APRIL, 1954

Radio-Television SERVICE DEALER

TV - AM - FM - SOUND

Includes: "VIDEO SPEED SERVICING" & "TV FIELD SERVICE" Data Sheet Sections

The Professional Radio-TVman's Magazine

Reaching Every Radio TV Service Firm Owner in the U.S.A.

ANTENN-GINEERED BY SNYDER

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INDOOR TV ANTENNA

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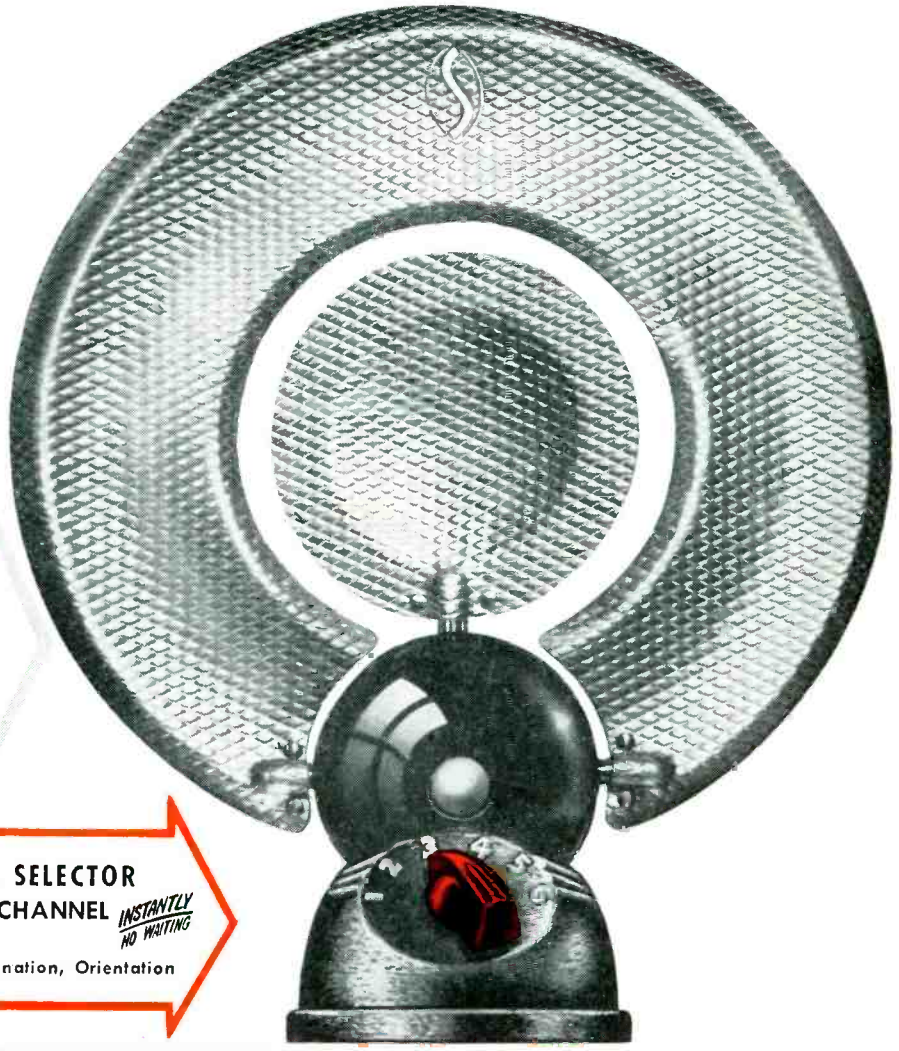
- **VHF/UHF**
- All channels
- Maximum adjustments
- Gold tone, diamond embossed aluminum halo element and phasing disc
- Heavy duty, topl-pruf base



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Independently operated for maximum orientation

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GIVES CLEAREST PIX ON EVERY CHANNEL INSTANTLY NO WAITING
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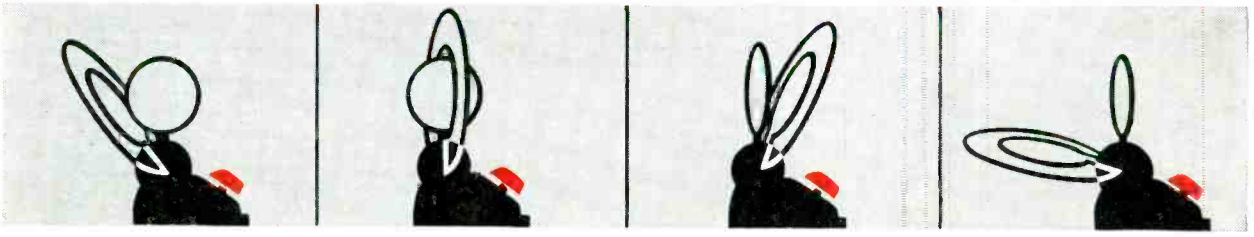


SNYDER

SNYDER MFG. CO., PHILADELPHIA 40, U.S.A. • BELLEVUE TUBE MILL, INC., PHILADELPHIA
SNYDER ANTENN-GINEERS LTD., TORONTO 14, CANADA • WORLD EXPORT: ROBURN AGENCIES, INC., N.Y.

$5,500
IN PRIZES

...easy to win

503
PRIZES!

$2000 - 1st prize

$500 - 2nd prize, $100 - 3rd prize
100 - $10 prizes, 400 - $5 prizes

HOW TO WIN

To win one of these 503 prizes all you have to do is complete in 25 words or less "I like Pyramid capacitors because_____" You fill in this statement on a Pyramid contest entry blank which can be obtained from any electronic parts jobber selling Pyramid capacitors. You have this entry blank countersigned by your jobber or one of his salesmen and forward it to us attached to a Pyramid Dry Electrolytic Capacitor box top —the top being the part which carries the description of the item. There is no limit to the number of entries which you may make in this contest but each entry must be accompanied by a box top. Full rules for the contest appear on the entry blank.

It's so easy. Here is the kind of statement that might win:

"I like Pyramid capacitors because they always check out perfectly and don't deteriorate and so I know I won't have to call back at my expense."

"I like Pyramid capacitors because the line is so complete that I can always get what I need and don't have to worry about an off-brand capacitor."

PYRAMID

PYRAMID FEATURES:

1. Only one quality—the best at no premium. All Pyramid capacitors are made of materials commanded by rigid military specifications.
2. All Pyramid capacitors are non-hygroscopic.
3. Highest quality insulator material used in all production results in low leakage factor.
4. Exclusive non-contamination technique guarantees close tolerances and no deterioration. Peak performances for life.
5. Pyramid capacitors operate unchanged at ambient temperature of 85° centigrade.
6. Designed by service technicians across the country for their requirements.
7. Individually packaged for protection.
8. Permanently legible, high visibility ratings on each item.
9. 100% absolute electronic inspection before shipment.

Pyramid is in its 10th year as a leading manufacturer of high-quality capacitors.

PYRAMID ELECTRIC COMPANY
1445 HUDSON BOULEVARD
NORTH BERGEN, N. J.

Burton browne advertising

MORE DEALERS ARE INSTALLING

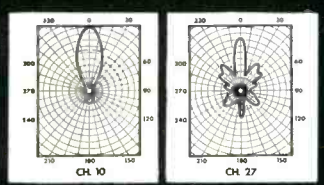
CHANNEL MASTER'S CHAMPION

THAN ANY OTHER ANTENNA IN TELEVISION HISTORY!

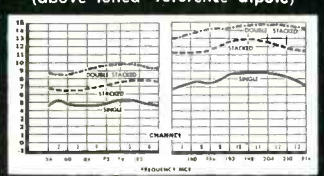
All-channel reception: VHF & UHF

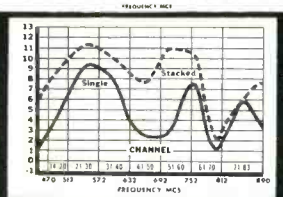
model no. 325-2

HORIZONTAL POLAR PATTERNS
(Relative Voltage)



Gain
(above tuned reference dipole)





ONLY THE CHAMPION enjoys this overwhelming acceptance: over 300,000 already sold!

ONLY THE CHAMPION is powered by the unique "Tri-Pole," the triple-powered dipole system that provides fabulous VHF-UHF fringe area performance. 100% aluminum; rugged, exclusive alloy. Installs in a flash!

ONLY THE CHAMPION gives you this four-star promotion program:

- ★ ***FREE** newspaper ads*
- ★ ***FREE** TV film commercials*
- ★ ***FREE** colorful display material*
- ★ ***FREE** consumer literature*

See your Channel Master distributor for full details.

The antenna America knows best!

Introduced to millions through the editorial pages of their favorite magazines and newspapers, and on TV.

DON'T BE MISLED BY "LOOK-ALIKES" . . .
*THERE'S ONLY ONE **REAL** CHAMPION!*

Model no. 325, Single bay; Model no. 325-4, Four bay; Model no. 325-6, Super Champ

FIRST IN PREASSEMBLED ANTENNAS

CHANNEL MASTER CORP. ELLENVILLE, N. Y.

The World's Largest Manufacturer of Television Antennas

Every Service Firm Owner in the U.S.A. Receives **SERVICE DEALER** *Monthly*

DISTRIBUTION THIS ISSUE OVER 65,000

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

VOL. 15, NO. 4 APRIL, 1954

FEATURE ARTICLES

CIRCUIT & SERVICE FORUM

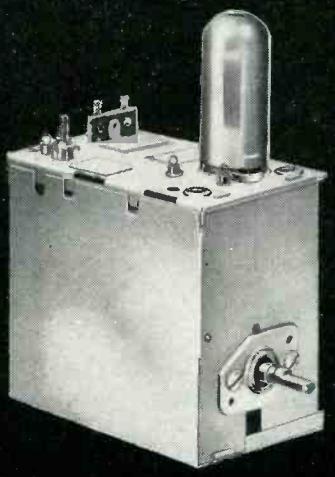
DEPARTMENTS

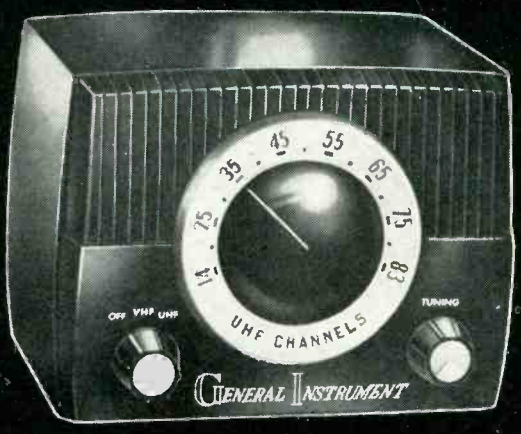
RADIO-TELEVISION SERVICE DEALER is published monthly by Cowan Pub. Corp., 67 West 44th St., New York 36, N. Y. Subscription price: $1 for 2 years in the United States, & U.S. Poss. Elsewhere $1 per year additional. Single Copies 25c. Reentered as second class matter Sept. 25, 1950 at the Post Office at New York, N. Y. under the Act of Mar. 3, 1879.

POSTMASTER: SEND FORM 3579 TO RADIO-TELEVISION SERVICE DEALER, 67 WEST 44th ST., NEW YORK 36, N. Y.

GENERAL INSTRUMENT all channel UHF converter

NOW with the Sensational NEW TUNING ELEMENT





MODEL 66

This improved design has been developed from the UHF tuner built by General Instrument and successfully incorporated in many of the products of leading TV set manufacturers during the past season.

Use of a fundamental frequency oscillator results in vastly improved design for the UHF tuning element—simpler construction—***greatly improved signal to noise ratio!***

FIRST...in side-by-side tests!

Jobbers:—some choice territories still remain open. Write for details.

General Instrument & Appliance
CORPORATION

Subsidiary of GENERAL INSTRUMENT CORPORATION • *829 Newark Avenue • Elizabeth 3, N. J.*

CONTI

EDITORIAL...

by S. R. COWAN
PUBLISHER

PLEASE ANSWER OUR QUESTIONNAIRE PROMPTLY!

EVERY ONE of the 66,000 individuals to whom "Service Dealer" is now sent monthly—44,000 paid and 22,000 free subscribers—has received or soon will receive from our circulation manager a Questionnaire Form Letter. Simple, non-confidential questions are asked, and your prompt cooperation is requested. Frankly, to get your attention and quick response, our form letter starts with what advertising men call a "shock heading" that states: *"This is your plate—we hate to destroy it!"*

It goes without saying, we won't kill a paid-up subscriber's stencil until the subscription actually expires, merely because that reader fails to answer our questionnaire, even though some readers did get that impression. But, as it is for the subscriber's benefit too, and costs him no more than a few seconds' time to respond—we ask for your indulgence . . . send us your filled-in job survey reply at once after you get it.

The survey in question is costing us thousands of dollars. But there are very sound reasons for such an outlay. We are not merely curious or "snoopy" about our readers and the nature of their work. We are *not* trying to pry into our readers' privacy or business secrets. Obviously, a technical publication can render greater service to its readership—plan and publish better text—when it knows beforehand just what kind of problems are paramount, just what kind of work is being done by its readers. Remember — servicing today is simple compared to what it will be in the months ahead.

You all know, by now, that it is the declared policy of this magazine to send a copy every month to the owner or operator of every firm in the U.S.A. that is engaged full time in doing radio-TV and electronics service work. Many firm names on our lists were obtained from reliable sources such as Parts Distributors or Classified Business Directories. In some cases we did not obtain the firm owner's name—in some cases we got the owner's name, but not his firm's name. So, your reply to our Questionnaire will enable us to recheck our mailing lists, eliminate duplications, and make certain we have not inadvertently omitted a firm or person who might otherwise be entitled to receive "Service Dealer."

We assure you all that the information you send us is kept in strict confidence and is verified solely by the certified auditors who periodically examine our files for the auditing bureau which we, and many other leading publications, are members of. Furthermore, every two years hence we will again make such a readership survey and we trust that your cooperation will be forthcoming so that "Service Dealer" can continue to provide you with the type of text most suitable for your job interests.

STARTING OUR 15TH YEAR

THIS ISSUE celebrates "Service Dealer's" 15th year of existence and the 25th consecutive year that I personally have been privileged to be associated with a technical magazine devoted to radio servicemen. I and thousands of my servicemen friends have gotten grey-haired of late. (Some of you got bald instead, but that's only incidental).

The passing years have afforded us all a certain amount of trial and tribulation. Had we softer guts, weaker hearts, less determination, or a keener desire for money alone, most of us would have deserted servicing as a business long ago. Instead most of us look with anticipation at the challenge that lies ahead. No longer are 5-tube superhets or TRF'ers, that can be "sniffed and tapped" for a solution, our big problems. We've almost licked UHF. Soon, in perhaps another year, it will be commonplace for us to ponder which of the 46 tubes, 322 capacitors, 276 resistors or 40-odd potentiometers are "sour" in the average color TV set that will confront us daily.

By the same token, no longer will free installations, free estimates, or 1-buck service fees be the order of the day, especially when color TV arrives. The new complex circuitry of electronic apparatus including television and 2-way communications devices will in due time weed out the non-competents. But even as this is written, the design engineers and manufacturers themselves are stumped by their brain children. They simply cannot yet produce on a mass price basis such things as color TV sets, so, we still have time—a stopgap period in which to keep abreast of them. But I assure you, this magazine will deal with realities rather than fancy, for we have no desire to publish a lot of bunk merely to fill up space. Start saving your money too. Soon, if you want to service color TV sets, you'll need a Dot Generator. These instruments are in the $150.00 price range.

Sylvania Electric Products Inc. has developed a manufacturing process that is said to increase greatly the stability and life of germanium diodes. The process will make possible the use of diodes, which convert an alternating current into a direct one and also are used to detect radio signals, in electronic equipment which require extreme stability.

The process, according to James J. Sutherland, General Manager of Sylvania's Electronics Division, produces germanium with a molecularly stable surface. The rectifying action of a germanium diode is accomplished by a barrier which is formed at the time the diode is made and gives it the desired characteristics. Diodes made in the past have occasionally developed a second barrier on the surface of the germanium. This unwanted barrier is electrically opposed to the original one which results in unstable operation.

Sylvania has also announced it has developed transistors that have complete stability as well as germanium-silicon alloys that will permit transistors to operate effectively at high heat levels.

CBS-Hytron has announced the winners in its nationwide Certified Quality Service contest for radio and television service-dealers.

A Mattapan, Mass., dealer won the top award, a Ford panel truck. He is Martin H. Sable, 29, owner of Mattapan Televisjon, Mattapan, Mass. Other winners were: Second prize of $1,000 in U. S. Savings Bonds—Richard E. Reish of Dick's Sales & Service, Marcellus, Mich. Third prize of $600 in Savings Bonds—George W. Gleason, of Gleason Radio & Television, Wheat Ridge, Colo. Seven other service-dealers were awarded Savings Bond prizes ranging from $500 to $25. In addition, distributor salesmen who helped the winners with their contest entries received Savings Bond prizes ranging from $750 to $25.

The contest, which closed December 15, 1953, involved completion in 25 words or less the sentence "I like the CBS-Hytron Certified Quality Service plan because . . . .".

A color television service training clinic is currently underway at CBS-Columbia plant in Long Island City, N. Y.

Electronic components necessary for the operation of home color TV receivers have been announced as commercial products by the RCA Tube Department.

The components, designed for the 15-inch tricolor kinescope, include:

Deflecting yoke (RCA-223D1)

Horizontal-output and high-voltage transformer (RCA-240T1)

Vertical dynamic-converging and dynamic-focusing transformer (RCA-241T1)

Horizontal dynamic-converging and dynamic-focusing transformer (RCA-242T1)

Vertical-deflection-output transformer (RCA-243T1)

Purifying coil, beam-positioning magnets, and neck-shield assembly (RCA-224D1)

Vertical isolation inductor (RCA-219R1)

A new plan to provide additional financial assistance for retail dealers, and thus enable them to increase sales of consumer products, has been approved by the board of directors of the Westinghouse Electric Corporation.

Gwilym A. Price, president, said Westinghouse will organize a credit corporation, a wholly-owned subsidiary to

be capitalized at $10,000,000, "to help Westinghouse appliance and radio-television dealers obtain inventory and retail sales financing assistance in areas where credit facilities are inadequate."

The new organization will supplement, not replace, the six-year old Westinghouse Equity Plan, under which more than 4,500 banks and credit agencies are providing local financing for Westinghouse dealers, Mr. Price emphasized.

Cash awards totalling $10,000 were distributed recently to the prize winners of the Transistor Application contest conducted by RAYTHEON. Presentation to the top four prize winners was made by John A. Hickey of the Receiving Tube Division in ceremonies held in Philadelphia, Washington and Los Angeles.

First prize of $5,000, in the nation-wide contest, was won by Mr. Robert T. Bayne of Los Angeles, California for his design of an Audio Frequency Meter employing two RAYTHEON CK722 transistors and four RAYTHEON CK705 germanium diodes. Second prize of $2,000 was awarded to Mr. Peter G. Sulzer of Kensington, Maryland for his entry of a Transistorized Audio Frequency and Voltage Standard. Mr. G. Franklin Montgomery of Bethesda, Maryland and Lt. Robert Perkins, a navy Dental Officer, were awarded $1,000 and $500 respectively for third and fourth prizes. Montgomery's entry was a General Purpose AC-DC Voltmeter employing transistors while Lt. Perkins received his award for his entry of a Vitalometer, a device for measuring the condition of tooth pulp, thus indicating the possibility of decay. Additional awards of $100 each are currently being made to the remaining 13 contest winners.

A design patent has been granted by the United States Patent Office to Emerson Radio and Phonograph Corporation for the Emerson "Pocket Radio", the world's smallest portable, which was introduced last July incorporating revolutionary advances in design, it has been announced by Dorman D. Israel, the company's Executive Vice President. The inventors are Mr. Israel, Arthur C. Germer and Kenneth E. E. James.

Until such time as Emerson Radio and Phonograph Corporation is convinced that an investment in a color receiver will give the consumer maximum satisfaction, the company will lease rather than sell its color sets to the public, it has been announced by Benjamin Abrams, Emerson's President, in a letter sent to all of its distributors. Emerson's President pointed out that the color receivers now being produced in limited quantities, incorporating a picture tube capable of presenting the equivalent of a 12½-inch picture, are already potentially obsolete. He added that the 19-inch picture tube expected to be available in the last quarter of this year "will be more in line with the public's taste for picture size." He also expects that color programming will be more frequent towards the end of 1954.

A nationwide program of color television service training meetings has been launched by the General Electric Co. in Detroit, Michigan. W. L. Parkinson, product service manager of the company's radio and television department here, said the program will be continued until meetings have been held in every market area in the country.

Invitations to attend the meetings will be extended by G-E distributors to their own service people and to service personnel of G-E dealers. However, where facilities permit, invitations will be extended to the entire service fraternity in that area.

The initial session, of four hours duration, was held at the Detroit Edison Auditorium. An estimated 800 television servicemen attended.

