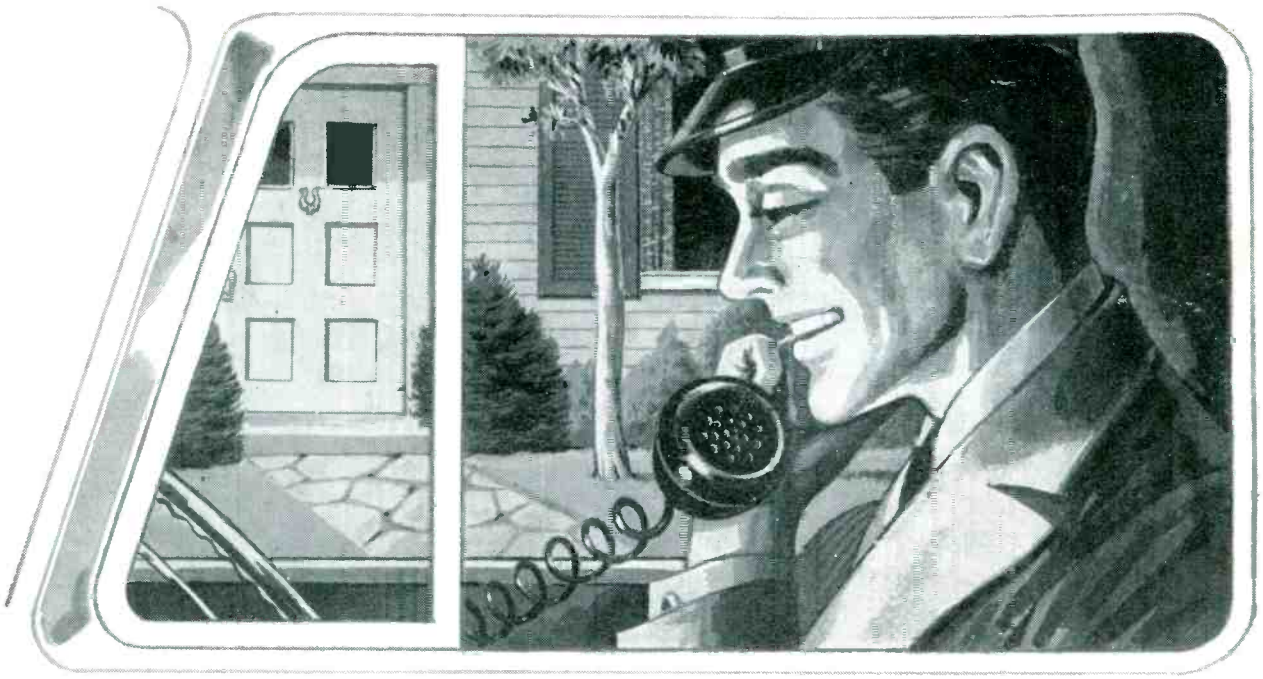
APRIL 1956
25¢

Radio-Television

SERVICE DEALER

TV-AM-FM-RADIO ELECTRONICS

Ante ndup



RADIART features the complete line of NEW COMMUNICATION VIBRATORS in 6 Volt and 12 Volt Series that outlast all others

These Ten Types Offer Complete Replacement for ORIGINAL Communication Equipment . . . the PROPER voltage for each application.

Old No.	New No. 6 volt	New No. 12 volt
5515	**5715**	**6715**
5518	**5718**	**6718**
★	**5721**	**6721**
★	**5722**	**6722**
★	**5725**	**6725**
5605	**5805**	**6805**
5620	**5820**	**6820**
5621	**5821**	**6821**
5622	**5822**	**6822**
★	**5824**	**6824**

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Again because of SUPERIOR ENGINEERING and CONSISTENTLY INCREASED QUALITY, Radiart offers you communication vibrators that are DEPENDABLE! The RIGHT vibrator . . . for EACH application! See for yourself . . . You're RIGHT WITH RADIART.

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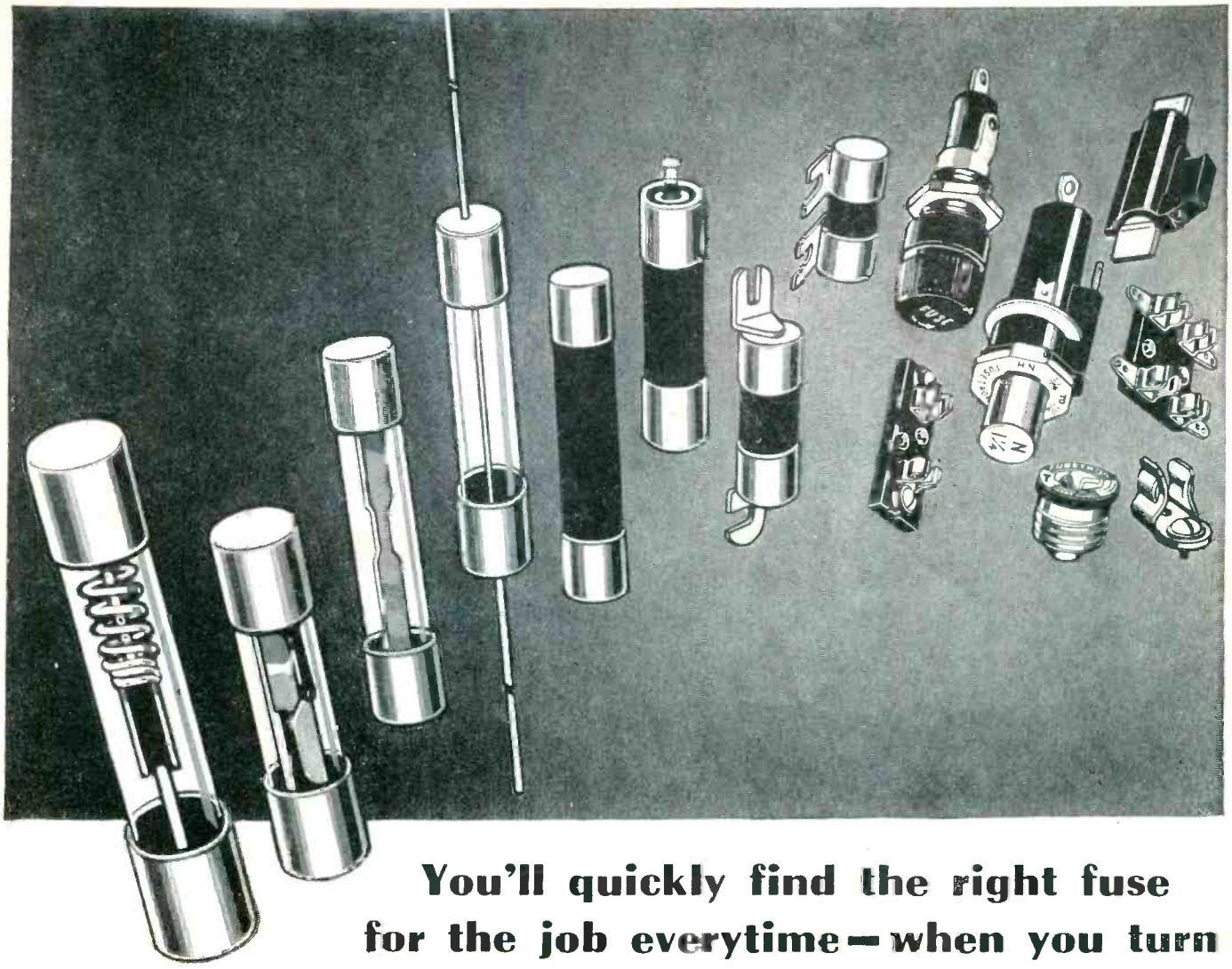
THE **RADIART** CORPORATION
CLEVELAND 13, OHIO

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



You'll quickly find the right fuse for the job everytime—when you turn to BUSS Fuses

The complete BUSS fuse line includes: standard types, dual-element (slow blowing), renewable and one-time types — available in all standard sizes, and many special sizes and designs. Plus a companion line of fuse clips, blocks and holders.

Simplify your purchasing, stock handling and records — by standardizing on this one, reliable source for fuses.

BUSS Trademark is your assurance of "trouble-free" protection

BUSS fuses are electronically tested to make sure they will operate as intended under all service conditions. A sensitive device automatically rejects any fuse not correctly calibrated, properly constructed and right in all physical dimensions.

And in sales and service — it is just good business to handle BUSS fuses. They are the known brand of fuses — accepted by the trade and consumer as the finest available. Handling established, quality items like BUSS fuses helps maintain your reputation as a reliable sales and service organization.

For more information on BUSS and FUSETRON small dimension fuses and fuseholders, write for bulletin SFB.

456

MAKERS OF A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC, AUTOMOTIVE AND INDUSTRIAL USE.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN MFG. CO.
(Div. of McGraw Electric Co.)
UNIVERSITY AT JEFFERSON, ST. LOUIS 7, MO.

"2300 RAYTHEON TUBES PERFORMANCE TESTED WITHOUT ONE FAILURE"

RAYTHEON

RAYTHEON RECEIVING TUBES for replacement pass every test for performance and quality at HOWARD W. SAMS & CO., INC.

The results of this thorough, impartial test of regular production Raytheon Tubes provide potent evidence that Raytheon Tubes are tops in quality and performance. Here's what the report says:

> *"Raytheon tubes were substituted in basic chassis, representing several hundred models. In these tests 2300 Raytheon tubes were tried in 230 different circuit applications with no apparent tube performance failure. Conditions were arranged to simulate fringe area as well as prime signal area, when testing tube types in RF, IF, Video, Sync, Vertical Oscillator and Horizontal Oscillator Circuits. Low Voltage Rectifiers, High Voltage Rectifiers, Vertical and Horizontal Oscillator, and Horizontal Output Tube types were also checked under low line voltage conditions. No types were found incapable of providing satisfactory results in these circuits, after adjustments of service controls."*

What more can we add to this conclusive proof that Raytheon Receiving Tubes are truly RIGHT . . . For SOUND and SIGHT.

RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations

Newton, Mass. • Chicago, Ill. • Atlanta, Ga. • Los Angeles, Calif.

Raytheon makes all these { Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes, Power Rectifiers and Transistors, Nucleonic Tubes, Microwave Tubes

RAYTHEON ®
Excellence in Electronics

Visit Raytheon Booth #4 at the ELECTRONICS PARTS DISTRIBUTORS SHOW May 21-24—Badges issued only in advance—No registration at the show

Effective May 1956 Issue The Title Will Be
SERVICE DEALER and ELECTRONIC SERVICING

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COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.
Telephone MUrray Hill 7-2080

VOL. 17, NO. 4 APRIL, 1956

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

RADIO-TELEVISION SERVICE DEALER is published monthly by Cowan Pub. Corp., 67 West 44th St., New York 36, N. Y. Subscription price: $1.00 per year in the United States, & U.S. Poss. Elsewhere $1 per year additional. Single Copies 25c. Second Class mail privileges authorized at New York, N Y. Tel.: MU 7-2080.

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EXPO PRESENTS

I. R. I. S.*

INFINITE REJECTION INTERFERENCE SYSTEM

the world's first fundamental and complete answer to the interference problem...

*** The Sensational I.R.I.S.**

gives infinite rejection of the interfering signal regardless of direction or channel or whether the interference is co-channel, adjacent channel or ghosts.

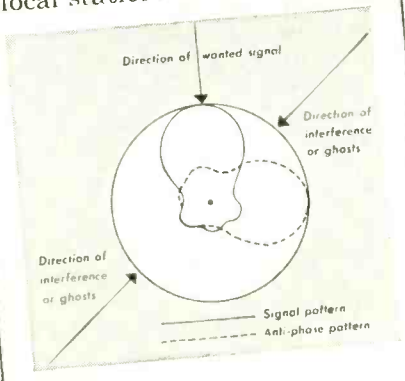
The rejection of the interfering signal is accomplished by opposing the interfering signal with a signal of equal amplitude but of opposite phase, thus producing complete cancellation. Simply rotate the upper section of the antenna to a position where the interference disappears.

Can be used either in a fixed installation or with rotor. All accessories and harness furnished for quick, easy installation.

The Famous EXPO Antenna

is used in **I.R.I.S.** with its fundamental unlimited bandwidth characteristic, thus insuring excellent performance throughout the 82 channels.

No more Venetian blinds, or ghosts or distortion from an interfering co-channel signal or "splatter" from a strong local station.



The combination of the principle of the exponential curve and the proved performance of I.R.I.S. offers an exceptional sales potential, both in antennas and TV sets. Now is the time to cash in on this exclusive opportunity.

EXPO-I.R.I.S. comes in the following models:

XO2R6	2-bay, 6 element EXPO-I.R.I.S.	List $20.95
XO2R8	2-bay, 8 element EXPO-I.R.I.S.	List $25.50
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ORDER TODAY FROM YOUR DISTRIBUTOR

whom we will supply until official distributors are designated in your locality.

EXPO

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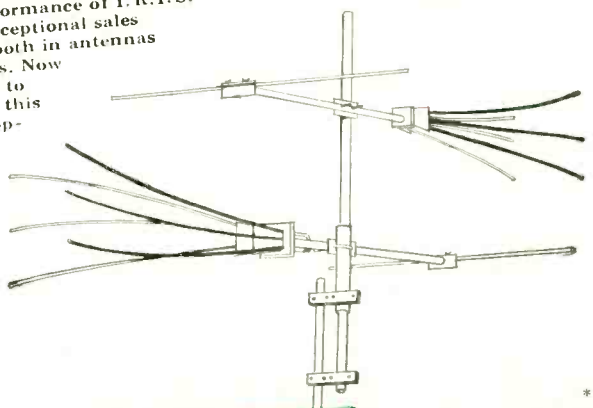
Fort Lauderdale, Florida



*Pat. applied for

EDITORIAL...

by S. R. COWAN
PUBLISHER

"ELECTRONIC SERVICING" Starts Next Month

Meeting Mr. Wm. W. MacDonald, Editor of *Electronics*, at the I. R. E. convention the other day I said, "Bill, have you heard the news that from now on SERVICE DEALER will add ELECTRONIC SERVICING to its title and we will henceforth cover editorially *all phases* of industrial electronic equipment servicing techniques *as well as* radio and television service procedures?"

To this my friend of many years replied, somewhat as follows: "It's about time! Hundreds of firms, working at capacity, manufacture diverse types of industrial electronic and commercial communications equipment. Hardly any of these firms have shown any inclination or indication that they want to handle the servicing of it when it is in the field. Obviously the service work must be done by someone—and obviously some publication must lead the way!"

For further details about our new format, new magazine title and broadened editorial scope be sure to read carefully pages 58 and 59 in this issue.

Servicemen Are Like Politicos

Webster's Dictionary defines the word *Forum* as follows: *"An assembly for the discussion of public matters or current questions."* Well, during the past three months I have held Forums with servicemen's groups in all parts of the country.

Many subjects were covered, such as: Licensing (pro and con); the benefits accruing to Servicemen's Association members; what retaliatory action, if any, can servicemen take against, 1)—Distributors who sell at retail, or, 2)—against Distributors who operate service departments in open competition with servicemen?; should tubes be tested free?; should repair estimates on TV sets be given free?; how radio-TV service firms can expand operations by getting industrial electronic and commercial communications service contracts; how servicemen can increase their prestige and income by using the proper business forms, newest pricing lists and digests, etc.

It goes without saying that all servicemen do not see "eye-to-eye" with other servicemen on many topics. For example, I am inclined to believe that just about as many servicemen now favor License Laws as oppose it; just as many favor joining Servicemen's Associations as oppose the idea and just as many favor testing tubes free as oppose the idea. Despite the quarter century of experience I've had working with servicemen, I've never before realized that servicemen certainly can and do become so adamant in their views that once they take a stand it's nigh onto impossible to make them change.

In light of the above, a publisher like myself must realize that if he favors one side of any issue he usually offends those who have contrary views. (Then when a "magazine preference survey" is made by an advertiser he finds his magazine being voted against by those who feel they have been opposed). If on the other hand the publisher takes no sides at all he becomes innocuous and has no justification for continuing in his profession.

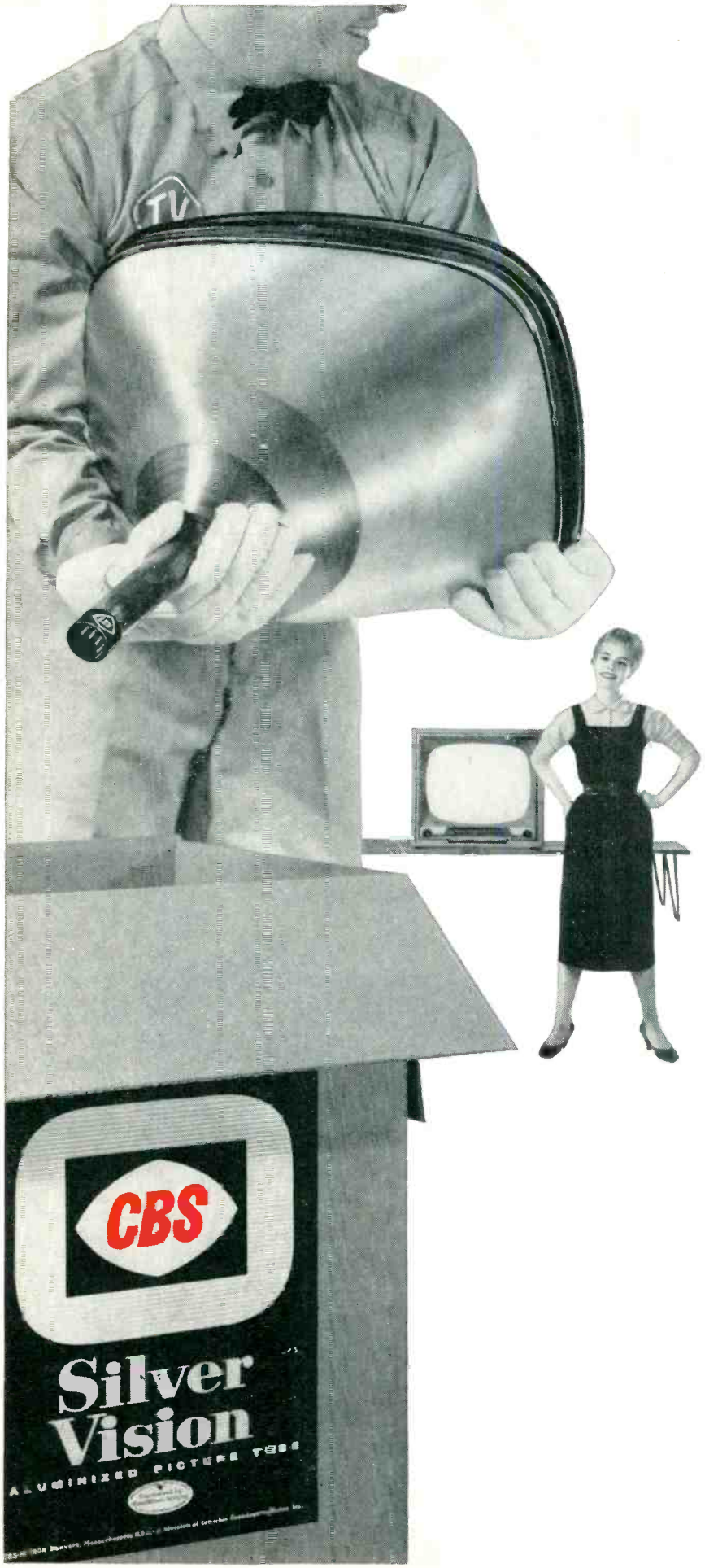
Now that this year's Forums are over I have decided to continue to expound my views even at the risk of stepping on some servicemen's feelings. I am sure that you'll agree that I would be remiss if I failed to express these views just as you have every privilege of opposing them when they conflict with your own. And yet we can all remain friends, eh?

Servicemen's Clinics Are Needed

Each year audiophiles can visit either Audio Fairs or Hi-Fi Shows which are held in key cities throughout the country. Likewise, radio-electronic engineers and parts distributors. Several conventions are held by and for them. But for radio-TV servicemen there are no genuine national or even regional conventions which they can attend to hear seminars on new service techniques or view all the new products, instruments, etc., that have been produced for their use.

We have discussed this subject—servicemen's conventions—with many manufacturers and distributors. Because most manufacturers sell their lines through distributors, they feel that practically all merchandising and educational efforts for servicemen should be attended to by the wholesalers. The latter group, distributors, are not inclined to combine forces and work together in holding regional conventions for servicemen because, they say: first—it would cost them too much and they'd get scant return for their investment, and second—if they did have a convention for servicemen the latter would not take time off from work to attend.

At this writing we believe servicemen need and should have conventions held for them in key cities throughout the country. How to accomplish this has yet been resolved, but we're working on it. Got any ideas?



It's easier to sell CBS

Silver Vision

the "High-Fidelity" Aluminized Tube

Your customer is aware that Hi-Fi does sound better . . . that it faithfully reproduces the original sound. And you can prove by demonstration that advanced-engineered CBS Silver Vision tubes can do for video what Hi-Fi does for audio.

You know Silver Vision's aluminization . . . silver-activated phosphors . . . and small-spot gun can accomplish this. But technical details do not interest the lady. She does appreciate Silver Vision's sparkling whites . . . deep blacks . . . and wide range of middle gray tones. She likes the way they can be blended to give her truly high-fidelity reproduction of the telecast picture.

Here's a tube whose performance sells it. And Garry Moore makes it still easier by convincing your women customers over the CBS Television Network: "There are no better tubes made than CBS tubes, the tubes with the Good Housekeeping Guaranty Seal." Sell the easy way, follow Garry's lead. Sell CBS Silver Vision . . . the "high-fidelity" aluminized picture tube.

Always show her the CBS carton with the Good Housekeeping Guaranty Seal.

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

TRADE LITERATURE

● ● ●

An extremely helpful booklet entitled, *"Scope Connections"* has been published by the Triplett Electrical Instrument Company of this city and may be obtained from the company for $2.00 a copy.

The booklet was written by Vern L. Walker, sales engineer for the large manufacturer of electrical testing and measuring equipment.

Subject matter in the booklet, which bears the legend "If you can use a VOM, you can use a scope," ranges from elementary data on the "Functions of an Oscilloscope" to information on "Overall Video IF Response."

Copies of "Scope Connections" are available from the Triplett Electrical Instrument Company, Bluffton, Ohio.

* * *

The Tube Division of the Radio Corporation of America has just brought out a new technical booklet on RCA Picture Tubes.

This brand-new, 16-page booklet—*RCA Picture Tubes* (Form No. KB-106)—contains ratings, characteristics, and base-connection diagrams for all RCA Picture Tubes including color tubes, and features a replacement directory giving information on recommended RCA replacements for more than 150 industry types.

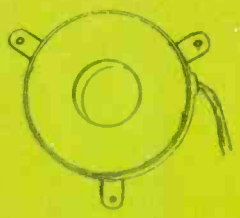
The picture-tube replacement directory included in this booklet is especially designed to enable the serviceman to select quickly an RCA Direct Replacement Type or an RCA Similar Type whichever is available. If an RCA Similar Type is shown, the chart lists the basic differences between the RCA Similar Type and the type to be replaced.

The booklet also keys all RCA "Silverama" Aluminized Picture Tubes for quick and easy reference. It is priced at $0.20 per copy and may be obtained from RCA Tube Distributors, or from Commercial Engineering, RCA Tube Division, Harrison, New Jersey.

* * *

A quick-selection chart listing General Electric's 600-milliampere series-string receiving type tubes—all of controlled heater warm-up design—now is available from the G-E Tube Department.

The chart (*ETD-1163-A*) may be obtained from the General Electric Tube Department, Schenectady, N.Y.



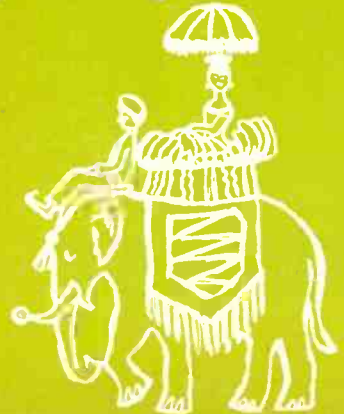
THE MERIT PARADE . . . '55-'56

We're beating our biggest drum . . . the spectacular parade of new items—over 100 in 1955—will go on! Constant engineering and research will continue to keep Merit the most complete replacement line in the field in 1956.

Truly under the big top . . . Merit is the only manufacturer of transformers, yokes and coils who has complete production facilities for all parts sold under their brand name.

Merit ...FIRST IN REPLACEMENT TRANSFORMERS

Merit Coil & Transformer Corporation
4427 North Clark Street, Chicago 40, Illinois

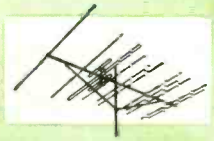


damaged, weather-worn, obsolete!

6 out of 10 need replacement now!

replace them with CHANNEL MASTER TV ANTENNAS

FIVE ALL-CHANNEL FAVORITES — TOPS FOR REPLACEMENT!

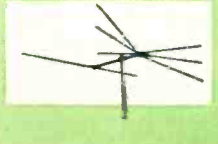


SUPER RAINBOW *model no. 331*
Still the most sensitive all-channel antenna made! Other popular Rainbow models also available.

"K.O." *model no. 1023*
(broad band)
Knocks out "venetian blinds" with the highest front-to-back ratios ever recorded!

TRAILBLAZER *model no. 335*
Extra elements provide extra performance at no extra cost!

New LANCER *model no. 337*
Popular fringe-area installation — new rugged powerful design. Also available: Super Lancer, and new economy "Challenger" model.



SUPER FAN *model no. 313A*
The finest of Fan-antennas — superior both electrically and mechanically!

Here's the greatest profit opportunity in TV today!

The "Golden Age" of antenna replacement is here! Time has finally caught up with millions of older TV antennas that no longer provide good reception.

A national survey shows that 65% of all TV set-owners in established areas are not getting the picture quality they *should* be getting. THEY NEED NEW ANTENNAS! And you can profit in a big way by replacing now with a powerful, new CHANNEL MASTER installation!

YOUR BEST REPLACEMENT BUY is Channel Master, America's most widely advertised and merchandised antenna line. Channel Master provides you with the most advanced electrical designs, the soundest construction, the easiest, fastest installation.

See your Channel Master distributor

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.
WORLD'S LARGEST MANUFACTURER OF TV ANTENNAS AND ACCESSORIES

JOHN F.

RIDER SPEAKS

SEVERAL people have asked why the electronic manufacturing industry is recruiting men out of the servicing industry rather than avail themselves of the maintenance facilities existing among television service shops all over the nation.

The answer has many facets. To begin with some specialized equipment manufacturers do avail themselves of local servicing facilities. Admittedly, there are not too many service shops which have contracts for maintenance-on-call, but there are some which do. We don't think it is too far fetched to say that as time passes, more and more electronic devices will get into the hands of non-technical people in business and professions and that there will be an increasing need for contract service.

At the present time however, the problem which faces the specialized electronic equipment manufacturers is not one of maintenance on electronic devices which are used in their factories for control, inspection, measuring, etc. The problem which must be solved is the need for technical personnel for a variety of other duties in connection with equipment which they develop and sell.

As a general rule, whenever a design engineer is hired, somewhere along the line his activity must be backed up by a certain number of technicians. Development and pre-production models must be built. Experiments must be performed — measurements must be made. In other words, numerous duties by technicians bulwark the mental processes of the engineer.

Obviously, work of this kind cannot be done on a contract basis. The men must be there. Then, there is the case of the maintenance which must be performed on specialized equipment produced by these manufacturers and sold to customers all over the nation, and all over the world. While it is true that the roster of television servicing personnel contains many names of technically competent individuals, it is nevertheless true that these new electronic devices involve techniques which are beyond the normal boundaries of television receivers. It is possible to say that if ample time were available and the necessary servicing information were at hand, a local television servicing facility would be able to repair these devices. Unfortunately, the organizations which buy these devices demand not only

immediate service, if an equipment failure occurs, but they feel that it is the responsibility of the manufacturer to supply specially trained people so that when repairs are necessary they can be made immediately. Time is important when an expensive device is inoperable. This means that many manufacturers of specialized eletronic equipment are obligated as a part of the sales program, to train people on the repair of these devices; send them to the user of the units, where they either train someone else to maintain the equipment or eventually find employment by the consumer of the product.

The period of training necessary at the factory is a variable one. In some cases it can be done in as short a time as four weeks, whereas in other cases it consumes as much as six months, if not longer, and even then further knowledge is gained by continuous experience on these units. Whatever may be the training time requirement, it is easy to see that the customer's needs —certainly at the start—cannot be satisfied by contract maintenance. Moreover, the need for factory training exists in the case of the local service facility which is seeking maintenance contracts of this kind. Recognizing that the entire thing is in the growing stage, can a TV servicing facility afford to set up the kind of maintenance department necessary for this work at this time to train, invest in equipment, etc?

Admittedly, there are relatively few electronic devices involving techniques, circuitry and theory which are so complex as to be beyond comprehension by an experienced and trained servicing technician. But gaining the understanding of the functioning of the device and rapid recognition of symptoms when something goes wrong are capabilities which are widely apart. Time is of the essence in such maintenance work and formal factory training on the particular device is deemed imperative in order to achieve the aforementioned recognition. This has been proven time and again and is a well-known situation in the television servicing industry. It is an acknowledged fact that given two competent men the television servicing technician who specializes on certain brands of receivers develops a greater familiarity with their behavior than the men who handle all brands in lesser quantities. This is so even without factory training.

The varieties of specialized electronic equipment cover a broad range. Some of them are completely electronic in organization whereas others are electro-mechanical. The development of the necessary manipulative skill in the assembly and disassembly of the electro-mechanical devices can come only from factory training and experience.

Take as a simple example an ordinary typewriter—anyone can disassemble it, but when service is required the individual who has had factory training is the one who knows how to take it apart, put it together again, and adjust it with a speed which will satisfy the person waiting to use the machine.

The manufacturing industry is pulling men out of the TV servicing ranks because they need testers, inspectors and other personnel for direct employment in the factory. These duties cannot be performed on a contract basis by personnel located outside of the factory.

Summarizing the efforts being made by equipment manufacturers to get men from the television servicing industry to leave the ranks, it is apparent that they are following the only path which is open to them; at least at the present time. But there is no doubt that eventually local TV servicing facilities will have occasion to participate in industrial electronic maintenance. All the men with technical backgrounds will not go to work for industry. Therefore, for at least a decade to come industry will feel the continued pressure of shortage of personnel and they just will have to avail themselves of presently functioning servicing facilities.

Of course this means (and we feel that it would be a very wise thing to do) that servicing facilities who have eyes toward the future, get themselves out from under the umbrella of "television". This doesn't mean that the television servicing effort should be discontinued. There is every reason why

[*Continued on page 43*]

ASSOCIATION NEWS

by Samuel L. Marshall

Radio Television Guild Of Long Island

The following are portions of an editorial appearing in the "Guild News" of February 1956:

The T.V. Serviceman, caught between the manufacturer and the public has had to bear the brunt of the public's abuse while attempting to fill some of the fantastic claims made by manufacturers for their products. This, along with the lack of education on the consumer level, plus the actions of a small group of opportunists has put the service industry in a bad light in the public eye. Let's set the record straight!

Human behavior does not respect part lines—neither does it respect the division of the electronic industry. Being in the manufacturing end of the industry does not automatically guarantee respectability, as they would have us believe!

In their mad scramble to move merchandise by any means, regardless of who gets hurt, they have always managed to do so with an air of respectability—counseling us like father to son, quoting their last year's profits as a basis for their authority—telling us how to go out there and get our share of this fabulous market.

