S" in a word would have an over-hang or trailing sound.

#### Ratio Detector Trouble

A typical ratio detector circuit is shown in Figure 1 and this differs

from the discriminator because the input is applied to a plate and cathode instead of two plates like the discriminator. Coupling between the last i-f amplifier to the detector is by mutual coupling between primary and secondary, with an additional coil from the center-tap of the secondary coupled to the primary also. This establishes the proper voltage reference level for detector function. This center-tap voltage could also be procured by use of a coupling capacitor as shown for the discriminator circuit in Fig. 2. The capacity  $C_5$  with  $R_3$  suppress amplitude modulation pulses by setting up a long time constant. In this man-

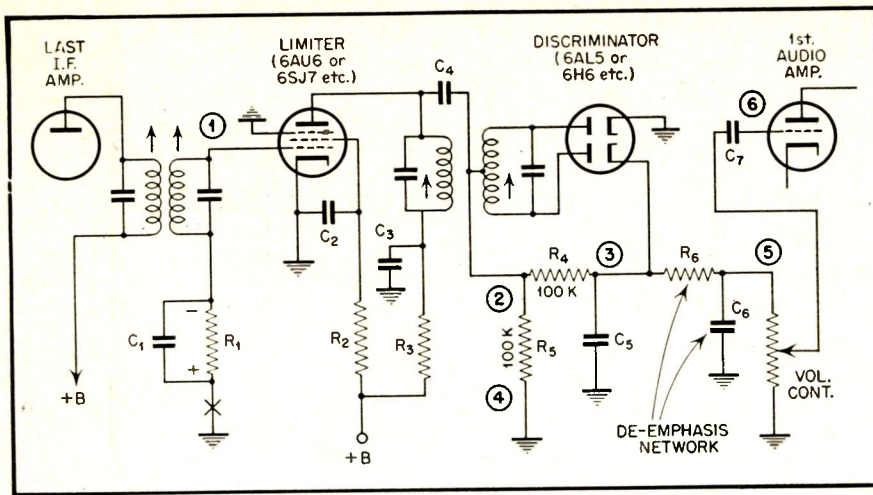


Fig. 2. The Limiter-Discriminator system of FM detection.

ner static, or other AM short duration signals are absorbed by the capacitor-resistor network and cannot build up to sufficient amplitude to be properly detected.

Thus, if static or noise pulses develop in the sound system,  $C_5$  and  $R_3$  should be checked for an open circuit, or for a change in values.  $C_5$  is usually a large capacity affair of 2 to 4  $\mu\text{f}$  or more, with low voltage rating. Inasmuch as there are no power supply voltages involved there will be no break-down troubles. The only troubles encountered here are changes in values or open circuits due to faulty soldering work.

$R_2$  and  $C_6$  comprise the de-emphasis network previously mentioned. Here, again, little trouble is usually encountered because signal voltages and not power supply voltages are present. With receivers having poor sub-chassis ventilation, however, capacitors with low voltages across them sometimes give as much troubles as those with high B voltages, due to the excessive heat melting the wax sealed ends and weakening the condenser structure. An open  $C_6$  will result in loss of de-emphasis and a pronounced accenting of high frequencies will result.

Low output may be due to an improperly tuned system and aligning should be checked if all other circuit components (including tubes) prove in good condition. The type of tube usually encountered is the twin diode type such as the 6H6 or the 6AL5. If considerable differences exist between the two diodes in their emission, the severe unbalance will cause distortion as well as somewhat decreased output. The twin diode should be checked on a tube tester which shows the emission characteristics of each diode section. Distortion may also arise because of a leaky coupling

capacitor ( $C_8$ ) and this should be replaced if the leakage resistance as read on a VTVM ohmmeter scale shows less than 500 megohms.

$R_4$  and  $C_7$  comprise the bass compensation network and when a new volume control is needed one should be used which has the tap at the proper resistance value. This circuit acts like a slight bass boost at low volume settings of the control.

The capacitor  $C_2$  has a relatively high plate voltage across it and failure of this capacitor will overheat or open  $R_1$  due to excessive current flow. This will make the audio section inoperative inasmuch as the i-f amplifier will receive no plate voltage. A dead stage may also result from an open  $C_8$ , or an open circuit in any of the signal carrying wires and components. The dead stage can be localized easily by applying a signal generator between test point (1) in Fig. 1 and ground. Set the signal generator at the i-f frequency and use either AM or FM of the signal generator. A vacuum tube voltmeter replaced across points (2) and (3) will give a voltage reading if there is no open transformer or defective tube or other component.

If the signal appears across points (2) and (3) but no sound comes from the loudspeaker, earphones can be placed across terminal (4) and ground. If the signal generator is frequency modulated the audio (usually 400 cps with most generators) will be heard across the volume control. If the signal generator is not provided with FM, regular AM can be used and  $C_5$  removed from the circuit by opening one lead. This will allow the amplitude modulated signal from the generator to be audible across  $R_5$  and will serve as a signal tracing check. If the sound is still present across  $R_6$  by using earphones at this test point

(5) the trouble would lie in the audio amplifiers or loudspeaker.

#### Limiter Discriminator Troubles

A typical circuit of a limiter-discriminator type of detection system is illustrated in Fig. 2. The function of the limiter is to clip off from the incoming frequency modulated signal all variations in amplitude. In order to accomplish this the tube is run with low electrode voltages and has a sharp cut-off characteristic. For this reason tubes such as the 6SJ7 or 6AU6 type will be encountered.

In order to have the bias automatically set at the proper level for clipping, grid-leak bias is employed, the capacitor  $C_1$  charging up when the grid runs positive and holding this charge until the next cycle of the signal comes along. The capacitor sets a voltage across the grid leak ( $R_1$ ) with a polarity as shown, thus applying a negative bias to the grid of the limiter. This action is similar to rectification, for the grid goes positive for each plus alternation of the incoming signal and d.c. flows in the grid circuit. This fact is of considerable aid to the technician during trouble shooting and aligning procedures, for this d.c. will increase with an increase in signal level, or will be absent in the absence of an incoming signal.

In the absence of sound output the point marked "x" below  $R_1$  can be opened and a d-c milliammeter inserted. If grid current flows at this point when a station is tuned in, it indicates that the signal is arriving at the limiter and the trouble would lie beyond this stage. (In the absence of a station on the air a signal generator can be applied to the grid of the mixer tube or one of the i-f amplifier grids.) This method of signal indication can also be used when aligning the i-f stages, for as the stages are brought to peak performance, greater current flows through the grid circuit.

Sometimes the grid leak is placed at the grid as shown in "A" of Fig. 3. The circuit function is still the same and the milliammeter can be inserted as indicated. A voltmeter (VTVM) can be placed directly across the grid leak in order to read the rectified d.c., but this practice upsets the limiter action due to the loading effect. A better method is to insert an extra resistor in the grid circuit as shown in C, and this will prove more effective than that as shown at "B" in Fig. 3. The added resistor can be anywhere from 5,000 ohms to 20,000, depending on the value of the grid leak. For grid leak values up to 500K, the larger resistor should be inserted for

resting purposes. The .002  $\mu$ f capacitor is placed across the VTVM to keep the r-f signals out of the voltmeter.

If the voltage dropping resistors of the limiter ( $R_2$  and  $R_3$  of Fig. 2) change in value so that plate voltage rises, limiter action will be affected. This also holds true for a change in tube characteristics as well as insufficient signal input. If signal input is low due to poor i-f alignment or improper tracing of r-f stages, the limiter will not be run at plate saturation and this stage will act as an amplifier instead of a limiter. This means that AM will ride through with FM, and the added amplification will increase tube noises. All this results in a pronounced hissing sound and high noise level.

It must be remembered, however, that this is a common occurrence when tuning an FM receiver between stations and is normal unless special squelch circuits are employed to eliminate inter-station noises.

The discriminator shown in Fig. 2 is conventional in circuit layout but some variations will be encountered in practice. The coupling method limiter and discriminator may be of the type shown in Fig. 1 between the last i-f and the ratio detector, where an extra coil is used instead of  $C_4$  in Fig. 2. Either coupling system works well with both types of detectors and manufacturers use the one most suited for their particular circuit set-up.

The discriminator plates are fed by the secondary of the coupling transformer, and at center frequency of the FM signal zero voltage exists across the two 100K resistors shown in Fig. 2. Close inspection of this circuit indicates that these two resistors are actually across the two cathodes of the discriminator tube, for one cathode is connected to point (3) and the other to ground, which is point (4). Each individual resistor does, however, have a voltage drop across it, but of opposite polarity to the other resistor, the sum total being zero. This is more

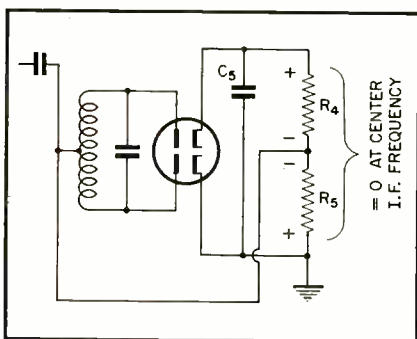


Fig. 4. The discriminator circuit of Fig. 2 re-arranged for simplicity.

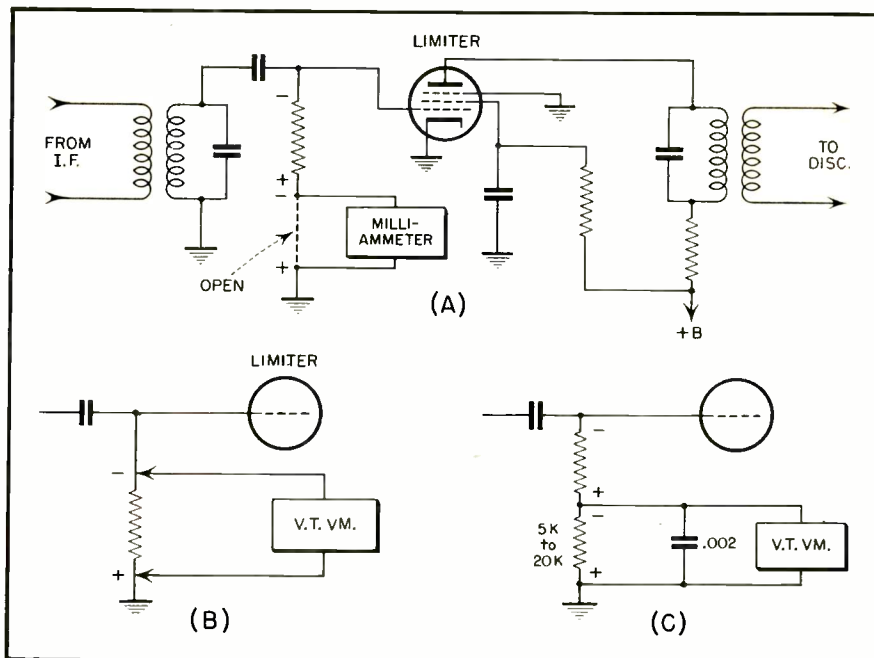


Fig. 3. Testing methods for limiters.

clearly indicated in Fig. 4 where the circuit has been rearranged for a clearer understanding.

During frequency modulation the carrier shifts above and below center frequency and this causes the respective voltages across  $R_4$  and  $R_5$  to differ from each other, resulting in the generation of an audio signal across the two resistors. This detection function again is of definite value during trouble shooting and servicing procedures, for a VTVM can be used to ascertain the presence of these voltages in order to check performance.

#### Checking Discriminator

If a signal generator is applied to the limiter grid (indicated as "1" in Fig. 2) and the frequency set to correspond to the r-f frequency of the receiver, equal and opposite voltages should occur across  $R_4$  and  $R_5$ . This can be checked by placing a VTVM across  $R_4$  then across  $R_5$ —using a low d-c scale. If there is a pronounced voltage difference, the tube diode sections are unbalanced, or the entire system needs aligning. Slight differences, however, are normal, though they should not be great enough to give more than a volt when read across both resistors.

Often it will be impossible to get zero voltage across  $R_4$  and  $R_5$ , even when all components check satisfactorily and the set has been properly aligned. This is due to the difficulty of securing a perfectly balanced circuit which would depend on both diodes conducting equally, each resistor being exactly 100,000 ohms, and

all other factors contributing to circuit balance. A voltage of 2 to 5 or more, however, calls for a check of circuit components, tubes, and aligning to reduce the possibility of distortion which may arise due to the unbalance.

Common troubles in the discriminator circuit follow those previously detailed for the ratio detector. For signal tracing the generator is placed at (1) and ground in Fig. 2, and the presence of d.c. at points (3) and (2), or (2) and (4), indicate the signal is getting through. A further check can be made with earphones at point (5)—the volume control, and at point (6) as detailed for the ratio detector. In order to hear the signal at points (5) and (6), the signal generator must be frequency modulated with an audio tone (usually 400 cps with most generators).

Other types of detectors will occasionally be encountered during servicing work, and some will incorporate the two diodes of the detector with the 1st audio amplifier in one tube envelope. The general theory of FM detection is still basically the same, and the trouble-shooting methods herein detailed still apply. Once such circuits are evaluated from a study of the manufacturer's service notes, the same trouble-localizing procedures can be followed, for the circuit components of resistors and capacitors will contribute the type of troubles previously enumerated. Proper use of the signal generator, the vacuum-tube voltmeter and a pair of 'phones will save many hours of servicing time.