[Continued on page 58]

ASSOCIATION NEWS

LIETA

LIETA reports interesting activities including business meetings, a cooperative advertising program, color-tv classes, and new business ventures on Long Island. New officers are: Jack Duggan, Director of Technical Information; Cliff Hults, Chairman, Technical Committee; Harry Shulman, Chairman, Co-Op Advertising Committee and Member, Executive Committee; William L. McKelvey, Member of Board of Directors and business Manager; LIETA *News*; George S. Oakford, Chairman, Membership Committee and member, Executive Committee; Henry J. McMonigle, Chairman, Entertainment Committee; William A. Cuffey, Chairman, Employment Committee; Don Eaves, Honorary Member.

CRTSA

The Council of Radio and Television Service Associations which includes Allied Television Technicians Service Associations of South Jersey, Northeast TV Service Dealers Association, Philadelphia Radio Service Men's Association, TV Service Dealers Association of Delaware County, TV Contractors Association, and TV Service Dealers Associations of Philadelphia, is sponsoring the first Color Symposium in this area on April 2, 3, and 4th. Local parts distributors are cooperating in the three day event at the Bellevue Stratford Hotel. The council's membership and other service technicians and service shop owners in the region are expected to attend. The Color Symposium features technical papers and demonstrations by the nation's leading electronic engineers and lecturers. In addition, many exhibits of color test equipment, component parts, and tubes used in color TV will be set up. Actual color programs for viewing are planned. To assure a fully rounded program, other subjects and demonstrations cover problems in UHF-VHF, hi-fi, tape recorders, transistors, business management, etc.

PRSMA

An article in a recent issue of the PRSMA *News* discusses the Pennsylvania Consumers Sales and Use Taxes, and tackle the problems of (1) the taxability of repair work; and (2) the

[*Continued on page 30*]

Your Own Portable "TV Station" For Receiver Adjustment

NEW!

PHILCO

TELEVISION PATTERN GENERATOR

DEVELOPS BOTH RF AND VIDEO OUTPUT

A Must for Areas Where Continuous Station Broadcasts are Not Available

Now use the dot and line patterns from the new PHILCO Model G-8005 to check linearity, focus, astigmatism, blooming and high voltage regulation. Trouble shoot receivers on any channel, 2 through 6, or with video output. The PHILCO G-8005 Television Pattern Generator is an instrument especially adapted for service work . . . designed to save you time.

Look at These Philco Features . . .

1. Provides new white dot pattern and either white or black vertical lines for *all* cathode ray tube circuits.
2. Easy to operate: connect Pattern Generator output to TV set. Select proper test pattern. Accurately check both the vertical and horizontal sweep circuit performance.
3. External Sync. Jack improves stabilization in many special cases. Provides wide range operation.
4. A custom type instrument with new and novel circuits designed to reduce service time in both laboratories and service shops.

AVAILABLE THROUGH YOUR PHILCO DISTRIBUTOR ON A NEW SPECIAL PAYMENT PLAN

PHILCO MODEL S-8200 3" OSCILLOSCOPE

A sensitive, portable unit adaptable to either bench or field service. VERTICAL AMPLIFIER: DC coupled, Sensitivity—0.05V rms/inch. Frequency Response—0-1 mc/s within 6DB. DC coupled Vert. Amplifier circuits and low capacity probes facilitate video circuit trouble shooting. Built-in voltage calibrator permits use as high sensitivity vacuum tube voltmeter. HORIZONTAL AMPLIFIER: Sensitivity—0.5V rms/inch. Frequency Response—10 cps to 125 KC/s within 6DB. Sweep Circuit Frequency — Variable 15 to 30,000 cps . . . preset frequencies at vertical and horizontal sweep rates.

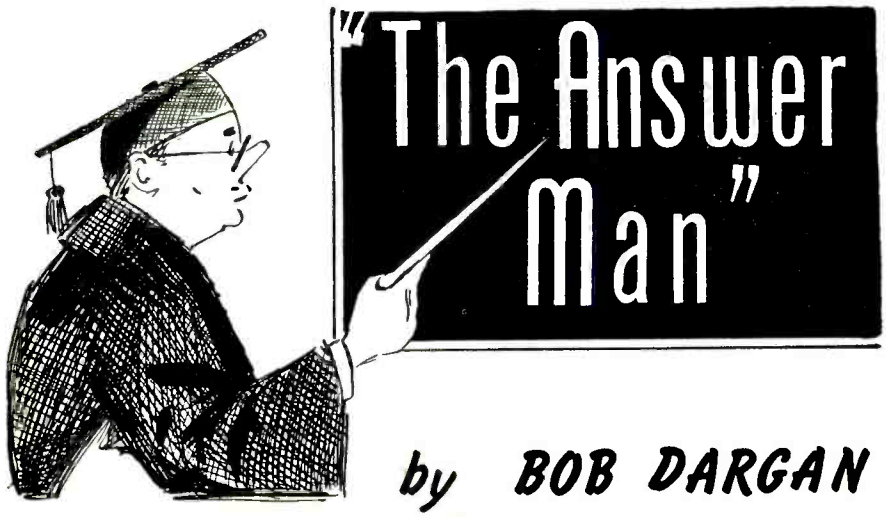
PHILCO
Famous for
QUALITY
the World Over

Take advantage of the great

SHARE and PROFIT Program

on Philco Receiving Tubes
Parts and Accessories

NOW AT YOUR PHILCO DISTRIBUTOR



Do you have a vexing problem pertaining to the repair of some TV set? If so, send it in to the Answer Man, care of this magazine. All inquiries acknowledged and answered.

Philco Model 48-1001: Pix Brightness

Dear Answer Man:

I have on the bench a Philco Model 48-1001. The brightness control fails to reduce the intensity of the brilliancy on the screen which remains at maximum all the time regardless of the position of the control.

I have checked all the voltages and resistances with my 20,000 ohm-per-volt-meter around the picture tube socket and everything is normal and checks with published information. The brilliancy control changes the voltage on the cathode as specified.

Also, I took resistance measurements on the picture tube pins corresponding to grid and cathode, and no reading (infinity) is registered on the meter. I still suspect the picture tube. I have also checked components in the cathode circuit of the picture tube.

Can you offer any suggestions?

O. B.
New York City

P.S. In my past experience with this trouble I found that a 30 megohm leakage between grid and cathode caused this trouble but at the same time altered the grid voltage which in this new case I have is normal as other voltages are.

Dear O. B.:

In regard to the problem of the Philco Model 48-1001 the fault is with picture tube, as you suspect.

If you will check between the cathode and filament of the picture tube you will find that you are able to read a definite, low resistance or perhaps even a direct short (zero resistance). This internal short between the cathode and filament grounds the positive cathode voltage at the filament ground connection (pin #1) and therefore no variation of cathode voltage with the brightness control is possible. See *Fig. 1.*

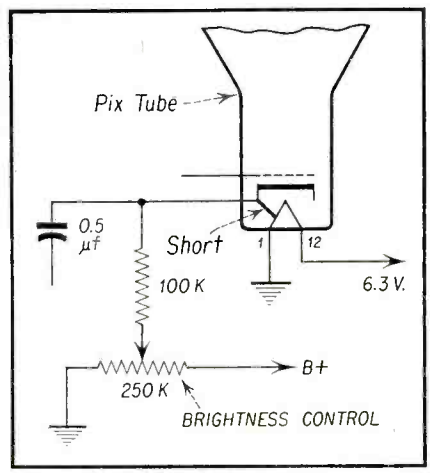


Fig. 1—Full or partial short between cathode and filament of picture tube affects brightness control action.

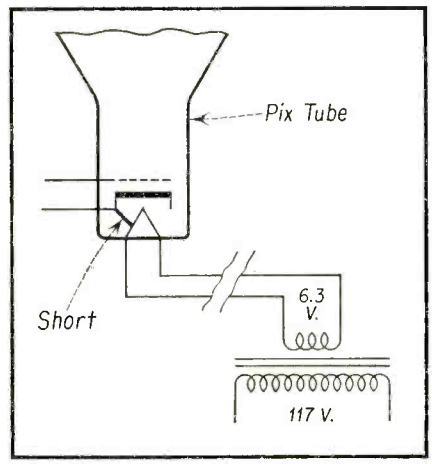


Fig. 2—Use of separate filament transformer enables continued use of shorted picture tube (no DC return).

If the picture tube provides an otherwise normal picture it probably would be desirable to obtain a separate filament transformer, 117 to 6.3 volts, so as to obtain filament voltage for the picture tube only. This will permit the use of the picture tube even though the short still exists between cathode and filament. The internal short in the tube cannot prevent control of the cathode voltage by the background control as with the separate filament transformer there is no return *dc* path from the filament of the picture. See *Fig. 2.*

Yagi Antennas on New Channels

Dear Answer Man:

In my locality Channel 4 is changing to Channel 6 and also increasing their power. I am about 25 miles from the transmitter and the most widely used antenna here is the 4-5 element "yagi" type cut for Channel 4.

Should these antennas bring in Channel 6 satisfactorily or will they have to be cut down? What frequency in the 6 *mc* bandwidth is used in determining the length of the driving element of these antennas?

Why is it that although all of these antennas are made for Channel 4, some manufacturers have the dipoles a different length, also the spacing between the directors and reflectors differs with different makes?

We are to get two UHF channels shortly which will require a lot of conversion to be done.

Do you recommend converters or tuner strips in secondary areas? Is it true that converters should give better reception because they have one stage of *rf* amplification?

Is the presence of selenium rectifiers in a set an indication that the set has a series filament circuit?

E. J. S.
Athens, N. Y.

Dear E. J. S.:

It is very likely that the existing Yagi antennas will bring in Channel #6 with satisfactory results. Channel #6 frequencies are close enough to the frequency for which the Yagi antenna was cut to give reasonably good reception particularly since the wave-

[*Continued on page 14*]

TV INSTRUMENT CLINIC

PART 1

Based on CHALLENGE CLINIC demonstrations, this new series will discuss many of the problems raised by service technicians.

by ROBERT G. MIDDLETON

Field Engineer,
Simpson Electric Co.

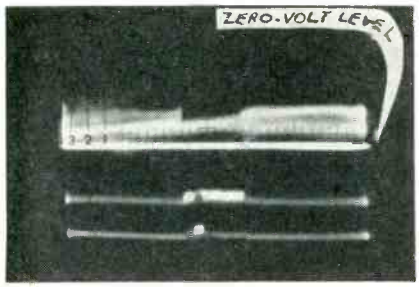


Fig. 1—When a signal is applied to the input terminals of an AC scope, only the AC voltage in the signal appears on the scope screen. Any DC voltage which may be present is eliminated by the AC scope circuits. The resting position of the scope trace shows the AC zero-volt level. The AC signal voltage distributes itself with equal positive and negative areas above and below the AC zero-volt level. The zero-volt level is the resting position of the scope trace.

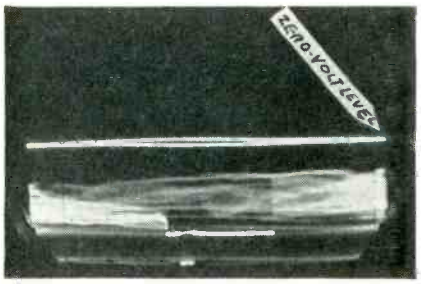


Fig. 2—When a signal is applied to the input terminals of a DC scope, both the AC voltage and the DC voltage in the signal appear on the scope screen. The DC voltage is indicated by the distance which the pattern rises above the DC zero-volt level. The DC zero-volt level is indicated by the resting position of the scope trace. DC information on the scope reveals much valuable servicing data.

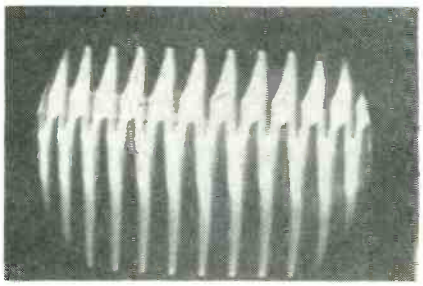


Fig. 3—The output from a signal generator may become distorted when the instrument is operating incorrectly, as shown in the illustration. The output from the generator can be applied directly to the vertical-input terminals of the scope, provided the output frequency from the generator is low enough to be accommodated by the vertical amplifier of the scope.

Q What are some of the advantages of a *dc* scope in TV service work?

A The two photos shown in *Figs. 1 and 2* illustrate several advantages of a *dc* scope, as compared with an *ac* scope. These photos were made by double exposure, to show the position of the signal with respect to the zero-volt level (resting position) of the scope trace.

Q. Is a *dc* scope also useful in combination with a demodulator probe?

A. More information is provided by the *dc* scope, whether or not a demodulator probe is used. *Fig. 2* was obtained by application of a crystal demodulator probe and *dc* scope in the signal circuits of an intercarrier receiver.

[*Continued on page 62*]

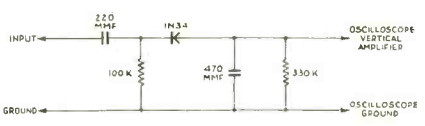


Fig. 5—A crystal demodulator probe designed to provide good reproduction of the envelopes of modulated waves.

—*Courtesy Simpson Electric Co.*

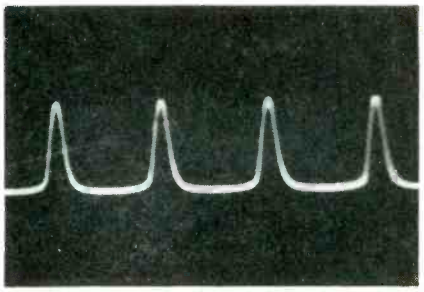


Fig. 4—When it is desired to check the modulation percentage and waveshape on the higher bands of the generator, a demodulator probe is utilized. The shape of the wave shows whether the modulation envelope is sinusoidal or distorted, and the operator can determine the percentage of modulation by observing how far the pattern rises above the zero-volt level on the screen of a DC scope. This is only one of the many applications of a DC scope.

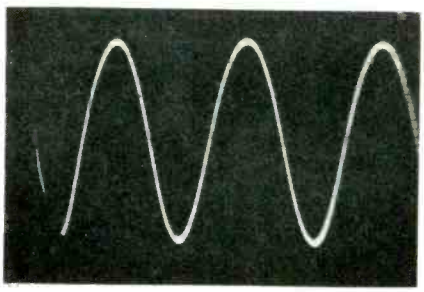


Fig. 6—When the probe shown in Fig. 5 was used to test the modulated output from a good-quality service generator, the pattern illustrated here appeared on the scope screen. When a DC scope is used, the percentage modulation of the output can also be checked. The probe illustrated in circuit form in Fig. 5 can easily be constructed with the parts shown.

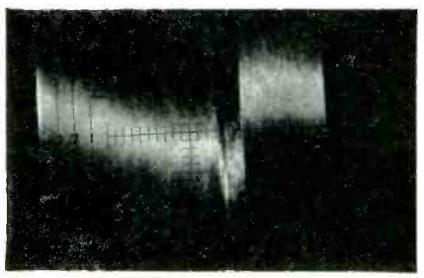


Fig. 7—This is the same type of display as seen in Fig. 2, but with a high noise level present. It should be recognized that the waveshapes and peak-to-peak signal-voltage data provided in receiver service manuals may be useless in fringe areas. In such case, the technician must rely almost entirely upon his generators for tests of signal circuits.

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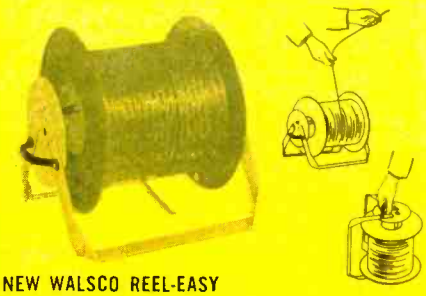

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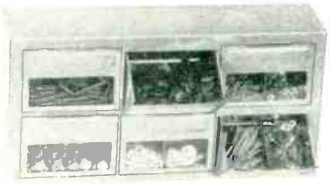

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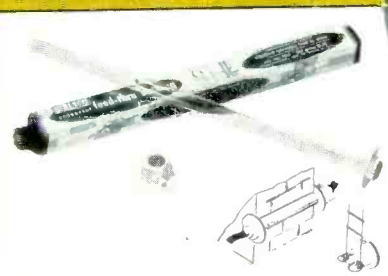

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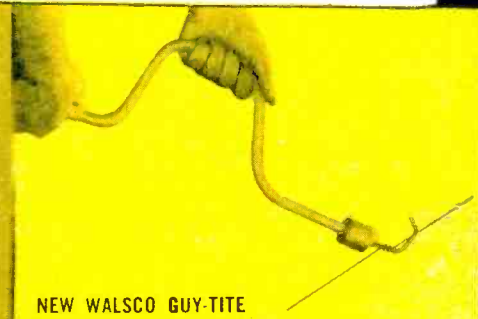

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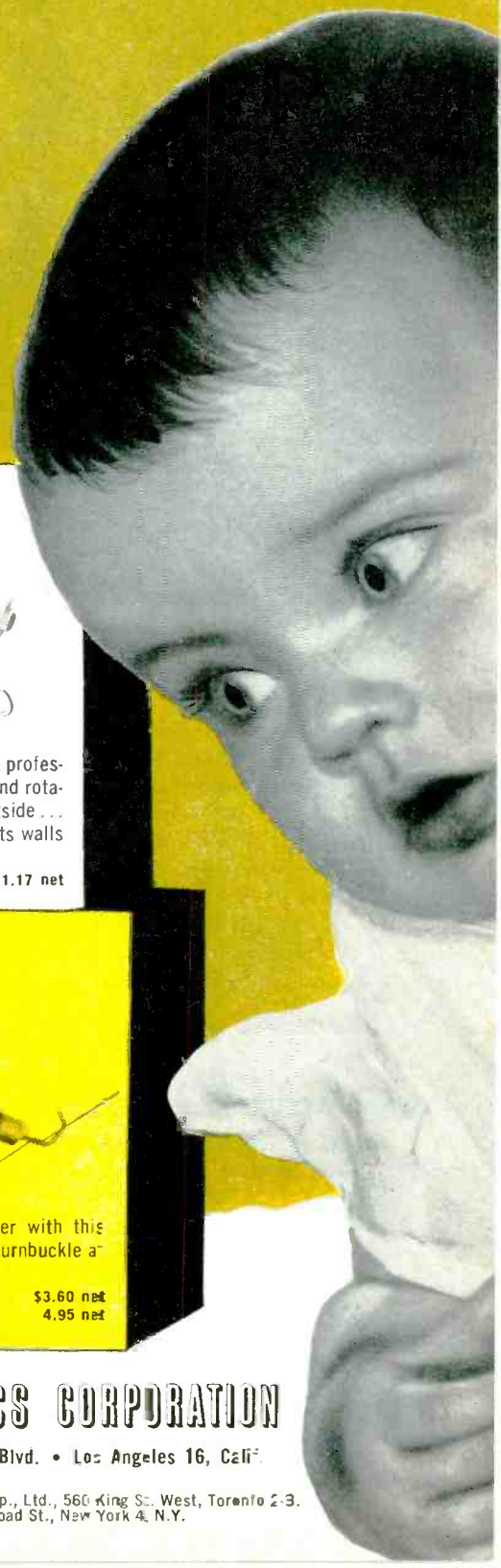

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ANSWER MAN

[*from page 11*]

length is being reduced and the channel to be received is one of highest frequency. It is not like trying to receive Channel 11 or 2 on the antenna.

However, should you desire to cut the antenna, the center frequency of the channel is the most desirable frequency to choose for the driven element for Channel 6. This would be about 5.65 feet. The reflector element would be about 5% longer than the driven element and the director elements would be about 5% shorter than the driven element.

Some manufacturers of Yagi antennas desire to sell their antennas for reception on two channels such as on Channel #4 and #5. In this case the dipoles would be cut for a different length than if the Yagi were to be used for Channel #4 only, or Channel #5 only.

In reference to your question concerning the spacings between the elements of the Yagi: the reason for different spacings is the impedance matching and back-to-front-ratio desired.

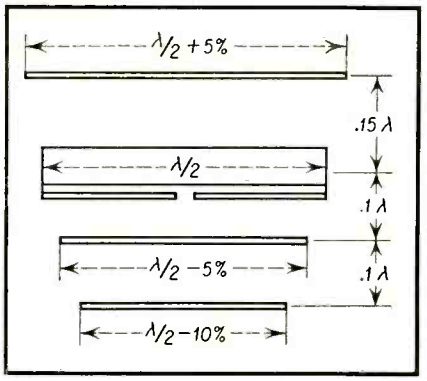

Fig. 3—Yagi antenna dimensions.

With reflectors, the length is usually cut to about 5% of the driven element, and the spacing to the rear of the driven element can be one-tenth to one-quarter of a wavelength. The distance decided on is determined by the amount of mismatch that is to be tolerated and the back-to-front-ratio provided by the Yagi antenna. The nearer the reflector is placed to the driven element, the less the impedance will be of the whole antenna system.

Varying the distance between the reflector and the driven element and altering the length of the reflector will change the field pattern of the antenna.