Might not the public's interests be better served by a bill to license the manufacturers? What do you think?

Empire State Federation of Electronics Technicians

A meeting was held at Binghamton, N. Y. on Sunday February 5, 1956. Subjects under discussion were licensing by State and local associations, and a report on the latest State legislation submitted in Albany.

RCA was under fire for the new tube date coding method they now use. Reports were given that would indicate the reason for the new letter code is to prevent the serviceman from reading it. We fail to see the reasoning behind such a move. ESFETA has sent a letter to RCA voicing an opposition and requesting RCA to return to the RTMA code or one similar.

Drug Stores selling via the do-it-yourself tube checker were discussed and some recommendations were made for combating it by stopping the source of supply through the manufacturer. Action will be taken by ESFETA.

Discussion was held on National Unity and opinions were divided as to the paths we should follow to gain unity.

Bob Henderson, Delegate

Television Electronic Service Association of Kansas, Inc.

T.E.S.A. of Kansas, Inc., announce that at the present time there are three (3) Chapters, and the State Organization.

Officers of State are: President: Wm. Nichols, 333 No. Waco, Wichita, Kans.; Secretary: E.A. Redmon, Box 154, Ellinwood, Kans.

The Wichita Chapter has just been reactivated and no officers elected as yet, however Wm. Nichols may be contacted.

The officers of the Salina Chapter are: President—John Doud, 829 Sheridan, Salina, Kans.; Secretary—Melton Shelton, 682 So. 9th, Salina, Kans.

The Midwest Chapter has as its officers: President—Harry Wright, 2019 Forest, Great Bend, Kans. Secretary—Ralph Renfro, Lyons, Kans.

The Midwest Chapter has just been formed and has had a very good response to its membership drive and will have over 50 Charter Members, when the drive is completed. This Chapter plans educational meetings, group advertising and other activities.

The Salina Chapter, at its last meeting, appointed a committee to investigate the possibilities of setting up a Licensing plan for members as well as non-members in order to guarantee their customers better service.

T.E.S.A. of Kans. is affiliated with N.A.T.E.S.A.

E. A. Kedmon
State Secretary

Radio and Television Servicemen's Association of Pittsburgh, Pa., Inc.

The Beaver Valley Chapter first Annual Banquet was held at Sheffield Towers in Aliquippa on February 14

and was a great success. The Chapter has elected three new Board of Directors members at their last meeting. They are, Bill Marcum, Midland, Pa. —Ken Biggs, Aliquippa, Pa.—George Christy, Beaver, Pa. Relieved were, Wm. Wallace Milligan, Beaver Area.—Gene Taylor, Aliquippa, Pa.—and Dave McBride, New Brighton, Pa. A headquarters has been established for the BVC at 639, Third St., Beaver.

Kings County Television Service Association of Seattle, Washington

The following officers were elected for the coming year. President—Bob Kelly; Vice-President — Harold Hart; Secretary-Treasurer—Clayton Faller.

National Alliance of Television And Electronic Service Associations

Announcement is made that the Spring Board of Directors meeting will be held at the Blackstone Hotel in Omaha, Nebraska on Sunday, April 22, 1956. The meeting will be hosted by TESA-Omaha, of which Tony Schneider is Local Affairs Chairman and Bill Briza National Affairs Chairman.

As in the past, this meeting will see a simultaneous NATESA business meeting and technical and business seminars for all service people, particularly local personnel. The meeting will be capped with a banquet at which Friends of Service Management Awards and Citations will be presented to those voted this honor at the last convention.

Every Affiliate is expected to be represented by the person they have chosen to be their Director to NATESA. If your group has not officially submitted to this office the name of its Director, please do so at once in order to assure your vote.

If you plan to stay overnight, write Bill Briza—5019 S. 24th St., Omaha, Nebraska for reservations.

Frank J. Moch, President
NATESA

Syracuse Television Technicians Association, Syracuse, N.Y.

The following are excerpts of a letter sent to the R.C.A. Service Co., Inc.

"In the past RCA has set policy toward pricing of service contracts. However, the people who are responsible for setting up prices seem to have lost contact with the cost of servicing television receivers—specifically in regards to the $99.50 service contract on color television receivers. This contract includes installation and set up, one-year extended parts warranty, plus unlimited service for one-year. Due to

[*Continued on page 41*]

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THE Holloway I.R.I.S. (Infinite Rejection Interference System) antenna (see *Fig. 1*) is basically two antennas connected 180° out of phase with each other at the downlead terminals as shown in *Fig. 2*. This 180° phase relation is obtained by transposing the inter-connecting harness.*

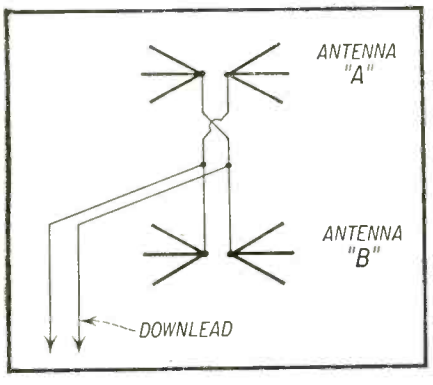


Fig. 2—180° phase difference obtained by transposing harness.

With the antennas positioned as in *Fig. 3* the reception pattern of antenna A coincides with that of antenna B; however, being fed 180° out of phase with each other to the downlead terminals, a *minimum* signal from *any direction* reaches the receiver. This position serves no practical purpose, but is included to illustrate the cancelling effect of one antenna on the other.

How To Install TV Antennas by Samuel L. Marshall John F. Rider, Publisher

Fig. 1—Infinite Rejection Interference System antenna (Holloway).

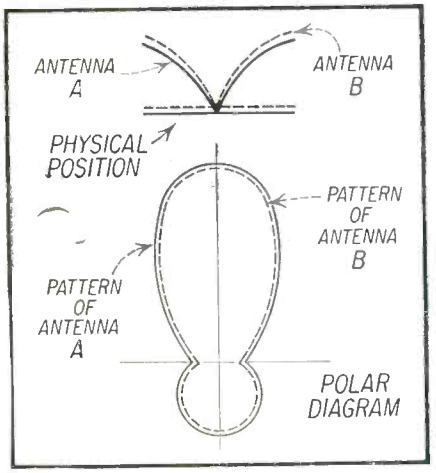


Fig. 3—Positioning for minimum signal from any direction.

Now suppose that the antennas are positioned as in *Fig. 4*. In this case the reception pattern of antenna A, shown as a solid line, coincides with the reception pattern of antenna B in the cross-hatched area. Therefore, reception from the direction indicated by the solid arrow will be at a minimum. Thus, an interfering signal arriving from a direction a few degrees displaced from a wanted signal may be rejected by orienting one of the antennas. Hence the use of the phrase: Infinite Rejection Interference System.

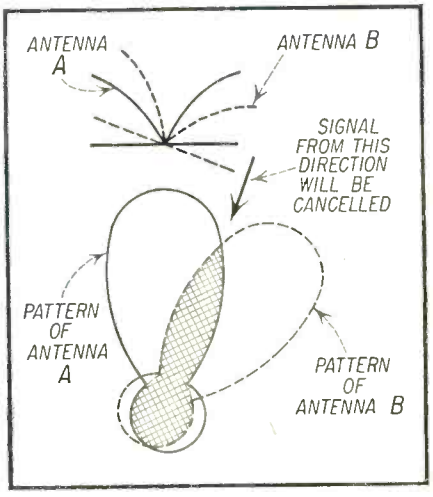


Fig. 4—Cancellation of the signal takes place in the direction indicated by the solid arrow.

It is obvious that if one of the an-

tennas were to be mounted in a fixed position, and the other antenna made rotatable, rejection of interfering signals in a wide arc around the horizon may be obtained. By the same token, if both antennas are made rotatable rejection of signals from any direction in favor of signals from other directions may be effected.

Because of the element design in each antenna, full coverage of the *vhf* and *uhf* spectrum is effected. This broadband characteristic makes this antenna particularly suited for the reception of color signals. [A-1]

Given a folded dipole resonant at some low frequency (Channels 3 to 4)

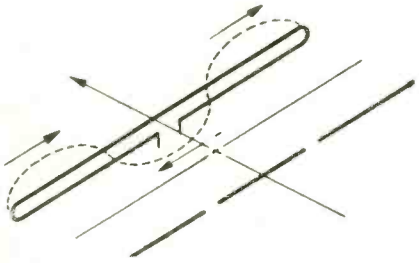


Fig. 5—Current distribution in folded dipole. (Channel 3 or 4)

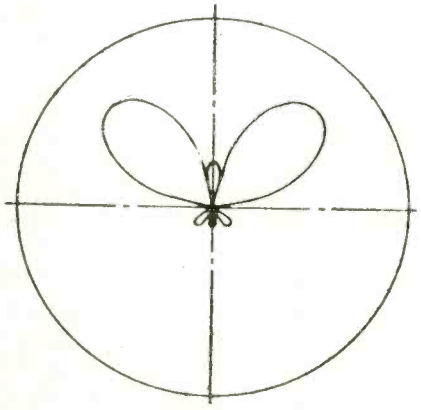


Fig. 5A—Polar response diagram resulting from current distribution indicated in Fig. 5.

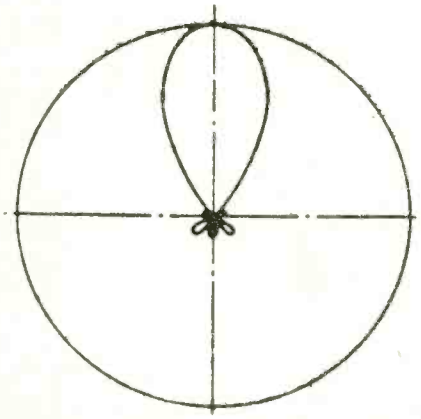


Fig. 6A—Polar diagram for current distribution shown in Fig. 6.

its high frequency (3/2 wave) current distribution and polar response will appear as in *Fig. 5* and *5a*.

In the new Walsco Wizard antenna the current in the central half-wave portion of the driven element is reversed by the insertion of a properly designed and spaced parasitic element immediately in front of the driven element. This expedient results in a current distribution as shown in *Fig. 6* because the parasitic element re-radiates a comparatively higher current in the driven element which is in phase with the currents in the outer sections. The corresponding polar diagram of this antenna is shown in *Fig. 6A*.

The antenna elements may be arranged in a horizontal plane to provide the effect of multi-stacked and multi-elements Yagis. Such an antenna providing Channel 2 to 13 reception is shown in *Fig. 7*. [A-2]

Trio Manufacturing Company makes available the "Zephyr Royal" TV antenna using three "wing" dipoles to obtain wide-band operation over the *vhf* range. These elements are stagger-tuned (see *Fig. 8*) to six pre-determined frequencies so as to obtain good performance throughout the *vhf* band.

On the low band, the "Zephyr Royal" has three driven elements stagger-tuned to Channels 2, 4, and 6, together with two directors and one reflector as shown in *Fig. 9A*. Other than the "wing" dipoles there are eight parasitic high-band elements as shown in *Fig. 9B*. The three "wing" dipoles add a total of nine driven elements pretuned to Channels 7, 10, and 13, together with three directors. [A-3]

The Zephyr Royal antenna shown in *Fig. 10* may be used with excellent results for color TV since a basic requirement for this type of reception is flat frequency response.

The Finney Company announces the addition of the Model B-6 (*Fig. 11*) to its Finco Geomatic antenna line. This antenna incorporates four coaxial capacitors in one folded dipole, causing the dipole to operate as if it is one length on low-band, and an entirely different length on high-band, thus enabling peak performance to be obtained on both bands.

This close spaced, reversed phase, twin driven antenna produces high gain with very high front-to-back ratio. Low-band reflector, high-band colinear reflector and combination director further increase the gain and sharpness of directivity. These characteristics, normally limited to low-band, are retained across the high-band by Finco's "Fidelity Phasing."

The Finco Model B-7 (*Fig. 12*) embodies all of the exclusive features and fine performance of the Model B-6. However, instead of a single combination director, the B-7 features two 3-element colinear directors on high-band and an inductance-tuned low-band director. This produces even greater directivity in pattern and intensity of gain, approaching maximum

Fig. 6—Current distribution using additional parasitic element.

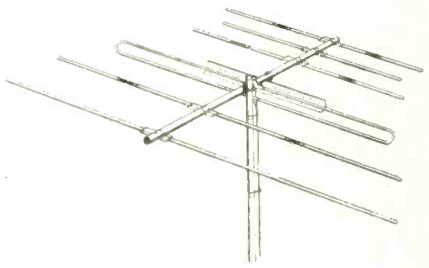


Fig. 7—Arrangement of elements to form a multi-element Yagi.

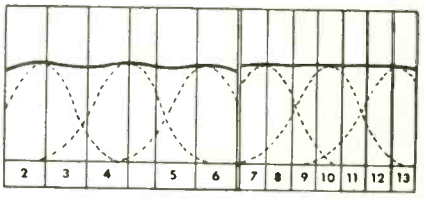


Fig. 8—Wide band operation produced by stagger tuning elements to six pre-determined frequencies.

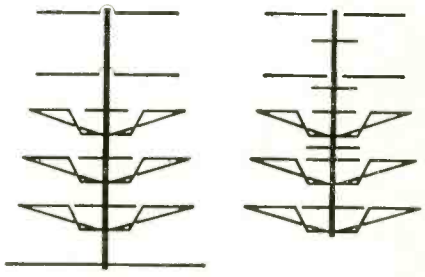


Fig. 9A—Zephyr Royal arranged for low band reception. 9B is the arrangement for the high band.

Fig. 10—Flat frequency response makes this an ideal color antenna.

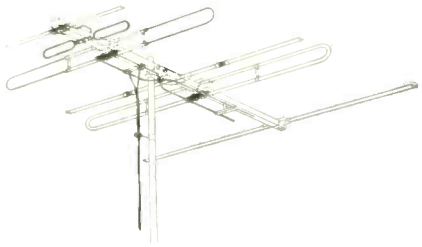


Fig. 11—Hi and lo band efficiency obtained by using coax connectors.

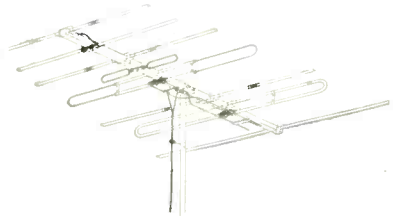


Fig. 12—Addition of directors gives high gain and directivity.

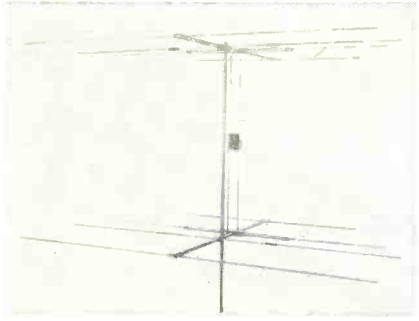


Fig. 13—Tricraft P-38 antenna for high gain on both bands.

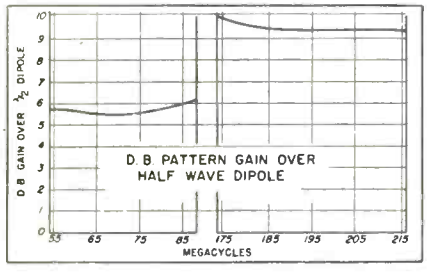


Fig. 14—Gain vs. channel characteristic for Tricraft P-38.

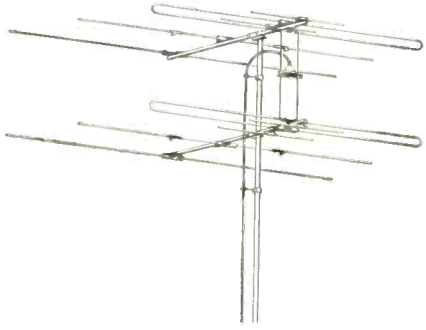


Fig. 15—Good directivity and broad band. (Amphenol Poweray)

possibilities. This powerful broad band antenna produces the high gain and front-to-back ratio protection against adjacent and co-channel interference. [A-4]

The Tricraft P-38 antenna (*Fig. 13*) is a television antenna that in a single bay incorporates seven elements. The design of the antenna is such that in the high television band three co-linear elements are fed with in phase equal currents.

Behind these three elements are placed a colinear reflector cut for the high television band, and a longer reflector that is active in increasing forward gain in both the high and low television bands. The resultant high-band antenna gain is nearly ten *db* over the entire high television band.

When operated in the low television band the three fed element group of the high band becomes a single half wave dipole with the approximately sinusoidal current distribution of any thin half wave dipole. Behind this dipole is placed the reflector cut to give maximum forward gain in Channel 2 and in front of this dipole is placed a director to cut to give maximum forward gain in Channel 6. As a result the antenna gain is nearly constant over the entire low TV band at approximately 6 *db* over a half wave dipole.

The theoretical maximum gain obtainable with a single dipole and reflector is 5.5 db. As the frequency is decreased below the frequency at which this gain occurs for a given antenna the forward gain in *db* rapidly decreases and becomes negative with the antenna receiving best from the rear direction. As the frequency is increased above the frequency of maximum gain the *db* gain remains positive but decreases with increasing frequency. Obviously a considerably greater gain could be obtained at any one point in the low television band if the reflector and director are cut for that frequency but the gain for the whole band would not be constant. *Fig. 14* shows the gain vs channel characteristics.

The feed arrangement used with the antenna is such that a good impedance match to a 300 ohm line is obtained over both television bands. The matching network is designed to improve this impedance match even more giving the ultimate in performance. [A-5]

Fig. 16—Directional patterns of the Amphenol Poweray antenna.

The new Amphenol Poweray fringe area TV antenna (*Fig. 15*) makes use of a folded dipole as the main element and a "sleeve" section (coaxial cable element) as the high frequency element. Where the overall antenna resonates at one frequency and the sleeve section at a higher frequency, an excellent broad-banded dipole element results.

In this antenna a 3-wire type of transmission line with the two outer conductors grounded is made use of in the sleeve dipole design. In the overall array uni-directional qualities are imparted to the antenna; at the low *vhf* by means of a simple reflector, and at the high *vhf* by a 3-section reflector.

This antenna provides a pair of directional patterns as shown in *Fig. 16* which encompasses a 4 to 1 frequency range. As such it should be excellent for color, and when stacked should provide good fringe area pickup. [A-6]

Channel Master Corp. features the "K.O." antenna (*Fig. 17*) which the company claims has a very high front-to-back ratio, totally eliminating co-channel interference and "venetian blinds."

The "K.O.'s" front-to-back ratios range from 20:1 to 50:1 relative voltage on the low band, and up to 13:1 relative voltage on the high band. In addition, the antenna exhibits extremely high gain characteristics: from 7 to 9 *db* on the low band, and from 8.5 to 10.5 *db* on the high band. These figures are for the single bay.

The "K.O." is a driven end-fire array. In effect it is designed as two individual antennas. There is a low band model, with 6 driven elements, covering Channels 2 through 6, and a high band model with 2 driven elements, covering 7 through 13. There is also a broad band model in which both these arrays are joined with an impedance matching Hi-Lo connecting harness. This effectively combines both sections into a single all-channel

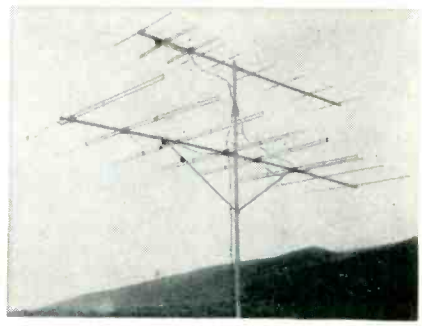


Fig. 17—Channel Master "K.O." has high front to back ratio.

antenna whose high and low band sections may be individually oriented.

Because the high and low band sections operate independently of one another, there is no sacrifice of performance due to compromise. The antenna functions with maximum efficiency on both bands. [A-7]

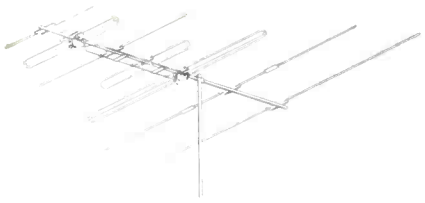


Fig. 18—RMS "Big Shot" all channel Yagi antenna.

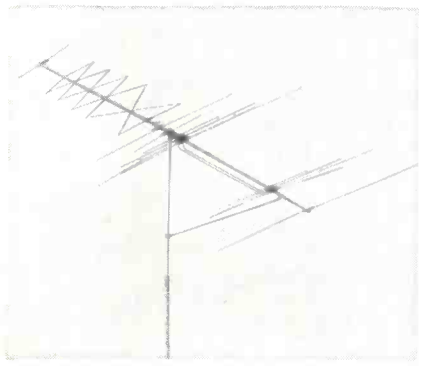


Fig. 19—Interference rejection featured by the "Shut Out Helix."

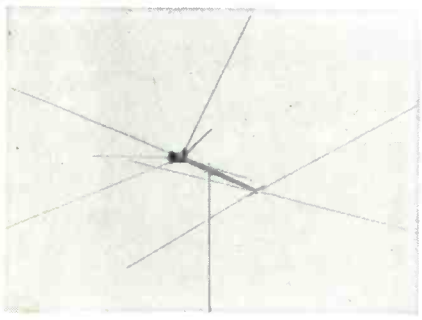


Fig. 20—Snap-Open Conical antenna by Clear Beam Antenna Corp.

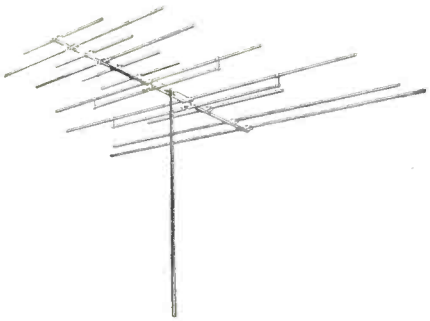


Fig. 21—Multi-channel Yagi, pretuned to channel of your choice.

Radio Merchandise Sales (RMS) features their "Big Shot" All-Channel Yagi Antenna as shown in *Fig. 18*.

On Channel 2-6 a full size folded dipole is utilized to develop maximum in-phase current across its total length. Through the use of a reflector designed for Channel 2 and a director for Channel 6, a flat response is developed over the low band.

When operating on the high band, the shorted high band dipole which is in front of the low band folded dipole shields the out-of-phase current which develops at the center from the other high band elements. This results in two electrically isolated high band dipoles on each extremity of the low band dipole, developing maximum in-phase currents on Channels 7-13. A special phasing harness feeds the Channel 7-13 signal developed by the front high band Yagi in the same phase as the other 2 high band dipoles. The result of in-phase additive operation of 3 half-wave antennas compensated through the step-up driven receiving elements produces perfect 300 ohm matched impedance to the receiver. [A-8]

JFD Manufacturing Co., Inc., features the Shut-Out Helix, custom-designed to reject co-channel interference on the channel specified by the serviceman. See *Fig. 19*.

The rear section of the Shut-Out Helix incorporates a second poly-phase dipole with reflector which is custom-cut to pick up the offending channel in phase opposition to the forward section. The resultant signals are combined in the harness. The net effect is complete cancellation of "venetian blinds" at the common transmission line terminals. [A-9]

The development of a completely new 100% Snap-open Conical antenna, the model C64, (*Fig. 20*), has been announced by the Clear Beam Antenna Corporation of Canoga Park, California. The new antenna is designed in such a way that all elements fold open and lock into position without the use of any tools. Assembly time of 11 seconds is reported by manufacturer. The unique design of the insulator includes wide air-plastic spacing to prevent signal loss. Other features in the antenna are the "Sur-lock," a device for locking the transmission line to the antenna insulator to eliminate strain on the terminals. All-aluminum construction, with end caps, prevents wind howl. The antenna is made up in six different combinations of dipoles and reflectors plus two bay models of each. [A-10]

Winegard Company features a multi-channel Yagi (*Fig. 21*) pre-tuned to the channel of your choice. This antenna is completely pre-assembled containing automatic Twin-Lock hardware

Custom-Combo Model No.	Channels Peaked for											
TC3-A	2	3	4	5	6	7	8	9	10	11	12	13
TC3-B	2	3	4	5	6	7	8	9	10			
TC3-C	2	3	4	5	6		8	9	10	11		
TC3-D	2	3	4	5	6				10	11	12	13
TC3-E	2	3	4			7	8	9	10	11	12	13
TC3-F	2	3	4			7	8	9	10			
TC3-G	2	3	4				8	9	10	11		
TC3-H	2	3	4						10	11	12	13
TC3-I		3	4	5	6	7	8	9	10	11	12	13
TC3-J		3	4	5	6	7	8	9	10			
TC3-K		3	4	5	6		8	9	10	11		
TC3-L		3	4	5	6				10	11	12	13
TC3-M			4	5	6	7	8	9	10	11	12	13
TC3-N			4	5	6	7	8	9	10			
TC3-O			4	5	6		8	9	10	11		
TC3-P			4	5	6				10	11	12	13

Fig. 22—Available pre-tuned combinations for Yagi of Fig. 21.

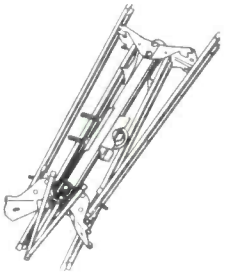


Fig. 23A—"Presto" instant mount conical. Shown closed.

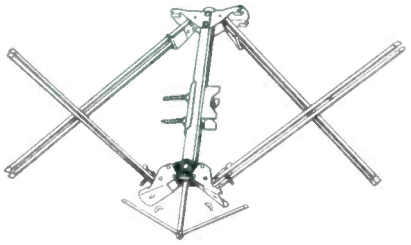


Fig. 23B "Presto" antenna shown in the process of opening.

Fig. 23C—"Presto" antenna shown in the fully opened position.

and is all aluminum and stainless steel construction. A chart illustrating the available pre-tuned combinations is shown in *Fig. 22*. [A-11]

Tenna Mfg. Company makes available a "Presto" instant mount assembly for its various conical antennas. See *Fig. 23*. [A-12]

Welco has developed a new ZEE-X, (*Fig. 24*) antenna element which can be used either as a director or as a

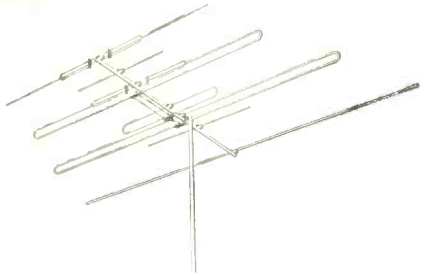


Fig. 24—ZEE-X antenna features linear response on vhf channels.

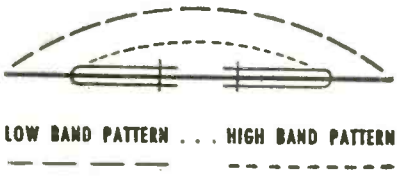


Fig. 25—Hi and Lo band current distribution. ZEE-X antenna.

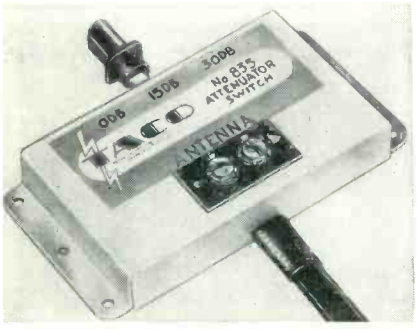


Fig. 27—Attenuator prevents overloading by strong signals.

reflector. As a driven element it has one major lobe with a linear response on all *vhf* Channels, 2-13. A diagram of the lo and hi band patterns of the ZEE-X electronic element is shown in *Fig.* 25. [A-13]

La Pointe Electronics makes available their new Rotenna designed for attic installation. Two models are available; one for Channels 2-13 and the other for Channels 2-83. The rotator employs a capacitor start motor which operates at a speed of 1½ r.p.m. See *Fig.* 26 which shows the *vhf* antenna at the left and the *vhf-uhf* antenna at the right. [A-14]

Technical Appliance Corp., (TACO), features a new attenuator switch. See *Fig.* 27. This switch is used when incoming signals are too strong, thereby overloading the receiver on one or more of the available channels.

The No. 835 will attenuate (cut down) these signals so as to provide stable operation of the receiver. In addition to a choice of two attenuation values, the unit may be switched to the '0 *db*' position for direct feed through (normal reception). Direct feed-through, 15 *db* or 30 *db* attenuation is provided with a flick of the switch.

Used in conjunction with TACO's No. 873 Selectronic Switch, this attenuator unit is easily adapted to a multi-antenna installation.

The No. 835 Attenuator is designed for both black and white and color television receivers. Good color reception requires a uniform undistorted signal. Excessive signal will cause the picture to "tear-out" and when this occurs, attenuation is required. This is especially true in extra strong prime signal areas. [A-15]

Kenco Engineering Company makes available a quick installation parapet mount. See *Fig.* 28. Made of heavy gauge steel and adjustable for walls up to 13½ inches, it is designed to anchor to the wall, and not to the coping. A cam lock prevents side movement on stone or tile copings. [A-16]

Easy-Up Inc., features their "Towerette" roof mounts shown in *Fig.* 29. These mounts are available in sizes from two to ten feet. They are shipped assembled and may be had in aluminum or steel. [A-17]

South River Metal Products Co., Inc., features the "Walk-Up-Drop-Lock" roof mounting shown in *Fig.* 30. This enables the installation man to

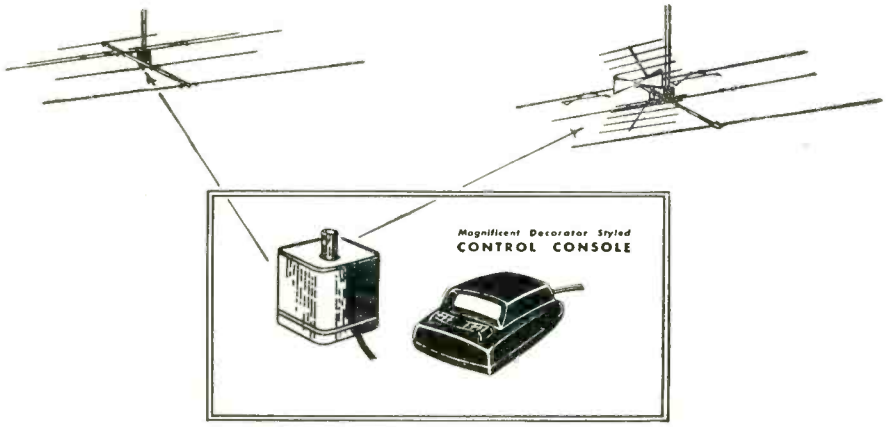


Fig. 26—Control unit and motor for the "Rotenna" made by La Pointe Electronics. The motor is shown at the left, and the control at the right.