# Theory and Practice of VIDEO DETECTOR CIRCUITS

by HENRY A. SCHWARTZ

**T**O transmit amplitude-modulated sound broadcasts radio frequencies of the order of 550 to 1600 kc per second are varied by the intelligence or information being transmitted. These r-f waves are called "carrier" waves. Their overall height (amplitude) is varied in accordance with the information being transmitted. This is known as amplitude modulation. (AM).

## Analogy Between AM and Video Detection

A close analogy can be drawn between the transmission of sound broadcasts and the transmission of video information contained in the composite television signal. The video intelligence is applied to the carrier in such a way as to vary its amplitude. The basic difference between AM sound transmission and AM video transmission is the frequencies involved. The video intelligence contains frequencies from 30 cycles per second to about 4 megacycles per second. On the other hand, the sound intelligence contains frequencies in the range of 30 to 5,000 cycles per second.

After the television signal is received it undergoes a process of demodulation during which the information is extracted from the carrier. This process is commonly called "de-

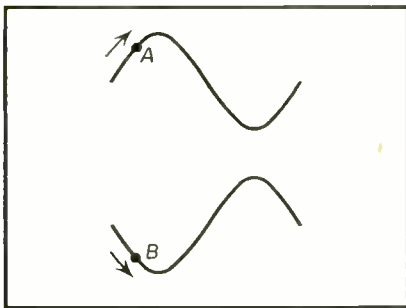


Fig. 2. Signal phase does not affect ear response.

**A discussion of video detector theory and circuits. Stressed, are the considerations of phase change of the signal as it progresses from the output of the detector to the grid of the picture tube. Also discussed are the practical effects of open, shorted, and otherwise defective components in the video circuit following the detector.**

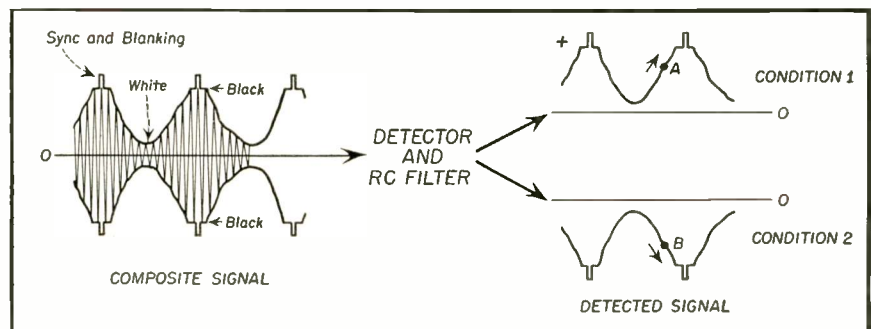


Fig. 1. Manner in which detector eliminates the r-f carrier.

tection". It is the theory behind, and the circuits necessary to accomplish detection of the picture information, that we will now concern ourselves with.

Referring to *Figure 1*, complete detection of the video signal eliminates the r-f carrier leaving only the intelligence (black and white of the picture) and the blanking pulses. The process of demodulation can be accomplished by means of the simple diode rectifier and proper loading circuit. We can select either the upper modulating envelope (condition 1) or the lower modulating envelope (condition 2). This is due to the operating characteristics of a diode tube. Let us assume that we feed the composite video signal into the plate of the diode. The tube will only conduct when the plate becomes more positive than the cathode. This will yield at the output the upper half of the composite signal.

If we had chosen to feed the composite video signal into the cathode of the diode, the tube would conduct only when the cathode is more negative than the plate (below plate). This would select the lower half of our video signal. Depending upon how the detector is connected into the circuit, like signals reversed in phase by 180 degrees can be obtained. We shall show the importance of this phase relationship.

In dealing with television circuits of any kind, it is a good thing to bear in mind the fact that the eye is infinitely more critical than the ear. This fact is clarified by the following discussion.

Sound can be transmitted to the ear by means of a speaker cone moving in or out. If the cone vibrates from rest outward, the ear will hear the same sound as if the cone were to vibrate from rest inward. This indi-

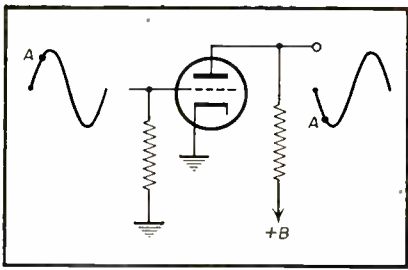


Fig. 3. Illustrating phase reversal of signal taking place in vacuum tube. Phase shift is 180°.

states that the ear is not sensitive to oppositely phased signals. Referring to Fig. 2, point A is increasing in a positive direction. This portion of the signal will move the cone out. At point B, opposite in phase to point A, the signal is increasing in a negative direction. This portion of the signal will pull the cone in. In both instances the ear will be subjected to the same sound. That is to say, if we use either the upper modulating envelope or the lower modulating envelope the same results can be obtained.

#### Signal Polarity

Video signals are transmitted so that the peaks of the modulated wave are the black areas and the troughs are the white areas. Feeding the detected signal to the control grid of a picture tube we can follow the same line of reasoning as we did for the sound system. Referring to Fig. 1, at Point A the signal is increasing in a positive direction placing an increasing voltage upon the grid of the Pix tube. This will cause a greater flow of electrons and hence a brighter spot on the tube (condition 1). At point B, exactly equal and opposite in phase to point A, the signal is increasing in a negative direction. This will put a more negative voltage on the Pix tube decreasing the flow of electrons and causing a dark spot on the screen (condition 2). Since the peaks are black, condition 2 would produce a true picture of the video signal. On the other hand condition 1 would show the black parts of the picture as white parts and the white parts as black parts. In other words condition 1 will produce a picture that is comparable to a photographic negative. Unlike sound systems it therefore becomes necessary to select the proper phase for this video signal in order to get a positive picture.

To obtain the proper polarity or phase of the picture, the troughs must cause a greater flow of electrons and the peaks a lesser flow of electrons. If the lower half of the detected signal intelligence was therefore fed to the

grid of the Pix tube, a correctly phased picture would result.

It is well to stress at this point that a vacuum tube has inherent properties which cause a phase shift of 180 degrees. That is to say if a signal is fed to the grid of a tube it will be amplified and reversed in phase at the plate (Fig. 3). The number of video amplifier tubes connected between the detector and the Pix tube will affect the phase of the detected signal before it is applied to the grid of the Pix tube.

Chart I should be an aid for proper identification of detector circuits. Note that in #2 and #3 we feed the cathode of the Pix tube. If we were to detect the upper half of the composite signal the black areas would be a higher value positive than the whites. By feeding this signal to the cathode of the Pix tube we make the

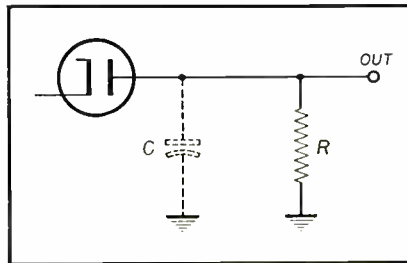


Fig. 4 Lumped interelectrode capacitance of tube represented by C.

cathode more positive than the grid during the time that the black areas are transmitted. This will have the effect of making the grid more negative than the cathode and will decrease the flow of electrons giving us a correctly phased picture.

#### Detector Loading

The value of the detector load strongly enters into the discussion of the circuit. Capacitance and resist-

ance in the detector loads perform two jobs. Capacitor, C represents the stray capacitance, the output capacitance of the diode (interelectrode capacitance) and the input capacitance of the first video amplifier. (Fig. 4).

The condenser charges to the peak of the first r-f phase and then commences to discharge. The time for discharge is controlled by the amount of capacitance and resistance in the circuit. The greater the C or R the longer the time for discharge. Referring to Fig. 5, we see that at point 1 capacitance C starts to discharge. It discharges until it strikes the leading edge of the following cycle at point 2, then charging up to the peak value of the second r-f cycle. By increasing R or C the discharge time can be increased. The voltage across the condenser now follows the value from 1 to 3. By decreasing R or C the discharge time capacitor voltage now follows the value 1 to 4.

In actual operation the peaks of the r-f carrier vary in amplitude with the information being transmitted. The time constant is selected so that the discharge and charge voltage of the condenser follows the peaks of the carrier. This faithfully reproduces the picture information (Fig. 6).

#### Frequency Response

The second job of the detector load is to provide an a-c impedance across which the detected signal can be developed. Since this voltage is a complex wave which contains frequencies from 30 cycles per second to 4 megacycles per second, the detector circuit must have a relatively flat frequency response over this range. At the high frequency end, the stray and interelectrode capacitance have a high shunting effect. That is to say they add in parallel and act as a low im-

Diode Connection			NUMBER OF VIDEO AMPLIFIERS	CONNECTION TO PIX TUBE	
①	SIGNAL →			EVEN	GRID
②	SIGNAL →			ODD	CATHODE
③	SIGNAL →			EVEN	CATHODE
④	SIGNAL →			ODD	GRID

Chart I. Various types and methods of connecting detector circuits to produce desired positive pix signal at CRT.

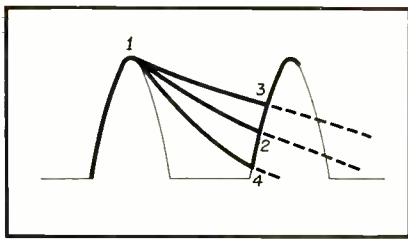


Fig. 5. Effect of varying R or C.

pedance path to ground for the high frequency components of the detected signal.

The load resistor  $R$  which is in parallel with  $C$  must have a value lower than the reactance of the condenser  $X_c$  at the high frequencies. This allows for a large percentage of the developed voltage to appear across  $R$ . It is evident therefore that  $R$  is selected to have a relatively lower value than  $X_c$  at the h-f end.

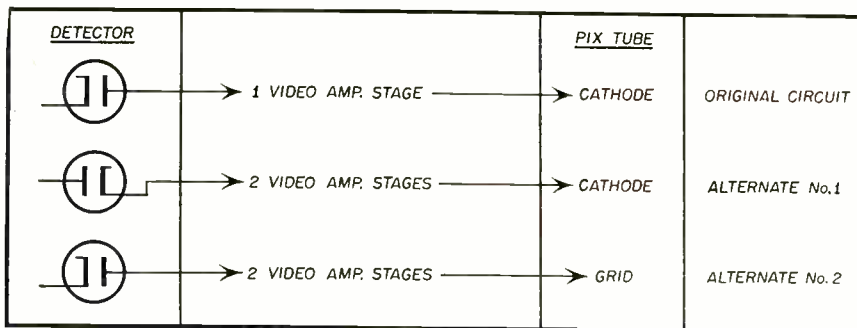


Fig. 8. Polarity reversals in circuits fed into cathode.

By putting series coil  $L_1$  in the circuit (See Fig. 7)  $L_1$  and  $C$  could be made to resonate at the high end of the band, allowing a greater voltage to be developed across the load resistor (a larger load resistor can be employed). To eliminate the shunt capacitance input to the following stage  $L_2$  was connected in the circuit. This inductance resonates with this shunting input capacitance at the high frequency end producing a very large resistance value instead of the low reactance value. The peaking coils  $L_1$  and  $L_2$  help to increase the band

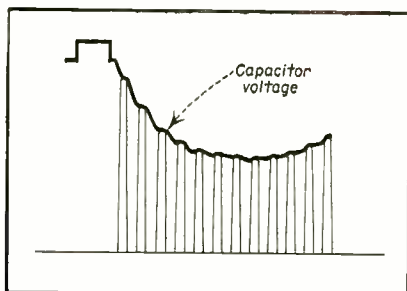


Fig. 6. The time constant of R and C is chosen so that the voltage of the condenser follows the peaks.

pass of the detector circuit.

### Practical Considerations

The complete circuit is indicated in Fig. 7,  $R_2$  is a damping resistor connected across the peaking coil  $L_1$  to reduce or damp the gain of the resonant circuit. Without this damping action the high frequencies instead of being lost due to stray capacitance would have a greater amplitude than the low frequencies. Visually this would produce the same effect as a circuit having a poor low frequency response. The vertical retraced lines would appear and the picture outline would be blurred. If resistor  $R_2$  opened or changed value to a higher value, the resonant circuit would not be damped and this affect would appear in the picture. If  $R_1$ , the load on the detector, were to increase, the overall video output would increase but the high frequencies would find an easier

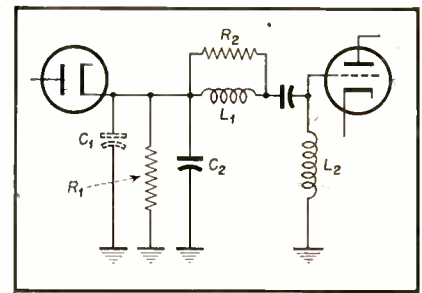


Fig. 7. Video peaking circuit.

This condition can be overcome by reversing the polarity of the detector or by feeding the signal to its complementary pin on the Pix tube. In other words, if the signal were originally fed to the cathode of the detector tube and then to the cathode of the Pix tube, upon the addition of a second stage of video amplification the hook-up would be changed to the following: The composite signal could be fed to the plate of the detector tube through two stages of amplification and then to the cathode of the Pix tube. This would give a picture of proper polarity. An alternate method would be to leave the composite signal on the cathode of the detector tube pass through two stages of amplification and then to the grid of the Pix tube (see Fig. 8).