The proper lengh of the reflector of a Yagi antenna can be determined from the following formula:

$$\text{Length in Feet} = \frac{480}{\text{Freq (in } MC)}$$

The proper distance between the reflector and the driven element can be determined from the following formula:

$$\text{Distance in Feet} = \frac{125}{\text{Freq (in } MC)}$$

Director elements are usually 5% shorter than the driven element of the Yagi and are also spaced in front of the driven element by from one-tenth to one-quarter of a wavelength of the frequency it is desired to receive. If the spacing is shortened the field response will be sharpened. The formula for the length of the director is:

$$\text{Length in Feet} = \frac{453}{\text{Freq (in } MC)}$$

The previously given formula for the spacing of the reflectors also applies for the spacing of the directors.

The formula for the driven element length is:

$$\text{Length in Feet} = \frac{468}{\text{Freq (in } MC)}$$

This is shown in *Fig.* 3. Notice that the driven element is a folded dipole that is made larger on one side. The impedance of the Yagi antenna is very low and can be as small as 55 ohms because of the many added reflectors and directors. If the driven element is made a folded element the impedance can be increased. If the top section of the folded dipole is made large it will also increase the impedance so that a better match to the lead-in can be achieved. In any event a matching stub can be connected between the Yagi and the leadin if a close match is desired.

Difference Between Tuner and Converter

With reference to your question about converters and tuner strips in secondary areas: it will probably be found that the strips will not provide as good a picture as the converters and tuners. It is important to understand the difference between a converter and a tuner so that the discussion can be carried on with a mutual understanding. The *tuner* as used for UHF reduces the UHF channels down to a VHF channel and supplies this into the antenna leadin to the television receiver.

A *converter* is usually built into the television receiver or is made available to be placed inside the cabinet where it can be closely shielded and connected to the tv receiver. The converter usually reduces the *uhf* frequency information down to the *if* frequency of 45 megacycles. Because the converter and the leads from it are shielded, very little interference can get into the signals. *This is not the case with tuners in general.* Since the tuner reduces the *uhf* channels to, in most instances, Channels 3 or Channel 6, the lead-in from the tuner to the back of the tv receiver can pick up a lot of interference such as auto ignition noise, etc., the same as any *vhf* antenna lead-in will do. Therefore in some instances tuners are not as good as converters. It is true that most tuners use an additional stage of *rf amplification.* This does not necessarily indicate that better reception will be available from a tuner. There are other considerations such as whether the *vhf rf* amplifier and mixer stage function as additional *if* stages when the converter is employed. It is not possible to state emphatically which is the best to use, tuners or converters. They each have their advantages and disadvantages and such factors as cost of installation of the converter will be one deciding factor. You will probably find that the separate tuner is the most desirable because it requires no installation time (not considering anything con-

[*Continued on page* 59]

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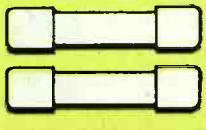

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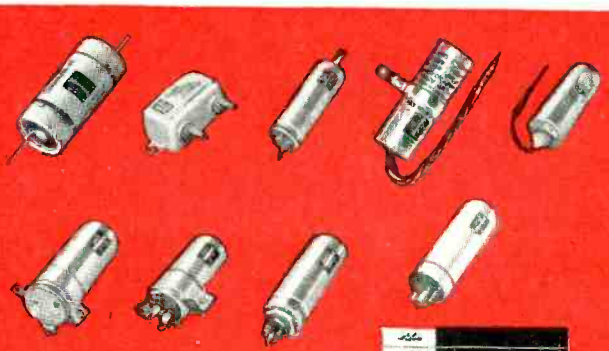

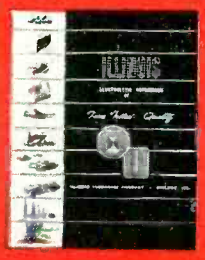

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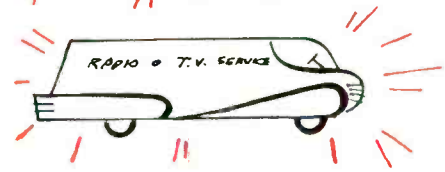

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An Open Letter to: M. Clements, publisher of TECHNICIAN

APRIL 15, 1954

We challenge and dispute claims made by you in a letter dated March 5, 1954—and in the advertisement on page 66 of TECHNICIAN'S March 1954 issue.

1st We stand ready to prove that *RADIO-TV SERVICE DEALER* has a much larger monthly distribution amongst professional radio/TV servicemen and service managers than TECHNICIAN, or any other servicing industry publication, for that matter.

2nd We stand ready to prove that *RADIO-TV SERVICE DEALER* reaches more radio/TV Service Firms and Dealers that operate service departments who are listed in Classified Telephone Directories than does TECHNICIAN, or any other servicing industry publication.

3rd We will prove that *RADIO-TV SERVICE DEALER'S paid* circulation now is as large as, or is larger than TECHNICIAN'S.

4th We will prove that *RADIO-TV SERVICE DEALER'S* advertising rates-per-thousand professional servicemen and service managers reached are much lower than TECHNICIAN'S.

DO YOU ACCEPT OUR CHALLENGE?

Will you provide to advertisers your audited circulation figures as of this date so they may be compared with our audited circulation figures as of this date?

(Of course such circulation audits must be made by the same accredited Auditing Bureau or firm of Certified Public Accountants and must be uniformly conducted in every respect, so that no evasive tactics may be resorted to.)

ADVERTISERS—WE NOW AWAIT A REPLY FROM TECHNICIAN

In the meantime we want you to know, in the simplest language we can use, and without evasive or ambiguous statements, *we stand ready to prove that:*

1. Practically every Service Firm Owner in the USA receives a copy of SERVICE DEALER monthly—and has regularly since November 1953. (There are upwards of 53,000 such firms.)

2. Furthermore, the total distribution of SERVICE DEALER'S April 1954 issue exceeds 65,000 copies . . . or approximately 15,000 copies more than TECHNICIAN says it will distribute.

3. Within a short time our circulation figures will be verified and substantiated by the *accredited* business publication auditing bureau which functions for the sole purpose of analyzing all facets of Business Publications' paid and free circulation.

RADIO-TELEVISION SERVICE DEALER

***Published by* COWAN PUBLISHING CORP.**

S. R. Cowan, President

TV COLORIMETRY

by BOB DARGAN
and SAM MARSHALL

From a forthcoming book entitled "FUNDAMENTALS OF COLOR TELEVISION"

Understanding Color TV requires a knowledge of the fundamentals of the science of color. Basic principles are dealt with in this installment.

LIGHT is a visible form of radiant energy. It comprises a narrow portion of the Electromagnetic Spectrum (*Fig. 1*) between 400 and 700 millimicrons approximately. A millimicron is a billionth of a meter. The wavelength of light at the center of the Light Spectrum (400-700 millimicrons) is approximately 1/50,000 inch. Since light waves, like radio waves, are part of the Electromagnetic Spectrum, they travel at a speed of 186,000 miles (300,000,000 meters) per second.

Light may be considered to be made up of a package of individual energy units, each unit having its own characteristic color. Thus, just as the Electromagnetic Spectrum encompasses the complete gamut of electromagnetic radiations, the visible Light Spectrum encompasses the complete gamut of colors ranging from violet to red as shown in *Fig. 2*. Each color has its own wavelength range. Thus, red has a range between 620 and 760 millimicrons. Below 400 millimicrons are the ultra-violet radiations, and above 760 millimicrons are the infra-red radiations, both being invisible.

The net effect of all of these colors on our sense of sight is colorless or "white" light. Nature's proof of the composition of light is the manner in which the spectrum colors manifest themselves in the form of a rainbow. Here the various colors are bent or refracted in different amounts as the rays of sunlight strike the curved surfaces of a raindrop—thereby making them individually visible as they fan out on the wavefront of a circular ray.

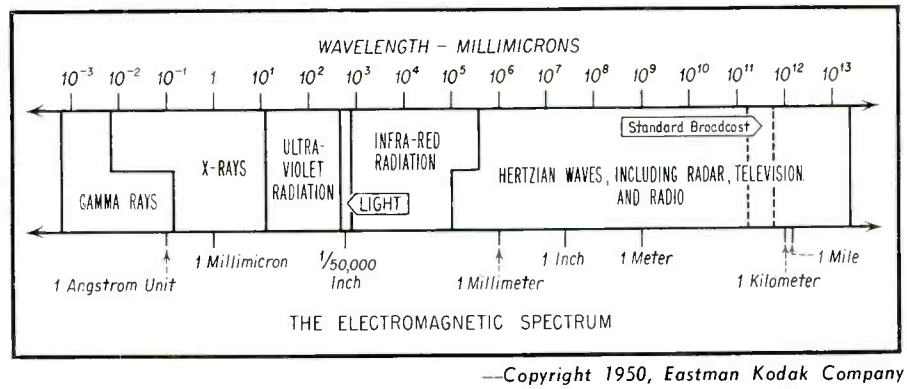


Fig. 1—The position of the Light Spectrum in the Electromagnetic Spectrum.

Dispersion of Light by a Prism

The dispersal of white light into its component colors may be demonstrated by means of a glass prism, a source of white light, and a screen as shown in *Fig. 3*. Actually, there are hundreds of colors in the spectrum; however, we generally group them into the broad categories of red, orange, yellow, green, blue and violet. The higher frequency (lower wavelength) colors contained in the spectrum are bent to a greater extent in the prism than the lower frequency colors, the net result being the panorama of colors as shown in the figure.

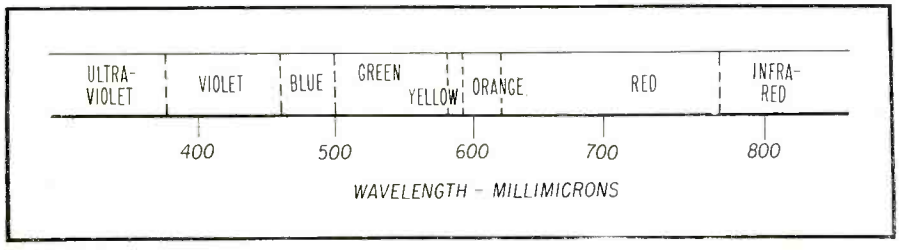


Fig. 2—An expanded version of the visible Light Spectrum.

How the Eye Reacts to Color

Each color of the spectrum (*Fig. 2*) has its own frequency range. Modern theories as to how the eye, in conjunction with the brain, reacts to these frequencies are as follows. Certain groups of the millions of tiny nerve fibers and connections are each roughly

resonant to the red, green, and blue frequency groups of the light spectrum. All color sensations in the brain result from a stimulation of each of these nerve groups brought about individually by the above mentioned colors and by combinations of these colors. It will shortly be shown how almost any color in the spectrum can be reproduced by various combinations of red, green and blue lights.

If two or more colors originate from the same point, or very nearly the same point in space, color addition results, that is, the eye sees the combined effects of both colors. Thus, red light when combined with green light results in a mental sensation of yellow.

White Light

A combination of red, green and blue light in nearly equal quantities will produce white light. As far as the eye-brain combination is concerned, red, green and blue in certain proportions stimulates the nerve cells which are resonant to the entire frequency range between 400 and 700 millimicrons. This being the equivalent of white light stimulation, the brain "sees" white. If the strength of each of these colors is reduced by the same factor, a scale of different shades of gray will be produced.

Primary Colors

As pointed out previously, almost all colors can be produced by suitable addi-

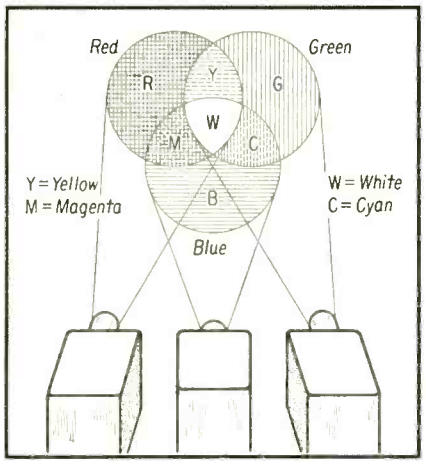


Fig. 4—The additive mixtures of red, green, and blue lights from the projectors may be made to produce various other colors, including white, depending on the combinations.

tive mixtures of red, green, and blue. Thus, referring to Fig. 4:

1. The addition of green and red light produces yellow light.
2. The addition of blue and green light produces cyan light.
3. The addition of red and blue light produces magenta light.
4. The addition of red, green and blue light produces white light.

Because of this property, and because we are "adding" colors, red, green and blue are called "additive primaries." Generally, when certain basic colors are used to produce a variety of other colors, they are called "primary" colors. When defining primary colors, it must be borne in mind that no two colors of a given set of primaries (when mixed) may produce a third primary

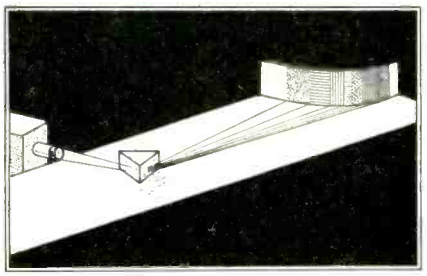


Fig. 3—Light entering a prism will be bent so that the various colors in the spectrum may be observed on a suitable surface as indicated.

color. Thus, red, green and yellow cannot be considered as a primary "combination" because red and green lights when mixed produce yellow.

It might be appropriate at this point to emphasize the fact that in the previous discussion we added colors by superimposing light of the various colors on each other. This system of mixing is "additive," and the primary colors associated with it are red, green and blue.

In contrast to the "additive" mixing of colors is the "subtractive" method of color mixing. In this case, the end result is a single color, or even black, as shown in *Fig.* 5. Here a filter is used to reject colors rather than add them, so that:

1. White light traveling through cyan and magenta filters results in blue.
2. White light traveling through cyan and yellow filters results in green.
3. White light traveling through magenta and yellow filters results in red.
4. White light traveling through magenta, yellow and cyan filters results in black.

It might be further pointed out that by a judicious mixture of yellow, cyan and magenta in correct proportions, any neutral shade between black and white may be produced.

When using paints or pigments a "subtractive" color process takes place. Thus, pigments, like filters, *absorb* all other colors except those by which they are identified. Therefore, a cyan pigment which is a combination of blue and green, when mixed with a magenta pigment (which is a combination of blue and red) results in blue alone. The reason for this should be evident inasmuch as magenta absorbs all colors except blue and red, and cyan absorbs all colors except blue and green. Thus, magenta absorbs the green passed by cyan, and cyan absorbs the red passed by magenta—so that only the blue can be seen. Because of this absorbtive characteristic, cyan, magenta, and yellow are called "subtractive" primaries, the latter classification being essentially associated with pigment mixtures and filters. It might be further added at this point that the practice of calling the combination of yellow, green, and blue primary colors is incorrect. Actually, the true primaries, if the subtractive primaries are referred to, are yellow, magenta and cyan.

Color Attributes

Three basic properties or attributes of light whereby we can distinguish one type of light from another are: hue, brightness and saturation. These will now be briefly discussed.

The basic characteristic of a *color* which distinguishes it from another color is its "hue." Thus, when we refer to a color as red, blue, green, or purple, we refer to its hue. In the spectrum chart, the hue of a color may be defined by its wavelength, in which case it is called the "dominant wavelength."

The intensity of the radiant energy of light is called "brightness." Variations in brightness of white light are more readily apparent to the eye than variations in brightness of colored lights.

When we attempt to describe a color with a definite hue such as red, but

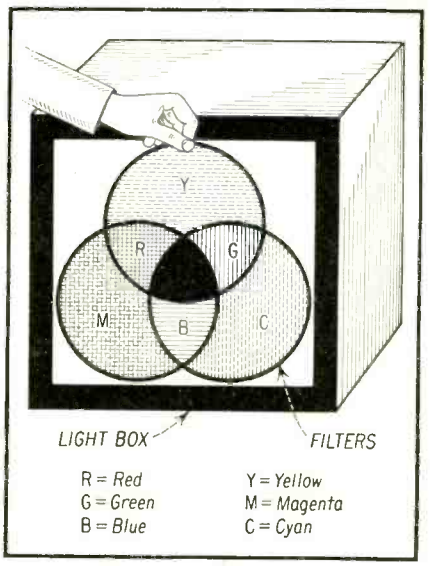


Fig. 5—The filtering action of the subtractive colors, cyan, magenta, and yellow is illustrated above.

diluted with varying degrees of white, thereby producing different tones of red from deep red to light red, we refer to its relative "saturation" or "chroma."

It is thus seen that a color may be completely identified by its hue, brightness, and saturation. These are impor-

tant terms in color TV, and many control adjustments require a knowledge of their meanings and effects.

It is evident that some difficulty might be encountered in distinguishing between brightness and saturation differences. Thus, a particular color with low saturation may give the impression of high saturation because it is viewed in relatively dark surroundings. Only by comparing this color with a highly saturated color standard, can we determine the relative difference in saturation.

Response Characteristics of Human Eye

Different colors light with identical luminous energy content subjected to the same light source, have varying relative brightness effects as far as the eye is concerned. This is shown graphically in *Fig. 6* which illustrates the relative brightness effects of the spectrum colors on the eye. Notice that green has the greatest relative luminous effect on the eye. This is followed by red, then by blue. Because of this characteristic, a color TV system must be adjusted to provide an equivalent relative luminous effect so that when the eye views these colors on a picture tube screen it should see in them the same relative brightness values it would see in the original.

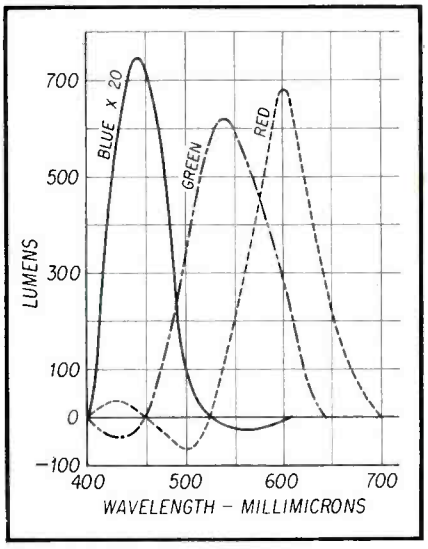


Fig. 7—Color matching using the additive primaries is shown above.

Color Standards

In color TV reproduction, the color picture tube should faithfully reproduce the colors picked up by the camera tube with reference to hue, brightness, and saturation. Furthermore, in the actual transmission and reception of these colors the various circuits and circuit components must process the color signal so that the relative proportions of hue, brightness and saturation present in the original scene, end up as such in the picture tube. If this is not done, the colors reproduced on the picture tube become a meaningless hodgepodge of color information. For these reasons definite standards of hue, brightness and saturation have been established in the design of the color TV system. Fidelity

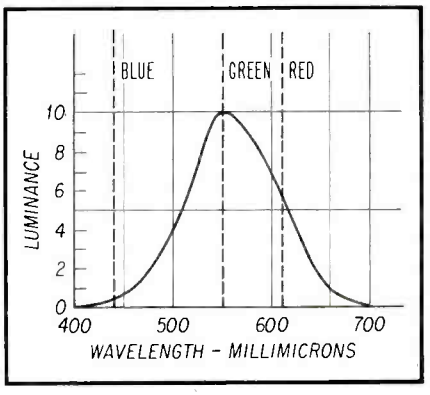


Fig. 6—Relative luminance response characteristics of red, green, blue.

of color reproduction is a measure of the adherence of the various circuits and circuit components to these standards.

Characteristics of Vision

It has been found in recent years that the eye can easily identify and differentiate between colors for relatively large areas or patches of these colors. Thus, if an observer is called upon to match a sample color patch of large area with large area mixtures of the three additive primaries (red, green, blue) he can in most cases effect a color match by properly proportioning these three primaries. However, as the areas are progressively reduced the matching process becomes more difficult, until for very small areas a positive match becomes almost impossible.

A second significant phenomenon, pertaining to how the eye will match *small area* color patches, is revealed in the following experiment. If we were to cut two small patches out of the sample sheet, a fair color match might be observed. Yet strangely enough an even better color match could be obtained by comparing one of these sheets with a sheet containing suitable mixtures of cyan (blue-green) and magenta (blue-red). Thus, it can be assumed that for small color areas, *only two* color mixtures are needed for proper matching, being the *color mixture* primaries, cyan and magenta.

Use of this principle is made in color TV where small color area information is involved. The three color signals corersponding to red, green, and blue, are electrically transformed into two signals corresponding to cyan and magenta mixtures. Then, at the receiver the cyan and magenta mixtures are transformed back again into the original red, green and blue signals. How this is done will be explained subsequently.

From the above it is evident that for large color areas, three-color presentation is necessary for color fidelity. As the areas of scan become increasingly smaller, two-color presentation involving cyan and magenta mixtures will suffice. Finally, for exceedingly small areas, only the luminence or brightness information need be transmitted. In our study of the color TV system, it will be found that full advantage is taken of these characteristics.

Color Matching

One color may be compared to or differentiated from another by means of three attributes: hue, saturation, and brightness. These terms have been defined to some extent previously. Pure physics does not provide us with a means of completely specifying a color along these lines so that we have been forced to adopt procedures known as "color matching" as a positive means of identifying various colors. Thus, color measurements and specifications involve matching the color in question against a set of standard primaries such as red, green and blue. This system is often referred to as the "Tristimulus" method of "Colorimetry."