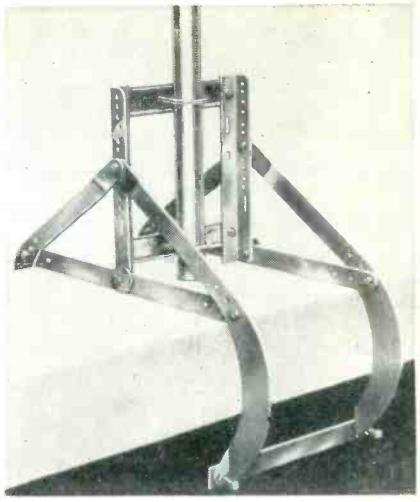


Fig. 28—Parapet mount for quick installation. (Kenco Engineering)

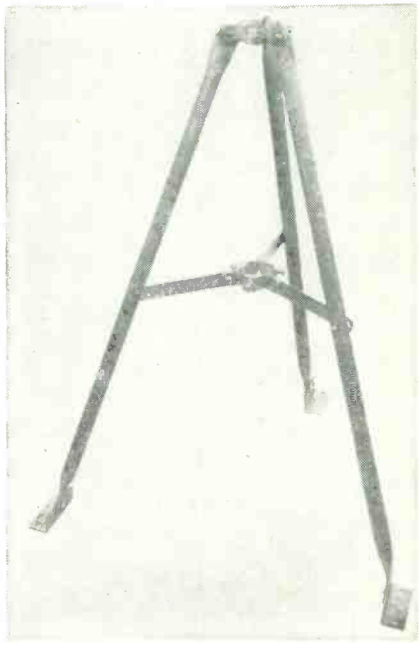


Fig. 29—Convenient "Towerette" Roof mount. (Easy-Up Inc.)

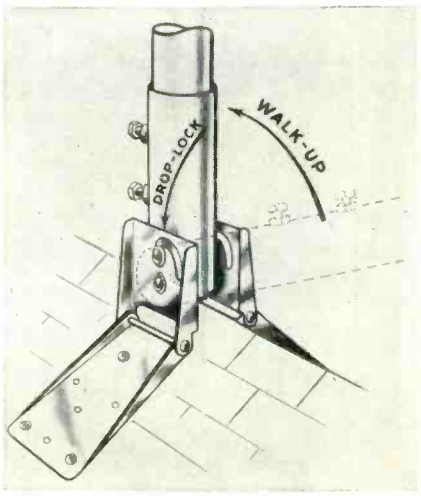


Fig. 30—Roof mount permits convenient raising of antenna.

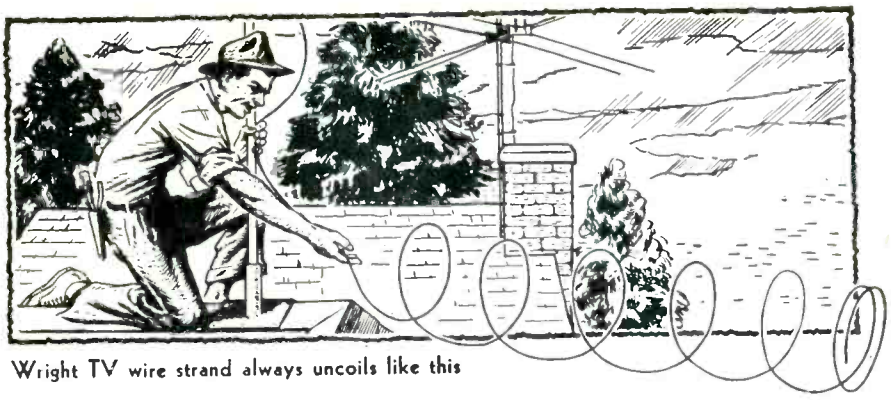


Fig. 31—Non-snarling guy wire for anchoring tall masts. Made in convenient lengths by G. F. Wright Steel and Wire Company.

walk the antenna mast from a horizontal to a vertical position, without the necessity of removing and replacing any bolts or nuts which hold the mast socket. Furthermore, as soon as the mast is elevated to a vertical position this patented device allows the mast to drop and lock securely at that point. This frees the service man's hands for the tightening of the holding bolts and nuts and the guying of the mast without additional help. [A-18]

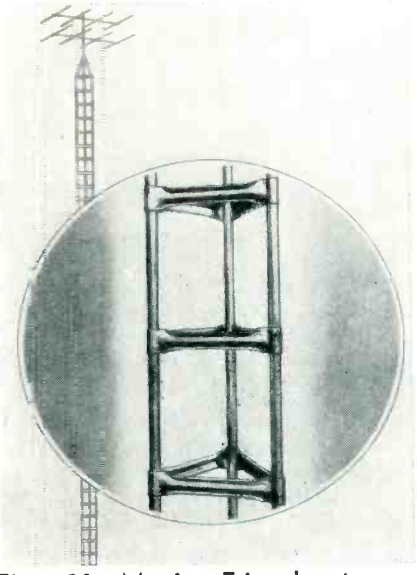


Fig. 32—Magic Triangle towers, available in ten foot sections.

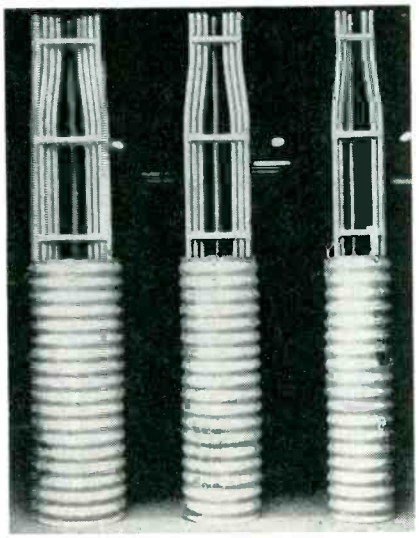


Fig. 33—Towers up to 48 feet without concrete foundation.

G. F. Wright Steel & Wire Company features a galvanized non-snarling TV wire strand. (*Fig. 31*). Each loop contains exactly two feet. Coils are available in various lengths up to 50 linear feet. Spools are also available in various lengths up to 1000 feet in four and six strand varieties. [A-19]

Rohn Mfg. Company features their "Magic Triangle" tower construction. The No. 6 tower shown in *Fig.* 32 is self-supporting up to 50 feet, and may be guyed up to 120 feet. These towers come in 10-foot sections. [A-20]

Spaulding Products Company provides towers of 24, 32, 40, and 48 feet heights. These towers require no concrete for the foundations, and utilize culvert base supports as shown in *Fig.* 33. [A-21]

Jontz Mfg. Company makes available towers of the telescoping mast type. An illustration of the latter is shown in *Fig.* 34. [A-22]

Telrex makes available its Super Thunderbird Model T-120, a wide-band, multi-element array. It employs a system of variable impedance phasing loops which permits precision tuning to provide the equivalent of 6 operating elements on the LO channels; 13 elements on the HI channels. Model T-120 is accurately matched to 200-300 ohm transmission line for both HI and LO channels with compensated "trombone" sections to yield exceptionally high gain and optimum signal transfer efficiency. LO band gain averages better than 5.5 db; HI band gains exceed 12 db, while front-to-back ratios range to 25 db.

These antennas are available also in 2 bay units—Model T-122, ¼-wave stacked for gain increases averaging 3 db on all channels; and Model T-122S, ½-wave stacked to provide gain in-

[*Continued on page 63*]

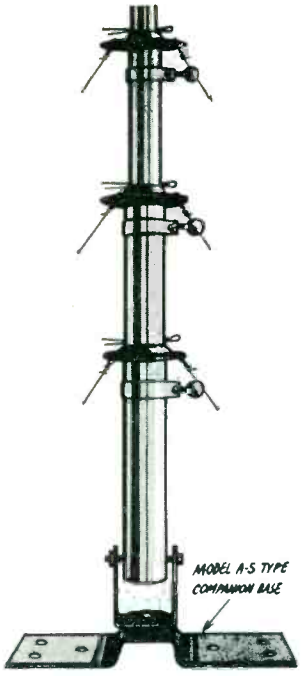


Fig. 34—Telescoping mast type of tower. (Jontz Mfg. Co.)

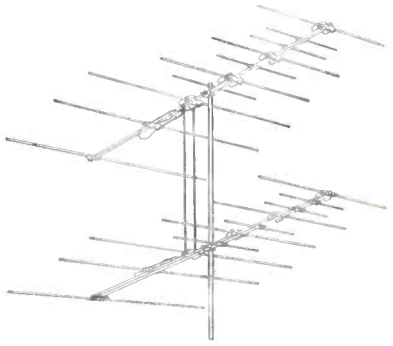


Fig. 35—Wide band multi-band array providing high gain.

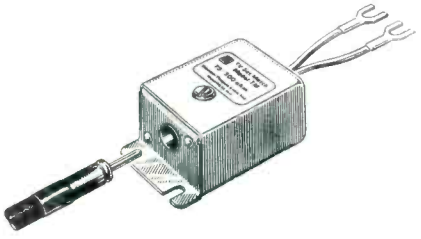


Fig. 36—Transformer for coupling 75 ohm line to 300 ohm receiver.

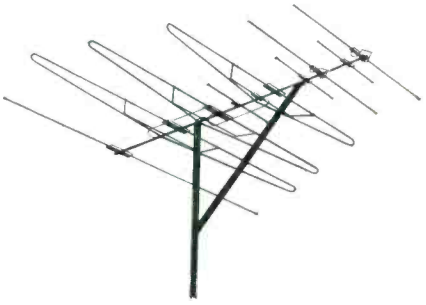


Fig. 37—"Super Scanner" for deep fringe area reception. (Tescon)

COLOR SYNC

This installment deals with the various types of 3.58 mc reference oscillators used in color TV receivers.

PART 5

by **Bob Dargan and Sam Marshall**

from a forthcoming book entitled "Fundamentals of Color Television"

THE fourth circuit in our discussion of the color sync section is the 3.58 *mc* reference oscillator. Present-day receivers employ many variations of reference oscillator circuits; however, all are crystal controlled. In general, three circuits are used. These are: (a) a modified grounded-plate Colpitts, (b) a tuned-plate tuned grid and (c) an electron-coupled type.

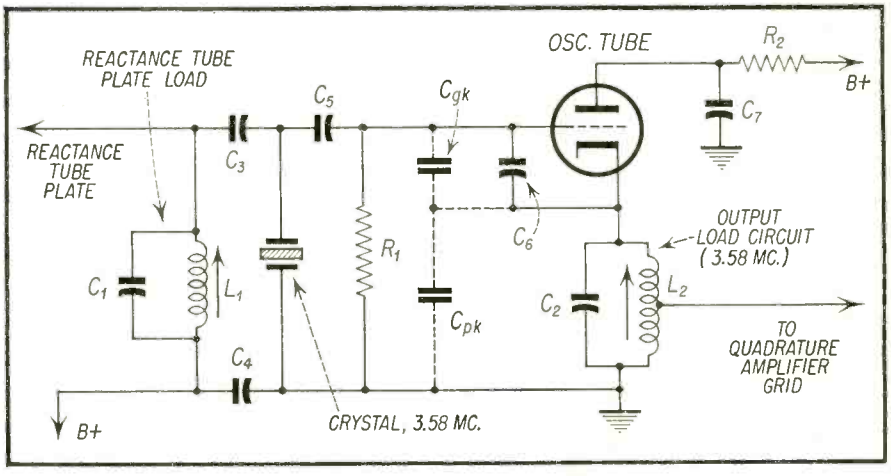


Fig. 1—Simplified circuit of grounded-plate crystal oscillator.

Modified Grounded-Plate Colpitts Reference Oscillator

A modified grounded-plate Colpitts oscillator circuit utilizing a crystal as the resonant element in the grid circuit is shown in *Fig. 1*. The crystal, in effect, is a high-Q tuned circuit which together with the capacitive and inductive effects of the components around it, resonates within a few cycles of the desired frequency (3.58 *mc*).

The split capacitance across the tube elements which is characteristic of a Colpitts oscillator circuit is derived primarily by the interelectrode capacitances C_{gk} and C_{pk}. External capacitor C_6 provides added positive feedback between cathode and grid, and is effectively in parallel with C_{gk}. Capacitor C_7 connects the plate to ground as far as *rf* is concerned.

Notice that the reactance tube plate load L_1C_1 is effectively connected across the crystal through C_3 and C_4. Adjustment of L_1, described in the previous section, determines the exact operating frequency of the reference oscillator in conjunction with the reactance tube. Coil L_1 is common to all reference oscillators used in color TV receivers.

While on the subject of characteristics common to color reference oscillators, it might be pointed out that these are controlled oscillators, and are operated so that their outputs are 90° out of phase with the color burst phase applied to the phase detector. This phase difference, as discussed in previous sections, is maintained by the APC loop circuit which develops corrective voltages at the output of the phase detector if phase differences other than 90° should occur.

Referring again to *Fig. 1*, we may observe that the grid bias on the oscillator tube, as a result of circuit oscillation, is developed by R_1 and C_5. The negative voltage developed across R_1 is a convenient measurement for checking the circuit for its state of oscillation. Of course a high impedance instrument such as a VTVM must be used in this case. Incidentally, all reference oscillators utilize this method of oscillator tube biasing.

The output of the oscillator is developed across a 3.58 *mc* tuned resonant circuit L_2C_2 located between cathode and ground. A tap on L_2 is provided for two reasons. The first is to reduce the voltage fed to the buffer grid because the voltage at the top of the winding is excessive. The second is to reduce the effect of capacitive loading (Miller effect) of the buffer grid on the tuned circuit L_2C_2.

As indicated in foregoing discussions the reference oscillator provides one of the signals applied to the phase detector. In some circuits, where a

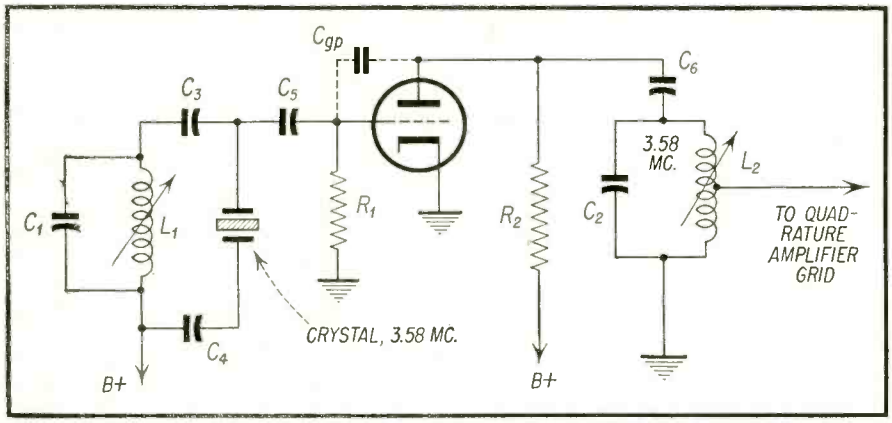


Fig. 2—Simplified circuit of tuned-plate tuned-grid shunt fed triode oscillator used in many color TV receivers.

ANALYSIS

Also discussed are the methods used in adjusting the various oscillators described, of which there are 4.

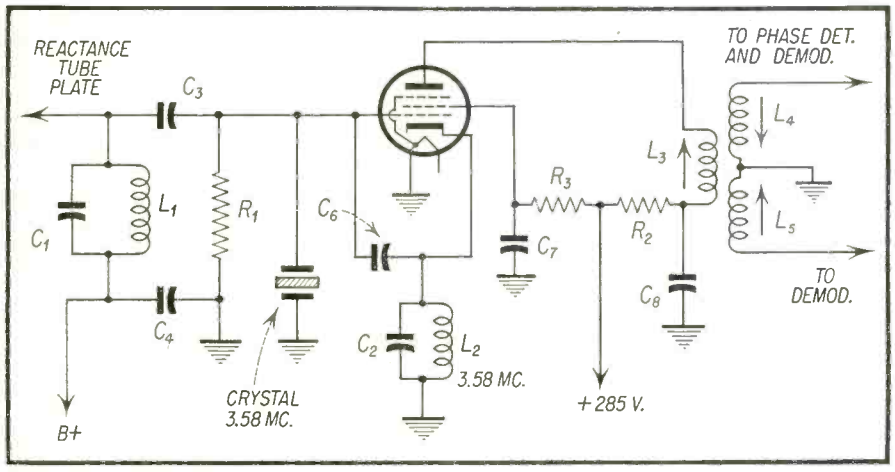


Fig. 3—Simplified circuit of electron coupled crystal oscillator.

single burst signal is fed into the phase detector a *pair* of 180° reference oscillator signals are fed into the phase detector. The reference oscillator also provides a signal for the buffer amplifier which in turn provides a *pair* of 90° signals for the color demodulators. Detuning of the oscillator by the subsequent tuned circuits is prevented by this buffer amplifier as indicated in *Fig. 1*.

In some oscillator circuits, as will be shown shortly, the output load circuit is isolated from the oscillator tube by using an electron coupled oscillator. Under these conditions a buffer stage is not required.

Adjustment of Output Coil

In the circuit in *Fig. 1*, tuning of the output coil will affect the resonant frequency of the crystal circuit. This detuning occurs because the output coil and the oscillating portion of the tube are not isolated from each other.

It is a common characteristc of this circuit that oscillations will be maintained only if the output circuit in the cathode leg is tuned slightly below resonance on the low frequency side. Thus, if we were to tune the output circuit from the high frequency end (core out of coil) we would observe that during the tuning procedure as we turned the core into the coil, the output of the oscillator would increase sharply at a certain point, following which it would pass through a maximum and then begin to decrease gradually. The setting of the coil for the most stable mode of oscillation in this circuit is thus on the low frequency side of resonance. For this reason, when adjusting the output tank circuits of oscillators of this type, the tank coil setting is adjusted by starting from the high frequency end, (slug turned out) turning the slug until a maximum indication is observed, and then continuing in the same direction until the oscillator output drops off to approximately 20%.

In actual practice this adjustment is made by connecting a VTVM to the cathode of the phase detector diode for measurement of the oscillator output. The adjustments are then made in accordance with the procedure just described.

Tuned-Plate Tuned-Grid Reference Oscillator

A tuned-plate tuned grid reference oscillator is shown in *Fig. 2*. In this circuit positive feedback required for oscillation is effected by means of C_{gp}, the interelectrode grid to plate capacitance of the tube. As in the previously discussed Colpitts oscillator, the exact resonant frequency of the crystal circuit is adjusted by L_1. Also the effectiveness of oscillation can be measured by means of the negative voltage drop across R_1.

In this circuit oscillator stability is achieved by adjusting the output tuned circuit to a frequency *higher* than resonance. Thus, it will be observed that when the oscillator adjustment is made, the tuning slug is first turned out of the coil as far as possible. It is then slowly turned in. At some point of the adjustment the VTVM will indicate a maximum. Continued adjustment in the same direction will cause the output to become intermittent, unstable, or even zero. Final adjustment is made by backing off the slug after resonance is obtained so that the final frequency is somewhat *higher* than the resonant frequency. Naturally a somewhat lower VTVM reading will result; however, a stable reference oscillator condition will be effected.

Electron Coupled Reference Oscillators

A third type of reference oscillator, shown in *Fig. 3*, illustrates an electron-coupled crystal controlled oscillator. In this circuit the screen grid is effectively grounded through C_7, while the cathode is kept at an *ac* potential above ground. The voltage developed across L_3, which is produced by the electron stream, does not react back through the tube because of the shielding effect of the screen. Thus, the plate circuit is isolated from the portion of the tube which acts as the oscillator.

Under these conditions the screen grid takes on the function of a plate and we find a striking similarity between the oscillator section of this tube and the oscillator section of the tube in *Fig. 1*. However, this circuit provides the added feature of isolation of the output coil in the plate circuit, which eliminates the need for a buffer or quadrature amplifier tube. This is seen by the fact that although L_3, the primary of the output coil is coupled directly to L_4 and L_5, which are in turn fed to the phase detector and the demodulators, these circuits are com-

[*Continued on page 60*]

HORIZONTAL AND DISCHARGE

This Article Discusss Various Types of Horizontal Oscillator Circuits and Methods of Servicing Them

by **Matthew Mandl**
Author
Mandl's Television Servicing

THE HEART of the horizontal sweep system of a television receiver is the horizontal oscillator and its associated discharge circuit. While other circuits of a television receiver have simple amplifying or control functions, the horizontal sweep oscillator must be locked in to generate the proper sweep frequency, and the wave-form must then be modified and amplified for sweep purposes as well as for the production of the high voltage. Besides this, the energy dissipated by the damper is utilized for voltage boost to reduce the amount of voltage which the power supply would otherwise have to provide. Thus, a clear understanding of the underlying principles involved in the oscillator and discharge circuits permits the service technician to interpret trouble symptoms more accurately and more rapidly.

There are two important factors in the horizontal deflection system of a television receiver. These are *pull-in* and *noise immunity*. The pull-in characteristic refers to the ability of the horizontal oscillator to pull into synchronization after a brief or prolonged absence of incoming synchronization pulses. This includes immediate pull-in when the set is turned on or when the station selector is rotated. When turning from one station to another, sync pulse entry into the horizontal system is interrupted and when the station has been chosen, the picture should pull in with such rapidity that the viewer is not aware that synchronization had been lost. Such rapid pull-in ability of the horizontal oscillator depends on the arrival of sufficiently strong sync pulses at the horizontal *afc* system. Correct circuit adjustment, close tolerance components, and good tubes are also required.

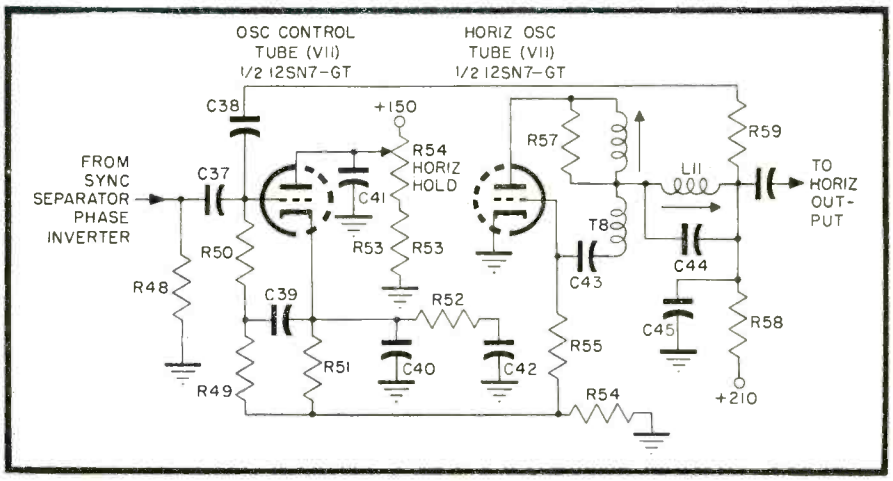


Fig. 1—Synchroguide horizontal A.F.C. circuit.

Noise immunity is the ability of the horizontal system to reject interfering noise which would disrupt the horizontal trace and cause sync loss. To increase the noise immunity of the sweep system the synchronization pulses are never applied directly to the sweep oscillator, since this would also permit entry of noise pulses. Instead, sync pulses are used to actuate a horizontal *afc* system consisting of a phase detector or control tube, which in turn regulates the frequency of the oscillator. Hence, sync pulses keep the oscillator locked on frequency indirectly and noise pulses have little or no effect on the stability of the horizontal sweep circuits. Faulty tubes or components, or low amplitude sync pulses, may make the system susceptible to noise. Since oscillator stability is directly related to good pull-in and adequate noise immunity, correct adjustments of the controls is an important factor in the maintenance of a stable horizontal sweep.

Synchroguide System

A popular *afc* system during the past few years has been the synchroguide type of horizontal oscillator and control circuit and this is still used in some modern recivers. A typical one is shown in *Fig. 1*, and represents the circuit used in Emerson's 120220-D chassis. A similar circuit is also used in all the current RCA receivers. A dual triode tube such as a 6SN7-GT or a 12SN7-GT is employed. The first section of this tube acts as the control for the second, or oscillator section. The latter is actually a blocking oscillator with a stabilizing coil consisting of *L11* and *C44*. This is similar to the so-called "ringing" coil employed with some of the other oscillator types. The flywheel effect consisting of the interchange of energy between the inductance and the capacitor at a set frequency tends to stabilize the oscillator and provides for a more reliable lock-in. This system utilizes only a single envelope dual triode to accomplish the functions of both control tube and oscillator. It requires careful alignment to assure good stability and noise immunity. When properly adjusted, both pull-in and noise immunity are excellent for the center range of the horizontal hold control.

OSCILLATOR CIRCUITS

Phase Detector Systems

The phase detector type of horizontal *afc* circuit is used to a considerable extent in the newer television receivers. While more tubes than the synchroguide system are employed, the adjusting procedures are simpler. A typical phase detector circuit is shown in *Fig.* 2. This represents the circuit employed in the CBS-Columbia Chassis 921-11 series. Similar phase systems are used in the Spartan 27D213 series receivers, the Philco 350 chassis, DuMont RA-312, Motorola WTS-518, Magnavox 300, and the Westinghouse V2263 chassis. The phase detector type of *afc* system compares the sync pulse frequency with the horizontal oscillator frequency and generates a correction voltage when the oscillator drifts and unbalances the symmetrical circuit consisting of the two phase detector diodes.

While adjustments for the phase detector circuits are simple, it is important that each diode tube of the phase detector system functions in a balanced circuit. Thus, duplicate resistors in each section (*R303* and *R304*) should be close tolerance with respect to values. As shown in *Fig.* 2, the test voltages indicate a balanced circuit when a peak to peak potential of 12 volts is present at both the plate and cathode inputs from the phase splitter as observed on the oscilloscope. Inability of the phase detector to lock the system in with good stability would initially call for tube replacement. If this does not help, voltage checks should be made to ascertain the degree of unbalance existing in the phase detector circuit. If this fails to disclose the trouble, the amplitude of the incoming sync should be checked since a decline in sync amplitude will result in poor performance.

Horizontal Oscillator

Most of the phase detector systems employ a cathode coupled multivibrator for the horizontal oscillator in contrast to the blocking tube type of oscillator used with the synchroguide *afc* systems. The common cathode resistor (*R309* in *Fig.* 2) couples the plate current energy of the second triode to the first triode circuit to sustain oscillations. Since the signal must develop across this cathode resistor for coupling purposes, the resistor must not be bypassed.

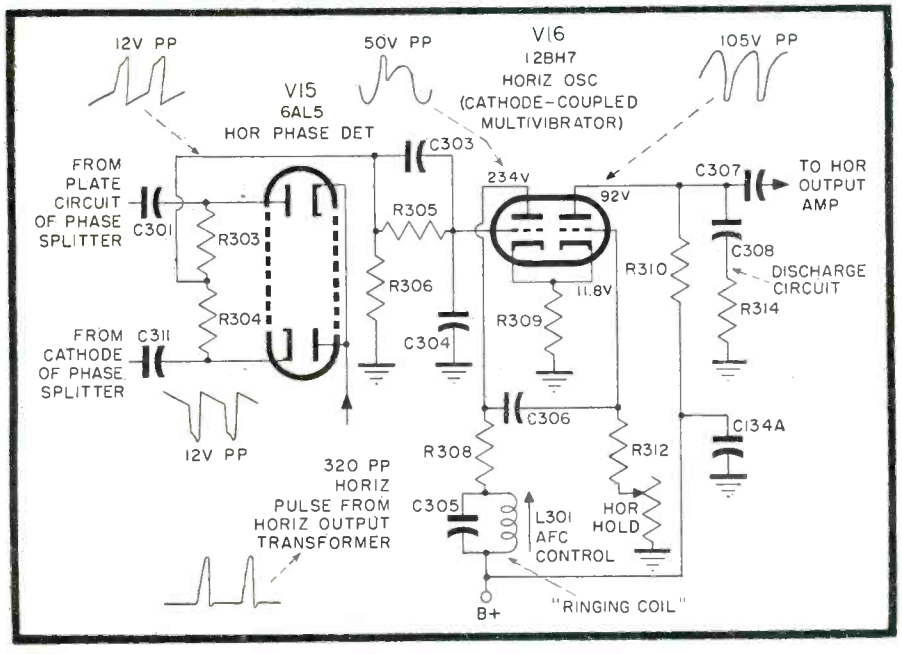


Fig. 2—Phase Detector horizontal A.F.C. circuit.

While the multivibrator has reasonable stability under ordinary circumstances, a stabilizing circuit (ringing coil) is usually included as an additional method for maintaining good lock. The stabilizing system with its flywheel effect consists of *C305* and *L301* in *Fig.* 2.

The two triode sections of a multivibrator are not identical circuits as is the case with the phase detector. For this reason, voltage differences exist between the input and output sections of the multivibrator as shown in *Fig.* 2. Waveforms also differ. If the oscillator does not lock in properly by adjustment of the hold control, a new tube should be tried. If this does not help, the phase detector system should be checked and a new tube tried in that circuit. If stability is still unobtainable, the component parts associated with the circuit will have to be checked and the voltages at the plates should be compared with those given in the service notes for the receiver in question.

Defects in the horizontal output circuit can also cause horizontal oscillator instability by increasing the load on the horizontal oscillator output section. The circuit component values between the horizontal oscillator and the horizontal output tube are also important since these contain the wave shaping circuit which forms the proper sawtooth for application to the grid of the horizontal output tube.

Wave Shaping Circuit

The purpose of the wave shaping circuit is to form the proper sawtooth waveform required for deflection purposes. A wave shaping circuit can be added to an oscillator by placing a capacitor from the plate of the oscillator to ground as shown in *Fig.* 3. When the oscillator grid waveform cuts off the oscillator tube (as shown at A of the waveform at the grid of *Fig.* 3) the capacitor will charge in the direction shown by the solid arrows. The power supply will build up this charge on the capacitor during the time the oscillator tube is in a non-conducting state. When the grid waveform at the oscillator swings above the conduction level, the

oscillator tube conducts suddenly. During conduction, the oscillator tube has a very low resistance and hence provides a ready discharge path for the capacitor. Thus, the capacitor will discharge rapidly through the oscillator tube as shown by the dashed arrows of *Fig.* 3. Hence, during the time the capacitor is charging, there is a rising voltage across it which represents the incline of the sawtooth waveform as shown in *Fig.* 3, from C to D. When the oscillator tube conducts, the capaci-

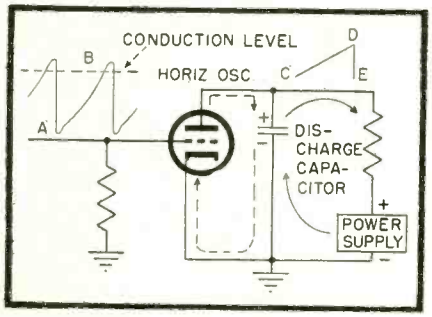


Fig. 3—Typical waveshaping circuit at output of horizontal oscillator.

tor discharges rapidly through the tube and the waveform produced is a declining voltage across the capacitor as shown from D to E on the sawtooth waveform. A repetition of the conducting and nonconducting cycles of the oscillator tube produces a repetition of the sawtooth waveform.

This type of waveform is suitable for electrostatic deflection systems, but actually a perfectly formed sawtooth voltage cannot be employed for good deflection in magnetic deflection systems such as those used in present day television receivers. When deflection coils are used, it is necessary to have the *current* in the deflection coils vary in a sawtooth manner, so that the fields of the coil will deflect the beam properly. In order to get a sawtooth current in the deflection coil it is necessary to apply a *modified* sawtooth voltage to it. Such a modified sawtooth consists of a sharp negative spike such as shown in *Fig.* 4 added to the original sawtooth. This waveform must rise from F to G, then fall to a negative peak at H, thence to I where the sawtooth incline begins again. In order to accomplish this, a resistor is usually placed below the discharge capacitor such as *R1* in *Fig.* 4. During the time the capacitor discharges through the tube as shown by the dashed arrows in *Figure 4*, a voltage is set up across the resistor having a polarity as shown, which adds the sharp negative spike during the discharge interval of the sawtooth.