Another form of detector circuit is one that employs a crystal detector rather than a vacuum tube detector tube (Fig. 9). This operates essentially the same way as a diode detector. The crystals commonly used in this circuit are Germanium crystals and usually bear the number 1N34. They are physically  $\frac{3}{4}$  inch long,  $\frac{9}{32}$  inch in diameter and can be mounted in any position. The crystal is normally mounted on the underside of the chassis. Often times these crystals are affected by heat and develop a high internal resistance. This would seriously reduce the signal. To check for this condition a d-c voltage of one volt can be applied across the crystal. The current flowing through the crystal should not be less than 5 ma.

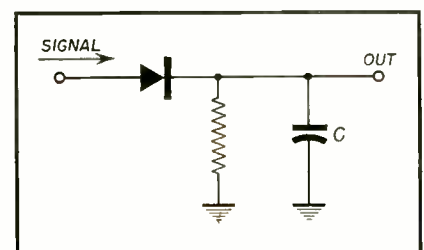


Fig. 9. Crystal detector circuit.

path to ground through the stray capacitance  $C$ . This would give us a picture that would be devoid of detail.

It is interesting to note that in many circuits capacitance  $C_2$  is added physically in order to resonate the circuit at the proper frequencies. If peaking coil  $L_1$  were to open there would be no picture information transmitted from the detector to the picture tube. If coil  $L_2$  were to open, the shunt capacitance in the input (grid to ground) of the first video amplifier would pass the majority of high frequencies to ground. This would result in a picture which would devoid of detail.

Many commercial sets on the market use but one video amplifier stage. In some instances the gain of this circuit is insufficient to give a good black and white picture. This condition may be improved by the addition of a second video amplifier stage. The important feature to bear in mind is that the signal will be reversed in phase by 180 degrees. If connected to the same pin on the Pix tube, the detected signal would now produce a negative picture.

# Horizontal

# A. F. C. CIRCUITS

by WALTER H. BUCHSBAUM

## Part 2

### The Synchrolock System

The circuit in *Fig. 3*, shows a Hartley type oscillator containing a 6K6 with a cathode tap on the tank circuit. The tank circuit capacity is made up of *C4* and *C5* as well as the series combination of *C7* and the tube capacity of the 6AC7. Once the slug in the oscillator coil is adjusted the 6K6 will oscillate in a sine wave fashion at a given frequency. This frequency can be changed either by adjusting the tuning slug in the coil or by varying the grid leak bias resistor *R16*. This last resistor is the potentiometer which acts as the horizontal hold control. There is one further possibility of changing the oscillator frequency. If the capacity of the 6AC7 would vary this would also affect the oscillator frequency. It is a well known principle that the tube capacity varies as the operating voltages, especially the grid bias, varies. The 6AC7 acts in this circuit as a variable reactance and is, therefore, often called the reactance tube.

The sine wave oscillator coil is wound on the same form with another coil which has a center tap. This second coil acts as a transformer, coupling some of the oscillator signal to the 6AL5 frequency discriminator. We know from the FM discriminator transformer that if it is tuned to the center frequency there will be zero voltage output at that frequency. Forgetting the incoming synchronizing pulses for a moment we see that the output of the 6AL5 at center frequency will be zero. However, the low side of the output network consisting of *R2* and *R3* is connected to a minus 4 volt point and this means that at center frequency a d-c bias of minus 4 volts will be applied to the grid of

In this second installment the author describes the operation, adjustment and possible sources of failure in the Synchrolock System of AFC as well as the Phase Detector System. Both systems constitute the types of circuits employed in the greater majority of TV receivers.

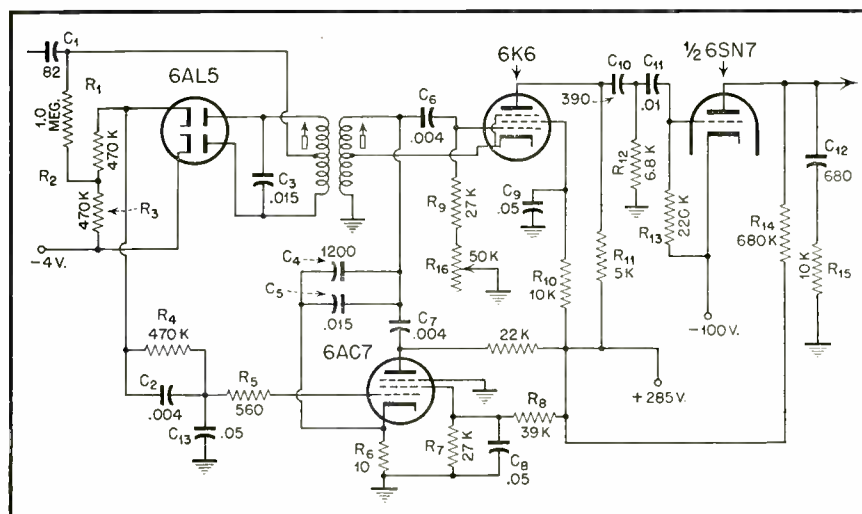


Fig. 3. Synchrolock A-F-C circuit

the 6AC7 reactance tube. Consider *R4*, *R5*, *C2*, *C13* as parts of an RC filter designed to keep the grid voltage on the reactance tube at a d-c value. If the oscillator frequency were to change, d-c voltage in addition to the 4 volt bias would be generated by the 6AL5 discriminator. This additional voltage could be either positive, in which case it would reduce the negative bias, or it could be negative and make the bias higher. In both cases it will cause the 6AC7 tube capacity

to either increase or decrease, and thereby vary the frequency of the oscillator.

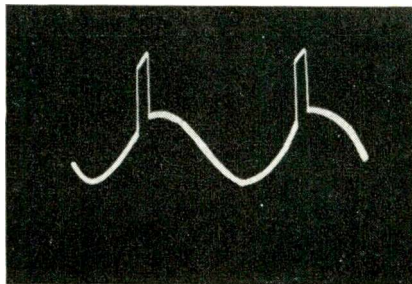
Now let us consider the influence of the incoming synchronizing pulses. These pulses are applied to the center tap of the discriminator through the windings to both plates of the 6AL5. If the polarity of the transformer is correct, the sine wave will cancel out the effect of the synchronizing pulses at both plates. This will only be true if the oscillator is at the same fre-

quency as the incoming pulses since otherwise the peak of each sine wave will not coincide with the arrival of each pulse.

At the beginning of this article it was shown that the basic elements of any AFC system must contain a frequency comparing section, an error voltage, and a means to applying the error voltage to control the frequency of the oscillator. The left half of the synchrolock transformer and the 6AL5 in *Fig. 3*, are the frequency comparing section. The grid bias on the 6AC7 is the error voltage and the reactance tube itself the means for controlling the 6K6 sine wave oscillator. The half of a 6SN7 at the right of *Fig. 3*, is called the discharge tube because it changes the sine wave generated by the 6K6 into a sawtooth wave by passing it through a suitable R-C network.

Here is an example for the operation of the Synchrolock system shown in *Fig. 3*. As the set warms up the oscillator drifts in frequency above the correct 15,750 cps. This causes the discriminator to become unbalanced and an additional bias is developed and applied to the grid of the 6AC7. The change in bias causes the tube capacity of the 6AC7 to increase. This increased capacity across the oscillator tank circuit naturally lowers the oscillator frequency. The process of frequency comparison, developing the error voltage and the resultant change in capacity and frequency goes on continuously. The amount of change becomes smaller as the oscillator approaches the frequency of the incoming synchronizing pulses. This accounts for the "locking-in" which can sometimes be observed during the warm-up time, when the picture appears to be cut in many strips which get bigger and fewer until the proper picture finally locks in. It should be understood that the range over which the AFC can control the oscillator depends in this case on the range over which changes in bias cause sufficient changes in the tube capacity of the 6AC7. If the inductance of the oscillator is tuned to the wrong frequency, or the discriminator winding misaligned, the AFC will not be able to operate at all. The adjustment of the synchrolock system is accomplished by tuning both windings of the discriminator transformer and by adjusting *R16* the horizontal hold control. In most receivers using the Synchrolock circuit the powdered iron slug tuning the oscillator winding is towards the back of the receiver. This slug is ad-

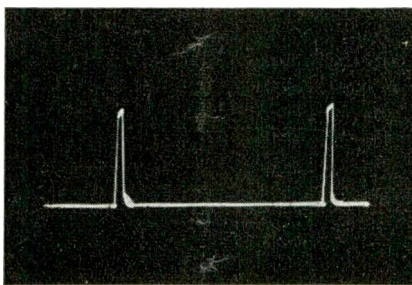
justed until the picture appears to lock in. The discriminator slug usually has to be reached from the inside of the chassis and is adjusted for proper phasing of the picture. This phasing adjustment brings the picture into the center of the screen and eliminates foldover and jumping. After the phasing is set correctly, the oscillator slug is re-adjusted until the picture remains stable with the hold control set at either extreme. Switch channels several times to make sure the picture



**Fig. 6. Wave shape at plate of left half of the oscillator in *Fig. 5*.**

is locked in, regardless of the hold control setting. A major re-adjustment of the frequency slug usually will also require a touch-up of the phasing control slug.

The most frequent defect found in the Synchrolock circuit will be due to the 6AC7 reactance tube. The next frequent offender is the 6AL5 and finally the oscillator tube itself. Criti-



**Fig. 7. Horizontal pulse at A in *Fig. 5*. 5 volts peak to peak.**

cal components include the Synchrolock transformer, *C4* and *C5* in *Fig. 3*, and the coupling condensers *C6* and *C7*. These components should be exchanged only with exact replacement parts. If non-linearity appears on the screen which cannot be removed by adjustment of the linearity coil, the discharge tube may be at fault. The half of a 6SN7 shown at the left in *Fig. 3*, feeds a sine wave voltage into a charge and discharge network consisting of *R14*, *R15*, and *C12*. This network determines the shape of the sawtooth voltage which is applied to the

grid of the horizontal output amplifier. Such a sawtooth voltage is shown in *Fig. 4*. (July 1950, RSD) As shown, this waveform results in a linear picture but if the curvature of the sawtooth were any greater, especially at the top, non-linearity would appear on the screen. The amplitude of this sawtooth may vary from about 50 to 80 volts peak to peak.

#### Phase detector

The phase detector type of AFC makes use of a combination multivibrator and sine wave oscillator. A multivibrator circuit is difficult to control by means of a d-c voltage and, therefore, not adaptable to an automatic frequency control system. Sine wave oscillators on the other hand are easily controlled by a variable bias voltage. The desirable features of both systems are used for the phase detector AFC system. (*Fig. 5*, July RSD)

Disregarding the tank circuit in the plate lead of one half of the 6SN7, this circuit appears like a cathode coupled multivibrator. *R10* is the common cathode resistor and *C7* couples the first plate to the second grid. These are typical multivibrator features. The grid resistor of the second triode section contains *R12*, the horizontal hold control which controls the discharge time of *C7* and therefore the frequency of the multivibrator. The grid of the first triode section is returned to ground through *R6* and *R7* and connected to a source of variable bias. To bring in the elements of a sine wave oscillator the tank circuit consisting of the coil *L* and *C6* is inserted with *R8*. This L-C network is tuned to resonate at the horizontal sweep frequency, 15,750 cps.

The output of the oscillator is a combination sine wave and square wave as shown in *Fig. 6*, the oscilloscope pattern on the first plate of the horizontal oscillator. Over one part of the cycle the tuned circuit controls the oscillation, producing the sine wave portion. During another part of the cycle the multivibrator takes over and causes a square wave to be superimposed on the sine wave. The output voltage must be a sawtooth similar to the one shown in *Fig. 4*, and the R-C network consisting of *R9*, *C8*, *C9* and *C10*, changes the square wave-sine wave combination into a sawtooth voltage of the desired characteristics.

The oscillator frequency is controlled by the horizontal hold control, but the grid bias on the first grid also has a very great influence. This grid bias depends on the d-c voltage across *R6*, a 4.7 megohm resistor, and as this bias voltage varies, so will

[Continued on page 38]

\*Part 1, See July, 1950 RSD



# High Quality Analyses Series

No. 5

by C. A. TUTHILL

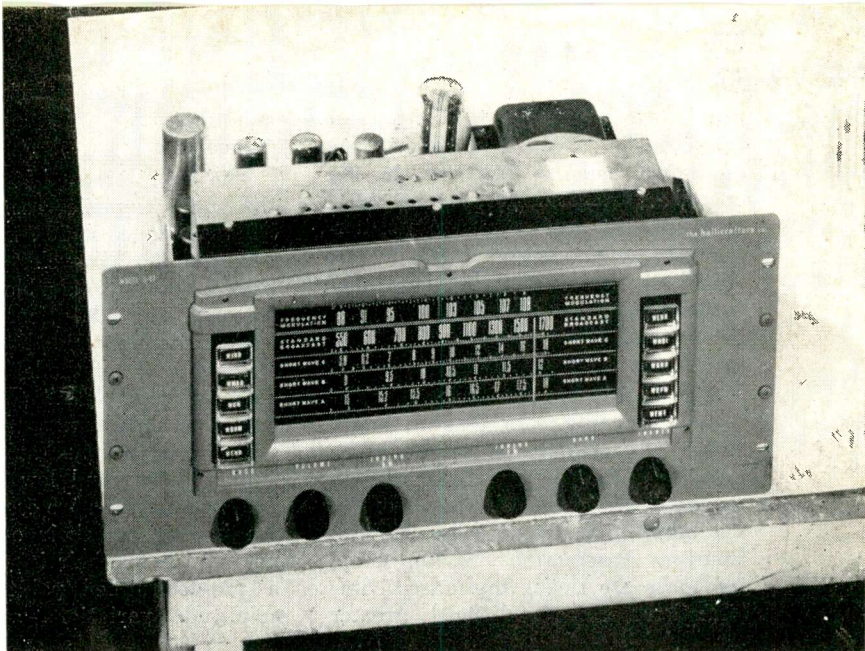


Fig. 1. The Hallicrafter S-41 High Quality Tuner.