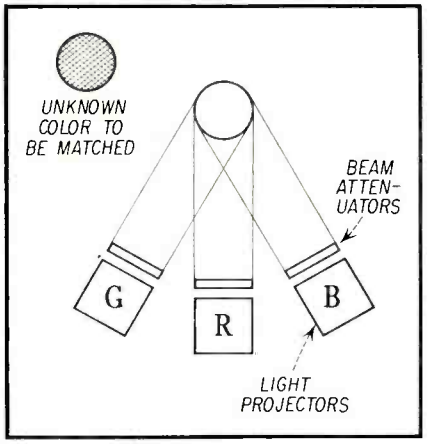


Fig. 8—Laboratory test set-up.

As previously pointed out, *most* colors (including white which may be defined as "achromatic" or colorless light) can be matched by the *additive* mixture of three properly chosen Primaries. This is shown graphically in *Fig. 7*, where the relative red, green and blue color mixture values are shown for all of the wavelength colors in the visible spectrum. The colors shown on this set of curves are said to be saturated, that is, they are *pure* to the extent that they are not mixed with white.

Notice that in some cases negative values of the Primaries are used to effect

a color match. The full significance of these negative values may be obtained by examining *Fig.* 8. This diagram indicates a laboratory setup whereby the data shown in *Fig.* 7 is derived. For a given unknown color the operator varies each of the primary light source attenuators until a color match is obtained. The attenuators are calibrated and thereby allow a measure of their luminous output to be read and hence plotted on the vertical scale of *Fig.* 7. Although a large range of colors may be fairly well matched in this manner, this technique does not work to produce a perfect match until one of the standard light projectors is moved to *add* to the unknown color. This latter operation is tantamount to subtracting light from the mixture being made on the right side of the figure. Referring to *Fig.* 7 we see that in the region between 400 and 600 millimicrons green light must move to the side of the unknown; from 460 to 530 millimicrons the red be-

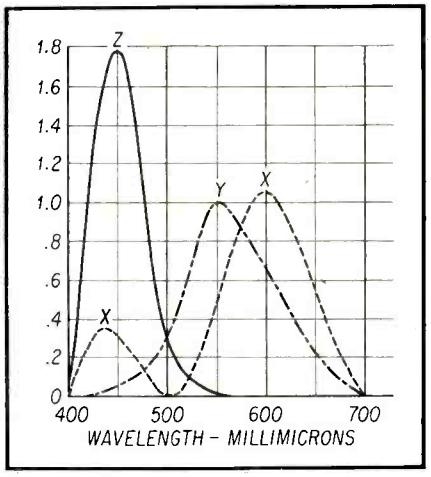


Fig. 9—Color curves using only positive values are more convenient.

comes negative; and from 530 to 610 millimicrons the blue becomes negative.

Colorimetry techniques find the negative values of blue and red undesirable. In order that values be positive only, the red, green, and blue primaries have been mathematically converted to three fictitious primaries, X, Y, and Z, so selected that their values will always be positive as indicated in *Fig.* 9.

Along these lines the International Commission on Illumination (CIE)* developed a set of color mixture curves shown in this figure. As an example, green light of wavelength 510 millimicrons is made up of the following relative values:

$$Y = .51 \quad X = .01 \quad Z = .17$$

Chromaticity Diagram

The color curves of *Fig.* 9 may be used to give more useful information

**Commission Internationale d'Eclairage.*

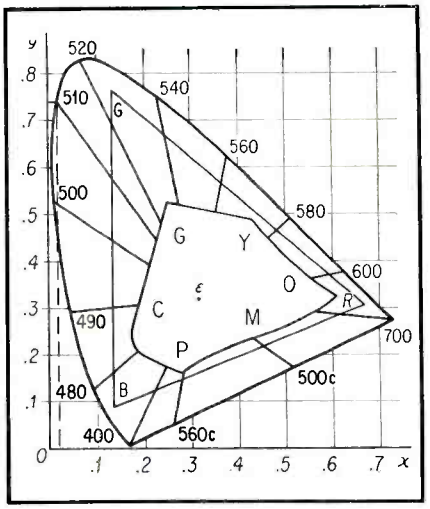
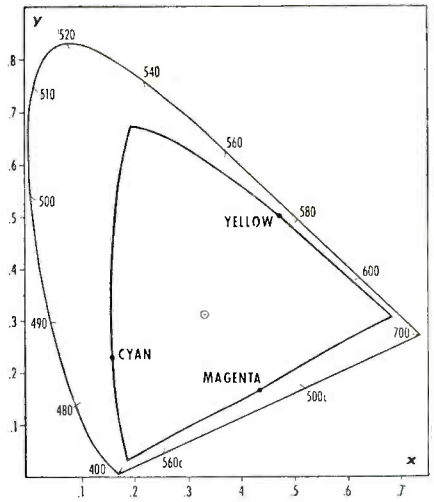


Fig. 10—Chromaticity diagram. Inside area shows purest colors that can be printed. Area enclosed by triangle is color range available for color TV.

relative to color matching by means of a graph called the "Chromaticity Diagram." Such a diagram, as shown in *Fig. 10* forms what may be described as a map of all possible colors in terms of hue and saturation, but not brightness. Hue is specified in terms of the spectrum wavelength color. Saturation of a color at any point on the horseshoe curve is 100%. Toward the inside of the horseshoe curve is a point of neutral color, or white marked E. A line connecting this point and the spectrum wavelength point to a particular color contains this color in all of its degrees of saturation from 0% at the neutral point to 100% on the horseshoe curve. Thus, the nearer a color sample is to the horseshoe curve the purer or more saturated is the sample.

In color TV we make use of two signals when transmitting a color scene, these being: luminance (brightness)



—Copyright 1950, Eastman Kodak Company

Fig. 11—Range of colors produced by subtractive dyes used in color films.

and chrominance (hue and saturation). The graph used in *Fig. 10* describes two attributes, hue and saturation, but does not give information relative to brightness. To include brightness a three-dimensional graph would be required.

An interesting diagram is shown in Fig. 11. Here we see the range of colors which can be produced by mixing three subtractive dyes of the type used in Eastman Kodak color films.

It must be borne in mind that the various degrees of brightness do not represent any change in the dominant hue and saturation of the color sample. In this manner the complete color signal can be specified.

A Chromaticity Diagram may be evolved from *Fig.* 9 as follows:

1. Consider any wavelength such as 510 millimicrons.

2. We solve for new values of x and y as follows:

$$x = \frac{X}{X+Y+Z} = \frac{.01}{.69} = .014$$

$$y = \frac{Y}{X+Y+Z} = \frac{.51}{.69} = .74$$

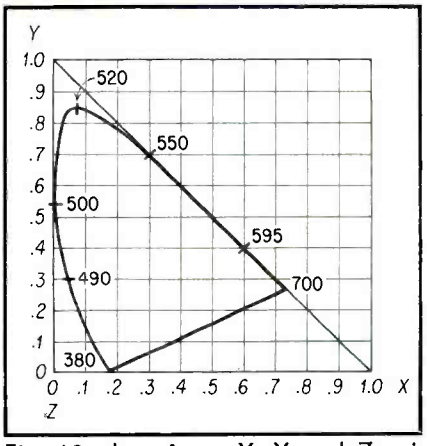


Fig. 12—Imaginary X, Y and Z primaries are the triangle vertices.

3. Locate the point corresponding to x and y on a graph and label it 510 millimicrons. See *Fig. 10.*

If we repeat the above steps for all of the spectrum wavelengths between 380 and 720 millimicrons the horseshoe shaped curve of *Fig. 10* will result. The coordinates of the curve are called "Trichromatic" coordinates, and the diagram is called a "Chromaticity" Diagram. Each point within the area of the horseshoe represents the chromaticity (hue and saturation) of a color. All realizable colors are contained within the domain bounded by the horseshoe curve connecting the spectrum wavelength points.

By drawing straight lines as shown in *Fig. 12* connecting points (x=1, y=0) and (x=0, y=1) a triangle is formed, the vertices of which are X,

Y, and Z CIE Primaries. Since these Primaries are outside the domain of realizable colors, they are imaginary Primaries, that is, their actual counterparts are not reproduceable. However, because of them and because of the Chromaticity Diagram which they define we are able to identify and classify *all* colors both as to hue and saturation.

White Light on Chromaticity Diagram

Recalling that white light is a mixture of the Primaries: red, green, and blue, it would seem most natural that white should fall on the point corresponding to the center of gravity of the triangle bounded by the CIE Primaries. This point, called "equal energy" white, is:

$$x = .33 \qquad y = .33$$

and is shown as point ϵ in *Fig. 10.*

White is not confined to a point, however. It covers a small area around the central point ϵ of the diagram. This area corresponds to the many types of illuminants that may be used, such as sunlight, fluorescent lamps, tungsten lamps, etc.

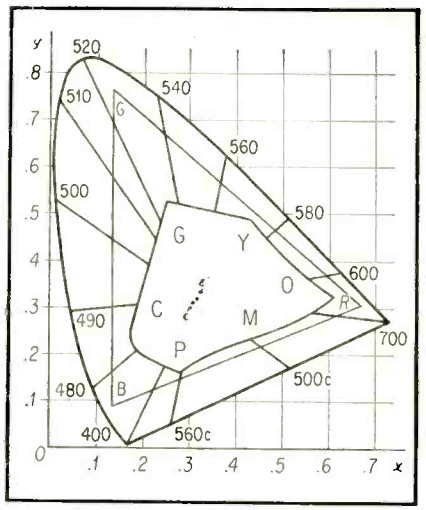


Fig. 13—Relative positions of Illuminant C and Illuminant E.

NTSC Color Primaries

The colors that may be reproduced in color TV are limited by the phosphor characteristics of picture tubes. These fall within the limits of the chromaticity diagram as shown in *Fig. 13*, and have been chosen as standard primaries by the NTSC. These are as follows:

	x	y
Red	0.67	0.33
Green	0.21	0.71
Blue	0.14	0.08

"Standard" or "Reference" white as chosen by NTSC has been assigned a slightly different value than E in *Fig. 10*, and is shown as point C or illuminant C in *Fig. 13*. Its values are:

$$x = .310 \qquad y = .316$$

The reasons for these values will be discussed in another chapter.

Relative Luminance

The relative luminance values of the standard NTSC primaries are determined from the amount of their mixture required to produce Reference White (Illuminant C). It can be shown that the relative luminance values of the green, red and white signals are:

Green: 59% Red: 30% Blue: 11%

This means that the output signal of a colorless object picked up by the three-color camera should be made up of the above relative luminance values. Under these conditions the color information and luminance as viewed by an observer at the picture tube will match the original values directed into the camera tube.

Summary

1. White light is made up of equal amounts of all the spectrum colors.
2. A contrast range (grey scale) is produced by varying amounts of lumi-

[*Continued on page 62*]

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REMOTE TV TUNERS

Sure-Fire Money-Makers for Servicemen

by SAN D'ARCY

DURING the quarter century that I have worked with Servicemen and Service Dealers I have continuously urged them to be as "sales conscious" as they are "service conscious." For example, I contend it is quite logical and profitable for servicemen to sell and install long play phono needles whenever they spot a record player in a home which in itself provides the opportunity. By the same token I deem it logical, and I know it is profitable, for servicemen to sell "plus items" like antenna rotators whenever the opportunity presents itself. Experience proves that customers will buy in a certain percentage of cases provided an attempt is made to sell them something of merit.

Now, here is a suggestion, regarding selling, that is sound, practical and profitable. Sell . . . or at least try to sell . . . your TV set customers, a Remote Tuning Control device. (Several are now on the market.) Any professional technician can install such a chairside tuning unit right in the customer's home in a matter of minutes, 20 to 30 minutes at most, and as a result he will enjoy a sales and service profit ranging from $30 to $50. That sort of profit is worth going after.

Remote Tuners Sell Themselves

More important, once a customer has a remote (or chairside) TV set tuner installed, case history proves that a high percentage of his (the set owner's) friends, visitors and neighbors will be favorably impressed by the benefits such a unit affords, and they will quickly want such an accessory installed in their TV receivers too. Consequently more and more recommendation business accrues for the seller and installer of the first unit.

What a Remote TV Tuner Is

In actuality, a Remote Tuner, such as the Regency model RT-700 is a complete, self-contained "front end" that permits the TV set owner to sit in his comfortable chair, away from the receiver, and while so seated, to turn on his TV set, select different channels as program changes are wanted, and he can adjust fine tuning, alter contrast, brighten picture, increase or lower sound levels to meet his preference. No longer need I get out of my chair, walk 17 feet over to the TV set, make adjustments or change stations. I do it from my chair comfortably. And, fellows, with a big screen set—I get better adjustments for contrast because I can adjust properly from the actual viewing distance, and that, as you know, can't be done so well when working right up at the set itself.

There's no need for me to discuss the technical aspects of a Remote Tuner's innards. Suffice to say that generally a Cascode tuner, (such as Regency uses) when installed in an old set, usually peps up the old job, and that in itself gives the set owner a big hunk of respect for your ability as a serviceman. And in case you're interested, UHF strips can be inserted in the tuner if occasion requires—and this is becoming an important sales feature.

Simplicity of Installation

The first Remote Tuners marketed about a year ago gave excellent service, but, because of inadequate "Installation Instructions," sometimes caused the installing technician to "sweat it out," for an hour or two on the first job he tackled. After that first "big one" there was no problem and installation time was cut to 10 or 15 minutes on the average. Figuring 15 minutes more for chassis removal and replacement, no serviceman need take over half-an-hour to install a Remote Tuner. In my neighborhood Service Dealers quote list price for the unit plus a $10 to $15 fee for installation—and they're having no trouble closing deals. They're averaging $40 profit per installation.

First of all I suggest that you take a peek at a Remote Tuner in operation. Probably your Distributor can oblige. You should have one operating in your shop for demonstration purposes too. Then, here's the procedure one should follow:

1. Determine the output *if* of the receiver involved and then use the model Tuner designed for that frequency. Practically all TV receivers in use today have a front end that operates either on 21 *mc* or 41 *mc*. Then, having the proper Remote Tuner, ascertain the type of *age* circuit that is employed in the receiver you are about to work on. There are three basic *age* circuits in popular use, and the installation procedure will differ slightly depending upon the one you encounter. The 3 basic *age* circuits are: simple rectified *age*, keyed *age*, and amplified *age*.

A typical installation procedure is as follows:

Step 1.

(a) Refer to *Fig. 1* and mount the adapter unit close to Grid 1 (*1st if*).

(b) Connect white wire to round (at *1st if*).

(c) Connect green wire to *1st if* grid.

(d) Insert dual .02 mfd condensers in series with lead to high side of volume control. (see *Fig. 2*) Then connect shielded lead to junction of dual condenser.

Step 2.

(a) Connect yellow lead to network, modifying existing re-

ceiver filter network per schematic. (*Figs.* 3, 4, 5, 6, and 7). In a keyed circuit it is necessary to reverse polarity of contrast control on control unit as shown in *Fig.* 6.

(b) Connect black lead as shown in schematic.

Step 3.

Connect shielded cable from control to adapter terminals (red dot). Connect shield to other terminal.

Of course all the few necessary components and much more detailed installation instruction come with every Remote Tuner but boiled down to essentials, it's as simple as outlined above. One point of note is this: The new instruction sheet supplied by the manufacturer states that "One should not shorten the connecting cable (which is a simple shielded microphone cable) —and if additional lengths are needed, add only in multiples of 27½ feet up to a total of 110 feet." I found my cable about 7 feet too long, and not knowing about the manufacturer's warning, cut that much off. But—my unit works fine —so why worry about it now? I don't—it's a blessing to get seated, stay seated, and view TV like a tired guy should—with all the controls right by my side on a small table. Try it yourself—then sell the idea to your customers.

Step-by-Step Procedure for Mounting and Installing the Remote Tuner

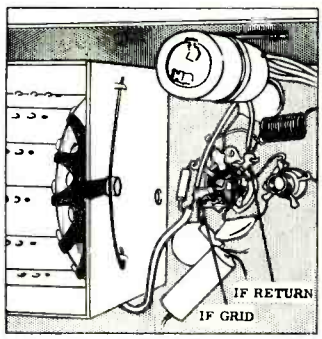

Fig. 1—Mounting the adapter unit.

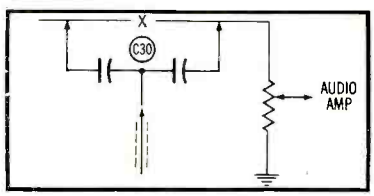

Fig. 2—Audio circuit is broken and C-30 connected in series with it.

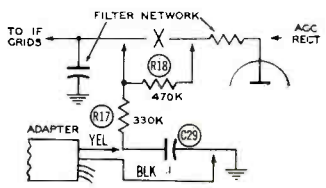

Fig. 3—If AGC filter network resistor is 1 megohm or more, wire as shown above. R17 and C29 (R18 when used) must be installed close to the AGC line. Yellow and black leads from adapter unit are then connected as shown. NOTE: R17, R18, and C29 are included with tuner. R30 and C54 are included with tuner but not used in this installation. See also Fig. 4.

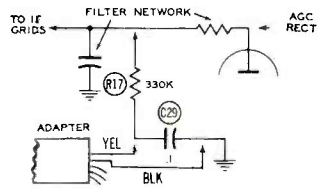

Fig. 4—If AGC filter network resistor is less than 1 megohm, connect as shown above. Yellow and black leads from adapter unit are then connected as shown. NOTE: R17, R18, and C29 are included with tuner. R30 and C54 are included with tuner but not used in this installation.

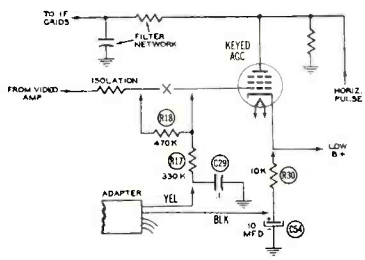

Fig. 5—In wiring to keyed AGC circuit, grid lead to keyed AGC tube must be broken at "X." Install R17, R18, R30, C29, C54 close to tube socket and connect yellow and black leads from adapter unit as shown. The contrast return line (black wire) is connected to junction of R30 and C54. Since this return line is also return for volume-control circuit, connecting point must be adequately by-passed to ground. C-54 does this.

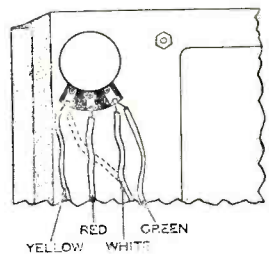

Fig. 6—Keyed AGC circuit requires positive voltage output from the remote unit. The remote unit, as supplied, is wired for negative output. To reverse its output polarity, the white wire to one end terminal of the COARSE BIAS ADJ potentiometer must be transferred to the other end terminal as shown.

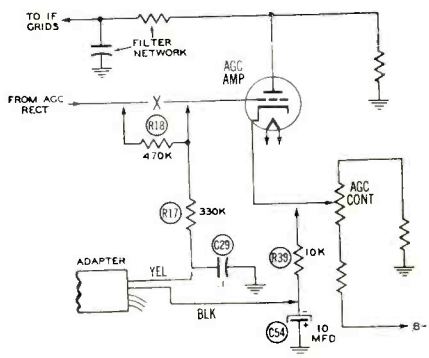

Fig. 7—In wiring to amplified AGC circuit, grid lead to AGC tube is broken at "X." Install R17, R18, R30, C29, and C54 close to tube socket and connect yellow and black leads from adapter as shown. Contrast return line (black wire) is connected to junction of R30 and C54. This filter network is connected between AGC amplifier cathode and ground. This connection also serves as return for volume control circuit. Again, C54 provides adequate bypassing to ground. This AGC circuit also requires positive voltage from remote unit. Follow procedure given under Fig. 6 and note drawing shown in Fig. 6.

ASSOCIATION NEWS

[*from page 8*]

collection of taxes on material used in repair work.

"It is the duty of the service technician," states the PRSMA *News* article, "to separate charges for parts and materials from charges for labor or other services. . . ." "Where the material loses its identity on the job, or where its value is insignificant—such as solder, for example, the service technician himself is the consumer of the property, and the customer need not pay a tax thereon. The service technician himself pays the tax on material which is consumed in the repair job, and he collects no tax on solder, etc., from his customers."

The article then states that "the service technician's real quandary relates to the collection of the tax." The problems of paying tax on parts and test equipment, and the question of "taxable retail sale" are then raised, with the opinion that ". . . compliance with the strict letter of the regulations imposes a heavy burden on the independent service technician who does not have the bookkeeping or accounting facilities for collecting and returning the tax."

The article concludes: "When the legislature reconvenes, it might be well for the service technicians in this area to request appropriate changes in the existing law."

LBRTA (Calif.)

The Long Beach chapter of the Radio Technicians Association reports it now "covers the greater portion of Southern California, with the largest technical group on the West Coast."