The capacitor and resistive network in the schematic shown in *Fig.* 2 consists of *C308* and *R314*. An additional resistor and capacitor may be employed for more precise wave shaping in some circuits. Where a greater sawtooth amplitude is required, a separate discharge tube is sometimes employed. A typical circuit of this type is shown in *Fig.* 5 representing the Zenith 19-R20 series chassis. The discharge tube has its grid connected to the grid of the oscillator so that duplicate waveforms prevail at both grids. Hence, the discharge tube is triggered in and out of conduction at the same frequency rate as the oscillator tube. The discharge network consists of *C56* as well as the horizontal drive trimmer *C58* and associated resistors.

The drive control for any receiver regulates the amount of discharge waveform amplitude applied to the grid of the horizontal output tube. The drive control setting is important, since a misadjusted drive control can contribute to excessive currents in the horizontal output tube as well as to high voltage and brightness defects. The discharge circuit must be capable of furnishing

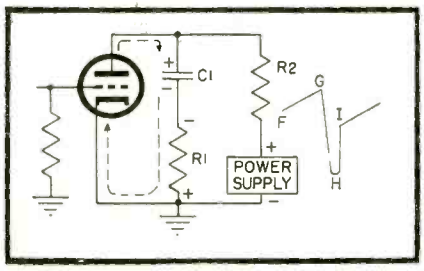


Fig. 4—Method used to peak wave.

power to the grid system of the horizontal output tube in order to drive the grid of the latter tube positive. When the grid of the horizontal output tube is driven positive at periodic intervals, a form of self-bias is established. Insufficient drive would mean that inadequate bias is established and the *dc* plate current increases above normal. Insufficient drive will result in low pulse amplitudes in the horizontal output system and in consequence will decrease the high voltage below the value required for good brightness. Insufficient high voltage will cause the picture to expand (blooming) since the reduced high voltage is insufficient for good beam velocity. Thus the beam can be influenced more readily by the sweep fields.

Excessive drive will create abnormal pulse currents in the horizontal output tube and overheating and arcing may result. An abnormally high voltage is also developed. This may cause additional arcing and voltage breakdown. In addition there is the possibility of picture shrinkage because beam velocity is too high to be sufficiently influenced by the sweep fields.

Trouble Shooting

Trouble shooting procedures and the diagnosing of faults depend on the symptoms which are in evidence with respect to sweep stability, pull-in, and noise immunity. General instability as indicated by occasional picture tear or loss of synchronization for short intervals should be checked by adjustment of the hold control and other controls such as the ringing coil slug adjustment, etc. In the synchroguide system, several 6SN7-GT tubes should be tried since some may be sufficiently different in characteristics from the original to require control readjustments. If tube replacement does not help in the synchroguide system, the service notes should be consulted for step by step realignment procedures.

For the phase detector systems, a minimum of adjustments is required, though the service notes should also be consulted for specific information relating to the particular model under test. Any instability which shows up as a horizontal movement of the picture with a dark vertical bar at the center would indicate trouble with respect to the phase aspect of the horizontal *afc* circuits (*Fig.* 6). If adjustment of the controls cannot correct this condition, a check will have to be made of the individual resistors and capacitors to determine a defective or off-value component which is causing the phase shift.

If the horizontal system had been operating properly and then suddenly developed troubles, the amplitude of the sync pulse arriving at the *afc* circuits should also be checked as previously

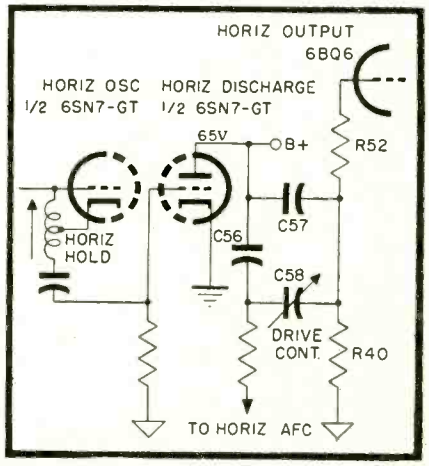


Fig. 5—Circuit using separate horizontal discharge tube.

mentioned. Insufficient sync amplitude may be caused by sync separator troubles or low signal amplitude in the video amplifiers feeding the sync signals to the separator stages. Picture bending and weaving at the top usually indicates low sync amplitude (*Fig.* 7). A contributing cause to low sync amplitude can be a misaligned video *if* system or poor tuner tracking. If sync troubles occur suddenly, however, it is

[*Continued on page* 55]

PHONO PICKUPS

THIER CONSTRUCTION, OPERATION AND SERVICE

by RALPH OGILVIE

PART 2

THIS is the second of two articles dealing with phonograph pickups. In the previous article, (SERVICE DEALER, March 1956), the author dealt with crystal and ceramic pickup cartridges.

THE VARIABLE RELUCTANCE PICKUP

The variable reluctance pickup has gained considerable popularity in recent years, particularly among high fidelity enthusiasts. Among the factors which have contributed to its popularity are:

1. It requires a comparatively low needle force (about 6 to 8 grams) and has a comparatively low moving mass. These are important considerations in preventing excessive record wear.

2. It has a wide range frequency response.

3. Its construction is such that mechanical linkage between the stylus and the generating element is eliminated. This will be seen in the description of the unit which follows. The elimination of this mechanical linkage minimizes an important source of distortion, since any linkage system has mechanical resonances and may also introduce phase lag.

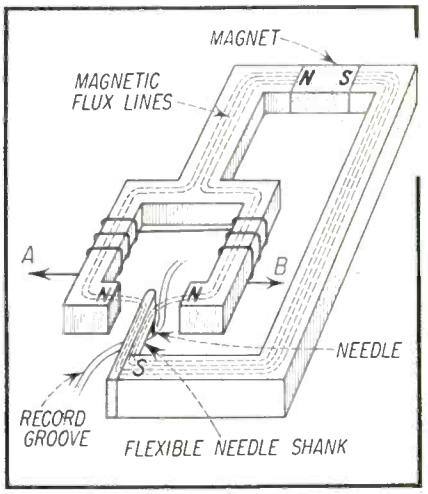
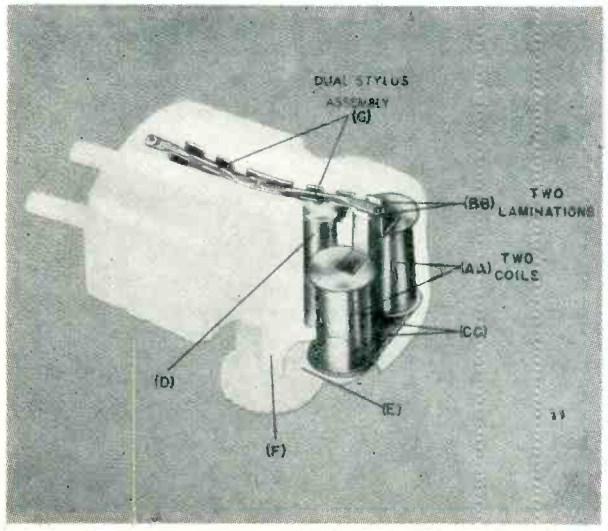


Fig. 1—Crystal pickup details showing its basic construction.



AA Copper wire coils wound on nylon spools

BB Laminations of high permeability alloy for ideal magnetic properties

CC Yokes of same alloy

D Alnico 5 magnet

E Sturdy plastic base

F Mu-Metal case

G Dual stylus assembly

Fig. 2—Cutaway view of G.E. variable reluctance pickup.

Principle of Operation

Fig. 1 is a sketch which helps to illustrate the operating principles of the variable reluctance type of pickup cartridge. It can be seen from this sketch that the magnetic flux lines, in completing a path from the north to the south pole of the magnet, divide at the U shaped portion of the unit. If the magnetic reluctance* along each path is the same, the lines of force divide equally. This will be the case when the record groove positions the needle and shank midway between the gap formed by the open ends of the U.

Now, suppose the shank is brought closer to the right hand pole by the action of the record groove on the needle. This of course reduces the air gap on the right hand side, and increases the gap on the left. As a result the reluctance is decreased along the right hand branch and increased along the left. The field strength, correspondingly increases in the right hand branch and decreases in the left.

Referring again to *Fig. 1*, it will be seen that a coil is wound around each branch of U shaped pole pieces. The strengthening of the field on one side, and the simultaneous weakening on the other, induces equal and opposite voltages in these coils. The coils are connected in series aiding, so that the voltage output between points A and B in *Fig. 1* is double the voltage induced in a single coil. As the shank moves from side to side under the influence of the record groove on the stylus, an *ac* voltage is generated.

A cut-away view of a typical commercial variable reluctance pickup is illustrated in *Fig. 2*. The coil construc-

*Reluctance is term which might be described as the "resistance" of a magnetic path or circuit. Thus, the smaller the reluctance of the path, the stronger the magnetic flux for a given magnetizing force.

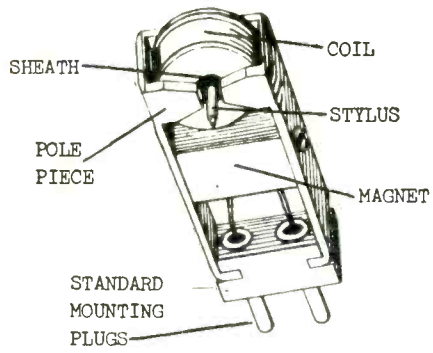


Fig. 3—Cutaway view showing Clarkstan variable reluctance pickup with labelled parts.

tion and the position of the stylus between the pole pieces may be clearly seen in this drawing. *Fig.* 2 also illustrates a dual stylus arrangement, to enable the use of this single cartridge with either standard or microgroove records. This aspect of pickup cartridges will be discussed in more detail later.

Figure 3 illustrates another type of construction which uses the same basic variable reluctance principle. Note in this case, however, that only a single coil is used. Here again, as the stylus assembly moves laterally between the pole pieces, the field is strengthened on one side of the coil, and weakened on the other. An induced voltage is thus

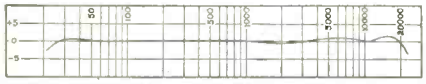


Fig. 4—Curve of frequency response with constant velocity signal over the entire spectrum. When used with constant amplitude, there is an attenuation of 6 db per octave below the transition point. (Clarkstan)

built up and appears across the terminals of the coil.

It is understandable of course that there will be differences in the characteristics of the pickups produced by different manufacturers. An overall picture may be had, however, by listing average characteristics, which apply in a general way to all of them.

Frequency Response

Variable reluctance pickups deliver a substantially flat output from 20 or 30 *cps* up to as high as 15,000 *cps*, and in some cases up to 20,000 *cps*. The published response curves are sometimes misleading, and must be properly interpreted. An unloaded pickup will exhibit a much wider range than it does when it is terminated by a load

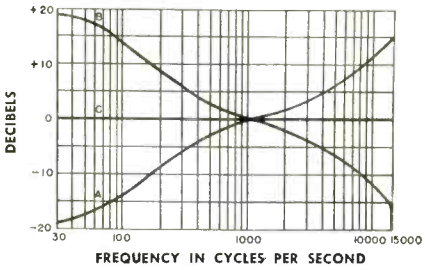


Fig. 5—Ideal equalizer curves.

resistance, as it must be in actual practice. The most useful response curve, obviously, is that obtained when the pickup is terminated by the recommended impedance. *Fig.* 4 illustrates a typical response curve.

Voltage Output

Variable reluctance pickups deliver an average output of about 30 millivolts, which is appreciably less than that delivered by the crystal and ceramic types previously described. This is one

Fig. 6—Equalizer by Pickering.

reason why a crystal or ceramic pickup cannot be directly replaced by a variable reluctance unit. A preamplifier must be used to bring the signal up to an adequate level. If the amplifier used has sufficient gain to begin with, a preamplifier of course is unnecessary.

Load Resistance

Recommended load resistance varies from approximately 20K to 50K ohms. Manufacturers' specifications should be adhered to.

Equalization

The subject of equalization is broad enough to be dealt with by a separate

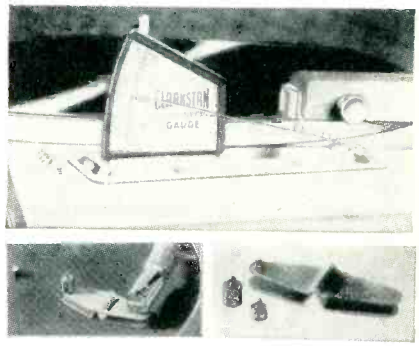


Fig. 7—(Top) Clarkstan needle force gauge. (Bottom) Operation of Audex needle force balance.

article. It will be sufficient for our purpose here to touch the subject in just enough detail to understand why it is required, and how it is accomplished.

The question naturally arises, "Why is equalization necessary if the variable reluctance pickup has such an excellent frequency response to begin with?" The answer lies in the methods used to make the original recording. There are two techniques used in making recordings which dictate the use of equalization. One of these is that a combination of constant amplitude recording and constant velocity recording is used. While

[*Continued on page 43*]

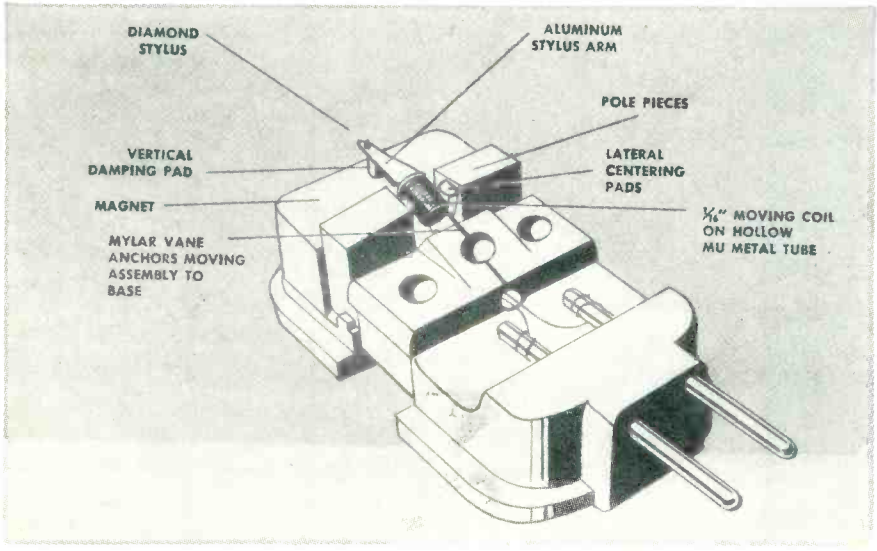


Fig. 8—Fairchild moving coil pickup.

Positioning Adjustments — If the picture is not properly centered in the mask, turn the set off and adjust the Centering Magnet as follows:

1. Remove the cabinet back and apply power to the set through a spare power cord.
2. Turn the set on and adjust all controls for a normal picture.
3. Move the centering adjustment tabs (figure 1) clockwise and counter-clockwise around the neck of the tube until the picture is properly centered.

If the picture is tilted, so that the scanning lines in the raster are not horizontal, loosen the Yoke Positioning Screw (figure 1) and move it to the right or left until the picture is properly aligned with the edges of the mask.

Ion-Trap Magnet — If the picture lacks sufficient brightness, is not properly focused, or if the centering magnet has been readjusted, check the positioning of the ion-trap magnet, as follows:

1. Remove the cabinet back, position the magnet as shown in figure 1 and apply power through a spare power cord.
2. Turn the set on, set the Contrast control in the middle of its range and turn down the Brightness to provide a very dim raster. Caution: Do not operate the receiver with the ion-trap improperly positioned for more than the few minutes needed to make this adjustment.
3. Slide the magnet back and forth along the neck of the tube, at the same time rotating it clockwise and counter-clockwise, until the position which gives maximum brightness and best focus is found. Turn down the Brightness to maintain a very dim raster while making this adjustment.
4. Turn up the Brightness until the raster just begins to increase in size, and readjust the ion-trap for maximum brightness and best focus. Best focus is obtained when the *white* scanning lines in the raster are as thin and sharp as possible.

Local-Distant Switch —

1. Turn the receiver on and tune to the strongest signal available.
2. Place the switch in the Distant position. If overloading (indicated by excessive contrast, unstable sync and/or sound buzz) occurs, set the switch in the Normal position.

In very strong signal areas it may be necessary to place the switch in the Local position.

Check reception on all channels and reset the switch if required. In areas where both very weak and very strong signals are received, best results may be obtained by changing the switch position when tuning from one channel to another.

Tuner Oscillator Adjustment — If the Fine Tuning control does not tune through the point of best picture and sound on one or more channels, adjust the tuner oscillator.

An individual oscillator adjustment is provided for each channel.

1. Set the Channel Selector on the channel requiring adjustment and remove the Channel Selector knob. The adjustment is accessible through the hole in the control panel and is located above and slightly to the left of the tuner shaft as shown in figure 2.
2. Insert a fibre screwdriver into the access hole in the tuner and adjust the slug for best picture and sound.

Height and Vertical Linearity — Adjust the Height and Vertical Linearity controls to provide a properly proportioned picture that fills the mask vertically. Both controls are located on the rear of the chassis.

The picture should extend approximately ½-inch above and below the mask opening, to allow for the slight loss in size which occurs when the line voltage drops during peak power-demand periods.

Horizontal Drive — If a bright vertical drive line appears in the picture, check the setting of the Drive control located on the rear of the chassis (see figure 3).

To adjust the control tune the receiver to a station and adjust the front controls for best picture and sound. Using an insulated screwdriver, turn the Drive control clockwise until the bright vertical line just disappears.

Width — If the picture fails to fill the mask horizontally, check the setting of the Width control located on the rear of the chassis. To allow for the slight loss in size which occurs when the line voltage drops during peak power-demand periods as well as to assure sufficient high voltage, adjust the control so that the picture extends approximately ½-inch beyond the mask opening on each side.

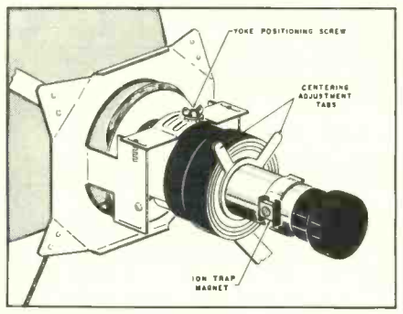


Figure 1

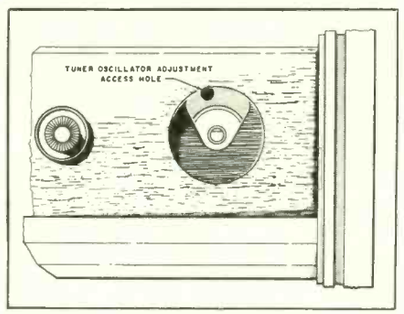


Figure 2

Horizontal Oscillator Alignment

1. Tune to a TV station, adjust controls for normal picture and sound and set the Horizontal Hold control in the center of its range.
2. Short terminals C & D of the horizontal oscillator coil (T8-1) and adjust bottom slug of T8-1 until picture is in sync. Set slug in center of range over which picture remains locked in sync.
3. Remove the short from terminals C & D of T8-1 and connect an oscillograph to terminal C of T8-1, through a 10 mmfd capacitor.
4. Adjust top slug of T8-1 for waveform shown in figure 4. The rounded peak and the sharp peak of the waveform must be exactly the same height.
5. Adjust the Horizontal Frequency adjustment (bottom slug T8-1) so that picture just begins to fall out of sync with Horizontal Hold control fully clockwise.

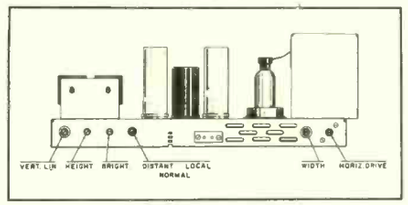


Figure 3

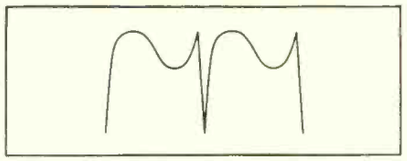


Figure 4

Alternate Sound Alignment Using TV Signal

1. Tune receiver to a strong TV signal, adjust controls for best picture, and set AM Rejection control at center of its rotation.
2. Attenuate signal at receiver antenna terminals (remove antenna and/or place Local-Distant switch in Local position) until a hiss is heard in the sound and adjust top slugs of T4-1, T4-2, and T17-1 (see figure 5) for maximum sound.
3. Increase signal level at receiver input to normal and adjust L5-1 (quadrature coil) for maximum sound and minimum buzz.
4. Attenuate signal at receiver antenna terminals, as in step 2, and adjust P5-1 (AM Rejection) for minimum noise (hiss).
5. Increase signal level at receiver input to normal and rotate fine tuning control. If buzz is present in sound readjust L5-1 (quadrature coil) for clearest sound with minimum buzz.

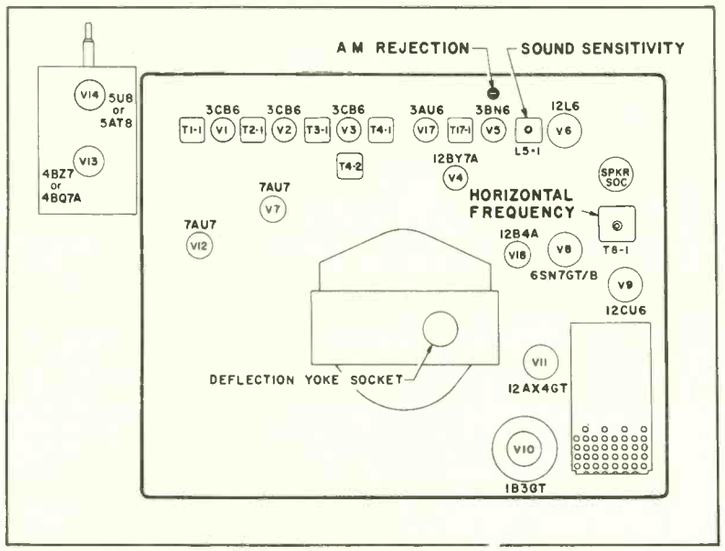


Figure 5. Top view of chassis showing sound adjustments.

RESISTORS

SYM.	PART NO.	DESCRIPTION	SYM.	PART NO.	DESCRIPTION
R1-1	30 273 230	Carbon, 27K ½W 10%	R4-18	30 682 230	Carbon, 6.8K ohm ½W 10%
R1-2	30 470 230	Carbon, 47 ohm ½W 10%	R5-1	30 392 240	Carbon, 3.9K ohm 1W 10%
R1-3	30 331 330	Carbon, 330 ohm ½W 20%	R5-2	30 102 230	Carbon, 1K ohm ½W 10%
R1-4	30 102 330	Carbon, 1K ohm ½W 20%	R5-3	30 223 330	Carbon, 22K ohm ½W 20%
R1-5	30 331 330	Carbon, 330 ohm ½W 20%	R5-4	30 102 330	Carbon, 1K ohm ½W 20%
R2-1	30 563 230	Carbon, 56K ohm ½W 10%	R6-1	30 105 230	Carbon, 1 meg ½W 10%
R2-2	30 102 330	Carbon, 1K ohm ½W 20%	R6-2	30 105 230	Carbon, 1 meg ½W 10%
R2-3	30 470 230	Carbon, 47 ohm ½W 10%	R6-3	30 565 230	Carbon, 5.6 meg ½W 10%
R2-4	30 331 330	Carbon, 330 ohm ½W 20%	R6-5	30 102 330	Carbon, 1K ohm ½W 20%
R3-1	30 181 230	Carbon, 180 ohm ½W 10%	R7-1	30 225 230	Carbon, 2.2 meg ½W 10%
R3-2	30 102 330	Carbon, 1K ohm ½W 20%	R7-2	30 154 230	Carbon, 150K ohm ½W 10%
R3-3	30 563 230	Carbon, 56K ohm ½W 10%	R7-3	30 104 230	Carbon, 100K ohm ½W 10%
R3-4	30 562 240	Carbon, 5.6K ohm 1W 10%	R7-4	30 105 230	Carbon, 1 meg ½W 10%
R4-1	30 104 330	Carbon, 100K ohm ½W 20%	R7-7	30 561 230	Carbon, 560 ohm ½W 10%
R4-2	30 472 130	Carbon, 4.7K ohm ½W 5%	R7-8	30 334 230	Carbon, 330K ohm ½W 10%
R4-3	30 105 330	Carbon, 1 meg ½W 20%	R7-10	30 105 230	Carbon, 1 meg ½W 10%
R4-4	30 105 330	Carbon, 1 meg ½W 20%	R7-11	30 102 230	Carbon, 1K ohm ½W 10%
R4-5	30 470 230	Carbon, 47 ohm ½W 10%	R8-1	30 334 230	Carbon, 330K ohm ½W 10%
R4-6	30 273 240	Carbon, 27K ohm 1W 10%	R8-2	30 824 230	Carbon, 820K ohm ½W 10%
R4-7	30 223 230	Carbon, 22K ohm ½W 10%	R8-3	30 334 230	Carbon, 330K ohm ½W 10%
R4-8	31 000 531	WW 5K ohm 5W 5%	R8-4	30 823 230	Carbon, 82K ohm ½W 10%
R4-10	30 102 230	Carbon, 1K ohm ½W 10%	R8-5	30 392 230	Carbon, 3.9K ohm ½W 10%
R4-12	30 102 330	Carbon, 1K ohm ½W 20%	R8-6	30 683 230	Carbon, 68K ohm ½W 10%
R4-13	30 274 230	Carbon, 270K ohm ½W 10%	R8-7	30 473 240	Carbon, 47K ohm 1W 10%
R4-14	30 823 230	Carbon, 82K ohm ½W 10%	R8-8	30 334 230	Carbon, 330K ohm ½W 10%
R4-15	30 105 230	Carbon, 1 meg ½W 10%	R8-9	30 154 230	Carbon, 150K ohm ½W 10%
R4-16	30 475 230	Carbon, 4.7 meg ½W 10%	R8-10	30 822 230	Carbon, 8.2K ohm ½W 10%
R4-17	30 123 230	Carbon, 12K ohm ½W 10%	R8-11	30 223 230	Carbon, 22K ohm ½W 10%

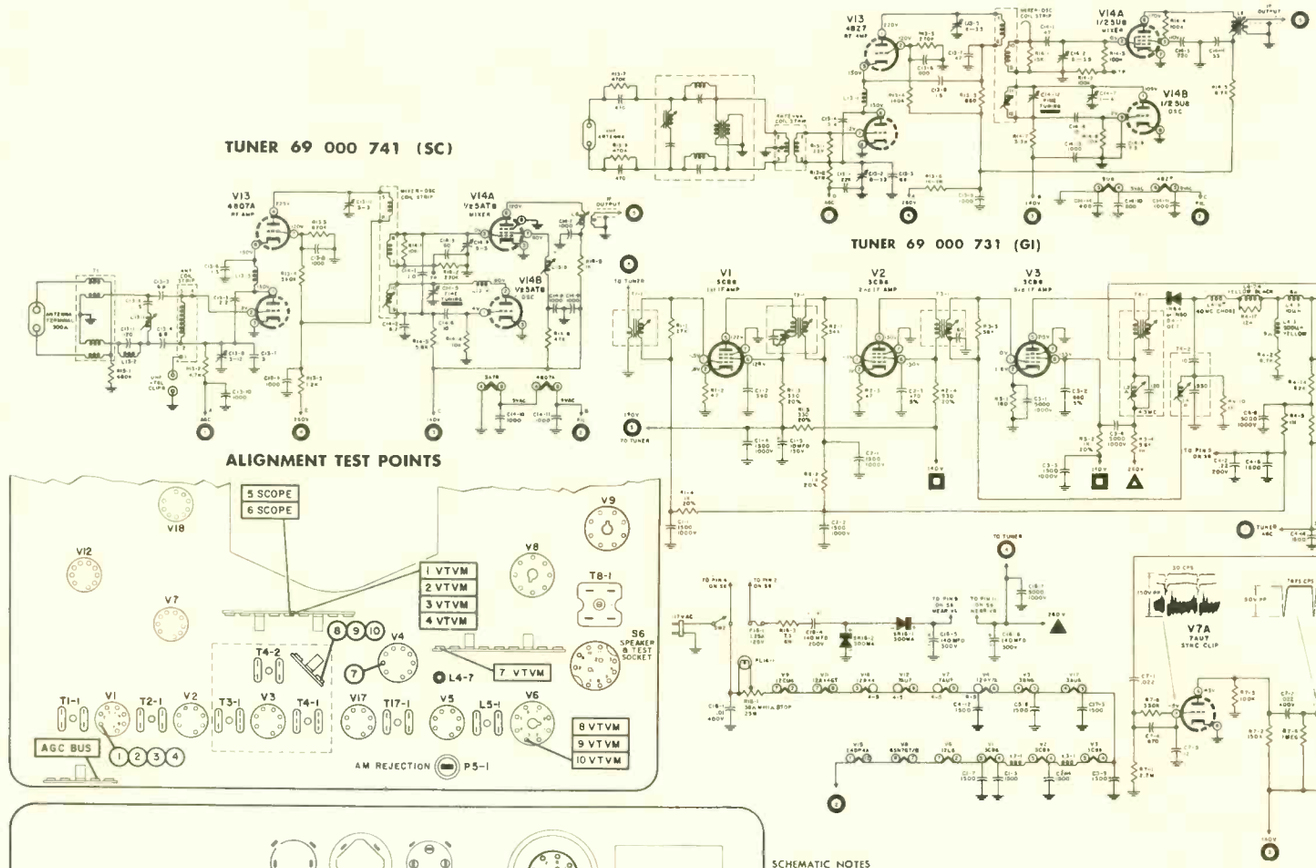
SYM.	PART NO.	DESCRIPTION
R8-12	30 274 230	Carbon, 270K ohm ½W 10%
R9-1	30 106 230	Carbon, 10 meg ½W 10%
R9-2	30 105 230	Carbon, 1 meg ½W 10%
R9-4	31 000 474	WW, 7.5K ohm 4W 10%
R9-6	30 101 330	Carbon, 100 ohm ½W 20%
R9-7	30 101 330	Carbon, 100 ohm ½W 20%
R11-1	30 683 240	Carbon, 68K ohm 1W 10%
R11-2	30 392 240	Carbon, 3.9K ohm 1W 10%
R12-1	30 223 230	Carbon, 22K ohm ½W 10%
R12-2	30 822 230	Carbon, 8.2K ohm ½W 10%
R12-3	30 822 230	Carbon, 8.2K ohm ½W 10%
R12-4	30 104 230	Carbon, 100K ohm ½W 10%
R12-5	30 154 230	Carbon, 150K ohm ½W 10%
R12-6	30 564 230	Carbon, 560K ohm ½W 10%
R12-7	30 225 230	Carbon, 2.2 meg ½W 10%
R12-8	30 681 230	Carbon, 680 ohm ½W 10%
R12-9	30 123 230	Carbon, 12K ohm ½W 10%
R15-1	30 124 230	Carbon, 120K ohm ½W 10%
R15-2	30 223 230	Carbon, 22K ohm ½W 10%
R16-1	31 000 485	WW, 38 ohm 25W 10% w/11 ohm tap
R16-3	31 000 472	WW, 7.5 ohm 6W 10%
R17-1	30 104 230	Carbon, 100K ohm ½W 10%
R17-2	30 121 230	Carbon, 120 ohm ½W 10%
R17-3	34 103 250	Carbon, 10K ohm 2W 10%
R17-4	30 123 230	Carbon, 12K ohm ½W 10%
R18-1	30 225 230	Carbon, 2.2 meg ½W 10%
R18-2	30 471 240	Carbon, 470 ohm 1W 10%
R18-3	30 681 230	Carbon, 680 ohm ½W 10%