**A thorough discussion of the circuitry and operation of another High Quality Tuner in this popular series. Truly amazing are the complex circuit innovations, combinations, and components that go to make up a receiver of this type.**

**I**N the early days of Frequency Modulation many shortcut abuses prevailed in the application of components within FM receivers. Listeners were unmindful then, but today, your customers are more exacting in their search for high quality reproduction. Progress has given us multi-element vacuum tubes designed for dual or even triple function without abuse of privilege. Even though the Hallicrafters S-47 tuner herein analyzed has fifteen tubes, including the audio amplifier, these, however, are cannily chosen and circuits are designed around their specific values.

Unlike units previously described in this series, we have in this flexible chassis, equipment which tunes five different FM and AM bands, (Fig. 1). The five bands in order of rotation in the switching system, plus phono pick-up facilities are:

1. Shortwave (A) - 15 mc - 18 mc.
2. Shortwave (B) - 9 mc - 12 mc.
3. Shortwave (C) - 5.8 mc - 18 mc.
4. Broadcast - 540 kc - 1700 kc.
5. Frequency Modulation - 88 mc - 108 mc.
6. Phono Input to Audio Amplifier.

Insurance of thorough coverage for amateur, home or commercial rack-mounted assignments is thus afforded. This chassis is highly practical for overall domestic or foreign tuning. It therefore lends itself to discreetly designed custom-built installation. A complement of 15 tubes is put to very gainful purposes yet draws a total

power consumption of only 180 watts when connected to a 60 cycle 105/125 volt supply.

As can be seen from the photo (Fig. 1), both manual and pushbutton tuning awaits one's choice. Provision is at hand for an external long wire antenna (AM) or a 300 ohm folded dipole (FM). Input circuits from antenna terminals connect to balanced FM and seriesed AM coils.

#### Coil Assignment

In the schematic (Fig. 2) the antenna coils are *L-10* for FM; *L-5* for shortwave and *L-2* for the usual AM broadcasts. Through the switching system these coils find proper capacitors across them for the various tuning bands. Following the 6BA6 r-f entrance stage three other coils serve as follows: *L-9* FM mixer coil; *L-1* shortwave mixer coil; *L-6* mixer coil for AM broadcast band. These are set up in triplicate and capacitor-tuned to resonance with their corresponding input counterparts. Following the schematic we see that the oscillator coils are; *L-8* for FM, *L-4* for shortwave and *L-7* for the broadcast (AM) band.

Coil *L-11* serves as a plate choke for the common 6J6 oscillator tube. Coil *L-12* is a filament choke. Coils *L-13*, *L-14*, *L-15* and *L-16* will be recognized as r-f chokes. In series with the primary of the FM mixer-coupler *L-9*, coil *L-18* serves as an r-f choke for the antenna stage plate. Lastly the iron-core coil *L-12*, seen between tubes

V-10 and V-11, is used as an audio choke. This completes the analysis of coil functions within the chassis. Despite the seemingly long list, more coils would be required to cover proper tuning of the five channels were it not for the well engineered switching system in which excessive structural capacitance has either been avoided or compensated.

#### Tube Assignments

The first three tubes in the tuner section, at the left in the schematic, serve all channels. Following the 6BA6 miniature r-f amplifier, a 6BE6 pentode serves as converter for the AM channel and as mixer for FM reception. The plate of this 6BE6 mixer connects to the primary of the first FM/IF transformer (*T-4*) by way of rotary switch 3E and the 220 ohm carbon resistor *R-33*. The third tube (6J6 twin-triode) functions doubly as oscillator and automatic frequency control regulator. The latter function (AFC) compensates for mechanical variations which may occur in the pushbutton mechanism. Whenever any aberrations occur to the intermediate frequency from the intended center of its band, due to a drift in the oscillator circuit, the resultant voltage is applied to the a-f grid of tube V-3 and it's associated resistor-capacitor network. Together these serve as a variable reactance across the oscillator tank circuit. When this reactance becomes positive or inductive the oscillator tends to shift in one direction.

When the voltage due to shift creates negative or capacitive reactance, and this is added to the tank circuit, the oscillator tends to drift off in the opposite direction. Hence the AFC stabilizes the oscillator against tendency to drift and thus avoids loss of selectivity and gain. The *Take-hold* or reactive characteristics are: *Before* 100 kc and *Release* before 450 kc at an 0.2 volt input signal.

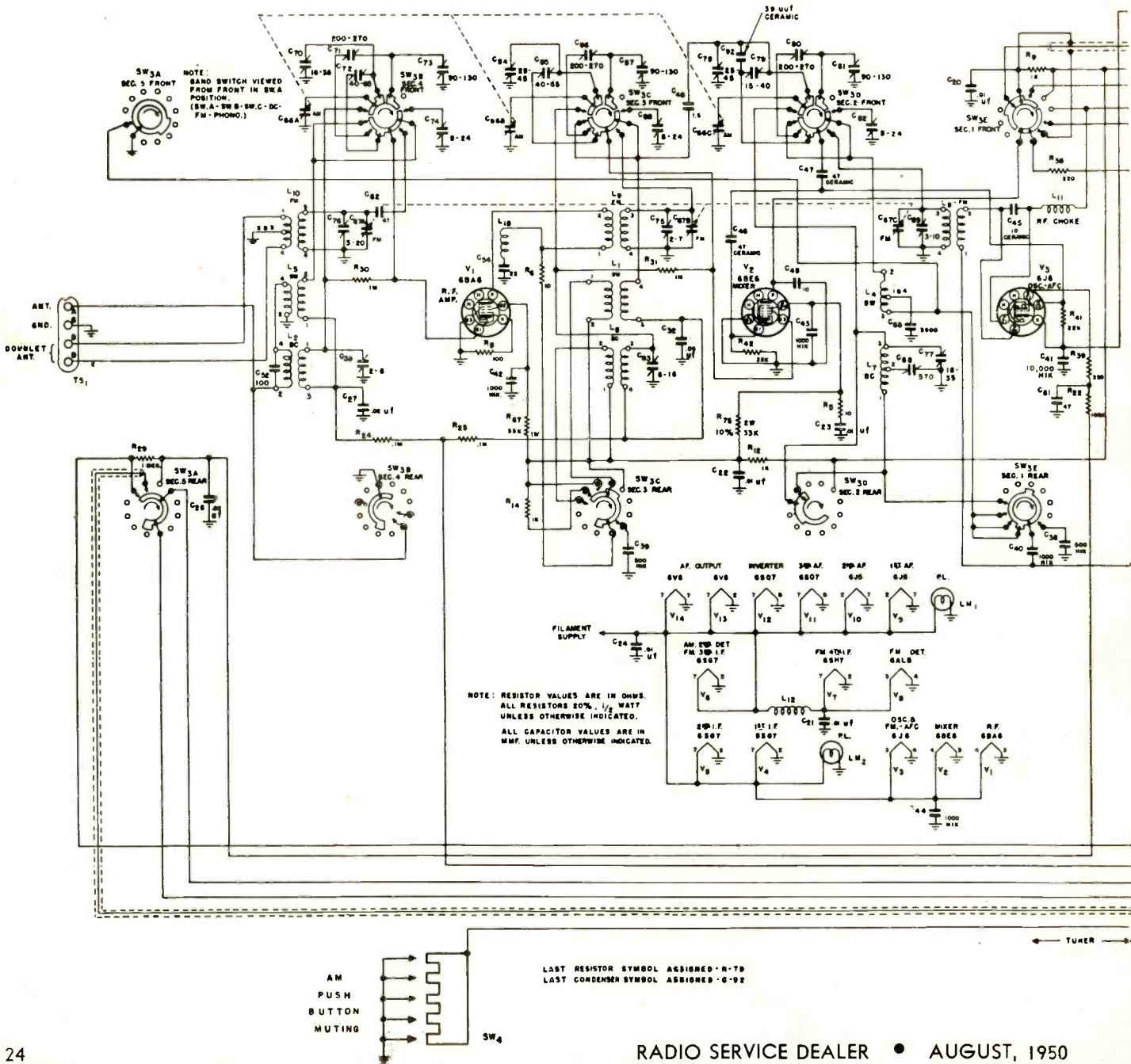
The chassis layout takes on subdivision from this point forward as regards tube assignment. It should be noted that the tuning stages prior to this point are completely shielded from the amplifying stages which follow. Spurious interactions or unwanted feedbacks are thusly minimized. Stabilization becomes enhanced; greater

freedom of wiring and layout from the manufacturing viewpoint is thus gained.

The first three 6SG7 stages above the audio amplifier section, serve as i-f stages tuned to 10.7 megacycles for FM and 455 kilocycles for AM. The third stage (V-6) doubles as a second detector for AM. Separate cathode leads offer isolation, thus minimizing losses due to cathode degeneration. The following 6SH7 (V-7), a sharp cutoff pentode, offers additional gain with limiter action. Having low screen voltage (45v) and low plate voltage (50v) these tubes are easily saturated. An increase in their output follows an increase in their input only up to a pre-determined point, hence any amplitude variations attending the

FM signal are practically eliminated. When driven by adequate prior gain, as is certain here, this limiter will smooth out variations and eliminate noise, static and such. It executes one of the genuine attributes of frequency modulation.

Contrary to procedure for the AM section, the signal used for alignment of the FM section must be great enough to permit normal operation of the 6SH7 limiter. Its grid must draw normal operative current or the alignment of its transformer will not be correct. The resonant frequency is changed by the load introduced when the 6SH7 grid draws currents. The ratio detector (V-8) which this limiter drives is discussed under separate heading.



### Transformer Assignment

Before proceeding into the FM detector and audio amplifier sections, it is well to consider the transformers employed prior thereto. Adjustable or tunable cores are used, thus controlling permeability and calling for fewer turns of wire (hence lower resistance) for a given value of inductance. The first i-f tunable transformer (*T-4*) couples the i-f section to the previous mixer. Its fixed-tuned secondary windings are series connected since there is no reaction of one upon the other. This applies similarly to i-f interstage transformers *T-3* and *T-2*. All three i-f transformers are of course shielded and mounted for shortest possible length of connectors. Certain of these adjustable cores are available for

alignment only after the bottom plate of the chassis has been removed. It will be noted that the input to the shortwave primary of transformer *T-4* is fed by a low impedance shielded cable for reasons of isolation, matching of values and stability.

The two interstage i-f transformers (*T-3* & *T-2*) have a third winding of very few turns. Directly connected to the switching system, and thence to small ceramic capacitors, these third windings make possible the broad selection of multiband tuning; they offer new coupling coefficients for each band chosen. It is within the i-f stages that adequate signal gain must be derived before the signal is introduced to translation; every possible engineering effort is spent here to

avoid transmission losses. A clean, high gain, constant amplitude variable frequency signal is coupled to the 6AL5 FM detector through transformer *T-1*. These signals must be converted back to amplitude variations corresponding to those from the original microphone pickup in the studio. For this purpose a twin diode (6AL5) ratio detector is used.

### Ratio Detector

The FM ratio detector used here, unlike push-pull discriminators which respond to voltage differences, responds only to changes in the ratio of the voltage across the two diodes within the 6AL5 envelope. It does not respond to changes in voltage differences caused by amplitude modulation of the r-f carrier. The tank tuning