Officers for 1954 are listed as: Clarence Spencer, Asst. Treasurer; Joe Martin, Technical Advisor; Fred Abrams,

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[*Continued on page 45*]

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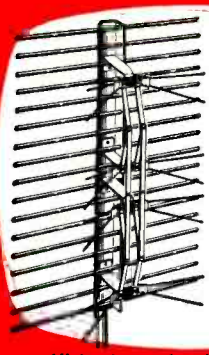

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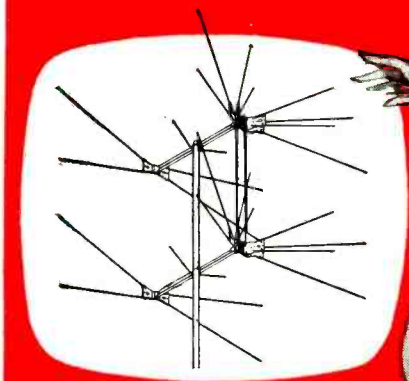

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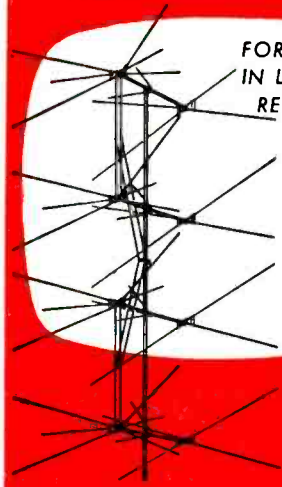

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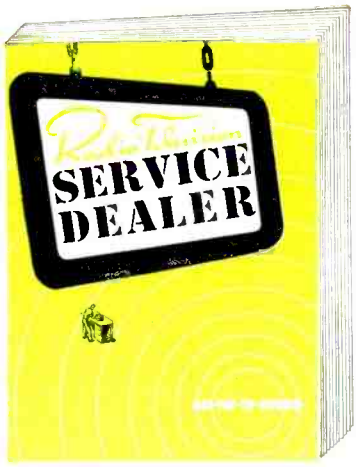

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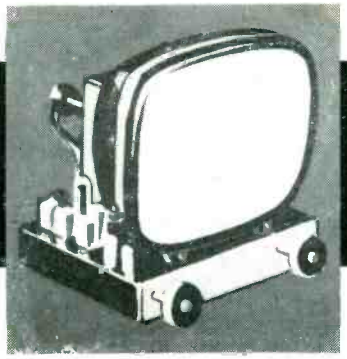
TV TROUBLE SHOOTING

USING Key Test Points



by BOB DARGAN

IN the previous articles of this series the servicing of the tuner, *if* strip, video amplifier section and the sound section was covered. This article deals with key test points in a section that can prove very puzzling to servicemen, the sync section.

Part 4 of this series discusses the sync section, analyzes its circuitry, and tells how to use a meter to pinpoint defects.

The Sync Section

The purpose of the sync section is to remove the sync pulses from the composite video signal and amplify these pulses to a sufficient amplitude level to properly lock in the horizontal and vertical deflection oscillators. This is shown in *Fig. 1*.

The sync section in most receivers consists of three stages. The first stage is usually a sync preamplifier which performs a certain amount of separation and amplification. The second stage accomplishes most of the clipping action by using either a large negative bias or a low plate voltage thereby not permitting the unwanted picture and blanking information to pass through. The third stage amplifies the clipped signal which is then fed to the differentiating and integrating networks where separation of the horizontal and vertical sync pulses occurs. The output of the networks should be clean sync pulses to be fed to the oscillator stages.

The first step in servicing troubles that appear to be sync difficulties is to determine definitely that the trouble is not in some other section of the receiver but in the sync section.

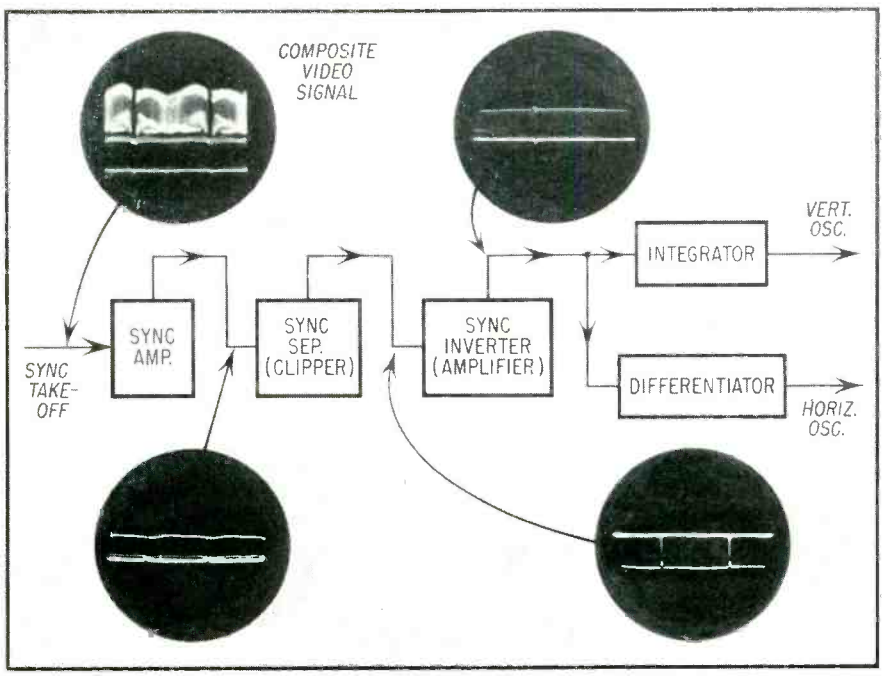


Fig. 1—Block diagram, with waveforms, of sync section. Here, sync pulses are removed from video signal and amplified for lock-in use.

Vertical Blanking Bar

The quickest and easiest means of confirming that the sync pulses are normal at the sync take-off point in the video amplifier stage is to examine the picture for the vertical blanking bars. If the picture is scrambled or out of sync due to the oscillator not being synced to the station signal, free-wheel (hand adjust) the oscillators so that the picture can be observed momentarily. Is the picture normal in that the high and low frequency information (detail and smear) is present? Naturally, if the picture signal does not contain the proper information there is no point in servicing the sync section until the other difficulties have been cleared up.

Permit the picture to slowly roll and examine the vertical blanking bar. Reduce the contrast or drive on the picture tube and increase the brightness. This will cause the blanking bar to be more discernible, making the three different levels stand out. There must be a distinct difference in shading between the sync pulses, blanking, and picture information. The sync pulses should be darker than the blanking pulses, which should be darker than the picture information as shown in *Fig. 2*. This check reveals whether the sync information supplied to the sync stages is normal and of the proper amplitude.

Horizontal Oscillator Circuit

Now it is necessary to ascertain definitely that the trouble is not in the horizontal or vertical oscillators or deflection system. If the oscillator is not operating at the correct horizontal fre-

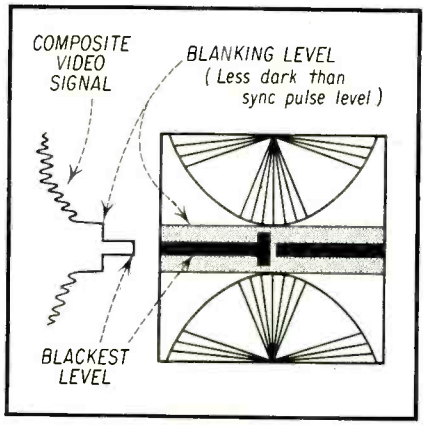


Fig. 2—The three signal levels. Sync pulse causes the darkest area.

quency to permit stopping the picture momentarily, or the size and linearity of the picture is not proper, the difficulty is in the deflection section and is not likely to be in the sync stages. Along these lines difficulties that would result in an improper raster should also be cleared up as a preliminary step in sync servicing.

An easy means of removing the possibility of the horizontal oscillator circuit as the reason for poor sync action or hook at the top of the picture is to pull out the sync separator or amplifier tube. This will permit the horizontal and vertical oscillators to be free-wheeled. Adjust the horizontal and vertical hold controls so that the picture can be made to stand still momentarily. Examine the sides of the picture. They should be perfectly straight, although possibly sloping diagonally across the picture tube. *THIS IS IMPORTANT.* If the sides of the picture are not absolutely straight, the trouble is associated with the horizontal oscillator circuit. If the coupling condenser from the sync circuit to the horizontal oscillator circuit is leaking, the sides will be bent. Intermittent breakdown in the horizontal oscillator or output circuits will continue with the sync tube removed.

The sync coupling condenser may be disconnected temporarily at the oscillator stage so that the horizontal sync pulses do not reach the horizontal oscillator stage. One means of being sure that the horizontal sync coupling condenser is not leaking or has not developed a high resistance is to measure between the open end of the condenser and chassis with a voltmeter. There will be a momentary surge of current when the set is turned on. After the surge the meter should not indicate any substantial current leak through the condenser. This condenser is very often the cause of pulling at the top of the picture. With the horizontal sync coupling condenser disconnected, the vertical oscillator will remain locked in sync. It will be an easy matter to examine the picture with only the horizontal hold control to adjust.

Signal Tracing the Sync Stages

There are a number of ways of confirming that sync information is present in the sync stages in those cases where the oscillators are not synced in. The same type of checking can be performed in the sync stages as in the video amplifier stages. That is, the grids and plates can be scratched to determine if a signal will pass through the system to the oscillators and thereby momentarily disturbing the deflection of the electron beam on the picture tube. Also when a meter is hooked to the components, the connections of the leads of either an output meter or a d-c voltmeter will momentarily disrupt or affect the oscillators.

The presence of sync information can be confirmed by connecting a .1 *uf* condenser between the grid or plate of a sync stage and the top of the volume control. Vertical pulse buzz in the speaker will indicate the sync signals are present in the circuit. With this method the signal can be followed from grid to plate in the sync stages. In the clipper stage, there will be a loss in amplitude due to the proper action of the stage which would have to be considered in the signal tracing process.

Output Meter

As in other stages of the television receiver, the existence of the pulses in the sync circuits can be determined with an output meter. If there are sync pulses at the different points in the system, there will be an indication on an output meter. Basically, this type of check is to show that the signals are present in the circuits and the amount of the output voltage meter reading is not important. See *Fig.* 3.

Sync Circuit Bias Measurement

Another means of checking stages is to measure the grid bias. As in other sections of the television receiver, if the signals are present there will be a negative grid bias because of the grid drawing current and charging up the coupling condenser. If bias is measured and it is not provided by a fixed source, it indicates the presence of signal voltage. There are some stages where the negative voltage will be small. This is where the signal has been reduced to a low amplitude by the normal clipping action.

Sync Coupling Condenser and Other Components

A coupling condenser is used to connect the signal from one sync stage to the next. This coupling condenser is very important and is the cause of many sync difficulties. If the coupling condenser should leak a small amount the negative bias on the grid of the coupled stage will be altered causing the stage to function improperly. Particularly suspect condensers which block high values of B-plus voltage as they are the most likely to cause trouble. This is probably the most frequent cause of sync difficulties. It is sometimes desirable to change these condensers in suspected circuits rather than waste time.

Another condenser that can cause some headaches is the by-pass or filter condenser at the bottom of the plate load resistor of a sync stage. If the by-pass condenser should open up the effective plate load on the amplifier is increased. Since amplification in any circuit is a function of the plate load resistance, too much amplification would result from the stage. The peak to

[*Continued on page 63*]

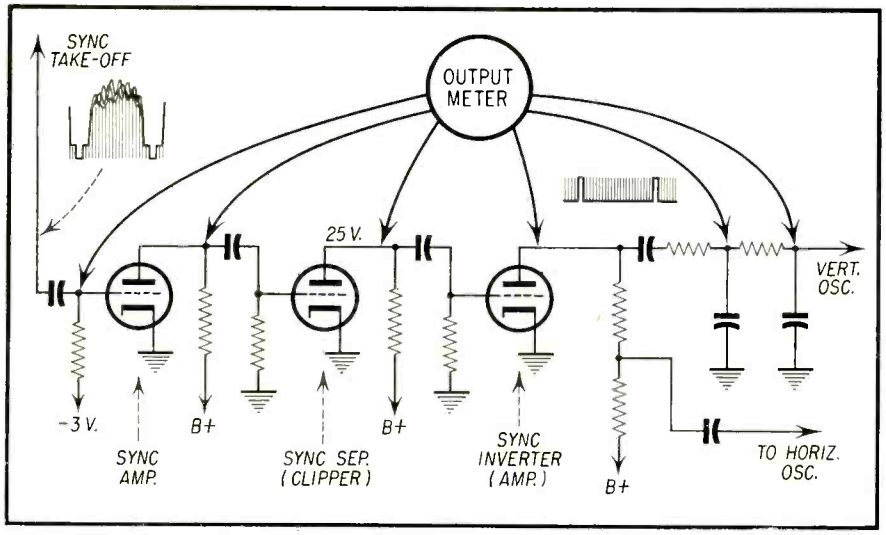


Fig. 3—General type sync section showing points for meter hook-up.

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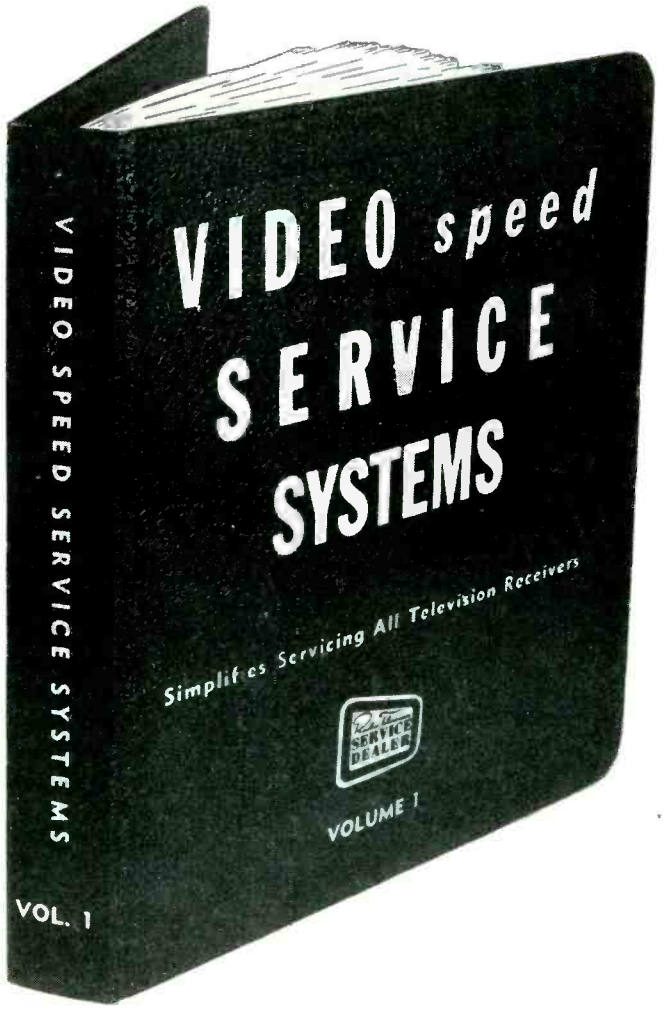

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CHASSIS DIFFERENCES

CHASSIS NO.	AUDIO	PICTURE TUBE	CONTROL PANEL NO.
CT 331A, B	Internal	20CP4A	1
CT 331C, E	Internal	20CP4A	3
CT 332A, B	External	20CP4A	2
CT 332C, E	External	20CP4A	4
CT 333A, B	Internal	17BP4A	1
CT 333C, E	Internal	17BP4A	3
CT 334A, B	External	17BP4A	2
CT 334C, E	External	17BP4A	4
CT 335A, B	Internal*	17BP4A	1
CT 335C, E	Internal*	17BP4A	3
CT 336A, B	External	17BP4A	2
CT 336C, E	External	17BP4A	4
CT 337A, B	Internal**	20CP4A	1
CT 337C, E	Internal**	20CP4A	3
CT 338A, B	External	16TP4	2
CT 338C, E, J	External	16TP4	4
CT 339C, E	Internal*	20CP4A	3
CT 340A, B	External	20CP4A	2
CT 340C, E	External	20CP4A	4
CT 341D	Internal	21FP4A	3
CT 341K	Internal	21FP4A	6
CT 342D	External	21FP4A	4
CT 343D, K	Internal	17HP4	3
CT 344D, K	Internal	17HP4	4
CT 345D, K	Internal*	17HP4	3
CT 346D	Internal	21FP4A	3
CT 347D, K	Internal*	20HP4A	3
CT 348D, K	External	20HP4A	4
CT 349D, K	Internal*	20HP4A	3
CT 350D, K	Internal**	20HP4A	3
CT 350H	Internal**	20HP4A	5
CT 351E	Internal	21EP4A	3
CT 351F	Internal	21EP4A	5
CT 351J	Internal	21EP4A	6
CT 352E, J	External	21EP4A	4
CT 353E, J	Internal*	21EP4A	3
CT 354D, K	External	17HP4	4
CT 355D, K	External	20HP4A	4
CT 356K	Internal	17HP4	3
CT 357K	Internal	20HP4A	3

*Connections for radio tuner.
**Vertical Mounting.

TUBE COMPLEMENT

SYMBOL	TUBE	FUNCTION
V1	6BC5	R-F Ampl.
V2A	½12AT7	Mixer
V2B	½12AT7	Oscillator
V101	6AU6	Limiter
V102A	½6T8	Discriminator
V102B	½6T8	1st Audio ampl.
V103	6V6GT	Audio output
V201	6CB6	1st Video I-F
V202	6CB6	2nd Video I-F
V203	6BC5/6AG5	3rd Video I-F
V204	6AU6	Video det. 1st Audio I-F
V205	6CB6	Video ampl.
V206	6AU6	AGC ampl.
V207	(See List)	Picture tube
V301A	½12AX7	Noise Invertor
V301B	½12AX7	Sync separator
V302A	½6SN7	Sync ampl.
V302B	½6SN7	Sync clipper
V303	6SN7	Vertical MV
V304	6W6GT	Vertical output
V401A	½6SN7GT	Hor. AFC
V401B	½6SN7GT	Hor. osc.
V402	6BQ6	Hor. output
V403	1B3	H. V. Rectifier
V404	6W4	Damper
V501	5U4G	L. V. Rectifier

Key Voltages

All voltages are measured between tube pins and chassis.

B+ voltage, plate of damper tube, V404, pin 5	250V DC
Boosted B+ voltage, cath. of damper tube. V404 pin 3	410V DC
Plate voltage of Vert. Osc., V303 pin 2	35V DC
pin 5	30V DC
Plate voltage of Vert. Out. V304, pin3	220V DC
Plate voltage of Hor. Osc. V401 pin 2	290V DC
Grid voltage of Hor. Out. V402 pin 5	—30V DC

Filament wiring

All tube filaments are connected in parallel.

OPERATION AND INSTALLATION

1. Plug the receiver into the AC outlet.
2. Turn the receiver on by turning the PICTURE OFF-ON control to the right about ½ turn.
3. Adjust the BRIGHTNESS control for suitable picture brilliance. If no light appears, it may be limited by incorrect adjustment of the ion trap. Adjustment of this trap is as follows:
   Turn the brightness control fully clockwise and adjust the ion trap until light appears on the screen. Reduce the brilliance to a point near extinction by turning the brightness control counter-clockwise. Readjust the ion trap for maximum brilliance.
   It may be necessary to reduce the brilliance still further and readjust the ion trap for maximum brilliance.
   The final adjustment should now be made for maximum brightness with the brightness control in full clockwise position.
4. Turn the CHANNEL SELECTOR to the desired channel number.
5. Adjust the FINE TUNING control for best picture

[*Continued on page 44*]

MAGNAVOX TROUBLE SHOOTING CHART

NO SOUND—NO RASTER
- Power input circuit
- V501

NO RASTER—SOUND OK
- HV Fuse (F501)
- Brightness control
- Ion trap
- V207, V401, V402, V403, V404
- HV xformer Hor. yoke CRT connections

WEAK PIX—SOUND AND RASTER OK
- Tuner fine tuning
- Contrast control
- V2, V201, V202, V203, V205, V206

POOR HOR. LIN.
- Hor. Drive and Lin. Controls
- V401, V402, V404
- Check 0.047 and 0.1 mf caps. connected to Hor. Lin. coil

POOR VERT. LIN.
- Vert. Lin. and Height controls
- V303, V304
- Check 0.047 and 0.1 mf caps. connected to pin 5 of V303

PIX JITTER SIDEWAYS
- Hor. Hold, Freq., Stab. and Lock controls
- V302, V401, V402
- Check 0.022 and 0.047 mf caps. connected to pin 6 of V401
- Check 82 and 47 mmf caps. connected to pin 4 of V401

SMEARED PIX
- Tuner fine tuning
- V2, V201, V202, V203, V205, V206
- Check 0.1 mf caps. connected to pin 11 of V207
- Check Vid. Peaking coils
- IF and RF alignment

POOR PIX DETAIL
- Tuner fine tuning
- Focus control
- V201, V202, V203, V205, V206, V207
- Check Vid. Peaking coils
- IF and RF alignment

SOUND BARS IN PIX
- Tuner fine tuning
- V1, V2, V201, V202, V203, V205
- IF and RF alignment

SNOW IN PIX
- V1, V2, V201, V202, V203, V206
- Antenna and transmission line

AC IN PIX (DARK HOR. BAR)
- V1, V2, V201, V202, V203, V205, V206

ENGRAVED EFFECT IN PIX
- Tuner fine tuning
- Contrast control
- V1, V2. V201, V202, V203, V205, V206, V207
- Check Vid. Peaking coils

VERT. BARS
- Hor. Drive control
- V402, V404
- Check 0.1 mf cap. connected to Hor. Lin. coil
- Check damping network connected to yoke terminals 1 and 2
- Defl. yoke ringing

PIX BENDING
- Hor. Hold, Freq., Stab. and Lock controls
- V301, V302, V401, V402

AUDIO HUM IN SOUND
- V101, V102, V103

DISTORTED SOUND
- Tuner fine tuning
- Tone control
- V2, V101, V102, V103, V204
- Check 0.01 mf cap. connected to pin 5 of V103
- Sound and Vid. IF alignment T-204
- Det. alignment T-101

NO SOUND—PIX OK
- Tuner fine tuning
- Volume control
- V101, V102, V103
- Speaker (open voice coil or defective connection)
- Sound and Vid. IF alignment T-204
- Det. alignment T-101

WEAK SOUND—PIX OK
- Tuner fine tuning
- Volume and Tone controls
- V2, V101, V102, V103
- Sound and Vid. IF alignment T-204
- Det. alignment T-101

NOISY SOUND—PIX OK
- Volume and Tone controls
- V101, V102, V103
- Check sound system for loose connections
- Speaker
- Sound IF and Det. alignment T-204, T-101

SYNC. BUZZ IN SOUND
- Tuner fine tuning
- V2, V101, V102, V201, V204, V206
- Sound IF and Det. alignment T-101, T-204

INTERMITTENT SOUND—PIX OK
- V101, V102, V103
- Poor connections in sound system

WEAK OR NO PIX—SOUND WEAK—RASTER OK
- Tuner fine tuning
- Contrast control
- V1, V2, V201, V202, V203, V206
- RF and IF alignment

INTERMITTENT RASTER—SOUND OK
- Brightness control
- V207, V401, V402, V403, V404
- HV xformer

RASTER BLOOMING

Hor. Drive control
V207, V402, V403, V404, V501
Check HV Filter cap.
Check 1 meg Ω res. connected to HV Filter cap.