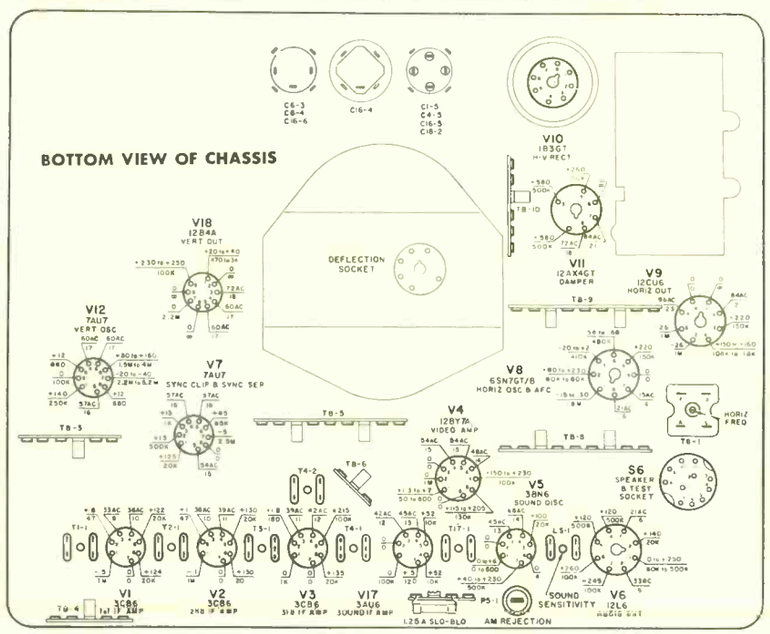
CAPACITORS

SYM.	PART NO.	DESCRIPTION	SYM.	PART NO.	DESCRIPTION	SYM.	PART NO.	DESCRIPTION
C1-1	23 064 640	Ceramic Disc., 1500 mmfd GMV	C4-15	.....	Part of L4-7	C9-4	25 000 061	Mica Trimmer, 25-250 mmfd
C1-2	23 002 190	Ceramic, 390 mmfd 500V 10%	C5-1	23 066 020	Ceramic Disc., .01 mfd 600V	C9-6	23 001 740	Ceramic, 1000 mmfd 500V 20%
C1-3	23 064 640	Ceramic Disc., 1500 mmfd GMV	C5-2	23 001 740	Ceramic, 1000 mmfd 500V 20%	C11-1	22 008 280	Paper, .1 mfd 400V 10%
C1-4	23 064 640	Ceramic Disc., 1500 mmfd GMV	C5-3	23 066 020	Ceramic Disc., .01 mfd 600V	C11-3	21 000 481	Elec., 5 mfd 350V N.P.
C1-5	21 001 131	Elec., 10 mfd 150V w/C4-5, C16-5, C18-2	C5-6	23 064 680	Ceramic Disc., 5000 mmfd 1000V	C11-4	23 002 200	Ceramic, 470 mmfd 500V 10%
C1-7	23 064 640	Ceramic Disc., 1500 mmfd GMV	C5-8	23 064 640	Ceramic, 1500 mmfd GMV	C12-1	23 000 591	Ceramic, 2000 mmfd 500V 20%
C2-1	23 064 640	Ceramic Disc., 1500 mmfd GMV	C6-1	22 011 620	Paper, .0047 mfd 400V 20%	C12-2	23 000 601	Ceramic, 5000 mmfd 500V 20%
C2-2	23 064 640	Ceramic Disc., 1500 mmfd GMV	C6-2	22 011 660	Paper, .01 mfd 400V 20%	C12-3	23 000 601	Ceramic, 5000 mmfd 500V 20%
C2-3	23 004 700	Ceramic, 470 mmfd 500V 5%	C6-3	21 001 141	Elec., 200 mfd 150V w/C6-4, C16-6	C12-4	22 011 660	Paper, .01 mfd 400V 20%
C2-4	23 064 640	Ceramic Disc., 1500 mmfd GMV	C6-4	21 001 141	Elec., 10 mfd 300V w/C6-3, C16-6	C12-6	22 007 720	Paper, .033 mfd 200V 10%
C3-1	23 064 680	Ceramic Disc., 5000 mmfd 1000V	C6-5	23 066 020	Ceramic Disc., .01 mfd 600V	C12-7	22 008 240	Paper, .047 mfd 400V 10%
C3-2	23 004 720	Ceramic, 680 mmfd 500V 5%	C7-1	22 011 700	Paper, .022 mfd 400V 20%	C12-8	22 007 720	Paper, .033 mfd 200V 10%
C3-3	23 064 640	Ceramic Disc., 1500 mmfd GMV	C7-2	22 011 700	Paper, .022 mfd 400V 20%	C12-9	22 001 600	Paper, .0033 mfd 600V 10%
C3-4	23 064 680	Ceramic Disc., 5000 mmfd 1000V	C7-4	23 002 200	Ceramic, 470 mmfd 500V 10%	C12-13	23 001 240	Ceramic, 1000 mmfd 500V 10%
C3-5	23 064 640	Ceramic Disc., 1500 mmfd GMV	C7-5	23 001 010	Ceramic, 12 mmfd 500V 10%	C15-1	22 011 780	Paper, .1 mfd 400V 20%
C4-1	22 011 240	Paper, .047 mfd 200V 20%	C8-1	20 007 010	Mica, 82 mmfd 500V 5%	C15-2	22 012 240	Paper, .047 mfd 600V 20%
C4-2	22 011 320	Paper, .22 mfd 200V 20%	C8-2	22 014 280	Paper, .1 mfd 200V 10%	C16-1	22 017 660	Paper, .01 mfd 600V 20%
C4-3	23 001 620	Ceramic, 100 mmfd 500V 20%	C8-3	22 008 200	Paper, .022 mfd 400V 10%	C16-4	21 000 981	Elec., 140 mfd 200V
C4-4	23 064 680	Ceramic Disc., 5000 mmfd 1000V	C8-4	22 007 840	Paper, .47 mfd 200V 10%	C16-5	21 001 131	Elec., 140 mfd 300V w/C1-5, C4-5, C18-2
C4-5	21 001 131	Elec., 10 mfd 300V w/C1-5, C16-5, C18-2	C8-5	20 007 010	Mica, 82 mmfd 500V 5%	C16-6	21 001 141	Elec., 140 mfd 300V w/C6-3, C6-4
C4-6	23 064 680	Ceramic Disc., 5000 mmfd 1000V	C8-7	22 008 240	Paper, .047 mfd 400V 10%	C16-7	23 064 680	Ceramic Disc., 5000 mmfd 1000V
C4-7	23 001 620	Ceramic, 100 mmfd 500V 20%	C8-8	20 007 090	Mica, 180 mmfd 500V 5%	C17-1	23 066 020	Ceramic Disc., .01 mfd 600V
C4-8	23 064 640	Ceramic Disc., 1500 mmfd GMV	C8-9	22 014 160	Paper, .01 mfd 200V 10%	C17-2	23 066 020	Ceramic Disc., .01 mfd 600V
C4-11	23 000 591	Ceramic, 2000 mmfd 500V 20%	C8-10	20 007 270	Mica, 820 mmfd 500V 5%	C17-3	23 064 640	Ceramic Disc., 1500 mmfd
C4-12	23 064 640	Ceramic, 1500 mmfd GMV	C9-1	23 002 200	Ceramic, 470 mmfd 500V 10%	C18-1	22 008 280	Paper, .1 mfd 400V 10%
C4-13	22 011 320	Paper, .22 mfd 200V 20%	C9-2	22 011 780	Paper, .1 mfd 400V 20%	C18-2	21 001 131	Elec., 100 mfd 25V w/C1-5, C4-5, C16-5
C4-14	23 064 640	Ceramic Disc., 1500 mmfd GMV				C18-3	22 012 200	Paper, .022 mfd 600V 20%

MISCELLANEOUS

SYM.	PART NO.	DESCRIPTION	SYM.	PART NO.	DESCRIPTION	SYM.	PART NO.	DESCRIPTION
D4-1	63 000 091	1N60 or 1N64 Crystal Diode	T1-1	12 001 171	1st IF Transformer		69 000 741	VHF Tuner (SC)
F16-1	43 000 070	Fuse, 1.25 Amp Slo-Blo w/pigtails	T2-1	12 001 111	2nd IF Transformer		84 000 351	Belt, Fine Tuning
L2-1	53 000 651	Filament Choke	T3-1	12 001 031	3rd IF Transformer		44 001 241	Anode Connector
L3-1	15 000 651	Filament Choke	T4-1	12 001 041	Reflex Coil—4th IF		19 000 081	Single Magnet Ion Trap
L4-2	16 001 364	Peaking Coil, Yellow-Black	T4-2	15 000 671	4.5 MC Take-Off Coil		79 000 321	Indoor Antenna
L4-3	16 000 045	Peaking Coil, Yellow	T6-1	.....	Audio Trans., part of speaker assy.		53 071 350	Antenna Terminal
L4-4	16 001 364	Peaking Coil, Yellow-Black	T8-1	15 000 741	Horiz. Sync. Stabilizer Coil		44 002 290	Connector, Male, Interlock
L4-5	16 000 045	Peaking Coil, Yellow	T9-1	12 001 181	Horiz. Output Transformer		80 000 821	Line Cord
L4-6	15 000 701	Choke	T17-1	12 001 151	4.5 MC Sound IF Transformer		44 000 230	Yoke Socket
L4-7	16 001 401	4.5 MC Trap	T18-1	10 000 661	Vertical Output Transformer		73 000 871	Speaker, 8" PM w/trans. & choke
L4-8	16 001 461	40 MC Choke	V1	61 001 041	3CB6		71 001 641	Cabinet Back
L5-1	15 000 721	Quadrature Coil	V2	61 001 041	3CB6		71 001 661	Mask
L6-1	.....	Filter Choke, part of speaker ass'y	V3	61 001 041	3CB6		77 000 434	Filter Safety Glass
L11-1A, B	16 001 491	Deflection Yoke w/cable and plug	V4	61 001 161	12BY7A		71 001 651	CRT Neck Protector
L11-2	15 000 702	Choke, 1.8 mh	V5	61 001 051	3BN6		04 005 891	Front CRT Strap Ass'y
P4-1	36 001 551	Contrast Cont., 750 ohm 1W Dual w/P5-2	V6	61 001 061	12L6		04 005 881	Rear CRT and Yoke Support Ass'y
P5-1	36 001 311	AM Rejection, 600 ohm ½W	V7	61 001 331	7AU7		76 003 721	Knob, Channel Selector (5C603)
P5-2	36 001 551	Volume Control, 350K ¼W Dual w/P4-1	V8	61 001 031	6SN7GTB		76 003 722	Knob, Channel Selector (5C604)
P8-1	36 001 501	Horiz. Hold, 100K ½W Dual w/P12-1	V9	61 001 121	12CU6		76 003 701	Knob, Fine Tuning, Front (5C603)
P9-1	36 001 531	Width, 10K 2W	V10	61 000 121	1B3GT		76 003 702	Knob, Fine Tuning, Front (5C604)
P12-1	36 001 501	Vert. Hold, 3 meg ½W Dual w/P8-1	V11	61 001 351	12AX4GT		76 003 691	Knob, Fine Tuning, Rear (5C603)
P12-3	36 001 521	Height, 2.5 meg ½W	V12	61 001 331	7AU7		76 003 692	Knob, Fine Tuning, Rear (5C604)
P15-1	36 001 511	Brightness, 250K ½W	V13	61 001 361	4BQ7A (S.C. Tuner)		76 003 701	Knob, On-Off Vol. & Vert. Hold (5C603)
P18-1	36 001 541	Vert. Lin., 2.5K 1W	V13	61 001 301	4BZ7 (G.I. Tuner)		76 003 702	Knob, On-Off Vol. & Vert. Hold (5C604)
PL16-1	64 000 111	Pilot Light, type #51	V14	61 001 221	5AT8 (S.C. Tuner)		76 003 711	Knob, Contrast & Horiz. Hold (5C603)
S6	44 002 250	Speaker and Test Socket	V14	61 001 201	5U8 (G.I. Tuner)		76 003 712	Knob, Contrast & Horiz. Hold (5C604)
SR16-1	62 000 061	Selenium Rectifier, 300MA	V15	60 000 291	24DP4A		76 003 331	Knob, Local-Normal-Distant (5C603)
SR16-2	62 000 061	Selenium Rectifier, 300MA	V17	61 001 241	3AU6		76 003 331	Knob, Local-Normal-Distant (5C604)
SW2	.....	Switch, Off-On, part of Volume Control	V18	61 001 191	12B4A		72 001 351	Decorative Flying "V" (5C603)
SW4-1	40 000 371	Switch, Local-Normal-Distant		69 000 731	VHF Tuner (GI)		72 001 352	Decorative Flying "V" (5C604)





Voltages are shown above and resistances below the lines drawn from the socket terminals.

SCHEMATIC NOTES

1. Solid geometric symbols indicate B+ voltage sources—open symbols indicate points of application.
2. Numbered circles indicate tuner lead connections.
3. Component symbols are coded to indicate tube near which component is located on schematic. Ex: C9-2; capacitor, located near V9.
4. All d-c voltages measured with a VTVM connected between the chassis and tube socket terminals, with channel selector set between channels and the Normal-Local-Distant switch (SW4-1) in the normal position. Where readings are affected by control settings, voltages are shown for the clockwise and counterclockwise positions of the controls. Tuner voltages taken with channel selector set to an unused channel and the Normal-Local-Distant switch in the normal position.
5. All waveforms and peak to peak readings taken with strongest signal available at maximum contrast; horizontal and vertical holds set at normal position.
6. All resistors are ½W, ±10% unless otherwise indicated K=X1,000; M=X1,000,000.
7. All capacitors are 500 WV unless otherwise indicated. Values less than one are microfarads and values more than one are micro-microfarads, unless otherwise indicated.
8. All coil and winding resistances were taken with the components disconnected from the circuit.

*Indicates change in schematic, as listed below.

In some chassis
L4-2 is 16 001 362 and R4-18 is 18K, ½W.
L4-4 is 16 001 362 and R4-17 is 8.2K, ½W.
L4-8 is omitted and C4-3 is 220 mmf.
Yoke balancing capacitor is 56 mmf.

ALIGNMENT PROCEDURE

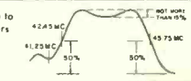
SOUND ALIGNMENT

Step	Signal Generator		Output Indicator	Connect to	Adjust
	Freq.	Connect to			
8	4.5 mc AM 30% mod.	Junction L4-2 & L4-3 (8)	VTVM (AC)	Pin #3 V6 thru 0.01 mfd 8 VTVM	Top slug of T4-1, T4-2 and T17-1 for maximum output indication. Use lowest signal generator output that gives satisfactory indication. Increase bias to —6V and set Local-Distant switch to Local before performing this step.
9	4.5 mc FM 25 kc dev.	As above (9)	VTVM (AC)	As above 9 VTVM	Volume control to approximate center and adjust L5-1 (quadrature coil) for maximum output indication.
10	4.5 mc AM 30% mod.	As above (10)	VTVM (AC)	As above 10 VTVM	P5-1 (A-M Rejection) for minimum output indication and repeat step 9.

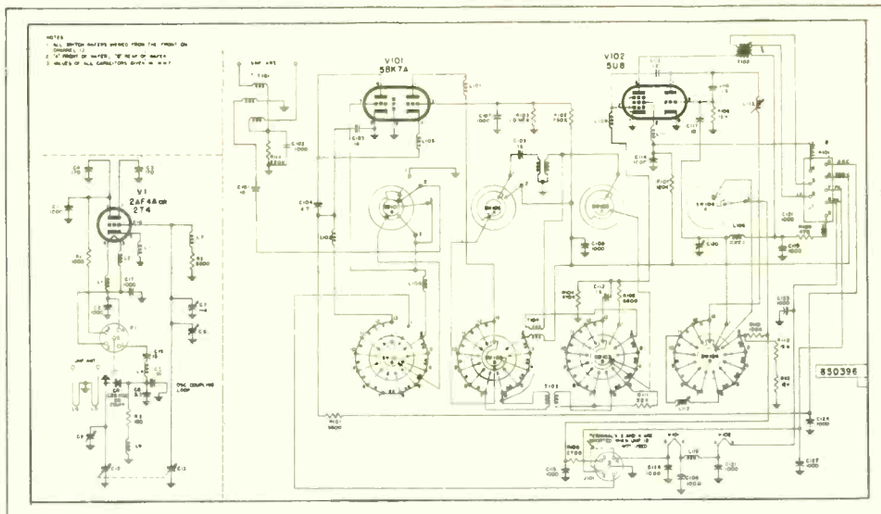
NOTES: 1. Connect signal generator output lead to mixer-oscillator shield. Slip shield partially off tube and hold in place with tape. Do not ground shield.

VIDEO ALIGNMENT

Place channel selector between channels (to disable oscillator) and set Local-Distant switch in NORMAL position. Disconnect ground lead from the cathode (pin 8) of V9, the 12CU6 horizontal-deflection amplifier. Apply -3V bias to AGC line. Use lowest possible VTVM range for all steps.

Step	Signal Generator		Output Indicator	Connect to	Adjust
	Freq.	Connect to			
1	42.7 mc No sweep	Pin #1 of V1, thru 1000 mmf. (1)	VTVM	Open end of R4-1 1 VTVM	Top slug T2-1 for maximum reading. Set sig. gen. for VTVM reading of —2.5 to —3V with T2-1 properly adjusted.
2	41.25 mc No sweep	As above (2)	VTVM	As above 2 VTVM	Bottom slug T2-1 for minimum reading. Set sig. gen. for reading of —2.5 to —3V with T2-1 properly adjusted.
3	45.5 mc No sweep	As above (3)	VTVM	As above 3 VTVM	T3-1 for maximum reading. Set sig. gen. for VTVM reading of —2.5 to —3V with T3-1 properly adjusted.
4	44.2 mc No sweep	As above (4)	VTVM	As above 4 VTVM	Bottom slug T4-1 for maximum reading. Set signal generator for reading of —2.5 to —3V with T4-1 properly adjusted.
5	43 mc Center freq. 10 mc deviation 42.45 mc and 45.75 mc	Mixer shield See Note 1 (5)	SCOPE	As above 5 SCOPE	T1-1 and tuner i-f coil (L-6) to place 45.75 & 42.45 markers at 50% point (see curve). 
6	43 mc Center freq. 10 mc deviation	As above (6)	SCOPE	As above 6 SCOPE	If necessary retouch T2-1 & T3-1 to correct positions of 45.75 & 42-45 mc markers and bottom slug of T4-1 for symmetrical curve.
7	4.5 mc No sweep	Pin #2 of V4, thru 1000 mmf. (7)	VTVM thru hi-Z stal probe	Junction L4-4 & L4-5 7 VTVM	L4-7 for minimum reading.

CAPEHART CX43 CHASSIS



NOTES

1. UNLESS OTHERWISE SPECIFIED MICA & CERAMIC CAPACITORS RATED IN MMF (NOT SPECIFIED) BODY D.C. WORKING PAPER CAPACITORS RATED IN MFD. 400V D.C. WORKING. RESISTORS 1/2 WATT 10% (UNLESS SPECIFIED) VALUE IN OHMS (K=1000 OHMS, MEG=1,000,000 OHMS).
2. COLORS REFER TO SOLID COLORS OF WIRE OR TRACER COLOR ON WHITE WIRE.
3. VOLTAGES MEASURED WITH VOLTOHMYST OR EQUIVALENT, FROM CHASSIS GROUND WITH NO SIGNAL INPUT. TOLERANCE OF VOLTAGES ±20%.
4. USED ON UHF ONLY.
5. WAVEFORMS FOR 117V LINE, 1000 MICROVOLTS OR GREATER SIGNAL, & ALL CONTROLS ADJUSTED FOR NORMAL PICTURE.
6. WAVEFORMS MEASURED WITH A HIGH DEFINITION, WIDE BAND OSCILLOSCOPE. WAVEFORMS CAN BE EXPECTED TO BE MODIFIED BY A NARROW BAND OSCILLOSCOPE.
7. VOLTAGES WITH ✣ PRECEEDING THEM DESIGNATE SUB LINES IN SET.
8. ⊙ DESIGNATES RESISTANCES MEASURED WITH TWO LEADS OF THE HORIZ. YOKE DISCONECTED FROM T602.
9. RESISTANCE FOR COILS AND TRANSFORMERS INDICATED ARE APPROX.
10. ⊙ DESIGNATES RESISTANCES MEASURED WITH ONE LEAD OF THE VERTICAL YOKE DISCONECTED FROM T502.

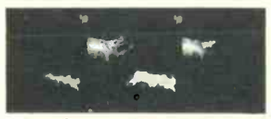
PRODUCTION CHANGES

The schematic shown here is correct for chassis coded R-2. Chassis coded R-1 will differ from those coded R-2 in the following manner.

1. R623 (3.3K-10%-2W) and R624 (8.2K-10%-2W) is replaced by R614 (6K-10%-7W).
2. C617 (.047-400V) is not used.
3. Pin 4 of V602 (12CU6) is connected to ground through a .1-400V capacitor (612).
4. C-405 (3000 mmf-20%-500V) is C404 (2000 mmf-20%-500V).

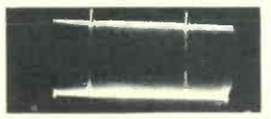
A. — 5V P-P

B. — 100V P-P

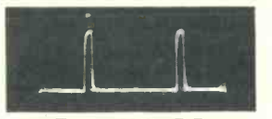


C. — 50V P-P

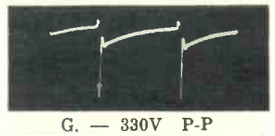
D. — 15V P-P



E. — 70V P-P



F. — 22V P-P

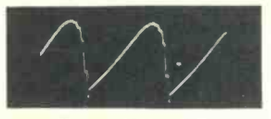


G. — 330V P-P

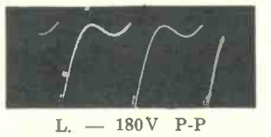
H. — 170V P-P

I. — 820V P-P

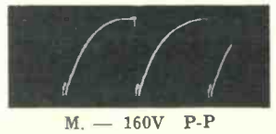
— 110V P-P



K. — 25V P-P



L. — 180V P-P



M. — 160V P-P

CAPEHART CX-43 CHASSIS TUBE SOCKET RESISTANCE CHART

WITH 20,000 OHM PER VOLT METER

REF. TUBE NO.	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V201 3CB6	850K	47	11	10.5	50K	50K	Short		
V202 3CB6	Inf.	47	10.5	10	50K	50K	Short		
V203 5AM8	100	Short	50K	10	9	50K	3.5	5K	Short
V204 6AU8	Short	2.2 meg.	650K	9	8	*1.6	1 meg.	50K	50K
V205 CRT	Short	100K	Pin 10 100K	*Pin 11 420K	Pin 12 3.5	**Short			
V301 3AU6	Short	Short	8	7	50K	50K	150		
V302 3BN6	*650	3.6	10.5	11	50K	7	300K		
V306 12L6	N/C	19	50K	50K	220K	50K	17	50K	
V402 6SN7	20K	50K	Short	*1.2 meg.	*900K	Short	7 meg.	5	
V503 12B4A	*1.9K	1.5 meg.	6	7	7	N/C	N/C	N/C	50K
V601 6SN7	550K	*240K	280K	*280K	12K	Short	5	3.5	
V602 6CU6	N/C	19	50K	50K	1. meg.	N/C	20	Short	
V603 1B3	N/C	INF.	N/C	N/C	N/C	N/C	INF.	N/C	
V604 12AX4	N/C	N/C	140K	N/C	50K	N/C	20	24	

* VARIES WITH A CONTROL SETTING

From Pg. 1

4. If necessary, connect the lead wire from an antenna to the terminals on the rear of the cabinet. Be sure to remove the lead wire from the "built-in" antenna from those terminals when using an external antenna.
5. Set the Channel Selector knob to a channel on which a program is being transmitted.
6. Adjust the Fine Tuning and Contrast controls to obtain the best reception. Tune for the sharpest detail in the picture.
7. Adjust the Brilliance control for the desired brightness and the Volume control for the desired volume. Check the sound quality.
8. Adjust the Vertical Hold control if the picture rolls vertically.
9. Adjust the Horizontal Hold control for picture synchronization. (Refer to ADJUSTMENT OF HORIZONTAL OSCILLATOR IF SYNCHRONIZATION CANNOT BE OBTAINED.)

Picture Centering and Focus

If the picture is off center and/or has a neck shadow, rotate either or both centering magnet levers CW or CCW until the picture is centered on the screen. Then readjust the Ion Trap as previously described.

The tube used in this receiver is either the new 21ATP4 or the new 24DP4A. Both of these tubes employ electrostatic focus. Since the characteristics of each tube may vary slightly, different focus electrode voltage taps are made available on a terminal board just above the R.F. Tuner. It may be necessary to plug the focus lead into each tap to determine which voltage provides the best focus. When checking each tap for the best focus it is recommended that the receiver be turned off when making the change as it is possible to receive a shock from the connectors. Voltages as high as 600 volts are present on this connector strip.

Adjustment of Vertical Linearity

Adjust the Height and Vertical Linearity controls to obtain the proper height and vertical linearity. It may be necessary to adjust the Vertical Hold control while making these adjustments if the picture should roll.

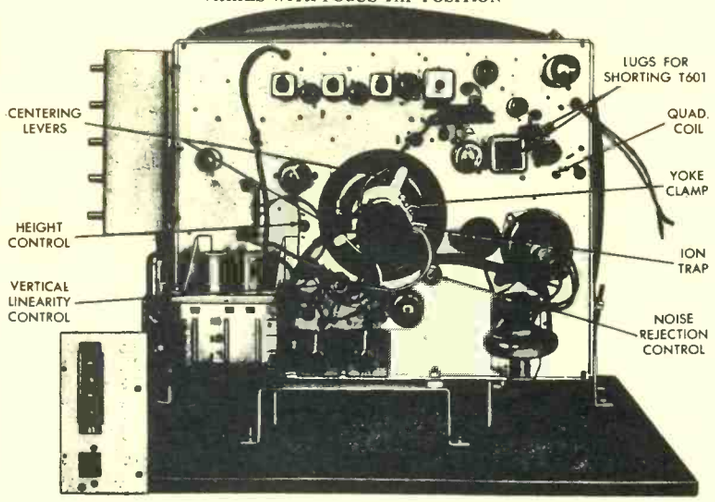
Adjustment of Horizontal Oscillator

Before making any adjustments one item of importance must be clarified. The front side of the chassis refers to the wiring side of the chassis. The rear side of the chassis refers to the tube side of the chassis.

Rotate the Horizontal Hold control to the extreme clockwise position. Short the Horizontal Stabilizing Coil (T601), terminal "C" to "D". (The terminals for making this connection are located on T601 as shown in the photograph.) Adjust the rear slug of T601 to the extreme counter-clockwise position. When reaching the extreme position, proceed to rotate the slug in the clockwise direction until picture synchronization is reached. After reaching the point of picture synchronization, back the slug out until the picture falls out of sync by approximately eight horizontal bars.

Remove the short from T601 and adjust the front slug (this adjustment is made by inserting a special hex-shaped alignment tool similar to the G.C. 8606, except the one tuning end must be 2¾ inches long, into the rear slug, passing on through and into the front slug) of T601 to the extreme clockwise position. After reaching the extreme clockwise position, adjust the front slug in the counter-clockwise direction until picture synchronization is again obtained. When reaching the point of picture synchronization, back the slug out in the clockwise direction until the picture falls out of sync by approximately 1 to 3 horizontal bars. Now adjust the Horizontal Hold control for the picture synchronization. Check the above procedure if necessary.

** VARIES WITH FOCUS TAP POSITION



Adjustment of the Quadrature Coil and Noise Rejection Control

Adjustment of the Quadrature Coil (L301) and Noise Rejection Control (R303) should be made at the time of installation to insure the best sound reproduction. These two items are readily accessible as shown in the chassis photograph.

With a station properly tuned in, adjust the Quadrature Coil for the strongest and clearest sound. Then attenuate the signal until the background noise is apparent in the sound. With the signal attenuated, adjust the Noise Rejection Control for a minimum background hiss and noise.

VHF Oscillator Adjustment Using a Television Signal

The VHF R.F. Oscillator frequency may be adjusted by the tuning coils identified as A1 and A2. A1 is the High Channel adjustment and A2 is the Low Channel adjustment. These adjustments are accessible from the top of the R.F. Tuner. Turn the receiver on and allow sufficient time for warm-up before making any adjustments.

(A) High Channel Adjustment

1. Set the Channel Selector to the highest VHF channel between 7 and 13 on which reception is being obtained.
2. Set the Fine Tuning Control so that the "flat" on the shaft is facing up.
3. Adjust the high channel oscillator coil (A1) to obtain the best picture.
4. The remaining high channels should then be within the range of the fine tuning.

(B) Low Channel Adjustment

1. Set the Channel Selector to the highest VHF channel between 2 and 6 on which reception is being obtained.
2. Set the Fine Tuning Control so that the "flat" on the shaft is facing up.
3. Adjust the low channel oscillator coil (A2) to obtain the best picture.
4. The remaining low channels should then be within the range of the fine tuning.

Final Checks

In sequence, set the channel knob to all channels on which reception is obtained. Adjust the receiver for operation as outlined in the section "How to Operate Your Capehart Receiver." Check the quality of reception, picture and sound on all available TV stations in the area.

Recheck the Ion Trap Magnet setting for normal brilliance.

CAPEHART CAPEHART MODELS 8T216 MR-4, -5, 9T246 MR-4, -5, 17C216 MR-4, -5, CHASSIS CX-43 SERIES

TROUBLE SHOOTING NOTES ON CX-43 CHASSIS

Due to the stacking arrangement of various tubes and the design of the instrument, it is well to assume that any component that will effect the 135 volt source, will also cause trouble in any of the circuits using the 135 volt line. For example: a defective component in the sound circuit may cause a loss of horizontal or vertical sync. The possible defects, and the components causing such defect, as listed below, is merely to provide the technician with a probable starting place in his servicing.

PICTURE CIRCUITS

1. No picture, No Sound, Raster Present.
   Use Oscilloscope to trace video signal. If video is not present at output of Video Detector, check:
   (A) R-F tubes V101 and V102 or I-F tubes V201, V202, V203.
   (B) Voltage readings on all R-F and I-F tube pins.
   (C) Shorted by-pass capacitors in the R-F and I-F stages.
   If video signal at Video Detector is normal, check:
   (A) Video Amplifier tube V204.
   (B) Voltage readings on the Video Amplifier V204.
   (C) Associated components of V204.
2. No Picture, Sound O.K., Raster Present.
   Use oscilloscope to trace video signal from video detector to isolate defective component. If video checks normal at the plate of the video amp., but is not present at the cathode of the picture tube, check:
   (A) Coupling capacitor C219 for open.
   (B) Open cathode on CRT.
3. A Single Black Bar (60 cycle hum) in Picture.
   Use oscilloscope to observe video signal at output of video detector. If video shows hum modulation, check:
   (A) Tubes in R-F and I-F stages for heater-to-cathode leakage.
   If no hum is present at the detector output, check:
   (A) Video Amplifier and picture tube for heater-to-cathode leakage.
4. Smear in Picture, check:
   (A) Video Amplifier tube V204.
   (B) Peaking Coil L204 for open.
   (C) Capacitor C219 for open.
   (D) Alignment of I-F Stages—Check response curve with sweep generator and oscilloscope.
5. Trailing Whites (Ringing in Picture).
   If condition is not present on all channels, check:
   (A) Fine Tuning adjustment for proper tuning. If not obtainable, check adjustment of local oscillator on the channels involved.
   If conditions are present on all channels, check:
   (A) Value of Detector load-resistor.
   (B) Alignment of I-F Stages.