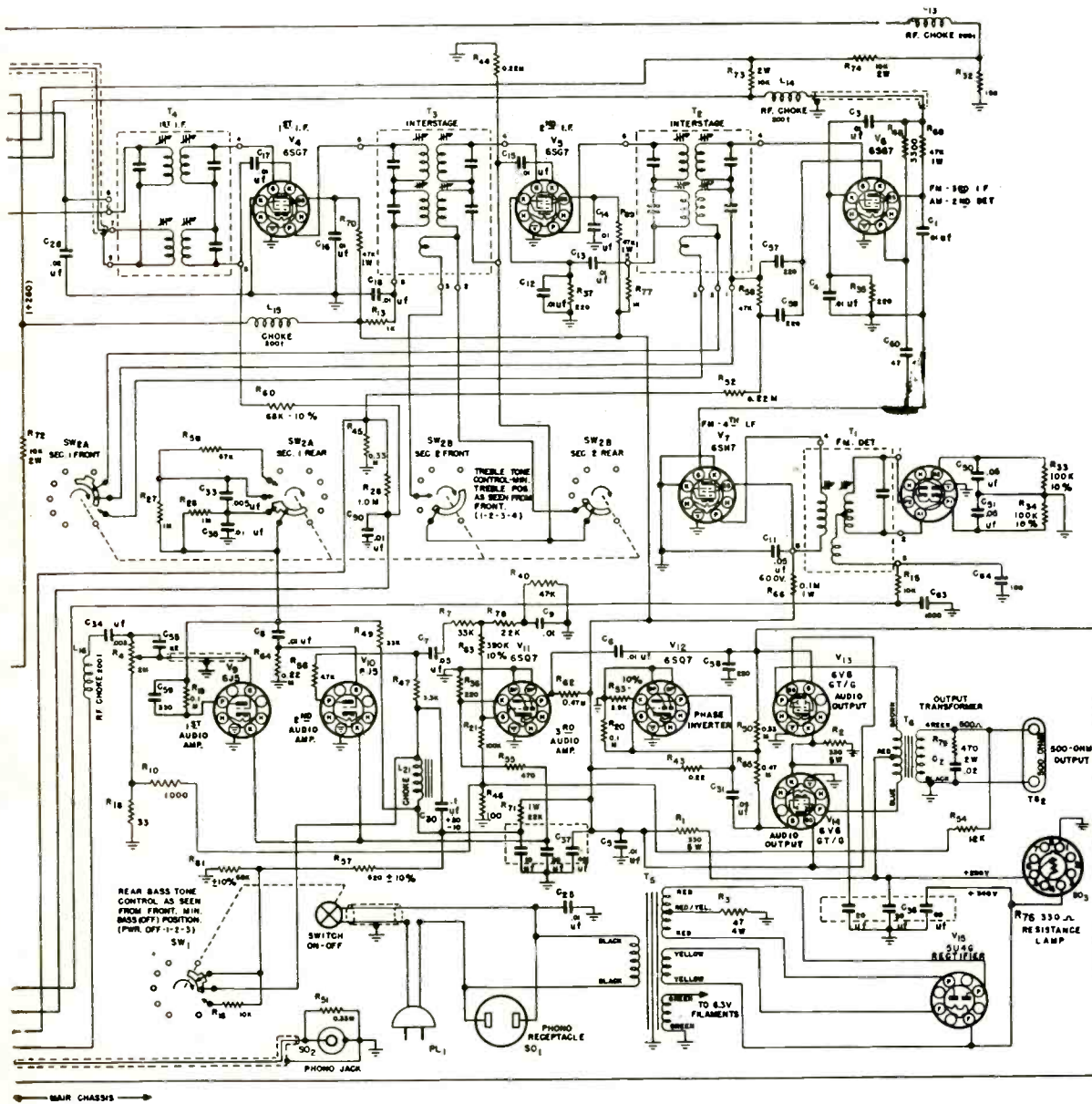


Fig. 2. Complete circuit diagram of Hallicrafter Model S-41 High Quality Tuner

and coupling of transformer *T-1* circuits are essentially the same as in push-pull discriminator circuits. The r-f potentials reaching the twin diodes are the direct result of the magnitude of r-f signal swing from the resonant frequency in each direction. From here forward there is a great difference between push-pull discriminators Lescarbours received the Officier postwar France, Austin C. Lescarbours and ratio detectors.

In this ratio detector the two diodes are connected in a closed series circuit which includes the two resistors *R-33* & *R-34* and the main secondary winding of transformer *T-1* thereby offering conductance throughout to a given r-f half cycle. So connected, the twin diodes aid each other. The voltage across capacitors *C-50* and *C-51* is equal to the sum of the diode voltages rather than to their difference as with discriminators. Yet for an instantaneous carrier frequency the voltage across the two diodes differs. As a direct result the voltages across capacitors *C-50* and *C-51* differ proportionately thereto, one capacitor having the larger of the two voltages at carrier frequencies below the intermediate frequency and the smaller at frequencies above the i-f. Finally, the ratio of these voltages varies at an audio rate and the resultant linear signal is applied to further audio amplification. The network to the right of the 6AL5 (*Fig. 2*) completes circuits permitting that tube to function as above. The third or tertiary winding of transformer *T-1*, tapped from the midpoint of its main secondary and inductively coupled to its primary, is returned through capacitor *C-64* and ground to the midpoint between resistors *R-33* and *R-34* also grounded. Rectified signals within this third winding are fed through resistor *R-15* and *SW-3A* section of the switching system to the volume control *R-4* and thence to the grid of the first audio 6J5 stage (*V-9*).

The high perveance of the 6AL5 diode particularly adapts it for ratio detection. When 4 volts are applied between plate and cathode of the 6AL5 its plate current is 14 milliamperes. More data on ratio detection is available in your December 1947 issue of Radio Service Dealer and in recent tube manuals.

#### Audio Amplifier

When, as in this model S-47, AM and FM detector outputs are fed into a common audio amplifier, differences in level arise. FM detector output does not depend upon received carrier magnitude as in AM. Instead it leans entirely upon frequency swing. Design has allowed AM detector output to exceed that of the FM detector in

order to allow ample gain for weaker AM signals. Therefore manual compensation through the volume control (*R-4*) is necessary at times.

The audio amplifier section of this Model S-47 chassis employs six tubes. The first two audio stages (*V-9* & *V-10*) employ two 6J5 medium *mu* triodes each having an amplification factor of 20. The output of the second stage is capacity coupled to a resistance network thence to a phase inverter using two 6SQ7s (*V-11* & *V-12*).

It is customary to include the tube that drives each of the two pushpull tubes when referring to a phase inverter. However to stick to the letter of this manufacturer's schematic, as divulged in *Fig. 2*, we will refer to 6SQ7 (*V-11*) as the third audio amplifier stage which drives *V-13* the upper (beam power tube) 6V6 of the pushpull stage. It is correct to so handle the subject. We all know by now that the grids of the two push-pull tubes must be excited 180 degrees out of phase. It is further known that in a single-ended amplifier such is



accomplished through a mid-tapped secondary of the input transformer. In this chassis, however, the two 6SQ7s are so connected that the second (*V-12*) becomes the phase inverter. A voltage drop from the plate of *V-11* is returned to the grid of *V-12* the inverter tube. In turn *V-12* feeds the grid of the lower 6V6 pushpull tube. Components within the circuits are of such values that the grids of the pushpull tubes are not only fed 180 degrees out of phase but also fed at identical voltages. Identical or closely matched tubes should be used for reasons of balance.

The final 500 ohm unbalanced output from the pushpull stage is coupled from the 6V6 plates through transformer *T-6* to a 500 ohm terminal block. Direct loudspeaker connection can result therefrom or, with proper padding, a 500 ohm transmission line may be set up.

#### Feedback Feature

It is not unusual to find negative feedback applied to one or two stages in good audio amplifiers. More than two stages so handled however present problems of instability due to the greater danger of phase shifts occurring within the amplifier. The amplifier at hand applies negative feedback to its third audio (*V-11*) and first audio (*V-9*) stages. In this case feedback is tapped off from the high side of the secondary of the final output transformer (*T-6*). The feedback bus can be seen returning through resistor *R-54* to a junction point at *R-46* the lower end of which is grounded. From that junction point negative (inverse) feedback is applied to the grid of *V-11* through resistor *R-21*. From the same junction point feedback is transmitted through resistor *R-10* to the volume control *R-4* and thence to the grid of *V-9* the first audio amplifier. Thus this entire amplifier is stabilized and a high quality audio output is achieved. Such development has come of necessity due to the ever-widening spectrum of FM channels properly handled. Further advantages from negative feedback are derived. Gain and frequency response become more independent of changes due to aging tubes, variations in supply voltages, temperature changes or mechanical vibration. Since but a few adequate resistors and capacitors are involved, stabilization continues over a great period of time.

#### Power Supply

A power supply included within the audio amplifier section of this chassis is comprised of transformer *T-5*; two electrolytic filters (*C-36* and *C-37*); one 5U4G rectifier tube (*V-15*); and one 330 ohm ballast lamp (*R-76*). All heaters are supplied from the unrectified 6.3 volt secondary of power transformer (*T-5*). The usual choke coil and by-pass condensers are included, one side of each heater being grounded.

#### Market

It is suggested that dealers demonstrate through colorful window display the simplicity and practicability of installation of AM-FM tuner chassis in custom-built rigs. A modern cubicle end-table next to father's favorite chair could easily harbor a chassis within its convenient end. One sector or panel of a bookcase is often within comfortable reach of mother's chair or the family divan. Loudspeakers neatly concealed behind scrims colored to match room decoration lend themselves to bookcase or more remote baffle mounting behind closet doors or in walls.

# CYCLE INVENTORY CONTROL

by HENRY HUTCHINS\*

**We have at last found an inventory control method suitable for small or average-sized Service Dealers and Service Organizations. Simple to install and easy to maintain--here's an outline of it.**

**E**VERY businessman, whether a manufacturer, distributor, retailer or operator of a radio servicing organization, and regardless of the size of his business enterprise, is constantly faced with the problem of maintaining records of his stock and overall inventory. Failure to maintain proper inventory records can be disastrous to medium and small sized businesses because such firms especially must constantly make every invested dollar work at peak capacity.

Business standards require that the normal turnover of any item should be four or more times a year. Profits can only be realized when items are sold. In business this is called "turn-over", and items that turn over less than four times a year are the same as capital that is "frozen". Bankers, being astute, consider that "frozen capital" is worth but 5 to 10 cents on the dollar, or less. So, unless you are very rich, with loads of spare cash handy, you must keep your capital as fluid as possible, and not let it get "frozen" or tied up. To accomplish this, you will have to know how your assets are apportioned and how your stock turns over. Only a running inventory record, as it is called, will give you all the answers instantly. Let's see if this isn't so:

Let's theorize that a man having \$2000 to invest, plus his time and technical ability, decides to go into business as an Independent Radio Service Dealer. By keeping himself

busy doing repair jobs a fair part of every working day this Service Dealer "turns over" and makes a profit on his time and skill. Part of this "profit" becomes a part of his weekly salary. Then, let's say he invested \$500 of his capital in test equipment and tools which he uses daily; he then mentally considers this as an inventory turnover on which he also makes a profit. However, if this Service Dealer also invested \$500 of his money in replacement parts, tubes and radio accessories, which because he bought carelessly fails to become useful and readily usable,— then he is endangering his enterprise's success. Only by means of an inventory record will the Service Dealer be able to discern *what* parts in his stock are dead, slow-moving or loss-causing. Stated another way, an inventory record will disclose what items, being frozen, are the equivalent to frozen capital, should be disposed of and replaced with active items that will earn dividends on their investment. By eliminating frozen capital assets or keeping them to a bare minimum a Service Dealer, (or Distributor or Manufacturer), avoids tying up cash. Remember, one cannot pay rent, draw a salary or make a profit on stock, (which is the equivalent of money), when it is tied up, lies dormant and serves no useful purpose.

#### **Simple Records Are Sufficient**

Some people have a perfectly remarkable mind for absorbing details as to what parts or tubes they have on hand, but even the best memory breaks down at some point and must

be supplemented by the written message.

In theory the perfect inventory control encompasses having the right item or items in stock when needed—no more no less. However, physical limitations, transportations, capital investment and other factors qualify the maximums and minimums of any item. This factor must be determined by you. Judging what quantity to stock or carry is in a constant state of flux. If TV has not reached your area yet it would be silly to stock TV antennas. But, by the same token, if TV has come into your sphere of endeavor, and you fail to maintain a sufficient stock of antennas to meet current needs, you will lose jobs which would bring you a profit. Likewise, if you invest a large sum in TV antennas and then fail to move them you may find yourself strapped for cash for other needed purchases, which could cost you profits on other jobs.

To judge the inventory your business requires for normal operation is fairly simple. The general practice is to divide the sales of that item for a given period by the turnover for the period that is desired and the resultant figure is the desired inventory figure. But . . . what were sales? If you have a tiny business you might keep such figures in your mind, but, in general the average small Service Dealer should normally stock several hundred items such as tubes, condensers, volume controls, etc., and a good parts distributor generally has an inventory running into the hundreds of thousands of units. Such

\*Elliot Electronics Inc., Radio Parts Wholesalers

LAST YEAR INVENTORY CONTROL	ITEM AND LIST PRICE	COST	SELLING PRICE	BEGINNING INVENTORY	REPLACEMENTS ORDERED												
					3/7	3/14	3/21	3/28	4/4	4/11	4/18	4/25					
10 10	01 A	1.00	.49	.99	7	2		4	4	1		1	2				
10 20	12 A	1.10	.53	1.08	18	5	5	7	6	9	10	10	9				
15 20	27	1.20	.59	1.17	31						2	1	1				
15 30	6A3	1.30	.64	1.25	16	19	21	22	27	20	18	24	26				
30 20	6A4	1.40	.69	1.35	20	10	11	9	7	8	10	6	12				
30 30	6A8	1.50	.73	1.40	19	14	16	20	19	21	24	19	19				
50 40	7A4	2.00	.98	1.90	34	6	6	7	4	5	3	7	6				
	etc.																

Fig. 1. Inventory Control can be established to meet your own particular requirements. Col. 1 shows what average stock of the item was carried last year. Col. 2 shows what stock quantity is now being carried. Col. 3 describes item and its list price. Col. 4 shows approximate net cost. Col. 5 shows selling price and Col. 6 shows number of units on hand at time this Inventory Control is started. Subsequent columns show how many replacements to fill stock were ordered on date shown at top of column.

figures can't be memorized completely. In business, a running paper record of inventory on hand is far more reliable than memory or the attempt to check your sales records for a period of time, or to check your stock shelves themselves if on some occasion you 'think' you are short or overstocked.

The merchant having a very large and very profitable business can underwrite the cost of maintaining a record and inventory department. But the medium sized or small businessman can't afford such luxuries so his alternate solution is to do the same thing in a cheap manner requiring but little time and effort. The proposed inventory system is somewhat described by its very name, the "Cycle Inventory Control". It is inexpensive to install,\* (a couple of dollars at most), and it is almost self-operative, needing no extra help and but a minimum of the businessman's time . . . less than 30 minutes a week for the average Service Dealer, and under an hour a week for a fairly large Distributor.

\*10 sheets, which would list 500 items, would cost about \$1.00, or 10c a sheet.