INSUFFICIENT BRIGHTNESS

Ion trap
Brightness and Hor. Drive control
V207, V401, V402, V403, V404, V501
Check 3.9K Ω res. and 0.047 mf cap. connected to pin 4 or V402
Low line voltage

EXCESSIVE RASTER (PIX SIZE)

Hor. Drive, Width and Height controls
V402, V403

INSUFFICIENT RASTER WIDTH

Hor. Drive and Width controls
V401, V402, V404, V501
Check 470 and 1000 mmf cap. connected to terminal "D" of Hor. Osc. Trans.
Low line voltage

INSUFFICIENT RASTER HEIGHT

Vert. Lin. and Height controls
V303, V304, V501
Check 0.1 and 0.047 mf caps. connected to pin 5 or V303
Vert. Out. Trans.
Low line voltage

NO VERT. DEFL.

V303, V304
Check 0.1 and 0.047 mf caps. connected to pin 5 or V303
Check 4700 mmf cap. connected to pins 2 and 4 of V303
Vert Defl. yoke
V. O. T.

NO VERT. SYNC.—HOR. SYNC. OK

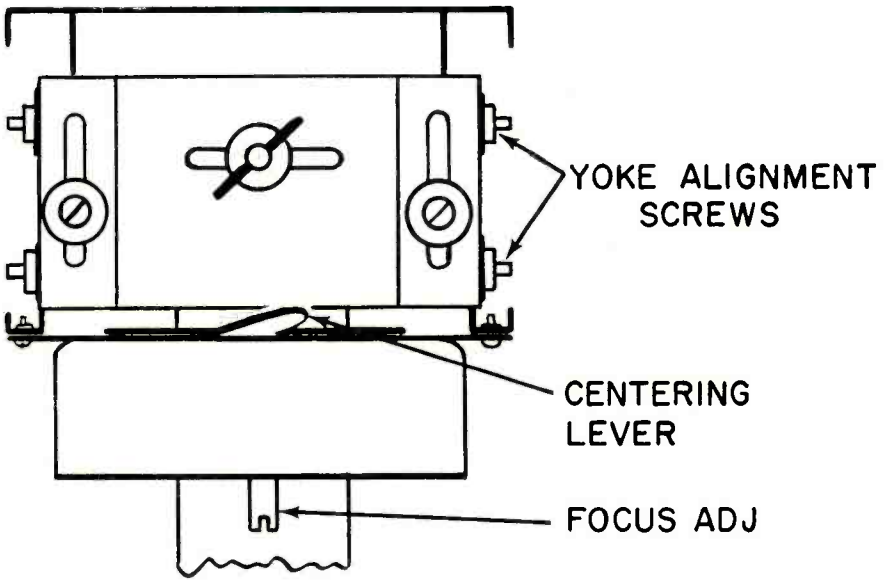
Vert. Hold control
Vert. Int. Network
V302, V303
Check 6800 mmf and 10K Ω res. connected to pin 2 or V303

NO HOR. OR VERT. SYNC.—PIX SIGNAL OK

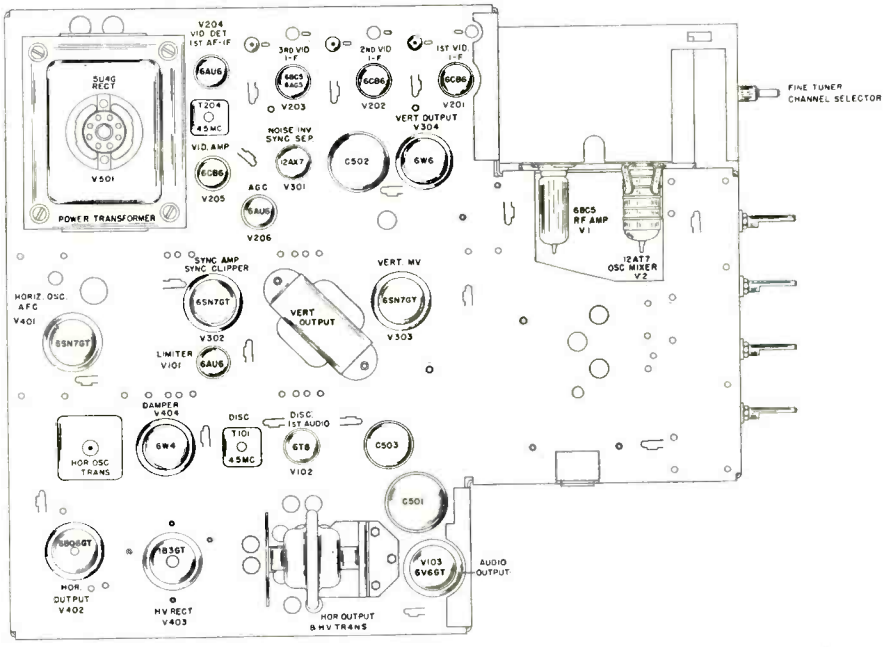
V206, V301, V302, V401
Check 0.047 mf cap. connected to pin 1 of V301

NO HOR. SYNC—VERT. SYNC. OK

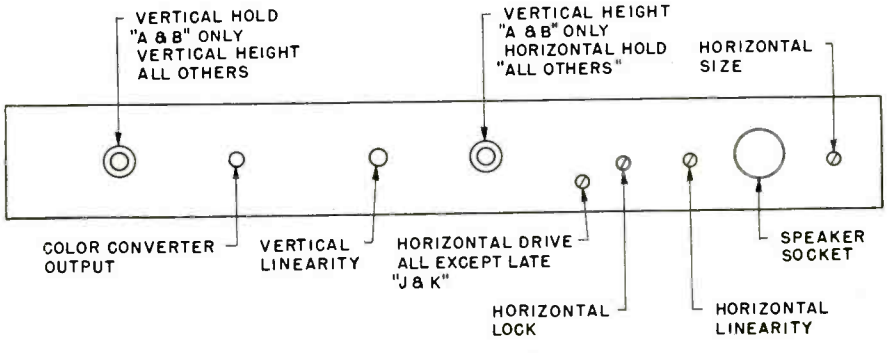
Hor. Hold, Freq. Stab. and Lock controls
V302, V401, V402
Check 150 mmf cap. connected to pin 1 of V401



PICTURE TUBE ADJUSTMENTS



TOP VIEW OF CHASSIS



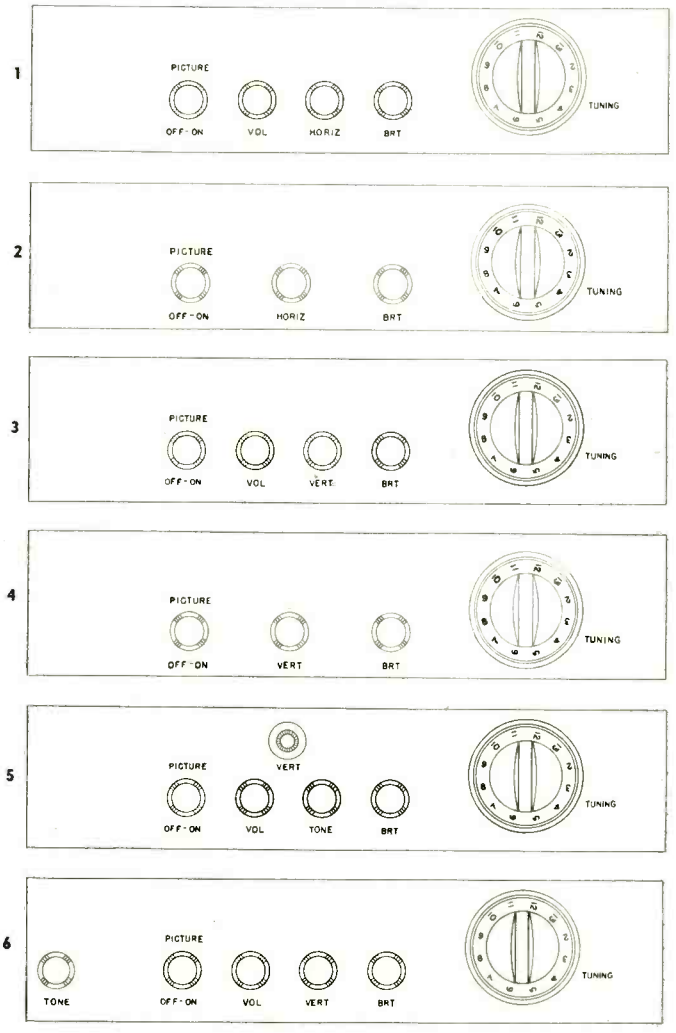
REAR CONTROLS

[*from page 41*]

quality. Do not tune for loudest sound as a distorted picture may result.

6. Adjust the PICTURE control for the proper degree of black, gray and white. With the brilliance at a point near extinction advance the control until sufficient picture detail appears without over-shading the light areas of the picture.
7. Adjust the VERTICAL HOLD control so the picture holds in vertical sync. If the picture rolls up or down, turn the control knob so the roll is downward, then turn it in the opposite direction until the picture locks in frame.
8. If the picture pulls out of horizontal sync, it can be brought back by adjustment of the HORIZONTAL HOLD control.
9. Adjust the FOCUS control so the lines making up the raster are clear and distinct.
10. Adjust the HEIGHT and VERTICAL LINEARITY controls so the picture just fills the mask and the linearity is uniform from top to bottom. Adjustment of either the vertical hold, vertical linearity or vertical height controls will slightly affect the other controls and readjustments may be necessary.
11. Adjust the HORIZONTAL DRIVE trimmer for the most drive consistent with good linearity. Turn it to the point where compression at the middle of the picture occurs, and then reduce it slightly.
12. Adjust the HORIZONTAL LINEARITY control for the most linear picture. Caution: There may be two positions of the slug which seem to provide horizontal linearity. Use the one which places the slug nearest all the way in.
13. Adjust the HORIZONTAL SIZE slug for proper width.
14. HORIZONTAL and VERTICAL CENTERING of the picture is accomplished by moving the centering lever on the front side of the focus magnet. Readjustment of the ion trap may be necessary after this plate has been adjusted. On receivers using electrostatic focus picture tubes, HORIZONTAL and VERTICAL CENTERING is accomplished by adjusting the CENTERING DEVICE located on the neck of the tube immediately behind the deflection coil. Properly adjusted, the ears of the CENTERING DEVICE will be to the right side when facing the back of the unit.
15. If it is necessary to make any large adjustments (greater than a fraction of a turn) of the horizontal drive trimmer, a check should be made of the range of the horizontal hold control. The following sequence should be used.
    a. Rotate the horizontal hold control fully clockwise and the picture should show a vertical blanking bar just emerging from the left side.
    b. Rotate the horizontal hold control full counter-clockwise. The picture should remain in sync.
    c. Switch off channel and then back on channel. Picture may come in immediately or diagonal bars may appear.

FRONT PANEL CONTROL CHART



    d. If diagonal bars are present, turn the horizontal hold control clockwise slowly. The number of diagonal bars will reduce, and after three bars are reached a slight additional rotation of the control in a clockwise direction should result in the picture locking in sync. If the picture does not lock in until after two bars are reached, the horizontal lock trimmer needs to be adjusted. When less than two bars are present, adjust the trimmer slightly in a counter-clockwise direction. In the J and K versions, the LOCK trimmer was replaced with a fixed capacitor.
    e. After making this adjustment check the pull in range again. With the horizontal hold control full counter-clockwise, switch off channel then back on. If diagonal bars appear, rotate the hold control clockwise slowly. The picture should lock in sync, with a slight rotation of the control, after three bars are reached. If necessary repeat the lock trimmer adjustment and then check until correct adjustment is attained. If this condition can not be obtained, check horizontal alignment, as outlined in alignment section.

Note—On sets with electrostatic focus picture tubes, the focus coil is omitted. Focusing is accomplished by adjusting the focus control on rear apron of chassis and to the left of the high voltage compartment.

ASSOCIATION NEWS

[from page 30]

SPRTTA

The Southern Pennsylvania Radio and Television Technicians Association reports a recent business meeting of its board of directors. Officers are: Joseph Hauser, president; Eugene Klinedinst, educational program chairman; Willard Strayer, correspondence secretary and membership solicitor. The board decided to meet each first and third Monday of each month.

RTGLI

The "Guild" *News*, new monthly paper of the Radio Television Guild of Long Island, made its first public appearance here recently. The *News* is an attractive little 6-page printed journal containing news and views of the association's affairs, as well as an informative article on "Flyback Transformer Testing" by Jack Buck, and interesting items on the background of the Guild. Congratulations to editor Murray Barlowe and his associates.

ARTSD (Columbus, O.)

Station WTVN (Channel 6), Columbus, Ohio, is giving a series of spot announcements calling to the attention of TV viewers the principles and code of ethics under which members of ARTSD operate.

A recent Raytheon "Service Saver" Meeting, conducted by Bill Ashby held over 250 technicians "glued to their seats" ARTSD reports.

Radio Old Timers Party

William C. McFadden (right), a manufacturers' representative from Columbus, Ohio, and secretary of the Radio Old Timers organization reviews

notes on last year's gala party with fellow Ohioan, Earl H. Dietrich, also a Rep of Cleveland, former secretary of the group composed of veterans of the radio and electronics industry. The Radio Old Timers annual reunion, regularly one of the highlights of the Electronics Part Show held here in May, is being organized by Mr. McFadden.

Get Started in P. A.

by GENE HESSEL

Chief Engineer, Air-Tone Sound & Recording Co., Philadelphia

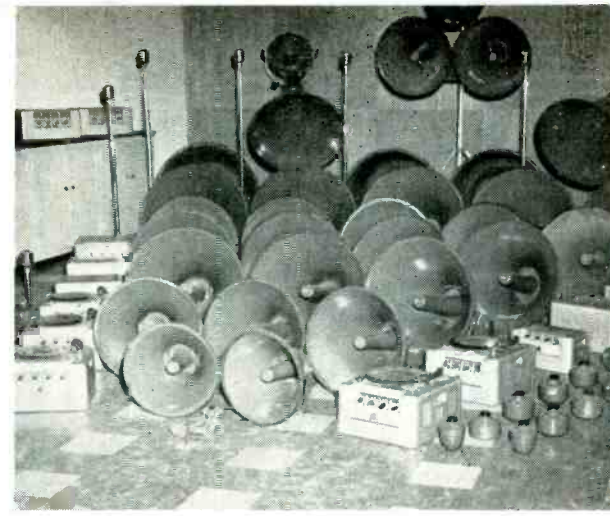


Fig. 1—Equipment at right was used in one installation by Air-Tone (Gimbel's Thanksgiving Day parade in Philadelphia).

TODAY there are thousands of ready-trained, thoroughly-qualified, and experienced men skirting around the edge of an undeveloped field just waiting to be exploited.

I refer, of course, to the field of public address systems and large-scale amplification. To the men who have served their apprenticeship in radio service and repair and who are thoroughly at ease in an electronic environment, this field of amplification constitutes an unlimited opportunity to move into a very lucrative and hitherto almost completely neglected phase of the sound and radio industry.

Never before has opportunity beckoned so invitingly and never before has it been so blithely ignored. Apparently, it's all a matter of perspective, the men closest to the field, and, necessarily, the ones in a position to profit most from its exploitation seem to be the men who are least aware of its excellent possibilities.

The public address field is literally no more than amplified radio service. It's the field of sound magnified and projected to the farthest corner of the stadium, auditorium, or concert hall. It consists of on-the-spot radio service, and, of course, calls for radio men. Those men who are familiar with the problems peculiar to sound and men who can call upon a solid radio background to help in their solution.

The radio man doesn't have to invest in any more equipment than that with which he is currently carrying on his business. The tools of the trade will remain identical and the period of adjustment usually required in any change-over becomes, for the most part, non-existent. His tube checking equipment, radio repair kit, test material of all kinds can immediately be brought into play when he starts in on public address and large-scale amplification. There are very few fields of endeavor so closely associated and allied as these fields of radio service and sound amplification, but in spite of their basic and inherent similarity, there are countless radio men who fail to recognize the enormous potential and, worse still, refuse to do anything constructive about it. It might be well for the radio man to look upon these two fields as a blending of two elements. Just as two rivers meet at a common junction and go on from that point to form a larger watercourse, gaining in intensity and power, so, too, can the radio man of today flow into the field of public address and take with him all the skill and experience acquired from his years in radio and broaden immeasurably the scope of an already huge and practically untouched market.

Where are these golden opportunities? To find them, just look around. They're in the schools of our country, on the athletic fields and playgrounds, amusement parks, municipal buildings, city streets, supermarkets, restaurants, churches, railroad stations, buildings devoted to cultural pursuits, museums, galleries, etc.

The public has never been so sound-conscious before. Witness the trend in the theater industry for example. Every new film process carries with it some highly-touted innovation in sound. There's stereophonic sound, high-fidelity sound, three-D sound, deep-dimension sound, Cinerama sound, etc. In countless ways the scope of sound application has been broadened almost beyond belief. Advertisers are more aware of it than at any other time in history and for that reason, the public consciously or otherwise is becoming more and more aware of the importance of good sound.

Where then, is this good sound to come from? It can come from only one source. Good sound engineers. And, who and where are the good sound engineers? They are the men who have made radio and sound and the study of their combined peculiarities their life's work, and they can be found at the benches of the radio shops throughout this country. They constitute the backbone of sound as an industry and it is these men who must necessarily be

[*Continued on page 56*]

Fig. 2—Cluster of p.a. speakers set up for announcements and music.

Fig. 3—Paging systems are used increasingly on subway surface lines.

A.G.C. SYSTEMS

Theory and Servicing of Average, Peak and Keyed AGC

BY PHIL MAUCHER

AUTOMATIC gain control (*agc*) is a means whereby a bias voltage which is directly related to the strength of the received signal is applied to either the *if* amplifiers, the *rf* amplifiers or both. In television, *agc* is employed for two reasons. First, to maintain the contrast level constant in the presence of stations with different radiated output powers, and second to keep the signal input to the sync system constant. Early TV sets without *agc* returned the grids of the controlled stages to a potentiometer (contrast control) in the negative return system (*Fig. 1*).

The most common *agc* system for a long time was the average type (*Fig. 2*). In this system, the video detector output is applied to *R2* (the detector load resistor), and to the filter consisting of *R3*, *R4*, *R5*, *C1* and *C2*. Since the direction of electron flow is toward ground, the voltage at the top of the detector load is negative. *C1* charges through *R3*, and *C2* charges through *R5*, until the voltages are equal. The time constants in both circuits are long enough to prevent the charge from leaking off over a reasonable period of time. For this reason rapid changes in signal levels have no effect on the bias developed. The full *agc* voltage is applied to the *if* grids and the reduced *agc* is applied to the *rf* amplifier grid. It has been found that the most effective operation is obtained under these conditions.