VERTICAL SYNC AND SWEEP CIRCUITS

1. Loss of Vertical Sync or Critical Hold:
   Use oscilloscope to check sync signal at grid of (Pin 4) of Vertical Oscillator (V402). If sync signal is normal, check:
   (A) C702B for short.
   (B) Defective 12B4A.
   (C) T501 defective.
   (D) R509 (Vertical Linearity) shorted or open.
   If sync signal at the grid of the Vertical Oscillator is not normal, check:
   (A) T501 for short or open.
   (B) C403 for short or open.
   (C) C402 for short.
   (D) PC106 defective.
   (E) C404 for open.
   (F) Defective 6SN7 (V204).
2. Loss of Vertical Sweep, check:
   (A) 12B4A defective.
   (B) Shorted or open Deflection Yoke.
   (C) R506 decreased in value.
   (D) Defective 6SN7 (V402).
   (E) R502 open.
   (F) Defective T501.
3. Insufficient vertical scan.
   (A) Weak 12B4A.
   (B) R509 Vertical Lin. Defective.
   (C) R506 decreased in value.

NO POWER

If instrument does not light, check:
(A) Filaments of all tubes.
(B) Fuse resistor (R701).
(C) Defective Line Cord.
(D) Defective Off-On Switch.

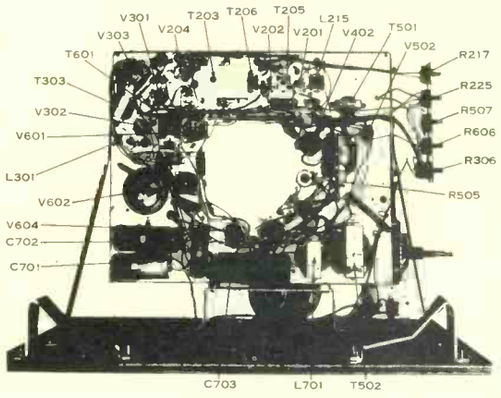
SOUND CIRCUITS

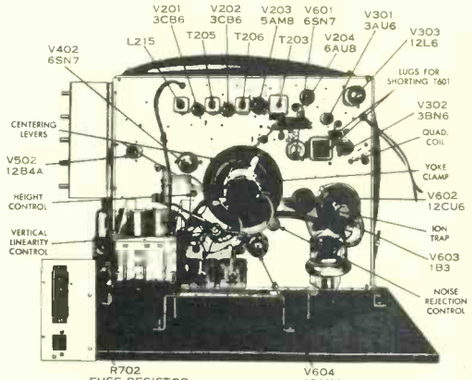
1. No Sound or Weak—Picture O.K., check:
   (A) Audio Output Tube 12L6 (V303) by substitution.
   (B) Audio Detector tube 3BN6 (V302) by substitution.
   (C) Sound I-F tube 3AU6 (V301) by substitution.
   (D) T302 shorted or open.
   (E) Coupling capacitor C308 open. Capacitor C307 for short.
   (F) Noise rejection control, R303 for open.
   (G) Output transformer T301 and speaker.
   (H) Alignment of Sound circuits.
2. Buzz in sound—Picture O.K.
   In some instances "buzz" in the sound may be the result of a transmitter difficulty. If the buzz is not a transmission difficulty, check:
   (A) Adjustment of Noise Rejection Control (R303) and/or Quadrature Coil (L301) as outlined under SET-UP ADJUSTMENTS.
   If satisfactory adjustment cannot be made, check:
   (A) Quadature Coil (L301) for short or open.
   (B) Noise Rejection Control (R303.)
   (C) C304 for short.
3. Distorted Sound
   Check Audio Output stage by feeding audio signal into the grid of the 12L6. Observe signal at plate with scope and if distorted, check:
   (A) Output Transformer and speaker.
   (B) Capacitor C704.
   If audio section shows no evidence of distortion, check:
   (A) Alignment of Sound I-F Stages.
   (B) Adjustment of Quadrature Coil (L301) and Noise Rejection Control (R303).

HORIZONTAL SYNC—AFC and SWEEP CIRCUITS

1. Loss of Horizontal Sync
   If vertical sync is also critical, check:
   (A) C401 open.
   (B) Short on 135 Volt line.
   (C) Weak 6AU8 (V204) and 6SN7 (V402).
   (D) PC-261 defective.
   If vertical sync is normal, check:
   (A) C602 shorted.
   (B) T601 defective.
   (C) Weak 6SN7 (V601).
   (D) C603-C604-C605 shorted.
2. Extreme Horizontal Sweep Distortion — Horizontal Sync critical, check:
   (A) V601 (6SN7) by substitution for heater-to-cathode leakage.
3. Tearing at top of picture, check:
   (A) Adjustments of Horizontal Oscillator.
4. No Raster—No High Voltage.
   Use oscilloscope to check waveform at grid (pin 5) of Horizontal Output (12CU6). If waveform is normal, check:
   (A) Horizontal Output tube 12CU6 (V602).
   (B) C612 shorted.
   (C) Horizontal winding of deflection yoke or horizontal output transformer for open.
   (D) Defective 1B3, 12AX4, or CRT.
   (E) C613 shorted.
   If waveform is not normal, check:
   (A) R612 shorted.
   (B) C609 shorted.
   (C) Defective 6SN7 (V601).
   (D) T-601 defective.
   (E) Shorted component from 135V line to ground.
5. Insufficient Horizontal Sweep:
   (A) Defective 12CU6.
   (B) Defective High Voltage Transformer.
6. Horizontal Foldover.
   (A) R612 reduced in value.
7. Trapezoidal Raster—Horizontal sweep decreased, check:
   (A) Horizontal winding of deflection yoke for partial short.
   (B) Capacitor C615 for short.

CHASSIS LAYOUT





Set-Up Adjustments

FINAL ADJUSTMENT OF THE VARIOUS "SET-UP" CONTROLS SHOULD BE MADE AT THE TIME OF INSTALLATION OF THE RECEIVER. The receiver should be given a thorough operating test at the same time and, of course, the owner should be instructed as to the operation of the various controls on the side of the cabinet. The owner should be cautioned that the "set-up" controls should be adjusted only by a competent television service technician.

Preliminary Checks

1. Remove the cabinet back and connect the receiver to an AC source using a "cheater cord." (A line cord that can be plugged into the AC interlock receptacle on the rear of the chassis.)
2. Turn the receiver on and adjust the Brilliance and Contrast controls to approximately one half of full rotation. If a raster is not seen after allowing time for the tubes to warm up, immediately adjust the Ion Trap Magnet to obtain a raster. Upon obtaining a raster, adjust the Brilliance control for normal brilliance (the setting where you would normally view a picture) and continue to adjust the magnet (by rotating it about the neck of the CRT and moving axially along neck of tube) until the brightest raster is obtained.
3. Check to see that the Deflection Yoke is flush against the bell of the CRT. If the raster is tilted, loosen the clamp located directly back of the yoke on the neck of the tube and rotate the yoke to correct the tilt. Cont., pg. 5

Mfr: Admiral **Chassis No.** 21A3AZ

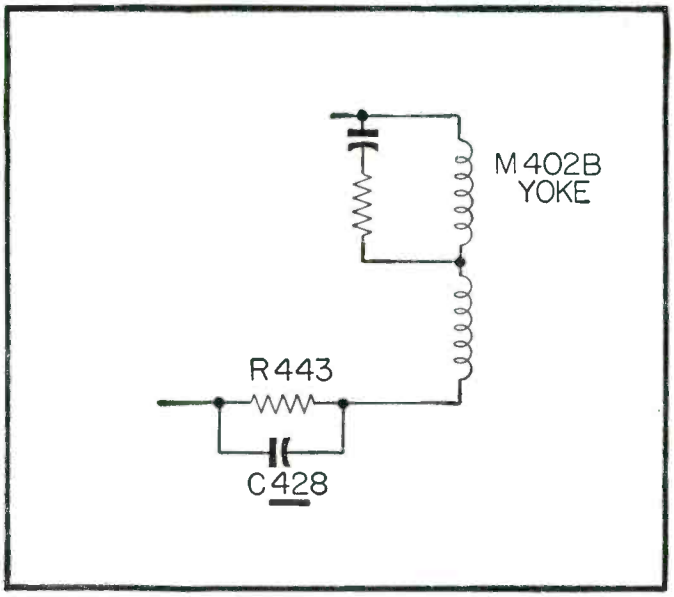
Card No. AD 21A3AZ-1

Section Affected: Raster

Symptom: Raster has jagged edges (Pie crust ringing)

Reason For Change: Circuit improvement

What To Do:
Connect: *R443* (1K) across *C428* (.1 μf)



Mfr: Admiral **Chassis No.** 21A3AZ

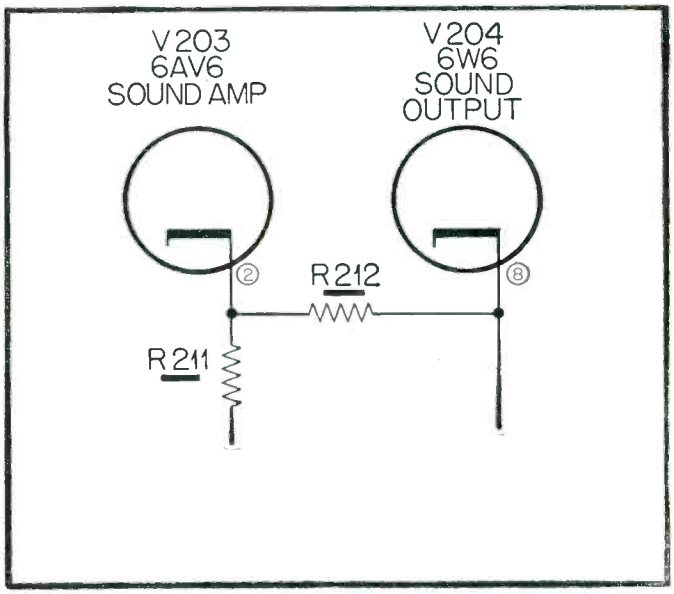
Card No. AD 21A3AZ-2

Section Affected: Pix

Symptom: Picture bounce at high volume settings

Reason For Change: Circuit improvement

What To Do:
Connect: *R211* (470 ohms) between pin 2 of V203 (6AV6) and ground
also, *R212* (27K) from pin 2 of V203 to pin 8 of V204 (6W6)



Mfr: Admiral **Chassis No.** 21A3AZ

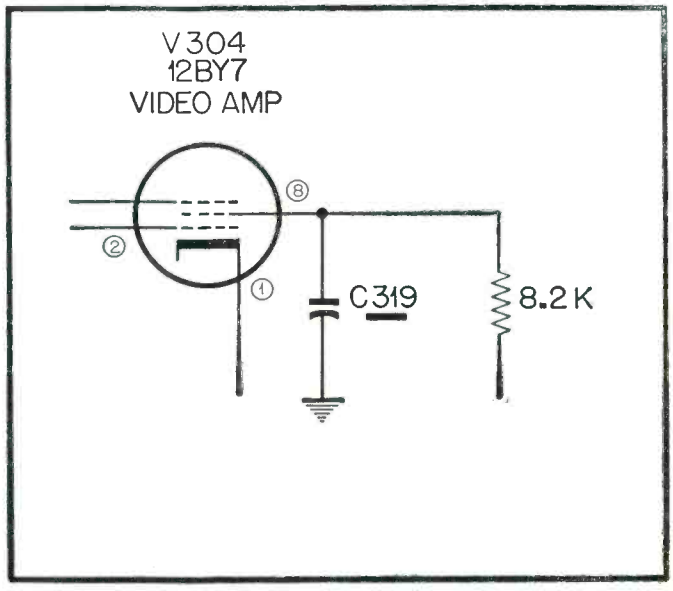
Card No. AD 21A3AZ-3

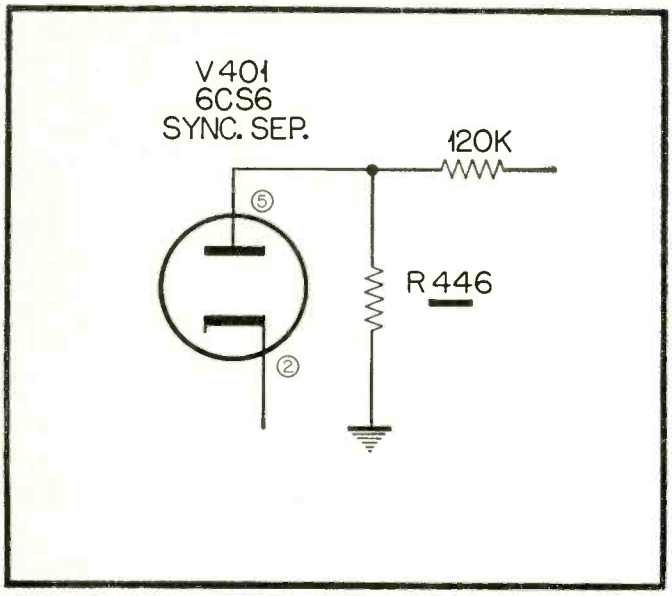
Section Affected: Pix

Symptom: Contrast increases and decreases intermittently

Cause: Leaky condenser

What To Do:
Replace: *C319* (10 μf)





Mfr: Admiral **Chassis No.** 21A3AZ

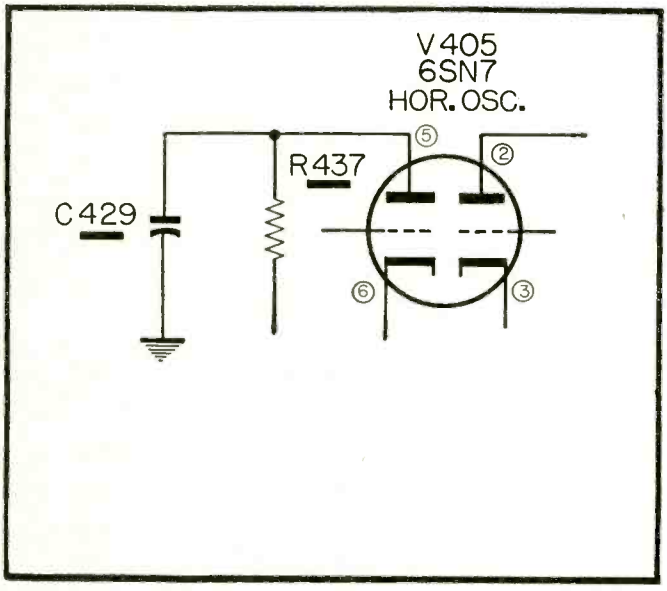
Card No. AD 21A3AZ-4

Section Affected: Sync

Symptom: Unstable horizontal and vertical sync

Cause: Open resistor

What To Do:
Replace: *R446* (6K)



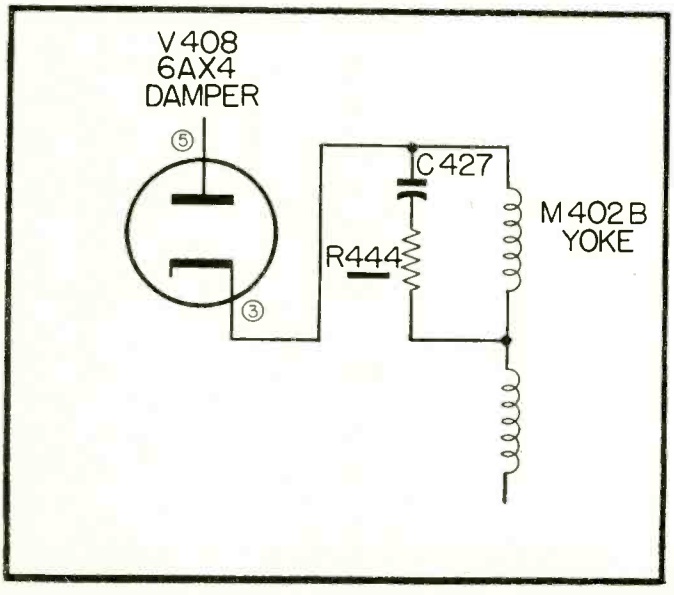
Mfr: Admiral **Chassis No.** 21A3AZ

Card No. AD 21A3AZ-5

Section Affected: Sync
Symptom: Bending at top of pix

Reason For Change: Circuit improvement

What To Do:
Connect: *C429* (47 $\mu\mu f$) from pin 5 of V405 (6SN7) to ground
Replace: *R437* (5.6K) with 8.2K resistor



Mfr: Admiral **Chassis No.** 21A3AZ

Card No. AD 21A3AZ-6

Section Affected: Raster

Symptom: Wrinkles at left side of raster

Cause: Resistor decreased in value

What To Do:
Replace: *R444* (750 ohms)

Mfr: Du Mont **Chassis No.** RA 340/341

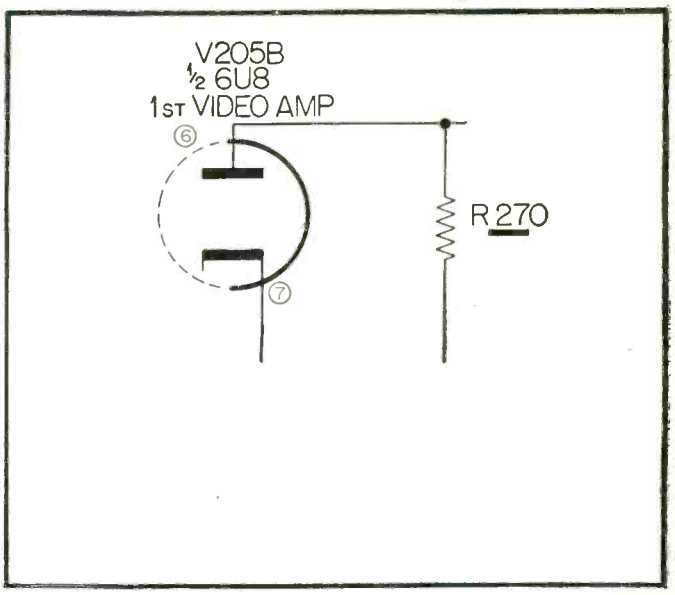
Card No. DM 340-1

Section Affected: Sync

Symptom: Vertical jitter and unstable horizontal sync

Cause: Resistor decreased in value

What To Do:
Replace: *R270* (22K)



Mfr: Du Mont **Chassis No.** RA 340/341

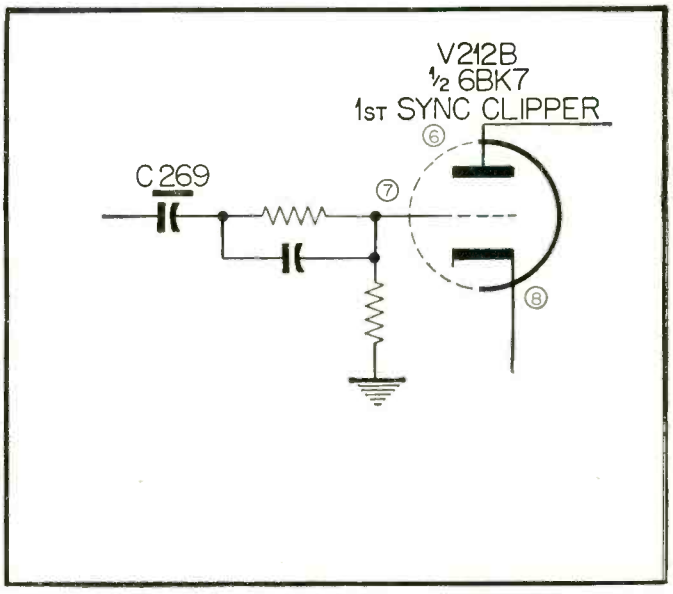
Card No. DM 340-2

Section Affected: Sync

Symptom: Vertical locks out of phase; unstable horizontal sync

Cause: Shorted condenser

What To Do:
Replace: *C269* (3,300 $\mu\mu f$)



Mfr: Du Mont **Chassis No.** RA 340/341

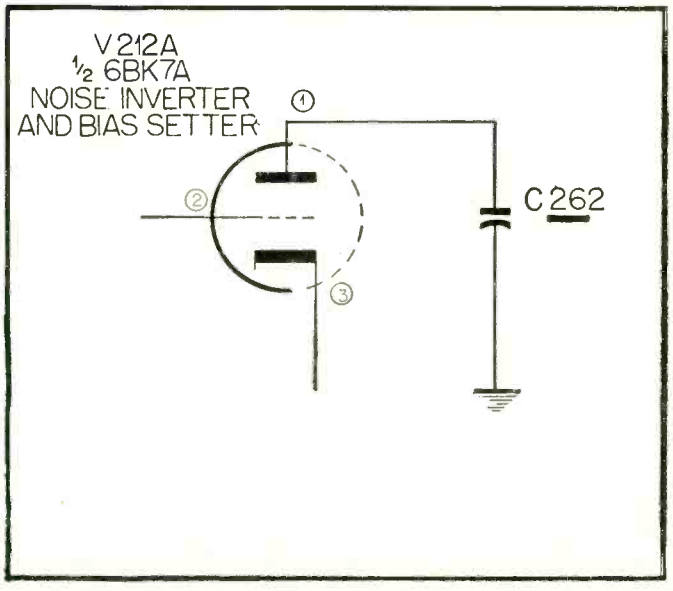
Card No. DM 340-3

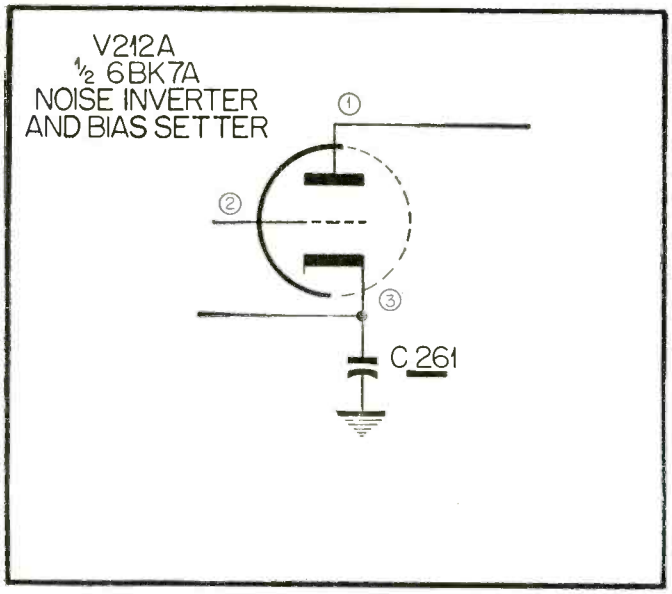
Section Affected: Sync

Symptom: Rapid horizontal jitter

Cause: Open condenser

What To Do:
Replace: *C262* (330 $\mu\mu f$)





Mfr: Du Mont **Chassis No.** RA 340/341

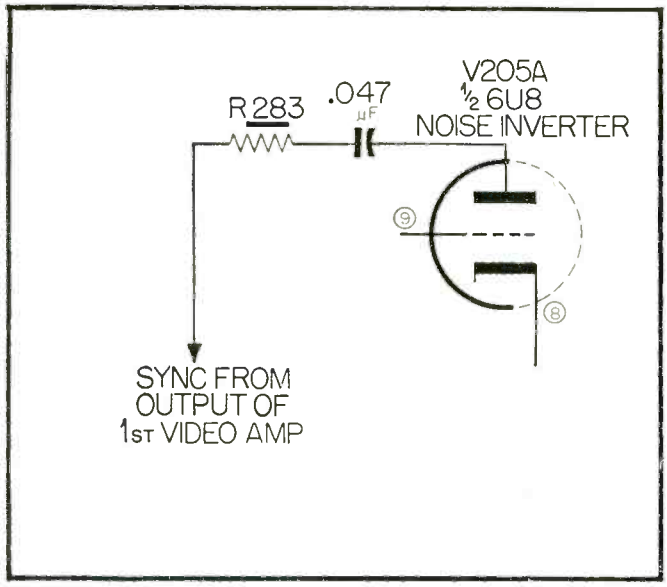
Card No. DM 340-4

Section Affected: Pix

Symptom: Negative pix

Cause: Shorted condenser

What To Do:
Replace: *C261* (.0068 *μf*)



Mfr: Du Mont **Chassis No.** RA 340/341

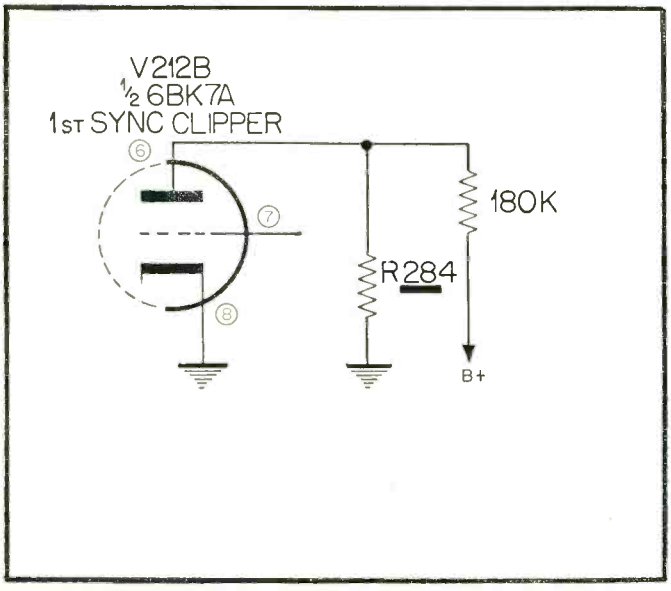
Card No. DM 340-5

Section Affected: Pix

Symptom: Insufficient contrast

Cause: Resistor decreased in value

What To Do:
Replace: *R283* (22K3)



Mfr: Du Mont **Chassis No.** RA 340/341

Card No. DM 340-6

Section Affected: Sync

Symptom: Critical horizontal and vertical sync

Cause: Open resistor (insufficient wattage)

What To Do:
Replace: *R284* (47K) with larger wattage resistor

ASSOCIATION NEWS

[*from page 13*]

present quality of color receivers $99.50 cannot sufficiently cover the cost of servicing and extending parts warranty to one-year.

"To further aggravate this condition, we find in this area, that 50% of this service policy is being absorbed by the distributor. Therefore, the customer is being led to believe that service on present color receivers can be purchased at a ridiculously low price. This seems to put RCA in the position of using unfair business practices in an attempt to put the local service dealer out of the color television servicing business, instead of providing a stimulus on a competitive level.

"Due to the above considerations we feel that this is not the time for us to promote color television to the consumer."

Donald G. Roberts
President—Syracuse Television Technicians Association

Philadelphia Area

Leaders of the television service industry in this area recently presented to District Attorney Victor Blanc a plaque of their code of ethics, and pledged their support to the code.

Presenting the service plaque to Mr. Blanc were Harrison Neel (President, Television Service Dealer's Association), Ray Cherril (President, Northeast Television Service Dealer's Association), William Poole (President, Philadelphia Radio Servicemen's Association), William Morrow (President, Television Service Dealer's Association of Delaware County) and Albert Haas (President, Television Contractors Association).

Pennsylvania Radio Service Men's Association (PRSMA)

PRSMA officers were elected for 1956. They are as follows: President, William L. Poole; Vice President, Samuel M. Brenner; Recording Secretary, Wm. P. Humes; Treasurer, Stanley W. Myers and for Corresponding Secretary, Fred Cohen.

Francis J. Wolf has been elected president of the Trenton Radio Servicemen's Association, Inc.

William H. Morrow has been elected president of the Television Service Dealers Association of Delaware County. He succeeds John J. Matthews who was elected vice president. Other officers are Secretary Joseph Bell and the Treasurer is Peter Rapagnani.

The Greater Hazleton Radio and Television Association has applied for a charter to the Luzerne County Court.

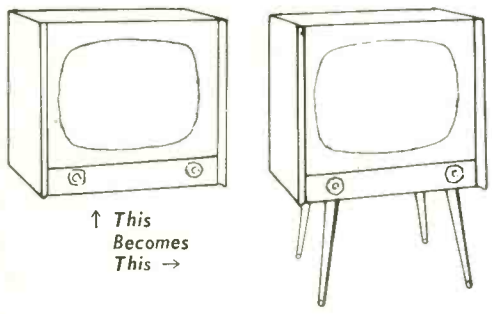
The FRSAP installed new officers at the January 1956 meeting.

AVAILABLE NOW TO SERVICE DEALERS AND SERVICEMEN

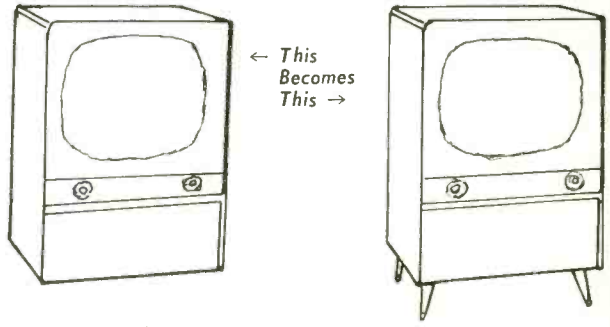
GENUINE JONKEN STEEL LEGS—5" to 28"

TAPERED — ROUND — SQUARE . . . SATIN BRASS, SATIN CHROME, BLACK ENAMEL

Quickly, easily and profitably you can convert TABLE MODEL TV SETS to HIGHBOYS or FLOOR CONSOLETTES to CONSOLES



↑ *This Becomes This* →



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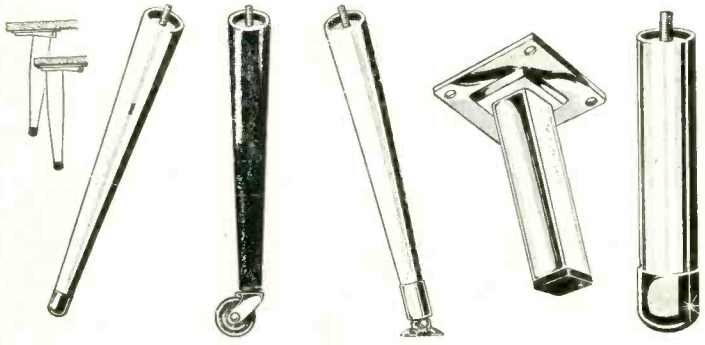


Showing selection of tapered, round and square legs with choice of snap-on ball glide, 2" wheel caster or swivel glide.

SNAP - ON Ball Glides allow for positioning legs in vertical or at 12° angle. All finishes available.

Wheel casters are 2" black styrene, with metal saddle available in brass finish.

Swivel glides are metal, in all finishes. Swivel base is black plastic.

TWO-IN-ONE or dual-purpose leg bracket is heavy gauge steel allowing legs to be set at either a 12° angle or in a vertical position.

The NET PRICES QUOTED on the adjacent page are FOB Long Island, New York and include sets of 4 legs with dual-purpose mount and your choice of snap-on ball glide, self-leveling swivel guide or wheel caster. 25% cash must accompany order, balance C. O. D. (unless credit terms are arranged for). Extra 5% discount on orders for 10 sets or more.

Some territories still available to electronic parts distributors on an exclusive basis.

ELEK-TRONIC BARGAIN HOUSE
2 EMBASSY COURT, GREAT NECK, N. Y.

Sirs: Send the following: (25% cash herewith, balance C.O.D. and F.O.B.)

Model No.	Quantity	Model No.	Quantity	Model No.	Quantity

BALL GLIDES ..... SWIVEL GLIDES ..... WHEEL CASTERS .....