**How It Works**

Cycle Inventory Control mirrors the fundamental information you require to determine quickly how every item in your shop is selling or moving, whether it be a complete radio set or a type of component or type of tube. It even does more, for as you will subsequently see, it becomes an aid to you in your stint of reordering on occasion from your supplier, or on checking how your suppliers are making deliveries, etc.

A glance at *Figure 1* gives you an idea as to what the printed Inventory Sheet, looks like. The form has space for all attendant information such as the name of the item, type, etc., the supplier or source from which you buy, his address, what price you pay, what the list is, what discount you get, what your selling price is, how many units you have on hand, how many units are on order, or in transit to you, how many such units you sold during any given period, etc. Yes, the Cycle Inventory Control is flexible and will show instantly all you want to know about any item. And yet, it is not difficult or complex to keep this running record. It might sound as

though you are to be loaded with bookkeeping details in order to get from such a record all the enumerated data, but such is not the case. Whether you know it or not, you are already assembling all this information now in the daily operation of your business, but now you are probably doing it in several ledgers or on many "memos" —but you are *not* getting a collated and complete picture unless your present inventory system is like the Cycle one.

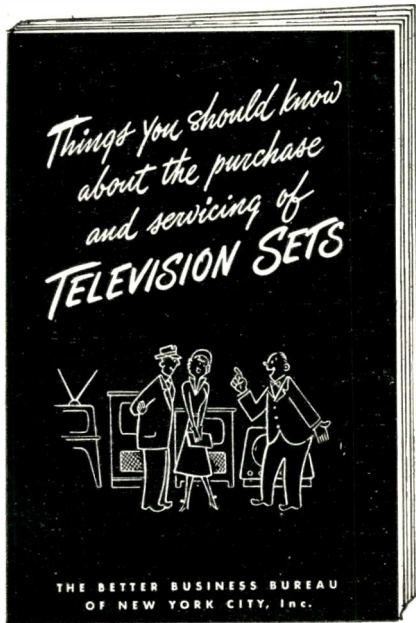
**Records "Control" Themselves**

If you have the Cycle Control system working for you, on a certain day each week, or every other week, all you need to do is check it against your sales slips for that period. In the case of a well managed service shop, those slips will enumerate, just as an example, how many Jones Brand 450 v. 8 mmf condensers were used or sold. That information recorded on the Cycle Control instantly tells you that if you had a certain number of such value condensers on hand when the last inventory record was made, and you got into the shop so many

[Continued on page 34]

## TRADE FLASHES

[from page 12]



Every TV Set Owner Should Have a copy of this fine booklet

Practices Code are to be enforced. First, offenders will be offered an opportunity to make amends. Failing to do so, sanctions will be applied, and in extreme cases the Bureau will take legal action against offenders who do not abide by the Code.

### Catalog

A new Microphone Catalog No. 110 has been issued by Electro-Voice, Inc., Buchanan, Michigan, titled "Your Future in Sound is Linked with E-V", this colorful new catalog presents up-to-date information and specifications on the comprehensive line of Electro-Voice Dynamic, Crystal, Velocity and Carbon Microphones—Crystal Pickup Cartridges and Accessories.

A copy may be obtained by writing to Electro-Voice, Inc., Buchanan, Michigan, cannot be divulged at this time.

### RCA's New TV Line Simplifies Servicing

Offering improved performance with 30 per cent fewer parts and 20 per cent fewer connections, a new chassis is incorporated in all new RCA Victor television receivers now being manufactured.

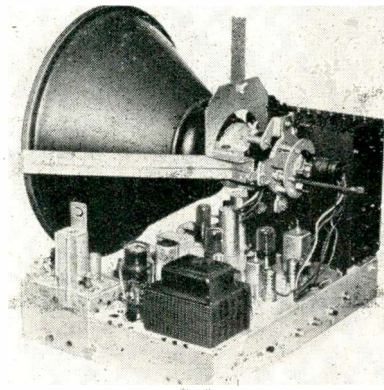
In announcing the new RCA line, C. M. Odorizzi, Vice President in Charge of RCA Victor Service, stated that the television industry suffers from a critical shortage of trained service technicians.

[Continued on page 32]

"Industry experts have estimated that between five and six million television receivers will be sold this year," he said. "Three to four million of that number will be sold between now and Christmas. That means that the nation's television technicians must be prepared to install and service in the next five months approximately as many television receivers as were installed and service during the first four years of post-war television, from 1946 through 1949.

"The new RCA Victor television chassis is a boon in this particular period of television's expansion, because it simplifies the problem of service. However, it can only alleviate, rather than forestall, the fast-approaching servicing crisis in the television industry. The fact of the matter is that in many television areas there are not enough fully-trained servicemen available to handle the demand for installation and service that will come this Fall. The RCA Victor chassis will help—but not enough."

In a move to ease the national servicing problem, the RCA Service Company has set up a program to acquaint the nation's servicemen as quickly as possible with the design and service details of the new chassis. During the next four weeks, RCA field technicians, in cooperation with the RCA nationwide organization of distributors, will hold a series of 80 special "new chassis" lectures in every television market.



### New Simplified RCA TV Chassis

"The new chassis is characterized by the consolidation of heretofore separated parts and components into pre-wired assemblies, arranged in functional order. This will permit servicemen to install the receiver and perform all normal servicing without removing the chassis from its cabinet," Mr. Odorizzi explained.

### Lowers TV Service Rates

The RCA Service Company today announced reduction in its factory-

service television contract prices resulting largely from the development of a streamlined and improved RCA Victor television receiver chassis which is expected to reduce installation and normal servicing costs. Two types of Service Contract are offered: Plan I: Installation, a year's guarantee on parts and tubes (including the picture tube) unlimited service for 90 days, and service as needed thereafter at a flat rate of \$5.75 per call in the customer's home and \$3.95 per call if receiver is brought to Service Branch. Prices for this contract start at \$19.95. Plan II: The standard contract covering installation, a year's unlimited service and parts and tube protection (including the picture tube) . . . all at a "package" price starting at \$39.95.

The complete basic price list for installation and service follows:

TELEVISION ONLY	PLAN I	
	With Built-In Antenna	With Standard Outdoor Antenna
All 10" & 12½"	\$19.95	\$39.95
All 16"	29.95	49.95
All 19"	39.95	59.95

TELEVISION ONLY	PLAN II	
	With Built-In Antenna	With Standard Outdoor Antenna
All 10" & 12½"	\$39.95	\$59.95
All 16"	49.95	69.95
All 19"	59.95	79.95

### Sylvania's Output Committed

J. K. McDonough, General Sales Manager of the Radio and Television Division of Sylvania Electric Products Inc., announced that the entire production of the 1951 line of Sylvania Television receivers had been sold.

### Wise Words By Philco's Service Manager

"You may not feel it yet but there is considerable pressure to organize television service on a large operator basis. There is a feeling that large operators can pay for capable managers and therefore do a better job. If this thinking prevails there is the distinct possibility that the days of the small service dealer and especially of the individual serviceman working for himself are limited.

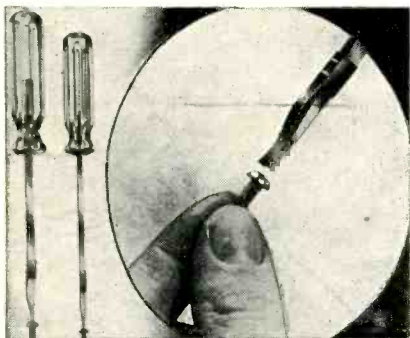
"There are many people who believe that the television serviceman is not a good business man. They say that he cannot manage his money and that he does not treat his customers right. Other people claim that the television serviceman is a poor technician. They say he is just a 'screw-driver mechanic.'

"We know that this is not true. We know that considering the rapid growth of television and the small amount of training provided by most manufacturers, television servicemen have been doing a fine job. We know

# NEW PRODUCTS

## VACO OFFERS SCREW-HOLDING DRIVER

The Vaco Klipxon is a new screw driver equipped with a sturdy, cleverly designed screw holder in the form of a spring clip which may be slid back up the shaft and out of use. The shank is square, made of forged



it is easy to secure a screw in the screw driver bit for starting a screw in a recessed hole, and equally easy to extract the screw.

Additional features are: handle is break-proof, shock-proof, fire-safe Ambery designed to prevent hand soreness despite long periods of use. The shank is square, made of forged chrome Vanadium. Available in two different bit diameters and in a variety of shaft lengths.

## PORTABLE TV SERVICE LAB.

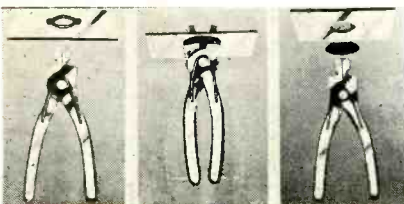
Oak Ridge Products offers new miniature composite test laboratory. The unit consists of



models 101 substitution tester, 102 high voltage meter, 103 signal generator, and 104 syncro-sweep generator, all in one convenient carrying case.

## GROMMET & INSETTING TOOL

Announcement is made of a newly designed metal formed grommet completely covered with



rubber. It is designed for insulating blanked holes in metal to prevent cutting, chafing, shorting and rattling of wires, cables, conduit, tubing, etc. which pass through the holes. The new grommet is called the Arco "Sta-Put" series 3120 and is manufactured by Automotive Rubber Company, Inc., 8601 Epworth Blvd., Detroit 4, Michigan.

The principal advantages of the "Sta-Put" grommet are that it can be installed very easily and that it holds in position at all times. Regardless of the amount of motion or vibration in the part that passes through the hole it will not loosen or pull out exposing the sharp edges of the blanked metal. Installation from the face of the hole is another feature. An expanding hand tool made available by the Company is used to roll and force the curled prongs tight against the under-surface assuring a positive secure fit.

Automotive Rubber Company will send upon request prepared data sheets on present available sizes.

## NEW 3-WAY PORTABLE

A new portable three-speed phonograph introduced by Webster-Chicago Corp. as the Model 130 Fonograf, plays all speeds and sizes of records manually.

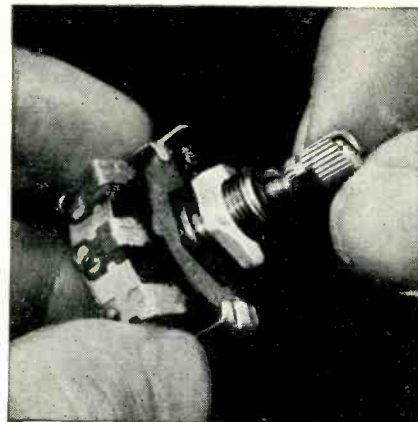
The new unit features a high-quality amplifier and a 4" x 6" speaker. It has a heavy-



flock turntable and a balanced tone arm for perfect tracking of the records. These features afford uniform frequency response. Webster-Chicago reports the 130 Fonograf has the most powerful motor ever used in a portable manual phonograph. A single needle is adapted to all speeds and types of records. The case is burgundy simulated leather.

## ATTACHABLE SHAFT FOR CONTROLS

Still another Pick-A-Shaft rounds out the already wide choice of attachable shafts offered by Clarostat Mfg. Co., Inc., Dover, N. H. It is the Type FKS-1/4" or finger-tip knurled and screwdriver-slot Pick-A-Shaft that snaps on to any Type AM or AT control. This type shaft is especially popular with those controls found at the rear of many TV sets and controlling such functions as horizontal linearity, horizontal and vertical size, horizontal and vertical position, and vertical hold. Since adjustments rarely required, the knobs are dispensed with. The knurled and screw-driver-slot



shaft proves mighty convenient. It is a short shaft, protruding only 1/4" beyond the control bushing. Being a Pick-A-Shaft with characteristic keyed end, it slips into the selected AM or AT control selected for electrical characteristics. A light blow snaps this Pick-A-Shaft rigidly and permanently on to the control.

Type FKS-1/4" is one of a wide variety of Pick-A-Shaft types, and therefore included with any AM or AT control that is purchased.

## NEW RADIO INDOOR TV ANTENNA

Radio Corporation, North Milwaukee Ave., Chicago, Ill. introduces its latest indoor TV antenna, the Model TA55 "Foto-Tenna." This

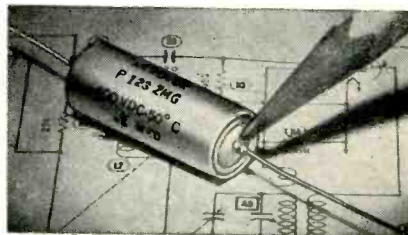


unit, a sleek brown leatherette photograph album, will provide superior reception in most metropolitan localities. The unit is novel in appearance. It is sold complete with 10 feet of 300-ohm lead-in.

## MINIATURE METAL - CASED

### TUBULARS

Extra-severe-service requirements in subminiature volume are met by the Type P123ZG Aerolite capacitors announced by Aerovox Corporation, New Bedford, Mass. The marked size reduction is attained primarily by the



metallized-paper section which is Hyvol K or M impregnated and placed in a non-magnetic hermetically-sealed metal case with vitrified ceramic terminal seals.