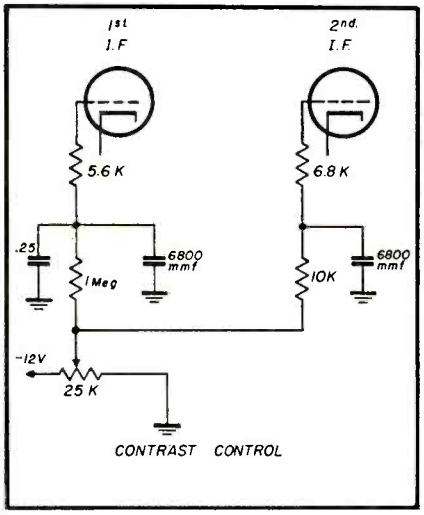


Fig. 1—Early sets used no AGC; returned grids to contrast control.

Peak AGC Systems

The "average" type system worked well while most sets were in primary reception areas. As installations were made farther and farther from prime reception areas, new problems arose. The main problem was the wide signal strength variations between different stations. These variations had a range between 100 to 600 microvolts depending on the distance of the station from the receiver. Noise pulses on weak stations naturally became of increasing importance. These matters brought out two limitations in the "average" type system which were not evident on strong stations. These limitations were caused by the effect of the background brightness on the average *dc* level at the detector and the poorer signal to noise ratio in fringe areas.

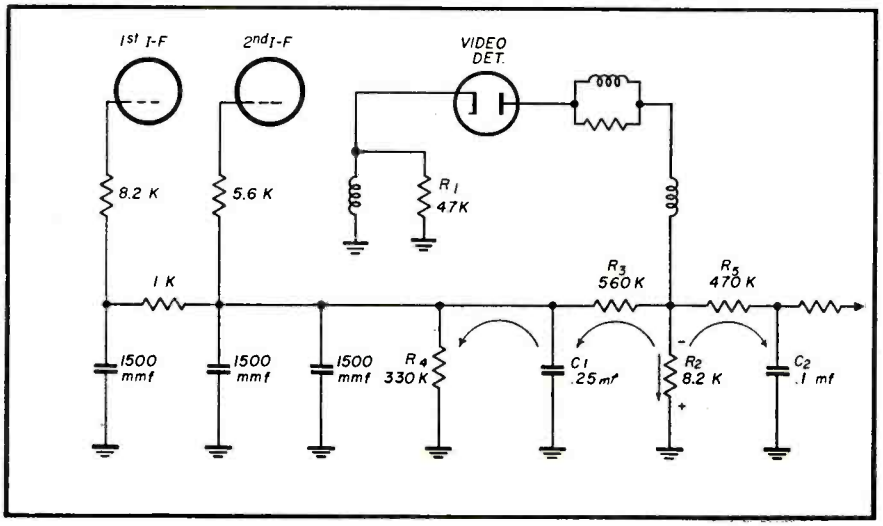


Fig. 2—"Average" type AGC caused trouble in fringe areas.

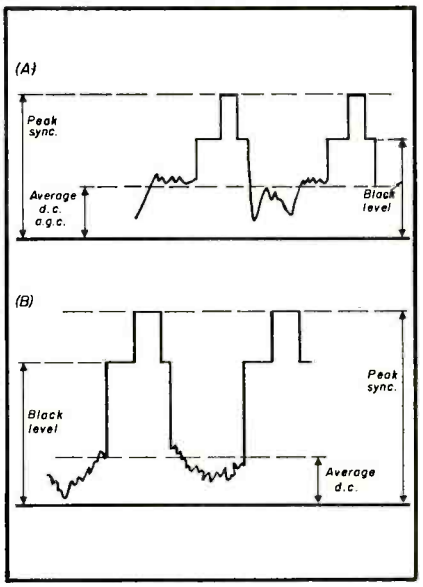


Fig. 3—Weak signal; dark scene. (B) Strong signal; light scene.

The signal at the video detector is the result of both the video information, and a *dc* level, the latter being a function of the overall brightness of the scanned scene. *Figure 3* shows the relationship between brightness level, video information and the average *dc*. It also shows how a dark scene in

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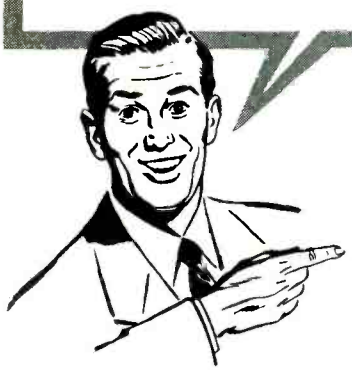

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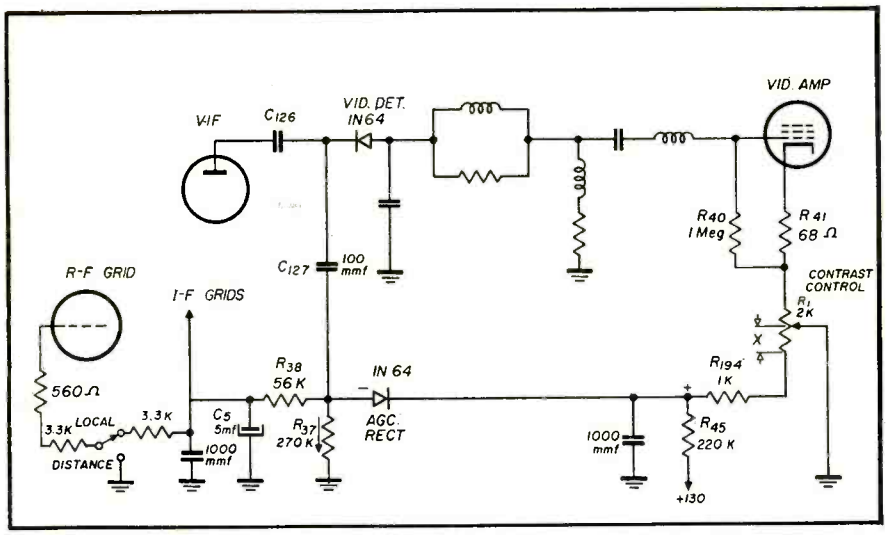


Fig. 5—Partial schematic, Arvin model 2160, showing peak AGC system and delay bias voltage applied to AGC.

a weak signal and a bright scene on a strong signal may develop an average *dc* which has the same amplitude. It is obvious that we do not want the same *agc* developed for both of these stations, but this is actually what can happen on an average type *agc* system. Noise has a similar effect in changing

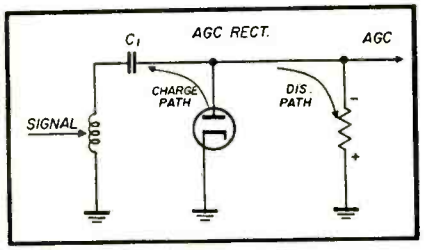


Fig. 4—Basic peak AGC system.

the average *dc* level. The overall TV has a component which is directly related to the carrier level and does not vary with the picture information. This is the sync pulse. An *agc* system determined by the amplitude of the sync pulse, therefore, may be used to establish the signal strength of a particular station.

Peak AGC and Keyed AGC

The peak type *agc* system and the keyed *agc* system which is a special type of peak *agc* utilize the above principle. *Figure 4* shows an equivalent basic peak *agc* circuit. In this system, a separate diode is needed. The time constants of this type of circuit are much longer than in the "average" *agc* circuits. As a result, the diode charges *C1* to the full value of the sync pulse. Because of the long time constant *C1* just about begins to discharge when the next sync pulse comes along and charges it again.

In most commercial designs of peak *agc* systems, it will be found that a delay bias voltage is applied to the *agc*, so that it does not function until the station strength is high enough to require it. Generally, as in the Arvin Model #2160, *(Fig. 5)*, this delay is a function of the contrast control so that as the control is set for a weak station, the delay voltage is applied.

In order to obtain this delay characteristic, the circuit operates as follows. Consider a video signal at the junction of *C126* and the *1N64* video detector. The *rf* path through *C127* will be applied to the *1N64 agc* rectifier. The resultant rectified current will flow through *R194* and the portion of *R1* set by the center arm of the contrast control. At the junction of *R38, R37,* and *C127,* a negative voltage is developed which is proportional to the sync peak value because of the time constant of the affected circuit.

Notice that a slight positive voltage is present at the junction of *R194, R45,* and the cathode of the *agc* rectifier. This voltage is a result of the voltage divider action of *R45, R194,* and the "X" amount of contrast control resistance. This positive voltage delays conduction of the *agc* rectifier until the video signal reaches an amplitude greater than this positive voltage. By increasing the amount of "X" resistance, this positive voltage is increased resulting in greater delay action.

In the ordinary operation of the receiver, a weak signal demands a lower bias on the video amplifier, meaning more of "X" in the circuit. This means a greater *agc* delay voltage which is just what we wanted.

In *Fig. 5,* note that, in addition to the delay bias, there is a local-distance switch. When the switch is in the distance position, the minimum *agc* which is developed even with contrast control in the minimum position is removed from the *rf* amplifier grid.

Keyed AGC Systems

A special type of the peak *agc* system which has become about the most popular in recent years is the "keyed" *agc* type. This circuit is shown in *Fig. 6.* Note that the cathode is returned to B+ through *R1* and *R2.* The grid is returned to the junction of *R1* and *R2* through *R3.* As a result both are positive with respect to ground. Since the cathode is more positive than the grid, a bias is established. The plate is connected to ground through *R4;* therefore, if any plate current can be made to flow through *R4,* the voltage at the plate will be negative with respect to ground.

The circuit depends on the horizontal sync pulse which occurs when the electron beam of the CRT is being retraced to the beginning of the next line. During retrace, a pulse is developed in the horizontal transformer by the collapse of the scanning trace. In most keyed *agc* systems this pulse is taken off through a voltage divider and fed to the plate of the keying tube. The pulse here is generally between

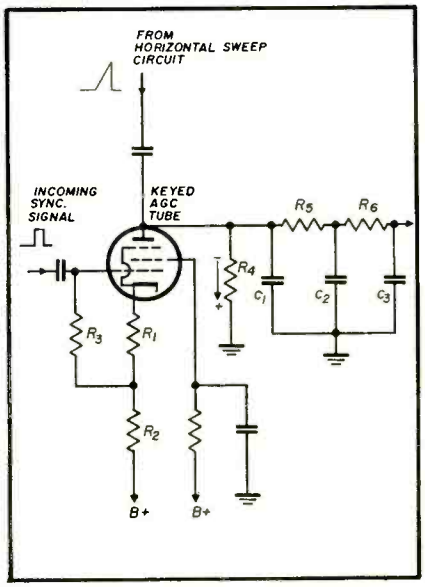


Fig. 6—Typical keyed AGC system.

400 to 500 volts peak-to-peak. If the tube is not in a cut-off condition, this pulse will cause plate current to flow through *R4.* This establishes the previously mentioned negative voltage with respect to ground. The amplitude of this plate current pulse is determined by the voltage at the grid.

The bias is set so that the sync pulse will take the tube out of the cut-off condition. The stronger the

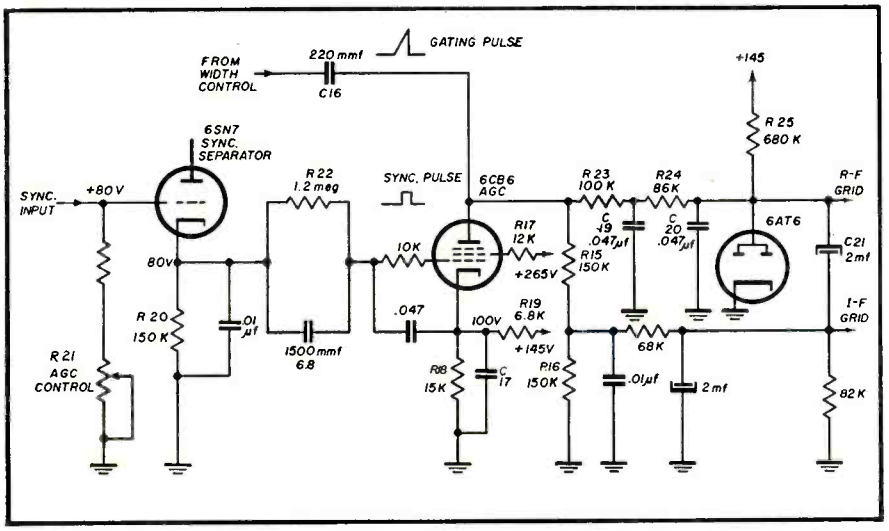


Fig. 7—Partial schematic, RCA KCS-66, showing keyed AGC system using separate lines for RF and IF stages.

received signal, the greater the sync pulse. As the sync pulse amplitude increases, plate current increases, and the negative voltage developed across *R4* increases. The resulting voltage wave form across *R4* is then filtered by means of *C1, C2, C3, R5,* and *R6*. The time constant of this filter network is small in comparison to that found in other *agc* systems, for the simple reason that it is based on the 15.75 *kc* horizontal sync cycle rather than on the 60 cycle vertical sync pulse. One of the effects of this action is that the rapid variations in signal resulting from the passage of planes overhead is minimized. Since the tube only conducts while the sync pulse and the keying pulse are present, any noise pulses which occur during the video portion of the picture will not be able to trigger the *agc* tube.

Special Keyed AGC

Figure 7, the RCA KCS 66, is an example of a type of keyed *agc* which bears explanation. There are, in addition to the standard features previously outlined, some noteworthy additions. The reasons for this are that modern *rf* circuits do not have the same dynamic characteristics as video *if* amplifier stages. By this, we mean that the *rf* amplifiers have different grid bias sensitivity characteristics than *if* amplifiers. Generally, it is desired that in weak signal areas very little or no bias be applied to *rf* stages.

The above requirements are met by the use of separate *agc* lines for the *rf* and the *if*. This usually takes the shape of a tap on the *if agc* bleeder resistor. In addition, a manual control is usually inserted to delay the application of *agc* voltage until the *rf* signal reaches a pre-determined amplitude.

In the RCA KCS66, the keying pulse is fed to the 6CB6 plate by means of *C16*. The plate return resistors are *R15* and *R16*. The screen is returned to +265V through *R17*. The cathode is on a voltage divider between ground and +145V consisting of *R18* and *R19*. The grid gets both its signal voltage from the top of the resistor *R20* in the cathode of the sync separator, and its −20V bias from the difference in *dc* voltage between the voltage across *R18* and *R20*. Since the *dc* drop across the cathode resistance *(R20)* of the sync separator can be controlled by its grid bias, the control *R21* in the grid circuit can act as the *agc* delay control. This is accomplished by varying *R21* which is part of a voltage divider network. The voltage at the *agc* cathode is stabilized by *C17,* a 10 *μf* condenser. *C18* and *R22* act as a filter for any noise pulses which might be present on the sync pulse.

When the sync pulse and the gating pulse arrive, the tube conducts through *R15* and *R16* to ground. The *rf* amplifier bias is developed across the filter *R23, R24, C19, C20,* and *C21*. Shunting this filter is a diode, the cathode of which is grounded and the plate return of which goes to +145V through *R25*. The diode itself is part of a voltage divider circuit with a slight positive voltage at the diode plate with respect to ground. This voltage bucks the negative voltage of the previously developed bias and results in a reduction of the net bias voltage applied to the *rf* amplifier. Diode conduction prevents the *rf* grids from going positive. The *if* voltage which does not have a bucking voltage is applied in full to the grids of the *if* amplifiers.

While the keyed *agc* system has many advantages, it has one major draw-back for the serviceman in that the horizontal system must be operating properly if the *agc* is to be effective. It can easily be seen that if the horizontal system goes out of order, the tube will be gated improperly. When this takes place, the sync pulse is not present at the grid; the voltage developed on the filters will trickle off and the bias voltage will become less negative. This will result in the *if* amplifiers being over-driven. This in turn will cause clipping of the sync pulses which in turn will further mess up the operation of the horizontal circuits. The final result is a vicious cycle with all circuit functions deteriorating to a point where the screen becomes a nightmare.

Servicing Keyed AGC System

The first step in servicing a set which has keyed *agc* is to be prepared with a 3 volt dry cell battery. Disable the *agc* by removing the keying tube. Connect the battery to the *agc* line. This should result in the restoration of the picture. This picture may not be in sync. If it is out of both horizontal and vertical sync, look for your trouble prior to the point where the two syncs are separated. This could be in the sync separator, the video amplifier, the video detector, and the *if* or *rf* stages. If only the horizontal is out of sync, check the horizontal oscillator or horizontal *afc* circuits. If both syncs are operating, the most likely source of trouble is in the horizontal output stages. Either the horizontal output tube is weak, or the pulse divider network is defective.

In any work on keyed *agc* systems, both the oscilloscope and the *VTVM* are indispensible. If the scope is calibrated, so much the better. Use the scope to check the peak to peak voltage of the keying pulse. It should be within 10% of the voltage called for in the manufacturer's specifications. If it isn't, look to the divider for a fault: either shorted turns in the transformer type of divider or leakage in the capacitive divider. Check the condition of the horizontal output tube and measure the resistance of the output transformer for shorted turns.

If the pulse voltage is of the proper amplitude, check the peak-to-peak voltage of the composite signal. If these measurements show less than the required amounts, the sync pulse is not driving the keyer sufficiently to develop enough bias voltage. With the *VTVM* on the *agc* line, switch from a strong station to a weak one. If the *agc* voltage does not change very much, it indicates that the defect is in the *agc* system.

SMELLO-VISION

A NEW DEVELOPMENT

by OSCAR FISCH

Chief Engineer, Lirpa Loof[1] Products

This new electronic marvel is designed to bring to you the true odors present in many TV programs

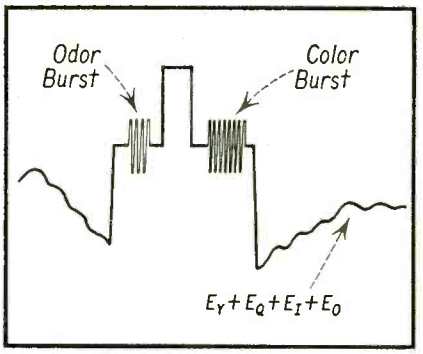


Fig. 1—Location of odor burst signal on front porch of the blanking pulse.

THOUSANDS of servicemen have recently attended "color courses" under the auspices of various manufacturers. Almost without exception these servicemen, the author included, were awed by the technical ingenuity achieved by engineers in working out this new realism. When one stops to consider that all of the innovations involved had to be worked out within the 6 *mc* bandwidth which had previously been set up by the FCC for monochrome transmission, the feat becomes even more amazing. Yet this is only the beginning. To use a colloquialism, "we ain't seen nuthin' yet."

If the term "Smello-Vision" were used, as it has been, we would all be inclined to think of the user as a "comedian" trying to be funny. Yet at this very moment, research is being conducted in the laboratories of some of our leading manufacturers to make TV reception even more realistic by the addition of "odors" to the signal. It is the purpose of this article to outline briefly the work which has been accomplished along these lines thus far.

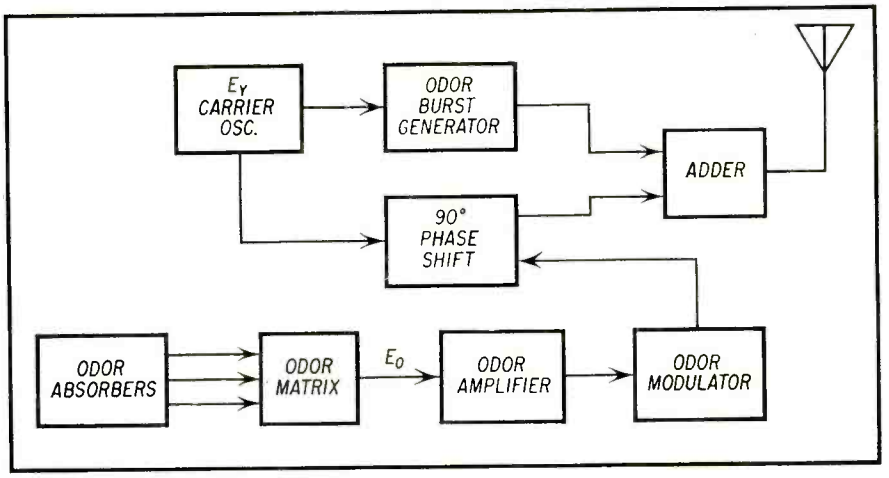


Fig. 2—Block diagram of a portion of an experimental transmitter used for developing the odor signal (E_o) modulation.