Name .....

Address .....

SERVICEMEN and DEALERS:

Department and specialty stores everywhere are selling these steel leg set at prices 40% to 50% higher than our net prices to you. Carry your own stock of Genuine Jonken Legs. Use them either to modernize your own, or your customers' sets. Or, sell them to customers who want to install them themselves. You can't lose—Jonken Legs are a plus-profit item with fast turn-over. When your customers know you have for sale, and can install Jonken Legs, extra profits, more service jobs and good-will will result.

RIDER SPEAKS

[*from page 11*]

it should be continued and expanded. As a matter of fact, a shortage of television technicians may well prove to be a boon.

While there may be some confusion at the present time concerning color TV and black-and-white TV, the fact remains that millions of black-and-white TV receivers will be sold during 1956 and for several years thereafter. The 8-inch and the 14-inch (and maybe there will be a 10-inch) screen portable looks like it will open up a brand new market. Apparently the manufacturers of the first 14-inch portable receiver fared much better than a lot of people imagined, and there will be others looking for the "second receiver in the home" market. These receivers will require service and if one can visualize two in 30 million homes this makes 60 million black-and-white receivers, in addition to whatever may be the color market and table black-and-white models. If TV technicians will be in short supply, those who remain will command better prices—that's for sure.

But getting back to the TV servicing industry spreading its wings, we have said this for years and we feel that the suggestion is as sound today as it was then—TV service shops should become electronic equipment maintenance shops. We recognize that the transition cannot occur in a year—that it will consume a number of years. But it can be done. There are many industries, especially those which are basically mechanical or which require only manipulative skill, with no theoretical background, that do not require too much advance time to gather and assimilate knowledge. The electronic industry is not one of these. In other words, the TV servicing industry must take advantage of the time that still exists between now and when it will be called upon to participate in the results of the expansion of the use of electronics techniques.

John F. Rider

PICKUPS

[*from page 28*]

it might seem that this is a complicated way of doing things, certain important advantages are gained. A discussion of these advantages however is not within the scope of this article. Without explaining these terms, let us simply point out that if the pickup generates a voltage because of pressure applied to it, such as the crystal or the ceramic pickup, it would respond faithfully to the constant amplitude, but not to the constant velocity type of recording. A pickup of the variable reluctance type, on the other hand, responds faithfully to constant velocity, but not to constant amplitude recording.

It has become standard practice in the United States to use a crossover point of 500 *cps*. This means that constant amplitude recording is used up to about 500 cps while the constant velocity technique is employed above this frequency.

The constant amplitude characteristic below 500 *cps* results in lower than normal output from the variable reluctance pickup at these frequencies. An equalizing circuit is therefore used for the purpose of restoring these lower frequencies to their proper relative strength compared to frequencies above 500 *cps*. This is done, actually, by providing an attenuation circuit which has a response just the opposite of the recording characteristic. The result of the combination is then a flat response curve.

The second technique used in making the recording, and which also makes equalization necessary at the playback end is the technique of high frequency pre-emphasis. In this process, the higher frequency components of the sound signal are increased in strength above their normal level. This results in a larger signal to surface noise ratio. By feeding the pickup output into a properly designed equalizing circuit, the high frequency components are brought back to their proper level, and surface noise is simultaneously reduced to a much lower level than would be possible without pre-emphasis.

The foregoing discussion of equalization might well be summarized by referring to *Fig. 5*. Curve A is a typical recording curve. Notice the low output at the low frequency end (constant amplitude recording), and the high output at the higher frequencies (pre-emphasis). Curve B in *Fig. 5* illustrates the ideal playback curve. Equalizing circuits boost the low frequency response and attenuate the highs. The combination of A and B results in the ideal overall response pictured at C.

A number of manufacturers put out equalizers which may very easily be added to existing equipment. *Fig. 6* shows one such equalizer. Installation simply requires plugging the pickup into the equalizer and the equalizer into the amplifier. As seen from the photograph, panel mounting is a simple matter. The particular model shown is designed to operate with any high impedance variable reluctance pickup

[*Continued on page 50*]

THE WORK BENCH

Unusual Service Problems And Their Solutions

by **Paul Goldberg**

This Month's Problem:
Troubles in TV sound systems

THIS month's installment deals with problems encountered in the less conventional type of sound system.

Westinghouse Chassis V-2315

The receiver was turned on and it was noted that the sound was very weak and gargled. The 6BN6 FM detector, the 6AN8 limiter, sync, and sound amplifier were replaced individually but had no effect. Next the quadrature coil *L203*, the two 4.5 *mc* traps *L201* and *L200*, and *R202* were adjusted individually but the trouble remained.

The diagram was then studied. This receiver uses a 6AN8 which is a medium mu triode and a sharp cutoff pentode. The composite video signal after being rectified by the crystal detector 1N64 is directly coupled to the grid (pin #2) of the sync and sound amplifier (6AN8 triode). The composite video signal is then amplified and fed to both the AGC tube and the sync separator, 6CS6. The composite video signal is also coupled through a 10 $\mu\mu f$ condenser (*C200*) into a high Q 4.5 *mc* trap (*L200-C201*). This trap presents a high impedance to the 4.5 *mc* beat between the sound and picture carriers and a lower impedance to all other frequencies. Thus the sound portion of the video signal is present on the grid, (pin #8), of the pentode section of the 6AN8.

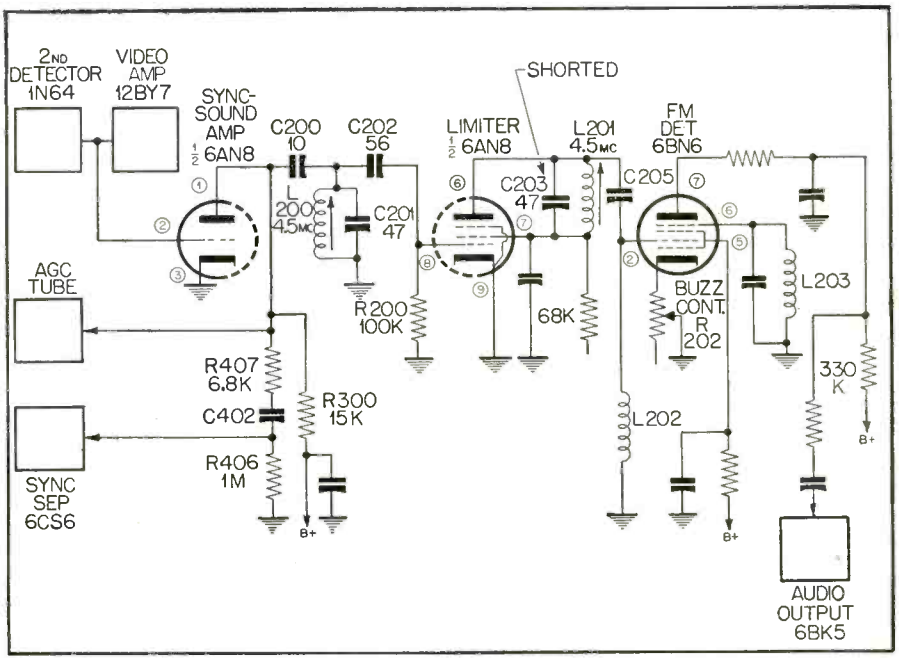


Fig. 1—Partial schematic of Westinghouse V-2315 chassis.

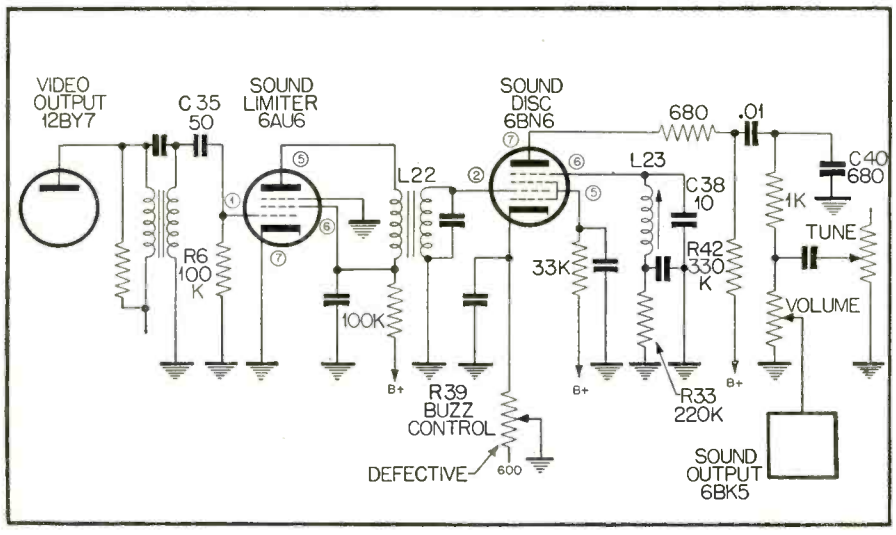


Fig. 2—Partial schematic of Zenith 19L26 sound I.F.

Limiting is accomplished by the sharp cutoff characteristic of the pentode section of the 6AN8. Components, *C202* and *R200* develop sufficient grid-leak bias to cause clipping of the negative half of the sound signal. Due to this tube's low plate and screen voltages, the most positive portions of the sound signal cause plate saturation to occur. This minimizes amplitude variations on the positive swing of the sound signal. Thus this limiter removes amplitude variations in the sound signal delivered to the FM detector.

With these facts in mind, we set up our FM generator at 4.5 mc with 400 cycles AM modulation. This signal was first fed into pin #2 of the 6BN6, FM detector. The response from the speaker was loud and clear.

Next the FM generator at the same setting was fed into pin #8 of the

6AN8, limiter. Here a very weak response was heard from the speaker. The trouble therefore seemed to be localized in the 6AN8 limiter circuitry.

A voltage check was then made first at the plate then at the screen of the 6AN8 limiter tube. The voltages checked approximately correct.

A resistance check was then made across *L202*. This coil checked OK. A resistance check was then made across the 4.5 mc tank circuit *C203* and *L201*. Here the meter read close to zero ohms.

As a positive check *C203* was clipped out of the circuit and measured. It was shorted. Capacitor *C203* was then replaced with a new 47 *μμf* condenser and the receiver was turned on. Components *L200*, *L201*, *L203* and *R202* were again readjusted for maximum undistorted sound at minimum buzz. The receiver now functioned properly. (*C203* and *L201* offer maximum impedance at their resonant frequency of 4.5 *mc*. When *C203* shorts, this load tank circuit offers zero impedance. Thus the load voltage drop will also be zero.)

Zenith 19L26

The receiver was turned on and a loud buzz accompanying the sound was heard from the speaker. The 6BN6 sound discriminator, and the 6AU6 sound limiter were replaced individually but had no effect. Next the quadrature coil *L23* was adjusted but the buzz remained. The buzz control, *R39* was adjusted but had very little effect. The 4.5 *mc* tank circuit coil *L22* was adjusted but did not solve the problem.

The diagram was then studied. This receiver uses a 6BN6 gated beam tube as the sound discriminator. Pin #2 grid acts as a gate. With zero or a positive potential applied, it passes the beam; with a negative potential applied, the beam is cut off.

In normal operation this grid is biased a few volts negative with respect to cathode. A 4.5 *mc if* signal is applied to pin #2 grid and for one half of each cycle the electron beam is passed and projected upon the quadrature grid, pin #6.

The quadrature grid is tuned to the *if* signal frequency (4.5 *mc*) and is driven by the space charge coupling. The periodic variations of the space charge in front of the quadrature grid (space charge coupling) produce a voltage across the tuned circuit *L23* and *C38*. The quadrature grid clips the leading portion from each half cycle and passes periodic pulses of current, about ¼ cycle in length on to the anode.

[*Continued on page 57*]

The ANSWERMAN

Inquiries Sent To The Answerman Will Be Acknowledged Only If Accompanied By Radio-TV Service Firm Letterheads Or Similar Identification.

by **RTSD Technical Staff**

Dear Mr. Answerman:

I have a problem involving a Zenith 20J22 chassis with intermittent vertical hold. There is no set pattern to this loss of vertical sync. During the time that it occurs there appears to be a small loss of height and a small amount of vertical foldover at the top of the picture.

The tubes such as the 6BL6 have been changed and normal items checked, such as voltages, resistors and condensers. The condition occurs irregularly about once each minute.

What, in your opinion, is the most likely cause of this condition?

F. P.
Chicago, Ill.

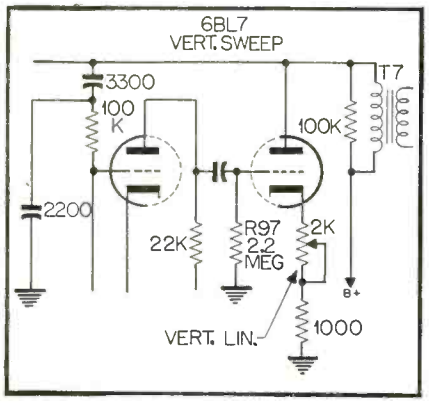


Fig. 1—Partial schematic of Zenith 20J22 chassis.

A number of components could, of course, cause this condition. However, from past experience it is suspected that the vertical output transformer is at fault. The same symptoms have been encountered in a variety of TV receivers over a number of years. In many of these cases, aside from tubes, coupling condensers, and burned out resistors, the vertical output transformer was at fault. In several cases, vertical foldover at the top of the picture was observed, in others intermittent vertical sweep appeared, and in still others vertical shrinkage occurred.

In several of the above instances the vertical output transformer winding partially opened up so that the ends at the break were just about touching, resulting in a high resistance connection. With the passage of current the variation in resistance may vary the plate voltage and cause the slight foldover and jitter observed. There is sufficient coupling to affect the vertical oscillator and cause the vertical sync to flip. This coupling may be observed in *Fig. 1* which shows the Zenith 20J22 chassis vertical deflection circuit.

One of the symptoms observed in such cases is jitter of the *dc* voltage at the plate of the vertical output tube.

Mr. Answerman:

I have a Philco RF84 chassis in which there is a pronounced hum from the speaker. I have checked all the conventional troublemakers such as tubes, etc. One noticeable point is that with the volume control in the minimum position the hum is still present. This would therefore seem to indicate the difficulty to be in the B plus filtering but this has been thoroughly tested, even to the extent of substituting new filters. I have tried lead dress at the audio amplifier grid circuit fearing that the hum was being picked up in the audio amplifier but this didn't remove the trouble.

Is there anything that you can suggest.

S. D.
Chicago, Ill.

The Philco RF84 chassis uses an electromagnetic speaker. Attached to this speaker is a hum bucking potentiometer which is used to adjust the amount of hum cancelling voltage that is applied in series with the voice coil. As with electrodynamic speakers a small amount of hum may be induced into the voice coil due to the strong magnetic fields associated with the B plus filtering in the field winding on the speaker. A hum bucking winding is provided in this case which picks up a small amount of hum voltage. Since this winding is wound in the opposite direction to the voice coil the induced voltage is of opposite polarity to that which is induced in the voice coil. The

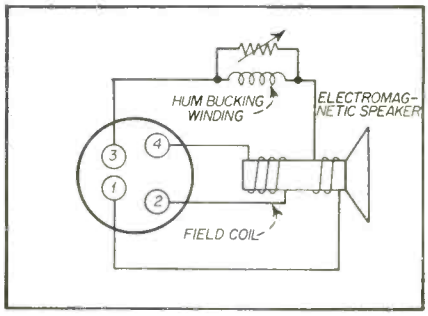


Fig. 2—Philco humbucking coil.

potentiometer across the coil as can be observed in *Fig. 2* provides a means of adjusting the cancelling hum bucking voltage so that it will cancel that picked up in the voice coil.

Naturally, the first point to examine in a case such as yours is the hum bucking control. This provides a means of adjusting the hum out of the speaker when no audio is present.

If there should be doubt as to the point of origin of the hum, the leads feeding the voice coil of the speaker can be disconnected and coupled to a test speaker of a permanent magnet type. With this arrangement the hum should not be present if it is due to the above cause.

If the hum bucking coil is inadequate to remove all hum one solution would be to substitute a choke for the speaker field and to mount a permanent magnet speaker in the cabinet. Of course this necessitates the purchase of an additional speaker. A better solution, at least a more economical one, is to add additional turns to the hum bucking winding. On the speaker used for the Philco RF84 chassis the hum bucking winding is accessible and this is easily done. Five extra turns of #24 enamel coated wire should surfice.

The addition of a hum bucking winding and a control is sometimes desirable in similar cases of hum in other receivers using electromagnetic speakers.

Dear Sir:

I have a Crosley "Super-V" chassis 426 which exhibits a loss in raster size

both horizontal and vertical. This would be typical of defective selenium rectifiers, I know, but I have tried replacements and it did not correct the condition.

This chassis does not employ a width control and I am not able to obtain enough width to cover the picture tube by changing tubes. If I could obtain about an inch or a little more on the width and height the picture tube would be filled.

All usual checks have been made such as tubes, etc. The only significant symptom I find is that the boost voltage is somewhat low. The flyback transformer does not appear to be defective and tests OK.

Do you have any ideas as to what might be the answer to my problem or how I might get an increase in width and height?

S. H.
Miami, Fla.

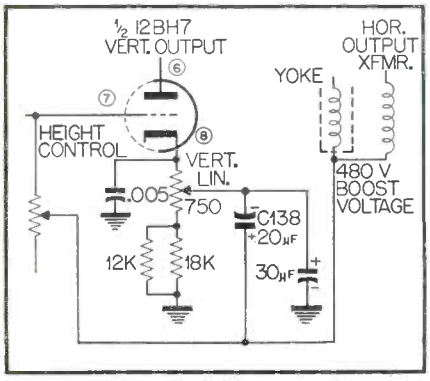


Fig. 3—Partial schematic of Crosley "Super-V" chassis.

The loss in boost voltage is *very* significant in problems of this nature. It is the source voltage for the vertical output stage, being fed to the vertical deflection coils and vertical output transformer. The boost charging condenser is *C138*, 20 *μf*, as shown in *Fig.* 3, is most likely defective. This electrolytic condenser should be checked for both leakage and capacitance value or a new electrolytic substituted for it.

Dear Mr. Answerman:

I have the following problem on a Philco RF-81, deflection chassis H1. When I increase the contrast the picture becomes smeared and seems to lose some of its high frequency detail. The only other bit of information I can offer is that the brightness control does not seem to have sufficient control over the picture tube in that I'm not able to cut off the picture tube completely.

Everything seems to check normal in the brightness, contrast and video amplifier circuits. I suspected the picture tube and substituted another one for it.

[*Continued on page 60*]

trade

The Radio-Electronics-Television Manufacturers Association recently endorsed a proposal to permit the operation of "translator" television stations in conjunction with primary TV transmitters as a means of bringing television to many of the isolated communities not now adequately served by either existing or contemplated TV stations.

Looking toward the successful observance of "National Radio Week," May 13-19, extensive preparations for the all-industry event have been completed. Under the guidance of the Public Relations and Advertising Committee, headed by Julius Haber, of the Radio Corp. of America, RETMA announced that the slogan for this year's nationwide campaign will be "Give a Radio" and will be actively promoted by the nation's local radio dealers, radio stations, national and regional radio networks and community leaders.

Westinghouse Electric Corporation and the International Union of Electrical Workers AFL-CIO on March 20 agreed on new five-year contract terms, with annual wage increases and provision for time studies of day-work operations. The agreement ends the 156-day strike which IUE had called on Oct. 16, 1955.

Effective April 1, 1956, Sylvania will change its warranty policy covering receiving tubes. Harold H. Rainier, manager, distributor sales department, Electronic Product Sales, Sylvania Electric Products Inc., has announced that at that time the company will adopt a tube-for-tube replacement warranty procedure on all receiving tubes sold by Sylvania distributors. Sylvania brand receiving tubes for renewal use are warranted against defects in workmanship, materials, and construction for a length of time to be determined by the code dates on the tubes. Mr. Rainier said that when the new policy becomes effective, distributors are to return defective tubes to their serving warehouse locations. Renewal returns should be made to Sylvania, Return Tube Section, Emporium, Pennsylvania for the East; Sylvania Return Tube Section, 2001 North Cornell Avenue, Melrose Park, Illinois for the Mid-West; and Sylvania, Return Tube Section, 2936 East 46th Street, Los Angeles, California for the Pacific Region. He said that this new policy represents a further effort on behalf of Sylvania to demonstrate its willingness to stand 100% behind its products.

International Rectifier Corporation offers a $25 U. S. Defense bond for any feature article accepted by the editorial department of TIPS, the periodical published by I.R.C. Also offered are four TV replacement rectifiers worth about $10 for any useable service hint accepted by TIPS. Mail your contributions to TIPS, c/o International Rectifier Corporation, El Segundo, California.

A serviceman who sprays colored Krylon over the ion trap and neck or a picture tube marks the spot where the ion trap should be positioned. When the ion trap is taken off and then put on again or, has been shifted by accident, its

flashes

position is clearly shown to the serviceman, thus saving him time in readjusting.

A twenty-five per cent increase in replacement sales of Du Mont television picture tubes in the Southwest during the past year is reported by Edwin B. Hinck, manager of replacement sales, Cathode-Ray Tube Division of Allen B. Du Mont Laboratories, Inc.

"An average of almost 7 million television receivers each year has been sold to the public since 1950," Mr. Hinck pointed out, "which means that every month another half million receivers pass their fifth anniversaries. It looks to me as though there will be a fairly steady replacement demand for television picture tubes at a volume around 10 million tubes a year.

"Because the replacement cost of a picture tube represents a substantial outlay of money, it is important that consumers and TV servicemen insist upon top brand replacements. As much care should be shown in specifying a replacement picture tube as was originally shown in purchasing the receiver," Mr. Hinck stated.

A nation-wide television and radio tune-up program to provide new customer contacts for service dealers who sell General Electric tubes, has been announced by John T. Thompson, manager of distributor sales for the Company's Tube Department.

Mr. Thompson urged service dealers to "get the lion's share" of the service business by promoting local tune-up programs in conjunction with the national plan. The tune-up plan, a part of the G-E Tube Department's five-ring "Circus of Values" sales program, will be introduced to the public in a series of large G-E color ads appearing in LIFE, LOOK, COLLIER'S, TV GUIDE, and THIS WEEK.

Royal Little, Chairman of the Board of Textron American, Inc., and Stanley B. Valiulis, President of General Cement Mfg. Company, of Rockford, Illinois announced that an agreement had been reached whereby Textron American will acquire all of the outstanding stock of General Cement Mfg. Co., subject to certain terms and conditions to be closed March 31, 1956.

The puchase of General Cement Mfg. Co. represents another step forward in the program of planned diversification in unrelated industries by Textron. With the addition of General Cement Mfg. Co., Textron now has nine (9) companies operating in non-textile fields that are completely different, six (6) having been acquired since merger last February.

A newly-designed portable television receiver—only slightly larger than a table model radio—soon will be placed on the market by the Radio Corporation of America, it was announced by C. P. Baxter, Vice-President and General Manager, RCA VICTOR Television Division.

"Production is now under way following more than a year of intensive development and design," Mr. Baxter stated.

[*Continued on page 51*]

PICKUPS

[from page 43]

and a suitable amplifier with a 47,000 ohm input resistance. Notice that 6 switch positions are provided. Each position provides a different playback characteristic to accommodate different recording characteristics or other special conditions. Position #4 has the playback characteristic we have discussed above and is used for modern American recordings. Other positions equalize for European 78's, London FFRR 33's and old LP's, and Capitol recordings and domestic 78's made before 1953. Another position removes most of the scratch and hiss usually found on old noisy records.

Needle Force

Needle force is one of the important factors in record wear. As a general rule, the smaller the needle force, the less the record wear. Reducing the needle force below the recommended value however can cause lateral "chatter" of the needle in the groove which will cause even greater record wear. Too small a needle force can also cause skipping of the needle across the space between grooves which is also damaging to the record.

Most variable reluctance cartridges have a recommended needle force of 6 to 8 grams. The force used is dependent to a certain extent on the type of tone arm or changer mechanism used.

Servicing Procedures

One of the tools which should be a part of every serviceman's kit is a needle force gauge. *Fig.* 7 shows two of several commercial types available. In view of the relationship between needle force and record wear, the importance of this device can be easily seen.

There is a tendency for dust, dirt, and lint to accumulate between the pole pieces and stylus-shank. The cartridge should always be examined with this in mind, and cleaned with a small camel hair brush. Some servicemen slip a piece of scotch tape between the stylus and the pole pieces to pick up the dust and lint. Occasionally, because of mishandling, the shank may become bent and rub against one of the pole pieces, causing distortion. When this occurs, it can usually be bent back to the central position.

There is always the possibility of an open coil in the cartridge. The resistance of these coils varies from one manufacturer's type to another. Some typical values are 340 ohms for the General Electric Cartridge, 800 ohms for the Pickering 200 series, 1500 ohms for the Recoton-Goldring Model 500, and 1800 ohms for the Clarkstan Model 204. An open coil is easily detected of course. A high resistance open may be judged by comparison of the measured resistance with the manufacturer's rated resistance. It must be remembered that if the pickup is connected to the amplifier, the input resistance of the amplifier is in parallel with the pickup. It is usually a simple matter to disconnect the cartridge from the amplifier by removing the phono plug from the amplifier. An open may sometimes be repaired if it is in the external portions of the cartridge. An internal open requires replacement of the cartridge.

As with the crystal pickup, a quick check on whether the pickup or the amplifier is responsible for weak or no output is the "finger" test. As described previously, if the input terminal of the amplifier is touched with the finger, a loud 60 cycle buzz should be heard. If this buzz is heard with normal loudness, the trouble lies in the pickup assembly. If not, the trouble is in the amplifier.

MOVING COIL PICK-UP

Fig. 8 represents a pickup of the

[Continued on page 52]

"The instrument, which operates on standard electric current, features a completely new RCA-engineered chassis, specially designed components, and a newly-developed RCA 'Deep Image' 90-degree picture tube having an outside diagonal measurement of 8½ inches."

General Dry Batteries, Inc., which for more than 36 years has manufactured private label batteries for leading producers of radios and other electronic equipment, announces that it has gone all out to win a similar position in the battery replacement market. The Cleveland, Ohio, firm took the first step in this direction during January and February, when it appointed manufacturers representatives and set up a network of warehouses across the nation. Now it is running a "Spring Promotion" on radio batteries. Plans for this promotion were outlined recently at regional meetings which the company held with its manufacturers representatives.

National Radio Week has been designated as May 13 to 19 in a joint announcement by the National Association of Radio and Television Broadcasters, the Radio Advertising Bureau, the Radio-Electronics-Television Manufacturers Association, and the National Appliance and Radio-TV Dealers Association. The purpose of the week will be to mark the advances made by radio as an educational, entertainment and advertising force.

At COLOR TV SCHOOL—Jack Luzi, of Elgin TV Service, 968 East 105th Street, Cleveland, Ohio, is shown at right above as he received special instruction from Kenneth Kleidon, color TV training director, at Raytheon's color TV school held in Chicago last week. Luzi learned of the

newest developments in color television and received special instructions in Raytheon's new 12-inch color receivers. School is held for servicemen once a month by Raytheon's television and radio operations in Chicago. Luzi resides at 9423 Elizabeth Avenue in Cleveland.

Sprague Products Company has made available to service-dealers, through their local parts distributors, large window-sized blow-ups of its recent, widely acclaimed advertisement entitled "Sprague Salutes the Independent Service Dealer."

The 2-color ad, containing no Sprague advertising, was written to promote the well-deserved patronage, respect, and confidence from the community served by the neighborhood independent service dealer.

Posters may be obtained from all Sprague distributors, or by letterhead request to Sprague Products Company, North Adams, Mass., for Posters RP-15.

PICKUPS

[from page 50]

moving coil variety. The principle involved is a familiar one. A small coil is mechanically connected to the stylus. Under the influence of the stylus, the coil is made to move in the field of a permanent magnet. As the turns of the coil cut the lines of magnetic flux, a voltage is induced. The variations of voltage will correspond of course to the

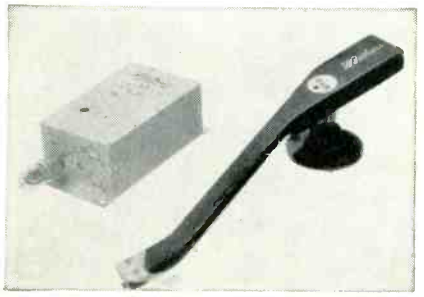


Fig. 9—Weathers FM pickup.

motion of the stylus in following the groove.

This moving coil or "dynamic" pickup, by the nature of its construction is a low impedance device. For this reason, a matching transformer is used between its output and the input to the amplifier.

The frequency response is uniform for a range of from about 30 *cps* to 17,000 *cps* with a gradual roll off to 20,000 *cps*.

The output at the matching transformer secondary is of the same order as that of the variable reluctance type of pickup. The unit pictured in *Fig. 8*, for example, delivers about 5 millivolts.

The recommended needle force for ordinary usage is between 6 and 8 grams. Equalization requirements are similar to those of variable reluctance pickups.

It is important to note that even

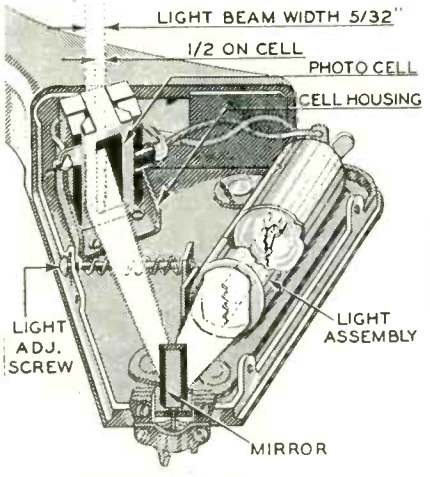


Fig. 10—Philco "Beam of Light" pickup details.

Subscription Price Increase

Effective May 1, 1956 the subscription price of SERVICE DEALER will be $3.00 per year (12 issues) and $5.00 for 2 years (24 issues) for subscribers in the U.S.A., U.S. Possessions, Canada & Mexico.

(Elsewhere the price will be $4.00 for 1 year, $7.00 for 2 years).

See pages 58-59 of this issue for complete details regarding the magazine's NAME CHANGE, NEW FORMAT and BROADENED EDITORIAL SCOPE which will become effective starting with our May 1956 issue.

ALSO NOTE THAT THIS MAGAZINE'S TITLE WILL BE CHANGED

← this title becomes this →

Subscribers May Extend Their Current Subscriptions For 1 Year Only For $1.00 and New Subscribers May Enter 1 Year Subscription Orders for $1.00 if Order is Sent in Prior to May 1, 1956

This $1.00 for a 1 year subscription offer expires May 1, 1956 and will NOT be honored after that date.

SERVICE DEALER and ELECTRONIC SERVICING — (FORMERLY RADIO-TV SERVICE DEALER)
67 W. 44 St., New York 36, N.Y. ☐ NEW ☐ RENEWAL

Gentlemen: Here is $1.00 for which enter my 1 year subscription. (All information detailed below must be given)

Name .....

Address .....

City .....

Zone ..... State .....

Name of firm ..... ☐ Owner ..... ☐ Employee .....

Firm's business address .....

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

Your Position or Title .....

Check whether firm is: ☐ Radio-TV Service Organization or ☐ Dealer having Service Dept. or ☐ Electronic Service Firm.

If some other type of company describe: .....

IF STUDENT, Name of School .....

though the matching transformer may be well shielded, care should be exercised in its placement. Hum pickup many result if it is placed too close to the turntable motor or to a power transformer.