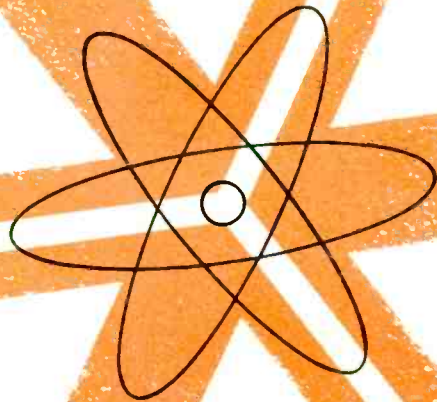
Type P123ZG Aerolites, are available in 200, 400 and 600 VDC, and capacitance values of .0005 to 2.0 mfd. Dimensions range from .175" dia. by 7/16" long, up to .670" dia. by 2-7/32" long. These bare metal-can units may also be had with plastic insulating sleeves, adding .062" to the diameter and 1/16" to length.



# RADICALLY NEW *Select-a-Beam*<sup>®</sup> REVOLUTIONIZES TV AERIALS!

BEAM SELECTION ELECTRONICALLY CONTROLLED

*Snyder*  
 PHILADELPHIA



## TX-50 AERIAL SYSTEM

FIRST SHOWING  
 NEDA CONVENTION  
 CLEVELAND  
 AUGUST 27-31

### ELECTRONIC CONTROLS INCLUDED

- 3 Combinations of Elements (3, 6 or 9)
- Each Combination Orients Electronically to Desired Station
- Switch Selects Combination

**SNYDER MFG. CO.**

**ONTARIO RESEARCH CORP.**

**ANTENNA-ENGINEERS<sup>®</sup>**

PHILADELPHIA

Export: ROBURN AGENCIES, INC., N.Y.

**YOU MAKE MORE MONEY WITH *Snyder***

**NO** ELECTRIC POWER

**NO** MOTORS OR MOVING PARTS

**NO** ROOF ADJUSTING

**NO** GHOSTS

## TRADE FLASHES

[from page 29]

also that they are constantly improving their service technique as well as their business methods. So long as independent servicemen work to give better service they will undoubtedly dominate the television service field.

"The high quality of your television service must be brought to the attention of the public by word and deed. You should never pass up the opportunity to do a good job and by all means don't hesitate to tell people of your quality work and reasonable prices. Independent service dealers have the best chance of being top man

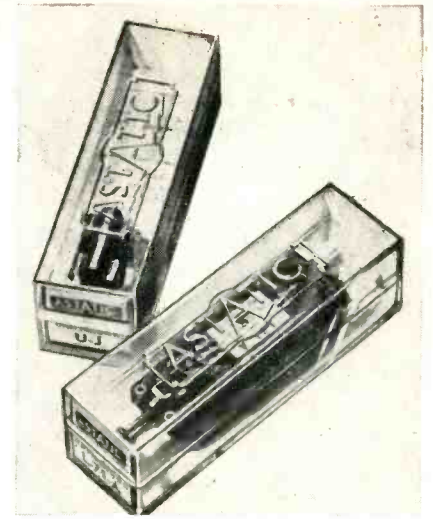
in the television service industry. Don't miss it!"

### Taco Expands

Increases in demand for Taco antennas and accessories have made it necessary for Technical Appliance Corporation, Sherburne, N.Y., to provide additional production space and facilities.

### Astatic's New Package

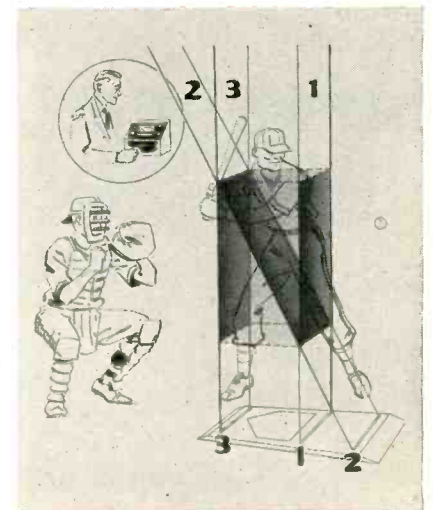
Latest innovation in the packaging of phonograph pickup cartridges is provided by The Astatic Corporation, Conneaut, Ohio, by means of a rugged, transparent plastic box. All Astatic Cartridges now are delivered in the new containers. The cartridge can be seen clearly through the trans-



parent plastic, and there is also an identifying label at each end of the box. The plastic is thick and rigid, which assures a container that won't collapse, tear or gap open, keeping the cartridge safer and cleaner. Visible through the bottom is a list of the cartridges which the one inside the box replaces.

### Electronic Empire

This drawing illustrates the "electronic empire," developed by the General Electric Company at Electronics Park, Syracuse, N. Y., and recently was used by the Brooklyn Dodgers for their spring training at Vero Beach, Fla. When a pitched ball passes



through the strike zone, the shaded area here, its shadow is seen by three electric eyes which look at the sky at the angles shown. If the pitch is a strike, the ball is seen by the eyes in 1-2-3 order and electric impulses are created which light a "strike" indicating lamp. An inside or outside ball is not seen at all and a high or low pitch results in the ball being spotted in an improper sequence, and the lamp does not light, thereby indicating a "ball"

**OUTSTANDING**

**OXFORD Speakers**

Constant research and development have made each and every OXFORD SPEAKER the outstanding unit of the industry. This is proved by the fact that over 77 television and radio manufacturers have used millions (yes — millions) of OXFORD SPEAKERS in the last 25 years.

The excellent engineering skill, fine sound reproduction, quality of components and durability of design, are just a few of the many reasons that make OXFORD SPEAKERS worthy of your consideration.

Precision-built for every sound application with the guarantee of unsurpassed performance, truly make Oxford Speakers **OUTSTANDING**.

Write for your free copy of our new catalog today—for the most complete speaker line available.

Leading jobbers carry OXFORD SPEAKERS for TV, FM, AM, AUTO and PA.



**OXFORD ELECTRIC CORPORATION**

3911 South Michigan Avenue • Chicago 15, Illinois  
EXPORT: ROBURN AGENCIES, NEW YORK CITY

was pitched. The strikes, as well as the speed of the ball are registered on the recording machine shown in the inset.

#### CCC To Finance RCA Buyers

The RCA Victor Division of the Radio Corporation of America announced today the completion of arrangements under which the Commercial Credit Company, national financing organization, will finance sales of RCA Victor products from distributors to dealers, and will also underwrite time payment sales by dealers to consumers.

Under the provisions of the financing plan, a dealer ordering RCA Victor merchandise from a distributor may pay down as little as 10 percent of the invoice price, plus freight. The Commercial Credit Company will then finance the remaining 90 percent for varying periods up to a maximum of six months.

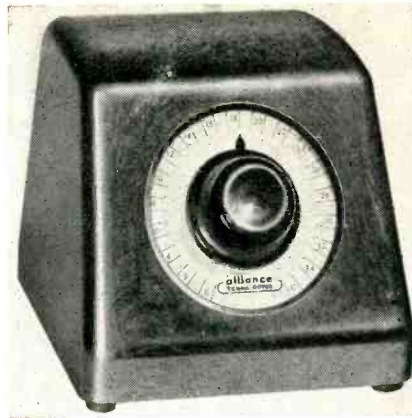
The dealer will have possession of the stock and may either warehouse it or place it on display in his store. With the sale of each of the instruments to a consumer, the dealer subscribing to this service will be required, before delivery of the set, to pay the finance company the amount due in cash, or with a retail time payment contract.

#### Automatic TV Antenna Rotator

Mr. John Bentia, sales manager of the Alliance Manufacturing Company, Alliance, Ohio, has announced the introduction of a new Model HIR Alliance Tenna-Rotor which will be ready for delivery by September first.

"Our latest model Tenna-Rotor is fully automatic. The viewer simply sets the pointer to any desired point on the dial. The antenna then rotates automatically to that point and stops. Actually—you 'set it' and 'forget it'", says Mr. Bentia. According to the manufacturer, this is the only rotator which requires no special installation for antenna direction orientation. The antenna is oriented from the control case—that is, the antenna need not be pointed at some specific direction when the rotator is installed. A 'Moving Mystic Light' along the dial shows the antenna position while rotating. The pointer always indicates the final antenna direction at all times. The model continues to incorporate the special 4-conductor cable with "Zip" feature. According to Mr. Bentia, installation time is faster and simpler.

The indicator dial may be optionally marked for new channels at any time—hence, is never out-of-date. As new TV stations come into an area,



Alliance Model HIR

the owner recalibrates his rotator.

"Both mechanically and electrically, we believe Model HIR is the most practical rotator unit on the market", said Mr. Bentia. Sales and advertising plans for the coming fall and winter seasons include a spot television campaign directed to over five million viewers around 60 TV stations.

#### Keller, to Organize New Group in

R. T. M. A.

At the annual meeting of the Amplifier and Sound Equipment Division of the Radio and Television Manufacturers' Association (R.T.M.A.) Mr. Keller, V.P. and Sales Mgr. of Anchor Radio Corporation, manufacturers of

## TV AND RADIO MEN Asked Us To Build This Kit

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- 3/16" Regular Bit No. ZB 34
- 1/8" Regular Bit No. ZB 24
- #2 Phillips Bit No. ZP 24
- #1 Phillips Bit No. ZP 14
- 3/16" Hex Wrench No. ZS 6
- 1/4" Hex Wrench No. ZS 8
- 5/16" Hex Wrench No. ZS 10
- 11/32" Hex Wrench No. ZS 11
- 3/8" Hex Wrench No. ZS 12
- 7/16" Hex Wrench No. ZS 14
- 1/2" Hex Wrench No. ZS 16
- 3/16" Metal Tip Aligner No. AT 45
- 3/32" Pocket Clip No. A 116-2
- #1 Phillips Thin Blade No. PO 1
- 1/4" Screw Holding No. OK 24
- 1/8" Insulated Blade No. VR 261
- 3/16" Screw Holding No. OK 38
- 3/16" Insulated Blade No. VR 381
- 1/8" x 10" Non-magnetic Adjuster No. VB 210
- 5/32" Fiber Television Aligner No. AT 510
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Ernest Keller

Quality TV Boosters, was appointed Chairman of the TV Booster Committee. He believes that under the guidance of R.T.M.A. that TV Accessories such as a Booster, aside from being a profitable item in itself, will play a vital part in extending TV sales to untapped markets. Television and Sound Manufacturers, TV jobbers, retail and service men interested in the above program are encouraged to send comments and further suggestions concerning this program to Box B, Room 700, 37 W. Van Buren St., Chicago 5, Illinois.

### New TV Aerial System

Announcement of the new "Select-A-Beam" TV Aerial system has been made by Snyder Manufacturing Company through Dick Morris, salesmanager of the Philadelphia television and radio accessory firm.

As described by Mr. Morris, the Snyder "Select-A-Beam," given the code number TX-50, is a revolutionary new aerial system. Beam selections are electronically controlled and no motors, moving parts or electric



Dick Morris

power are required, while roof adjusting and ghosts are eliminated.

Three combinations of elements are possible, with each combination orienting electronically to the desired

broadcasting station by means of a selector switch.

The first showing of the Snyder "Select-A-Beam" will be made at the NEDA Convention being held at Cleveland, August 27 to 31.

### Decca To Make 45 RPM Records

It was announced July 10th that Decca and its subsidiaries, Coral and Brunswick, will add 45 RPM unbreakable vinylite recordings to their present line of 33-1/3 Long Play and 78 RPM records. The initial Decca 45 RPM release to dealers, consisting of a minimum of 50 famous albums and numerous standard single records by Bing Crosby, Guy Lombardo, the Andrews Sisters, Fred Waring and other national favorites, will be made on August 15.

"All new Decca single records will now be recorded in both 45 and 78 RPM speeds," Mr. Rackmil said. "In addition, we will make available on 45 RPM records, as soon as conversion can take place, a quantity of outstanding single recordings and albums from Decca's extensive catalog."

### Doyle Resigns From Alliance

Mr. R. A. (Buss) Doyle, who has been associated with Alliance Manufacturing Co. since its inception 25 years ago and president of the firm since 1946, has resigned from that office. Mr. Doyle continues as a stockholder and director of Alliance but otherwise his future business plans cannot be divulged at this time but will be very soon.

## INVENTORY CONTROL

[from page 28]

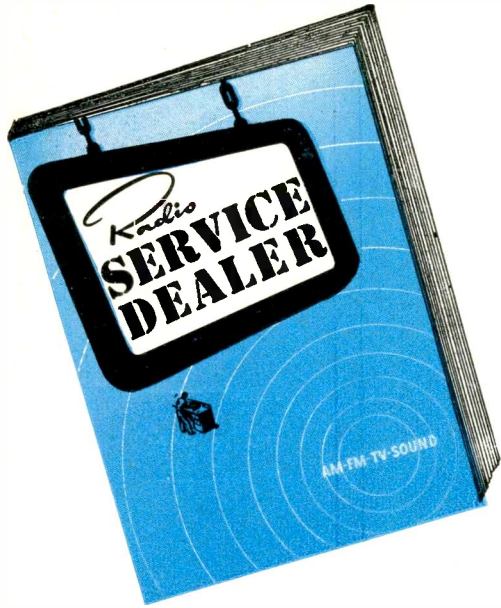
more during the intervening period, and you used the stipulated number shown, then you must have on hand the difference. Or, if you'd rather check your inventory on the shelves, say once a week or month, you can do this and then by deducting the quantity from the figure shown as "Inventory Control" you'll know immediately how many units must be ordered to make up the difference. It's templated carrying 20 type 27 tubes infallible.

Referring to Fig. 1 again let's use a hypothetical case where the shop owner sees at a glance that he con- in stock. When he made up the inventory he had 31 in stock. For several months he ordered no replacements, and then he only had to order 2 or 1 a month. This brings to light the fact that the dealer should only stock about 4 or 5 type 27's and not 20. On the other hand, and in the

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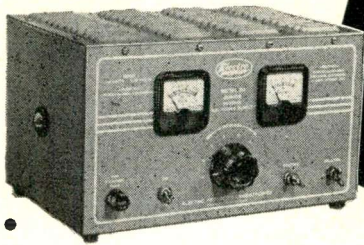
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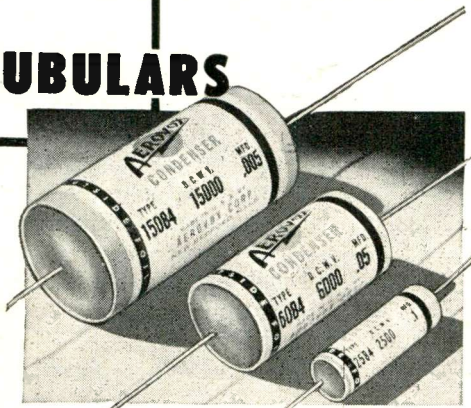
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same way, such an inventory control shows that the type 6A3 tubes are selling very well and that it would be practical for the dealer to stock 40 of them regularly instead of 30, and in like manner as 7A4's a relatively slow-mover he should cut his inventory on that type down to about 15 instead of 40. The system tells you when you are overstocked or running short of an item. It tells you what items are fast, and what are slow movers. If under "Inventory Control" you figured on stocking 40 units of an item and then find you have only reordered 1 or 2 such units once a month, the record automatically tells you that this is a slow-moving item and as such you should only try to keep 5—not 40—such items in stock, to eliminate tying up money in slow-moving stock. It tells you at a glance how your money is invested and if it is invested wisely or foolishly. For example, one Service Dealer we know started to maintain an inventory control system like the Cycle but then for some time he didn't keep it up to date, as he was "very busy handling jobs", to quote him. Business seemed to be thriving, and he was doing a large volume of TV installation work. Consequently he was continually ordering several models of a certain brand of TV antenna, feeling his orders were in line with the number of installations his shop was handling. Then one day to his utter amazement, this Service Dealer discovered that he was completely overloaded with a certain type of dipole antenna. In fact he had several hundred dollars tied up in them, and sad to relate, his sales records, when he finally got around to studying them, showed that he hadn't used such a dipole for any TV installation in over three months. Still sadder was the fact that this particular type of dipole had become obsolete, and even at this writing the Service Dealer referred to is carrying them on his books and in his stock, where they are using up valuable space, and where they will in time become nothing more than an absolute loss. A running inventory control would have eliminated this—it couldn't happen.

In like manner we could cite how a certain parts jobber who does not maintain a suitable inventory control method has gotten into serious difficulty and the bad grace of many of his customers, all local Service Dealers and Service Organizations. This particular jobber is located in a so-called "fringe area", about 160 miles from three TV stations. When TV first made itself felt in his territory, as an

accommodation, this jobber ordered two boosters from a well-known manufacturer. One was for his display window, and the other for demonstration and sale. (To make a TV set work in that section *requires* the use of a booster). So, as time went on, this jobber sold boosters, in ever increasing quantity, gradually getting his sales volume up to around 10 units per week. But the way this over-cautious jobber worked created havoc amongst his Service Dealer customers. He, the jobber, was always out of stock of boosters and his customers always had to wait for him to get in a supply to fill their orders. Consequently, in time, upwards of twenty Service Dealers were all waiting for their boosters, and of course that meant that sixty or seventy TV set owners were waiting for their Service Dealers to get their sets into operation. Complaints about the delays were getting worse and worse by the hour, and it all stemmed from the jobber's lack of foresight, which he would have gotten from inventory sales records, *if he kept them*, that he *should* have reordered those boosters in double or even larger volume than he was during the period in question. The upshot of the whole thing is this, another Service Dealer located about 50 miles away from that particular town heard about the "booster shortage and riled up a group of TV set owners who weren't getting service" so without ado this opportunist "moved in", ran a big newspaper advertisement guaranteeing 24 hour installation, etc., and believe it or not obtained as a result the orders from about half the people who were already waiting for service from their own local Service Dealer. The latter bunch got cancellations of orders and now, as you can readily understand, the jobber in question is really in the "dog-house". In fact, he is being boycotted and the Service Dealers are buying their parts from other jobbers situated many miles away. (The jobber referred to is just about ready to fold up).

As stated before, the initial cost of installing the Cycle Control Inventory method is nominal. A shop having up to 5 thousand items on hand could install all the necessary forms, except for the binders, for about \$6.00. As the Cycle system is covered by Copyright we can not disclose all of its workings, but they are covered by the instructions that come with each set of sheets. However, in concise form we can outline what the general procedure is once you have the required Forms: list all the facts on each sheet in the space provided (such as Mfg's.



When a customer buys an expensive TV set it's only natural for him to demand the best in reception. You can help make sure he gets it, too, when you install a PHOENIX Antenna for him. Phoenix SUPER GAIN Antennas bring in a signal that's as strong and clear as a church bell on a moonlight night in January. Sound engineering and craftsmanship pays off! Phoenix antennas are made to satisfy your customers. They're doing it now in thousands of homes all over the country. Install PHOENIX!

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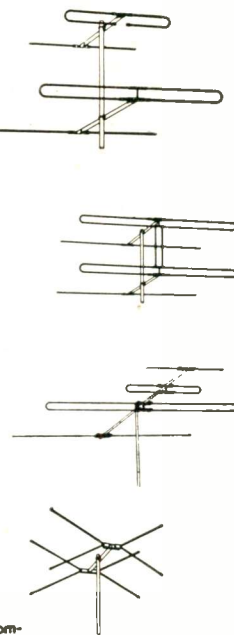
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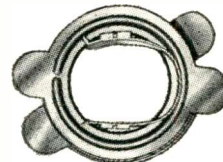
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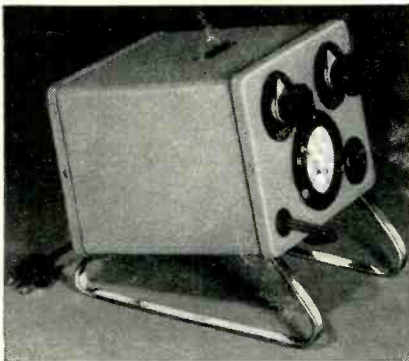
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Name, Jobber's name, address, etc., type of item, number on hand, number on order, etc.), and then from the daily routine records you maintain, fill in what sales each item had during the period in question. Naturally you aren't expected to set up this entire inventory control system in an hour or a day. Working at it a few minutes daily, the average Service Dealer can get his complete inventory control records established within a matter of a few days at most. Then the secret is to keep the inventory control system *working for you*, as it will, if you keep feeding it the data it needs, say in half an hour's time every Friday, or Tuesday, as you choose.

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The instructions\* sent with the Cycle Inventory Control system do not give you an alphabetical resume of what items you are to list, for that is asking the impossible. But as the pages are loose-leaf, the inventory recorder or installer can simply record his inventory of one segment of his shop at a time, and then even into the service bench and store rooms, with the result that eventually everything will be covered. And in passing, it might be worth mentioning that many radio manufacturers might do well to look into this or any similar inventory system, and having ascertained its merits, possibly make the system available to the buyers of their products in the form of a premium, or purely in an altruistic manner, as an aid to small businessmen who obviously require such business aids to make them more businesslike in their operations.

\*Instructions are supplied by Elliot Electronics, Inc., Tucson, Ariz.

**HORIZONTAL AFC**

[from page 22]

the oscillator frequency. The voltage across *R6* can therefore be considered as the error voltage.

The 6AL5 double diode is not connected as a discriminator as in the Synchrolock circuit. At *point A* in *Fig. 5*, a positive synchronizing pulse is applied as shown in *Fig. 7*, while at *B* another pulse, of the same amplitude and shape but of opposite polarity appears. This is achieved by inserting equal resistances (*R1* and *R3*) in the plate and cathode of the 6SN7 synch pulse amplifier. The positive synch pulse goes to a diode plate and the negative pulse to a cathode of the 6AL5. At the junction of *R4* and *R5* no voltage exists because the two pulses balance each other out. At *point C* in *Fig. 5*, a sawtooth voltage is applied which is obtained from the horizontal output transformer and, after passing through *R14*, *C12*, it appears as shown in *Fig. 8*. If the zero or center value of this sawtooth voltage coincides with the arrival of the synch pulses at the opposite plate or cathode, the 6AL5 cannot conduct. As *plate A* goes positive its cathode is at the same level as the plate of the *B* diode section. The current passed by both diode sections is there-

fore equal and of opposite polarity and at the junction of *R4* and *R5* no error voltage is produced. If the oscillator runs either faster or slower, *point C* will not be at zero when the synch pulses arrive at *A* and *B*, causing either diode to pass more current and setting up either a positive or a negative error voltage across *R6*.

Here is an example of the operation of the phase detector. Assume the oscillator runs slightly faster than the incoming synch pulses. This causes the top of the feedback voltage shown in *Fig. 8*, to appear at *point C* at the instant when the synch pulses appear at *A* and *B*. The cathode associated with *plate A* will become more positive, causing less current to flow

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through this diode section. The plate associated with *cathode B* will also become more positive but in this diode section it will cause more current to

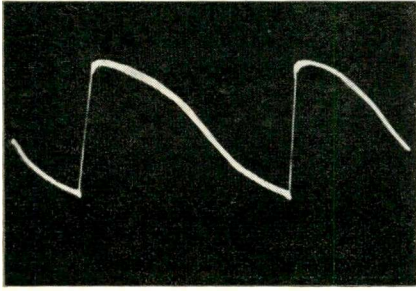


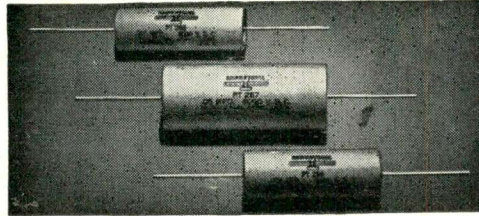
Figure 8

flow because here the voltage between plate and cathode is increased. The result of the two different diode currents will be an unbalance at the junction of *R4* and *R5*. A voltage will therefore appear across *R6* of such polarity that it will change the oscillator frequency back to the proper synch pulse speed.

It should be understood that the phase detector system of AFC can operate only when the natural frequency of the horizontal oscillator is very close to the synch pulse frequency. If the peak of the feedback voltage shown in *Fig. 8*, appears at *point C* at an instant when no synch pulse is present at *A* and *B*, the circuit cannot produce the proper error voltage. This is one of the reasons why the adjustment of the horizontal oscillator coil is so critical and why the range of the hold control is not as broad as in the Synchrolock circuit.

The adjustment of the phase detector type of AFC is not complicated, but for good performance it should be done very carefully and checked thoroughly. First the slug of the oscillator coil is adjusted for lock-in at the center position of the hold control potentiometer. Next *C10*, the horizontal drive trimmer is adjusted for picture width, brightness and linearity. Since this trimmer controls the shape of the sawtooth voltage on the grid of the output tube, it also determines the high voltage and thereby the brightness of the picture. If too little capacity is used in *C10* the picture will have a bright vertical bar, often called the overdrive bar. Tightening down *C10* will invariably eliminate it and one good way to set this control is to let the overdrive bar appear and then screw the trimmer down until the overdrive bar disappears. The adjustment of *C10* usually affects the frequency of the oscillator somewhat and it may be necessary to reset the slug of the oscillator coil once more. Check the setting of this

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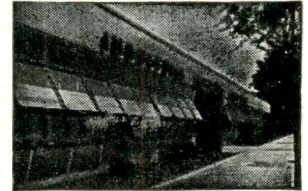
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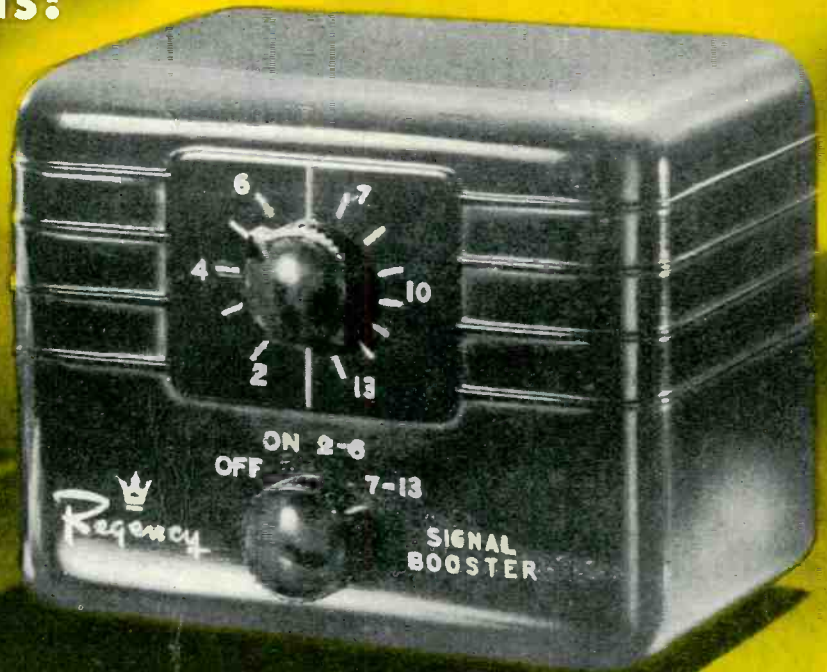
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