THE WEATHERS FM PICKUP

In 1951 a new type of pickup made its appearance in the high fidelity field. This was the FM pickup manufactured by Weathers Industries. In principle, the cartridge contains a variable capacitive element, which forms part of the tuned circuit of an oscillator. Motion of the stylus varies the spacing between the conductors of the capacitor thus varying its capacitance. An *fm* signal is thus developed, which is then demodulated to provide the audio signal. *Fig.* 9 shows the tone arm and oscillator unit.

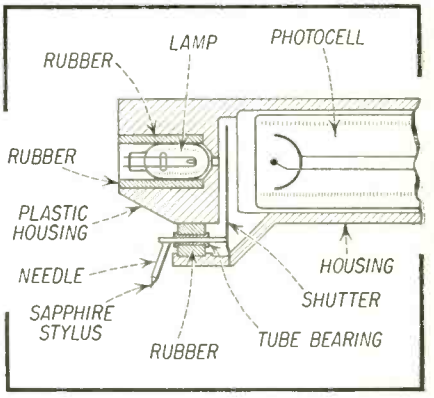


Fig. 11—Cross section of Videotone photo electric pickup. Various parts of this pickup are appropriately indicated.

One of the most unusual features of this pickup is that it operates with a stylus force of from only one to two grams. The manufacturer claims that record wear is negligible as a result of this very low stylus force, and of the low moving mass. A sapphire stylus at this pressure, it is claimed, will last longer than a diamond at 6 gms. The estimated life of a diamond stylus with normal usage is in excess of five years.

The oscillator operates at a mean frequency of 20.7*mc*. Its placement is not critical since it is immune to interference at power line frequencies. The cartridge itself is not sensitive to hum pickup.

The frequency response of the unit is substantially flat over the entire audio range. The company makes its own preamplifier which provides the necessary equalization. Provision is also made for using the unit with other amplifiers.

The voltage output is about 3 volts *rms* with the preamplifier and .8 volts *rms* without it. The recommended terminating output impedance is 100,000 ohms.

PHOTO ELECTRIC PICKUPS

A number of years ago Philco introduced its "Beam of Light" pickup. The basic construction of this pickup is pictured in *Fig. 10*. In operation, a very light mirror, mechanically connected to the stylus reflects the light from a small lamp to a photocell. The motion of the mirror under the influence of the stylus varies the amount of light falling on the photocell. This causes a variation in the voltage at the output of the photocell. The varying output voltage serves as the audio signal voltage, and as such is fed to amplifier input.

This "Beam of Light" pickup is more of historical than of practical interest, since it is no longer used by Philco.

A photoelectric pickup of different design but operating on the same basic principle is being worked on at the present time by Electron-Radar Products. It goes under the trade name of the "Videotone Phonograph Pickup Cartridge" and its construction is shown in *Fig. 11*. Its manufacturer claims certain important advantages such as extremely small moving mass, wide range frequency response, low needle force, and high output.

The specific characteristics are not yet available. Time alone will tell whether or not this pickup will become one of the leading contenders.

Dual Play Cartridges

Many cartridges are designed for "dual-play" operation. This simply refers to the fact that a convenient mechanical means is provided whereby either a one mil or a three mil needle may be used with the pickup unit. The one mil needle is used for 45 and 33-1/3 r.p.m. recordings, while the three mil needle is employed for 78's. In some cases, the change is accomplished by turning the cartridge over to expose the other stylus. These are called "turnover" cartridges. In other cases, the cartridge remains in the same position, and the needle carrying assembly turns to bring one or the other needle into the correct playing position.

HORIZONTAL OSCILLATORS

[*from page 26*]

unlikely that the alignment would be a factor since there would be no sudden change in *if* alignment or tuner tracking. The *age* system, however, may be at fault and this should be checked.

If proper sync amplitude arrives at the horizontal system and a check of tubes and component parts, including voltages, fails to disclose the defect which is causing sync trouble, the drive control and the horizontal output system

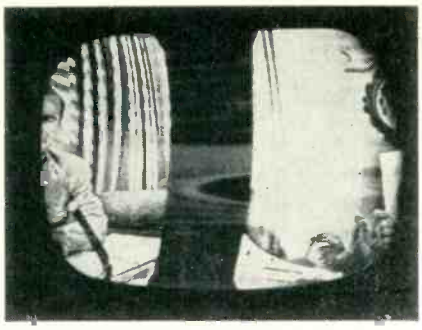


Fig. 6—This figure illustrates phase misadjustment of the A.F.C.

should be thoroughly rechecked.

Excessive drive not only overloads the horizontal output tube but also places an undue drain on the discharge circuit of the horizontal oscillator. The oscillator may be able to furnish the excessive power when the tube and the components are new, but in the aging process the continual overload may cause a breakdown of the component parts or weaken the tube's emission and cause sync instability. The drive control should be adjusted right below the point where left hand stretch and/or center compression occurs. Sometimes overdrive is also indicated by a white vertical line at the left hand center of the screen. With overdrive, the damper tube has difficulty in eliminating the transient oscillations because pulse amplitudes are excessive.

While loss of raster, but presence of sound, indicates loss of high voltage, an inspection of the high voltage and horizontal output system often fails to disclose any troubles. It must be remembered in such instances, that failure of the horizontal oscillator will also cause loss of high voltage because it removes the necessary drive signal from the horizontal output tube. An oscilloscope can be used as a simple means for ascertaining whether or not the oscillator is producing the necessary drive signal. If the drive signal appears at the grid of the horizontal output tube then the trouble must lie in the circuits which follow. Absence of the drive signal will then localize the trouble to the horizontal oscillator and discharge circuit.

Poor picture linearity which cannot be corrected by adjustment of the linearity control may be caused by defective components in the wave shaping circuit. When this occurs, the ohmic value of the discharge resistor should be checked against the value specified in the circuit schematic and the capacitor should be checked with a capacitor checker to make sure it is of proper capacity and is not leaky. One side of the capacitor should be disconnected from the circuit so that an accurate

Fig. 7—This figure illustrates low sync amplitude.

reading can be obtained. While this is being done, a check should also be made of the coupling capacitor between the oscillator and the grid of the horizontal output stage. A leaky coupling capacitor will cause *dc* leakage to the grid of the horizontal output tube which reduces the bias and causes excessive currents. This also imposes an additional drain on the horizontal oscillator with resultant reduction or loss of output or poor synchronization and linearity. The cathode resistor of the horizontal output tube, as well as the screen dropping resistor and screen bypass should also be checked because defective or off-value parts will cause poor performance in the horizontal output stage and consequent loading on the oscillator.

If trouble in the horizontal output stage resulted in a blown fuse or a burned out cathode resistor, the replacement specified by the service notes should be utilized. In some receivers the cathode resistor wattage is predetermined at a certain level so that this resistor will burn out during overloads. Replacement with a larger wattage resistor in order to minimize burn-outs is not recommended. The same holds true with respect to the fuse. If either item burns out repeatedly, a thorough check should be made of tubes and circuit components to reduce the excessive currents which cause repeated fuse or resistor failures. The grid leak (*R40* in *Fig. 5*) or the parasitic suppressing resistor *R-52* in series with the coupling capacitor and the grid, do not usually cause trouble since they handle only small currents. Components which rarely give trouble, however, should not be overlooked in routine servicing procedures. Many a service man has spent futile hours checking parts which are "likely" to go bad while a little extra time spent in checking the parts which *rarely* go bad could save considerable time and effort.

WORKBENCH

[*from page 45*]

Modulation of the *if* signal frequency affects the phase displacement between the half cycle electron stream and the voltage produced on the quadrature grid causing corresponding variations in the length of anode current pulses. *C40*, capacitor 680 $\mu\mu f$ acts as the *if* bypass. Thus the voltage drop across the load resistor *R42*, 330K which is *dc*, is a direct function of the original modulation.

The sound limiter is a 6AU6. The low plate and screen voltages with the added grid leak action of *C35* and *R6* causes clipping of the negative half of the incoming signal.

With these facts in mind, voltage checks were taken at the plate, pin #7, and screen, pin #5, of the 6BN6. These voltages checked approximately correct. The plate and screen voltages of the 6AU6 limiter tube, also checked correctly. Next the slug adjustment of *L23*, the quadrature coil, was examined. It appeared to function normally. Coil *L22* was aslo examined and found to be OK. Potentiometer *R39* was then resistance checked. It measured 150 ohms instead of 600 ohms. It was therefore replaced with a new 600 ohm pot.

Components *L23*, *L22*, and *R39* were then adjusted for maximum undistorted sound at the zero buzz point. The receiver now functioned normally.

[*Continued on page 60*]

We Proudly Announce

No longer will all the servicemen's magazines be alike and undistinguishable. One will be truly outstanding and inimitable — bigger, better — more valuable. It It will open vast new vistas in electronic and television servicing.

For the past 16 years SERVICE DEALER has been published as a "standard size" magazine with text pages 7 inches wide by 10 inches deep. Henceforth, starting with our May 1956 issue, SERVICE DEALER will change over to the most modern and successful format called "King Size." The over-all size will be almost square—11¼" by 11⅛"—while text pages will be 10 inches wide by 10 inches deep. Thus every text page will be 33⅓% larger than heretofore . . . and of equal importance . . . future issues will be almost 40% greater in content and volume.

- This is the type size and column width now used in our text section.
- This is the type size and column width that will be used in our text section hereafter.

Our Title Will Change Too

Effective in May our magazine's name will be changed from RADIO-TV SERVICE DEALER to the more appropriate title SERVICE DEALER and ELECTRONIC SERVICING.

- *Why are we making such a drastic and expensive format change?*
- *Why are we changing the magazine's name after 16 successful years?*
- *Why are we broadening our editorial scope into electronic servicing?*

The Answers are: *You Asked Us To Do It*

Thousands of radio-TV servicemen in every section of the country told us that although SERVICE DEALER is fine now it can be made into a vastly more worthwhile working-tool—and these servicemen spoke out freely in guiding us as to their needs and preferences.

Servicemen want to save time as it is one of their prime assets. Servicemen want larger and more clearly printed schematics. They want the text material referring to these diagrams to be adjacent to them, and not back several pages. They do *not* want to flip page after page, and they don't want to have to prop up their copies and break the spine of their magazines so they can get them to lie flat on the bench while referring to them. In a "standard size" magazine these evils cannot be avoided but a "King Size" format easily allows the granting of the readers' preferences. (You'll see, the "King Size" is modern and makes the "standard size" quite obsolete.)

BROADENED EDITORIAL SCOPE

Recent contacts with servicemen everywhere have brought to light their desire to broaden the scope of their activities so they can earn more money on a stabilized month-by-month basis in contrast to their present "peak and valley" predicament. Radio and Television Servicing is big business—and this year alone radio-TV servicemen will buy over $1 billion worth of replacement tubes, components, accessories, test equipment, etc.

But the insurmountable problem facing all men engaged *solely* in servicing radios and television sets is the unpredictability and unseasonability factor. In parts of this country inclement weather prevents servicemen from installing outdoor TV antennas for 3 to 5 months at a stretch. In summertime masses of TV set owners leave big cities, head for mountain or seashore resorts, and kerploop, another 30-day void in service jobs occurs. Auto radio servicing, battery-operated radio set servicing —these and other facets, such as P.A. rentals, are seasonal problems that cannot be overcome by servicemen UNLESS they broaden the scope of their activities. The plea of thousands of servicemen who have asked us to show them the way to stabilize their income by opening *new service vistas* is now being answered by SERVICE DEALER and ELECTRONIC SERVICING. That's a promise!

The Electronic Servicing Field

What is electronic servicing? Whereas the radio and TV servicing field is simple to define, the electronics servicing field is so vast and all-encompassing that volumes would be required to cover it . . . and in fact it is growing so fast and is so embryonic that a market analysis made today would be obsolete within a short time. However, to define the electronics servicing field somewhat, let's start with a logical approach which touches on the abilities of men now doing ordinary radio and TV servicing and who want to expand their endeavors.

Ship-to-shore radio communications sales and servicing is typical. Upwards of 3.5 million cruiser-type pleasure boats are now afloat and within 5 years, according to experts, over 3 million such craft will have ship-to-shore radio communications equipment aboard. Many of these boats will also carry radio direction finders, depth determining devices, radar, gas detectors and automatic compasses. Each of these relatively simple electronic equipments will require servicing and it is a very profitable type of business for those qualified to handle it.

Industry of every type today uses a vast number of electronic devices such as Computers, Calculators, Checkers, Counters, Regulators, Weighers, Sorters, etc.

A Dramatic Format Change

Upwards of 700 different manufacturing firms produce thousands of different types of industrial electronic devices ranging from simple photo-cell actuated automatic door openers to electronic microscopes to ultrasonic dental drills. That firms engaged in aviation and military production use many electronic devices is an understatement. All these electronic devices constantly require preventive maintenance and periodic service. Much of this servicing today is done by rote by the manufacturer's field servicemen but it is opening up more and more to qualified independent service contractors. **Taxi, trucking, police,** aviation, railroad and similar industrial users of 2-way radio communications find that much of their equipment is idle frequently because of the dearth of servicemen qualified to repair it.

Stated another way, the industrial electronic and commercial communications equipment servicing business is here, there and everywhere NOW . . . and servicemen are needed to handle that business, as well as radio-TV servicing. The truth is that industrial electronic servicing volume equals or exceeds radio-TV servicing dollarwise right now, and although the method of handling it differs from the competitive tactics used by radio-TV servicemen, that group is the logical one to expand its field of operations. SERVICE DEALER and ELECTRONIC SERVICING will show the way!

Think of the Hi-Fi and P.A. fields! $100 million worth of Hi-Fi and $250 million worth of P.A. and sound distribution equipments are presently in use. The applications range from juke boxes to outdoor theaters, to home Hi-Fi installations to P.A. and music-playing installations in factories. All these installations require servicing. Who is getting that business now? In the main it is attended to by jobbers, manufacturer-owned distributors' service departments or the manufacturers themselves. But independent service firms and servicemen can and will get more and more of this type of service business. We'll show how!

Radio-TV PLUS Electronics

SERVICE DEALER and ELECTRONIC SERVICING in its new format will publish more material than heretofore on the basic subjects of radio and television servicing, Color TV, the use of test instruments, etc., and in addition, with more text pages available *will also* cover the vast vista of servicing Hi-Fi, P.A., Commercial Communications and Industrial Electronics devices of every category. We will double or treble the present-day radio-TV serviceman's scope of endeavor.

New Features Added To Old

In its new format SERVICE DEALER and ELECTRONIC SERVICING will retain all the time-tested and proven-successful feature departments such as Answer Man, VSSS, Complete Mfgr's TV Schematics, etc. And several new features will be added. The Buyer's Guide is typical. Here the products of tube, components, instruments and accessories manufacturers who advertise regularly in our columns will be published under indexed and cross-indexed headings regardless of whether or not they happen to be advertising in that particular issue. Because these advertisers cater to the needs of servicemen, are reliable, and their products are fully warranted, servicemen will naturally prefer to specify and buy their brands.

In addition there will be an expanded, simple to use, Reader's Service Department. Using it, the newest literature, catalogs, specification sheets and new product releases of manufacturers can be obtained directly from them or their representatives by our servicemen subscribers. It will frequently get for servicemen the latest data on new lines, etc., even before the Mfgr's catalogs are available through local distributors.

Big Page Size—Concentrated Reading

A time-study shows that a page of text in a "standard size" magazine is read by the average serviceman in 8 to 9 minutes. In contrast, "King Size" text pages, with larger and more readable type will afford 13 to 15 uninterrupted reading. In addition, a "King Size" page permits advertising to appear on it without detracting from the text—in fact—such advertising can be much more effective alongside of text instead of being "bunched together" thus losing its identity, as is common practice in the obsolete "standard size" magazine. Yes, the new format of SERVICE DEALER and ELECTRONIC SERVICING gives you a flat-lying magazine that eliminates frequent flip-flop of pages and lost reading continuity.

SUMMARY

The May 1956 issue of SERVICE DEALER and ELECTRONIC SERVICING begins our 17th year of endeavor on behalf of the nation's radio-TV-electronic servicing fraternity. Nearly 20,000 *more* professional servicemen read our magazine monthly than any other serviceman's publication. And now we open a new era with exactly the type of technical magazine that is most wanted and which will be more valuable to all segments of the industry—from the servicemen handling all types of electronic devices, from a battery portable to a hearing aid to television to industrial electronic devices or commercial communications equipment to the Mfg'r and supplier of the serviceman's needs.

THE NEW TITLE WILL BE

SERVICE DEALER
and ELECTRONIC SERVICING

COWAN PUBLISHING CORP.
67 W. 44th Street New York 36, N. Y.

Also publishers of
"CQ—The Radio Amateurs' Journal"

WORKBENCH

[from page 57]

The 6BN6 was replaced as a positive precaution because of the possibility that the defective R39 was caused by an intermittently defective 6BN6.

ANSWERMAN

[from page 47]

The picture tube was good. Also, all peaking coils and condensers in the video amplifier stage have been checked.

J. C.
Salt Lake City, Utah

The difficulty in this Philco RF-81, H1 chassis is most likely caused by a failure of the *dc* blocking condenser in the vertical retrace circuit. In *Fig. 4*, if

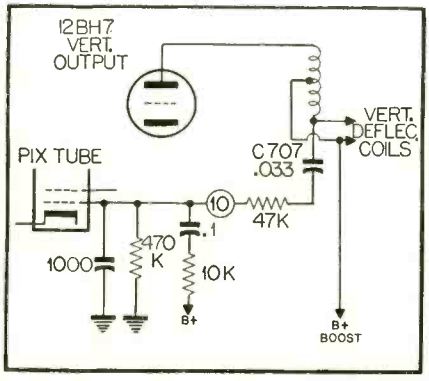


Fig. 4—Partial schematic of Philco RF81, HI chassis.

the condenser *C707*, .033 *μf*, should short, that end of the 47K resistor is placed at B plus. Since the picture tube grid now has much more positive voltage being applied to it, the control of brightness will not be correct.

Failures in the retrace elimination circuit have not been frequent but when they do occur they are most difficult to locate since they are not generally suspected and usually introduce troubles common to other circuits, such as the video amplifier or *if* stages.

COLOR

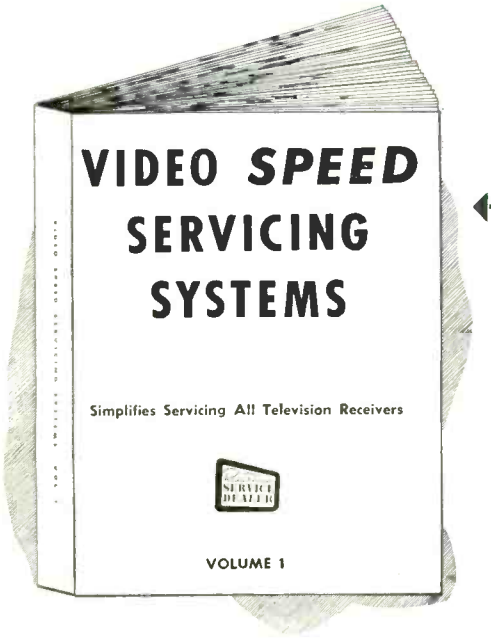
[from page 23]

pletely isolated from the oscillator function of the tube.

A crystal controlled electron-coupled oscillator of somewhat different form is shown in *Fig. 4*. Here we observe that the crystal is returned to screen grid, and that the output circuit comprising L_2, L_3, and C_2 is shunt-fed to

[Continued on page 62]

By popular demand, the serviceman's most-wanted book, Video *speed* Service Systems Vol. 1. is now also available in a low cost PAPER BOUND COVER EDITION



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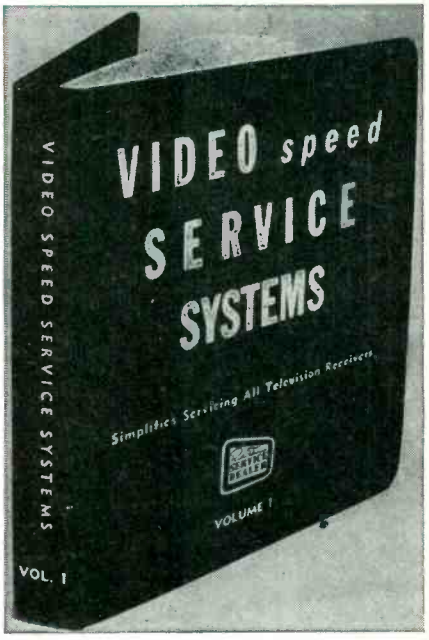

Facts About Video *speed* Service Systems:

CONTENTS:

A compilation of specific receiver service repairs, "bugs", chronic troubles, field circuit changes, manufacturers' production revisions, etc. The compilation enables the service technician to pin-point what is wrong with any given TV set and to correct the fault in the shortest possible time.

SOURCES:

The material was obtained directly from manufacturers, distributors' service departments, TV service organizations, and top TV Service-dealers throughout the country. Furthermore — all material has been checked carefully to assure dependability and accuracy.

USES:

The VSSS data sheet for any particular TVset maker's model or chassis number gives: 1—the *section* of the set affected; 2—the *symptom;* 3—the *cause* of complaint; 4—the *solution,* in simple, understandable and usable form.

Video Speed Service Systems is guaranteed to simplify servicing all TV sets. Contains over 600 service items representing over 2500 of the most serviced TV models now in use. Over 25 different manufacturers' lines are covered. Almost 15,000 copies of VSSS have been sold at $4.95. Every technician needs a copy.

CUT OUT AND MAIL

COWAN PUBLISHING CORP., 67 WEST 44TH STREET, NEW YORK 36, N. Y.

Please send me postpaid Video speed Service Systems Vol. 1 in ☐ Paper Bound Edition for $2.95 . . . or ☐ Hard Cover Ring-Binder Edition for $4.95. My check for $..... is enclosed. (If you reside in New York City add 3% to cover city sales tax.)

Name .....

Address .....

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

COLOR [from page 60]

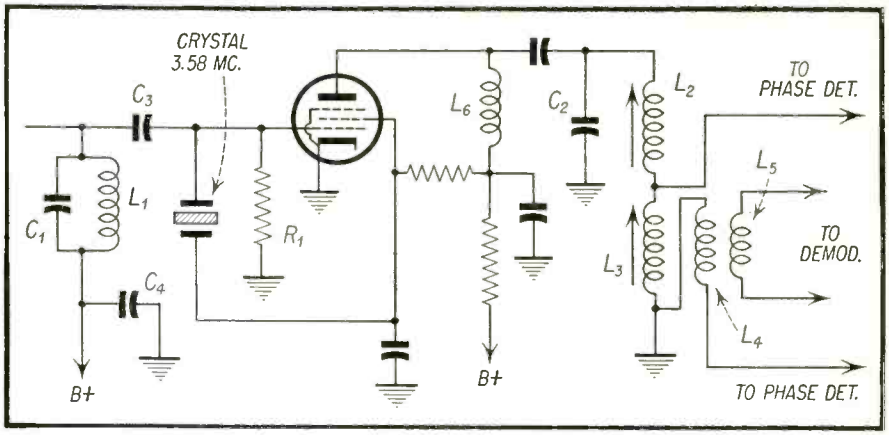

Fig. 4—Simplified electron coupled oscillator using Pierce circuit.

the oscillator tube. Inasmuch as the screen grid acts as the plate, and the crystal is connected between the screen grid and control grid, the circuit is identified as a Pierce oscillator. Further information on this circuit is available in the Literature.

Isolation of the output coil L_2, L_3, permits it to feed the phase detector and demodulator tubes without the need of a buffer or quadrature amplifier tube. In this circuit L_3 and L_4 feed the phase detector a pair of 180° signals, each 90° out of phase with the incoming burst. Coil L_5 provides the signals which eventually feed the color demodulator tubes.

Adjustment of electron-coupled oscillators, as far as the output coil is concerned, consists of adjusting the primary of the output coil for a simple maximum output indication of a VTVM connected at the phase detector. This is in contrast to the Colpitts circuit where the final adjustment is set at a point on the low frequency side of resonance, and the tuned grid tuned plate circuit where the final

adjustment is set at the high frequency side of resonance.

ANTENNAS & ACCESSORIES

[*from page 21*]

creases up to 4.5 db on LO channels, over single bay units. [A-23]

Blonder-Tongue Laboratories, Inc., announces its new Model TM matching transformer.

In many TV installations it is necessary to use 75 ohm coaxial cable, RG-11/U or RG-59/U, in combination with 300 ohm antennas and TV sets. In master TV systems, in bad weather or salt-spray areas, in high interference locations and where ordinary ribbon line might have to go through steel supports, walls or conduit, the use of shielded coaxial cable is advised.

The B-T Labs Model TM Matching Transformer is designed for matching a 75 ohm coax line to a 300 ohm TV set. Connections are easily made with spade-lug leads to 300 ohm terminals, and the jack-plug that is furnished to solder on to the end of the 75 ohm coax line. This plug also provides a quick-disconnect feature.

A precision, weatherproof unit, Model MB, is also available for outdoor antenna matching. This model can demonstrate a 6 db improvement in signal over a direct connection of 75 ohm cable to a standard TV antenna. [A-24]

A completely new deep fringe area antenna, the Super Scanner, is now in production at Tescon TV Products Co., Springfield Gardens, N. Y.

Fig. 38—Two-Set coupler by Anchor Products Co.

Featuring extremely high gain with entirely flat response from Channels 2-13, the Super Scanner is also certified for color with more uniform gain. A new phasing method provides increased performance with equal efficiency on both high and low bands—superior high and low directivity. Furthermore, a new electronic design now eliminates minor lobes from both sides and rear . . . one narrow forward lobe offers extremely sharp directivity. [A-25]

Anchor Products Co. makes available its C-202 two-set TV coupler with a matched impedance of 300 ohms. [A-26]

Advertising Index

FROM DELCO RADIO come the speakers with highest performance. You trust them... so do your customers!

Engineering skills of Delco Radio and General Motors combine to offer a full line of speakers for home and auto radios, phonographs, TV, and Hi-Fi. National advertising behind the Delco Wonder Bar Radio develops a bigger service market for you! For fast service call your UMS-Delco Electronics Parts Distributor.

14 Standard Models: Designed and built to R.E.T.M.A. standards with heavily plated metal parts and Alnico-V magnets. Precision felted cones give uniform response over full operating frequency range. All are fully dustproof and dependable.

Dual-Purpose Hi-Fi Model 8007: A superior speaker for custom-built audio systems and for replacements in AM, FM, TV and phonograph sets. Size 8″, 50 to 12,500 CPS frequency range; Alnico-V magnet; 10-watt power rating; 4.1 v.c. impedance; $1\frac{3}{16}$″ voice coil.

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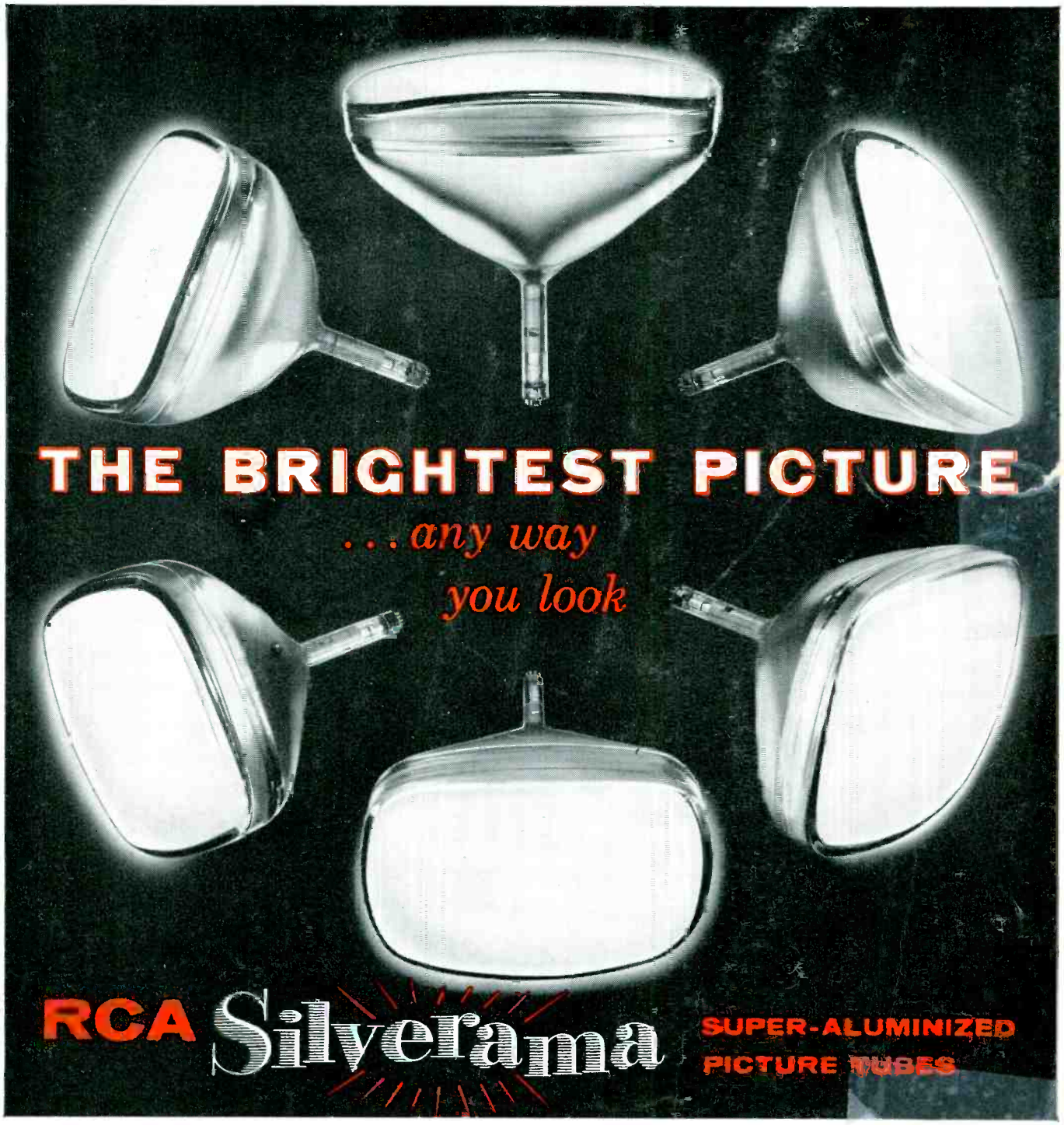

Designed with a super-phosphor that develops greater light—and aluminized by an exclusive "advanced-technique" process that sharpens image contrast, does away with "mottling", increases picture "snap"—RCA SILVERAMA Picture Tubes are setting unparalleled records for superior performance. And RCA is telling this story to your customers across the nation—*through the most dynamic consumer advertising campaign in the history of picture tubes.*

Your RCA Tube Distributor can help you make this far-reaching advertising effort pay off for you NOW—with the most complete selection of sales promotion material ever created to sell picture tubes. Ask him for the facts. Let him show you how 25 types of RCA SILVERAMA Picture Tubes can handle over 110 replacement types for YOU. Be convinced that RCA SILVERAMA makes the brightest picture—any way you look.

PICTURE TUBES

RADIO CORPORATION OF AMERICA
HARRISON, N. J.

Ask your RCA Tube Distributor for your copy of the new RCA Picture Tubes Booklet (Form KB-106).

Nationwide Consumer Advertising

See RCA's hard-hitting consumer ads on SILVERAMA in LIFE, POST, and TV GUIDE. Watch RCA's dramatic commercials on top TV programs like MILTON BERLE, MARTHA RAYE, and NBC Spectaculars.