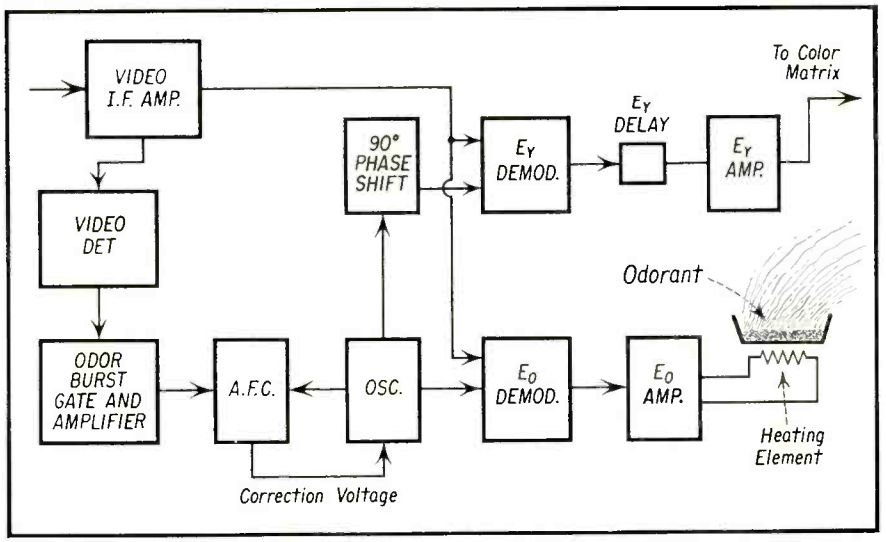
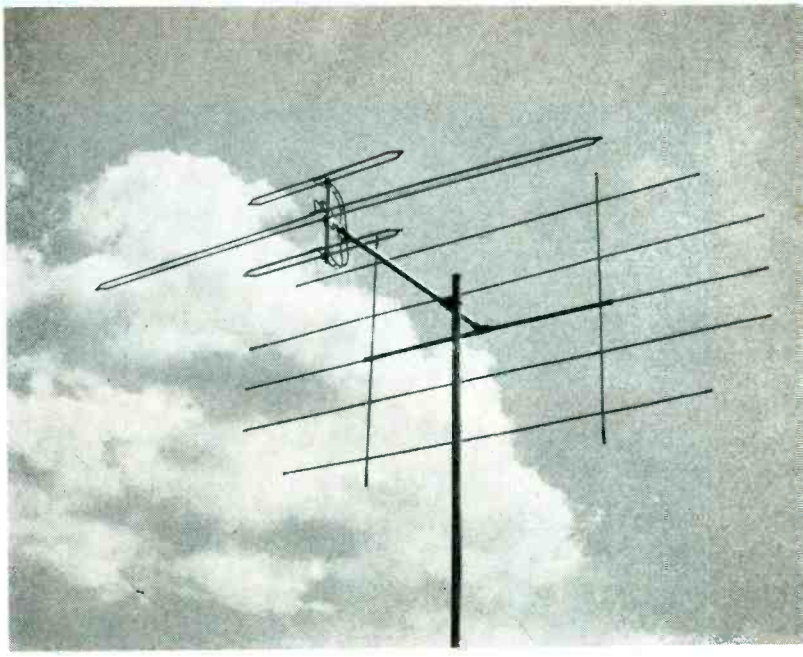


Fig. 3—Block diagram of an experimental "color-odor" receiver, showing only the stages involved with odor production.

The present color signal utilizes the principle of interleaving and also that of quadrature transmission in order to work three separate signals (Ey, Eq, and Ei) in the framework of the 6 *mc* band previously used to carry only the monochrome signal and its associated sound. The color carrier handles two of these by these signals, while the old video carrier is modulated by the third (Ey). Obviously a fourth signal could be introduced by applying the quadrature principle to the video carrier also, i.e., this fourth signal or the "odor" signal uses the same frequency as the video carrier but is transmitted 90° out of phase with the Ey signal. In the same way that a color burst signal is now located on the back porch of the horizontal blanking pulse for the purpose of providing a reference signal to be used in the synchronous color detectors, an

[*Continued on page 59*]

A HIGH GAIN, ALL-BAND, VHF-UHF ANTENNA



by HAROLD HARRIS
Vice-President, Channel Master Corp.

and HARRY GREENBERG
Chief Engineer, Channel Master Corp.

BY THE end of 1953, 234 *vhf* stations were operating in this country. This meant that the single channel *vhf* area had virtually disappeared and that the rapid decline of the single channel Yagi had been heralded.

Dr. Yuen T. Lo, of the Channel Master Antenna Development Laboratory anticipated this condition more

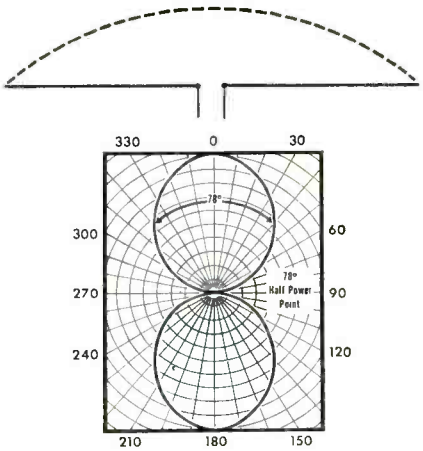


Fig. 1 (top)—Current distribution, ½-wave dipole. (Bottom)—Polar diagram. See explanation in text.

than two years ago and launched a major development effort toward the creation of a more efficient type of all-channel *vhf* antenna.

After carefully reviewing all existing broad band antenna types, and analyzing their limitations, Dr. Lo based his research project upon a new and entirely original theory and in doing so, developed a basically new dipole system. This new dipole system is known as the "Tripole."

The Problem—and How It Was Solved

The basic probem in broad band antenna design is to achieve a way of utilizing the full length of a low band dipole on high band operation. A half-wave dipole has a current distribution as shown in *Fig. 1a*, and a horizontal polar diagram as shown in *Fig. 1b*. The size of a half-wave dipole varies inversely with frequency, while the voltage that a dipole intercepts is directly proportional to its length. Since the frequency ratio of the middle of the low band is approximately 3:1 with respect to the middle of the high band, a high band dipole is only 1/3 the length of a low band dipole. Therefore, it will pick up only about one-third the energy.

If we attempt to use a low band dipole for receiving high band signals, a current distribution will result as shown in *Fig. 2a*, and a horizontal polar pattern as shown in *Fig. 2b*.

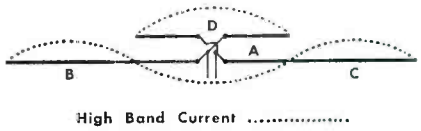


Fig. 3—Reversing phase, center pole.

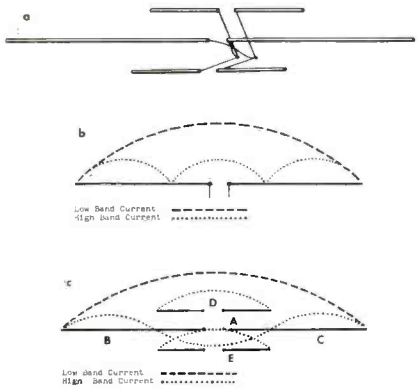


Fig. 4—Current in the tripole system.

Under these conditions, the low band dipole can be considered to be three half-wave high band dipoles tied together. However, the middle dipole is 180 degrees out-of-phase with the two outside dipoles. If we could get the three dipoles to act in-phase a theoretical gain of 3.2 db would result. It must also be remembered that for low

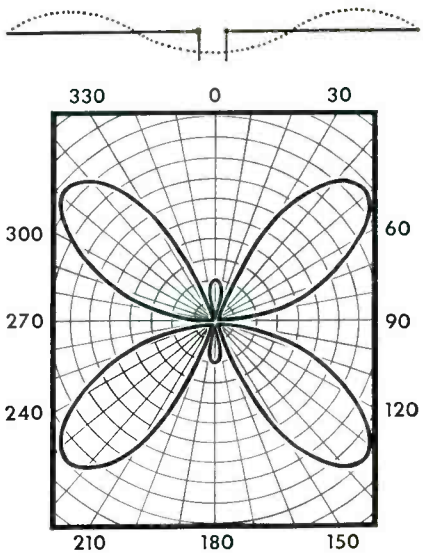


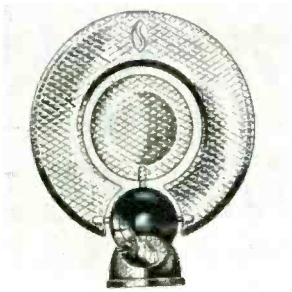
Fig. 2—Patterns for low-band dipole. Top shows current distribution. Bottom is polar diagram. Compare with Fig. 1.

band operation, these three high-band dipoles must function as a single half-wave dipole.

Dr. Lo, in his early experiments, hit upon the idea of reversing the phase of the center dipole during high band operation. See *Fig. 3*. We can readily see that, since dipoles "A" and "D" are in approximately the same point of space, they will cancel one another so that high band operation is achieved only through the use of dipole "B" and

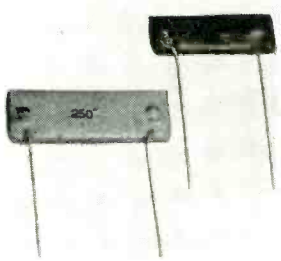
[*Continued on page 60*]

New Products



Snyder "4D" Indoor Antenna

The "4D" is a compact indoor antenna for VHF and UHF in metropolitan areas. The "4D" is designed with an independent operating halo element and center phasing disc, both affording maximum orientation. Constructed in the base is the exclusive Snyder 6-position electronic beam selector switch. Catalog and advertising material on the "4D" may be obtained by writing to **Snyder Manufacturing Company**, Philadelphia 40, Pa.



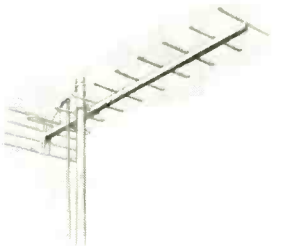
New Type Econ-Ohm Resistors

Econ-Ohm resistors are individually wound on non-hygroscopic ceramic cores to which are attached tinned copper leads in such a way that stresses put on them in any way will not injure the resistance wire.

For more detailed information write to—**TRU-OHM PRODUCTS. Division of Model Engineering & Mfg., Inc.** General Sales Offices—2800 N. Milwaukee Avenue, Chicago 18, Illinois.

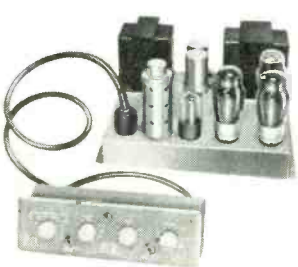
Fuse Tells Whole Story

The Eagle "O.K." Glass Plug Fuse manufactured by **Eagle Electric Mfg. Co., Inc.**, Long Island City 1, N. Y. has a magnifying glass center through which one can easily see the word "O.K." When there is an overload or short, part of the "O.K." vanishes. It positively indicates a blown fuse when the entire "O.K." vanishes. The "O.K." fuse is constructed to expel the gases caused by a blow.



Taco UHF Yagi Incorporates Unique Assembly

A new concept in UHF antenna design is announced by **Technical Appliance Corporation**, Sherburne, N. Y., manufacturers of Taco antennas and accessories. Incorporating welding techniques used in production of antennas for the military and aviation industry, Taco's UHF Yagis have a Rigi-Channel frame to which aluminum driven and parasitic elements are welded.



New Leak Amplifier and Remote Control Unit

The new Leak TL/10 Amplifier-Pre-Amplifier combination with master remote control unit features record-equalizing adjustments and tape recorder jacks (input and output) built onto the front panel. Model TL/10 uses a new ultra-linear 10 watt circuit with KT-61 output tubes in push-pull. For further data write to Dept I.P-2, **British Industries Corp.**, 164 Duane St., N. Y. 13.

Walsco "Clean-O-Matic"

Exclusive patent rights were secured recently by the **Walsco Electronics Corporation**, Los Angeles, for the "Clean-O-Matic" which fits all standard coil tuners, cleans and protects all contacts, except the one in use.

The "Clean-O-Matic" is individually boxed, complete with instructions, and includes a small tube of Walsco "Tunerlub" and a crocus cloth for cleaning highly oxidized contacts.

"501" Series of Mikes

The new "501" series of the **America Microphone Co.**, Pasadena 1, Calif., includes dynamic and carbon hand-held microphones for all communications needs: mobile, police, ship-to-shore, and aircraft communication, as well as amateur radio, paging, and inter-communications systems. The "501" series microphone weighs only ten ounces exclusive of cable and plug. For further information, write the manufacturer.

Twisted Tab Mounted Controls

Clarostat's Series 47 Twisted Tab Control eliminates the usual bushing, lockwasher and nut. The unit is mounted by inserting the tabs through slots in panel or chassis, and twisting them to secure the control in place. Electrically, the control is the same as the Clarostat Series 47, 15/16" dia. units. For more information write for drawing number 251914. (Clarostat Mfg. Co., Inc., Dover, N. H.)

New Tuf-Guy Ten Spot

Guy wire in a flat handi-pack called TUF-GUY TEN SPOT is spot-marked every 10' for easy measuring. A 7" circle on the top of the box is perforated for easy lifting. The wire is unwound from the center. For details write to the **Fenton Company**, 15 Moore Street, New York 4, N. Y.

Hickock UHF-VHF Marker Generator

Hickock Model 690 covers frequencies from 4.25 to over 225 mc on fundamentals with a 0.25 volt RF output and provides dual markers with any TV sweep generator. Unusual accuracy is assured by a Non-Parallax device. Other features make for accurate and easy use. For details, write to **The Hickock Electrical Instrument Co.**, 10533 Dupont Ave., Cleveland 8, Ohio.

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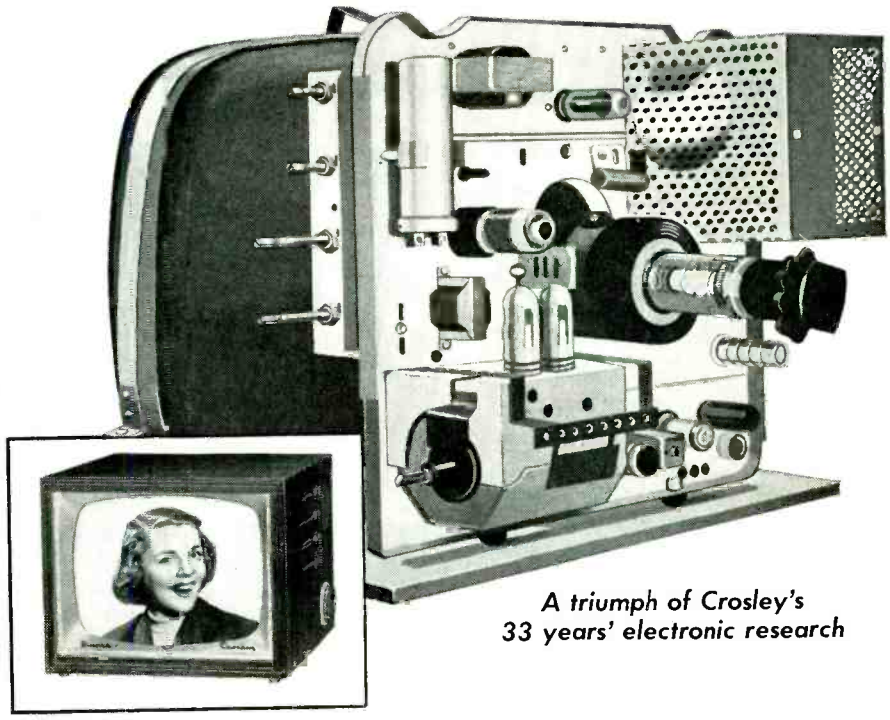
The Super-V is a cinch to install. It's compact, weighs only 53 pounds. And in many places, you'll find its built-in antenna is all you need for perfect reception. Service men who've seen the Super-V call it the greatest forward step ever taken in TV chassis design.



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P. A.

[*from page 47*]

the backbone of good public address and large-scale amplification as these elements assume proportions sufficient to stamp them as a major industry within an already major industry.

Consider for a moment the use of sound in schools. Aside from the systems ordinarily found in the assemblies, you will discover that sound is required in gymnasiums, athletic fields, playgrounds, portable systems in buses, (used in class field trips) etc. Progressive administrations in the educational field stress the importance in many ways of not only visual education but, through the use of sound projectors, devote a good deal of time to educational facilities combining both visual and audio media.

The use of sound is then carried a step further and, in this day and age, plays a very important role in the recreational facilities and activities of the modern institution. The sound system has become an absolute necessity in the proper presentation of almost any athletic contest or social event held under the auspicies of the school. And whether an elaborate, complex, and relatively costly system is available or, a fairly simple and rather inexpensive system is used, you can be quite sure that there will be some form of Public Address or outdoor amplification in evidence.

Need for Quality Sound

Speaking of recreation and recreational facilities combined with sound, did you ever notice how the huge amusement park with its scenic railway, merry-go-round, food stands, noisy crowds, barkers, etc. becomes one large, well-organized and controlled playground when it enjoys the advantages of a good public address system? The atmosphere-creating continuous background music played through a fine speaker system complete with paging facilities, available through the use of a voice-operated relay, make the chaos and general confusion so much a part of such a situation, seem minor and quite coincidental.

When the poor-quality and tinny-sounding horns have been replaced with good equipment and announcements can be made as simply as possible with practically no loss of time, the efficiency and overall improvement in any amusement park area is practically unbelievable. This type installation, however, must be done right and the emphasis should, above all, be placed upon quality sound and, consequently, calls for, and demands, the attention of experienced sound and radio men.

The churches of this country repre-

sent another very important source of activity with regard to outdoor amplification and public address requirements. A large number of churches are investing in bell tower systems, permanently installed public address systems inside the church, and, at least one portable system to be used in various church functions of a social nature or set up and used in Sunday schoolrooms. Their systems range, of course, from very elaborate multi-controlled installations to the fairly small, hardly more than adequate microphone, amplifier, one speaker outfit usually intended to cover the congregation located in the extreme rear of the church.

The large installations, however, are usually capable of covering a gathering of a few hundred people and in addition, make some sort of provision for the hard of hearing by incorporating into the system a hearing-aid section specifically set aside for that purpose.

We might mention, in keeping with the discussion on church public address requirements, the increasing popularity of church bell tower systems. These are, of course, admirably suited to the demands of a small community church operating within a rather limited budget, but, which, at the same time, would like to have some sort of a carillon, chimes, or bell effect available at certain times.

The set-up consists of one horn suspended in an upside-down position simulating an authentic bell very admirably and usually mounted in a light metal but durable six to eight foot tower. It is fed from a record player contained in a rack along with the necessary amplifier, pre-amplifier, and timing apparatus. The system can, of course, be operated manually but a time switch is most commonly set and regulated so that the system will automatically go into operation at the desired times. These systems, too, can get extremely complex or elaborate and very definitely demand the attention and consideration of a man well-versed in the field and completely confident of what he is doing. Needless to say, however, it should be very obvious to all and sundry how very easily the experienced radio service and repair man could handle a job of this nature.

One important consideration that must be ever before the radio man who intends to make the move into the outdoor amplification field is the fact that, just the way that people are constantly looking for something better in everything else these days, so, too, is the emphasis upon quality sound. No longer is it possible to hook up a mike to an amplifier and a battery, push it through a speaker and call it a public address system, expecting people to believe it. In this day of binaural, stereophonic, omni-dimensional sound, people listen, analyze, and reject what they don't like.

Today, more than ever before, the public demands quality, and there's no reason why they shouldn't get it. Every day sees the development of some device which advances the cause of sound. Who should be more aware than the man in the sound field that today there is little or no excuse for poor sound. Radio men naturally have a fuller understanding and a much greater appreciation of what can be done with the medium which is their livelihood, and, because of that greater understanding, are more obligated than anyone else to see that the thing is done properly.

So, there's no doubt about it any longer, the time has come for the man in the industry to definitely get with the trend. Stop ignoring the fact that the chance to progress is really here. All it needs is the added push it will get from your taking an active part in its ultimate development. Cash in on this golden opportunity. Look around you. Make the break into the large-scale amplification field. Compared to almost any other field it is sound both in name and nature.

TRADE FLASHES

[from page 7]

DuMont says that a number of extravagant claims were made when color television was first introduced to the trade in January at the Chicago Furniture Show. DuMont at that show took the stand that it would not manufacture color receivers for sale to the public until a larger size color tube was available, until the prices were commercially practicable, and until a true color set was ready, and not merely a laboratory experiment hiding behind the name of "Color Television Receiver."

Officials of Technical Appliance Corporation, Sherburne, N.Y., manufacturers of Taco high-gain television and radio antennas, announce full production schedules at the present time. Factors contributing to the ever-increasing shipment of Taco products are listed by officials as the tremendous acceptance of the new Trapper antenna, the growing demand for other Taco high-gain VHF designs, and the growing popularity of the UHF Grid Yagi.

Creation of a "Seal of Approval" for television dealers and servicemen who make good quality UHF conversion installations was announced today by Station WRTV on Channel 58, metropolitan New York's first UHF outlet and the north Jersey coast area's first television station.

Harold C. Burke, vice-president in charge of operations for WRTV, said the station will issue store window decals, counter cards, and advertise both in newspapers and over the air the names of dealers and servicemen who receive the "Seal of Approval", as a means of directly supporting those installers whose work meets specifications which the station believes necessary to properly receive WRTV.

The Board of Directors of the Radio-Electronics-Television Manufacturers Association and the two Committees of the Board, the Radio-Television Industry Committee and the Electronics Industry Committee is taking steps to facilitate the elimination of radiation by some TV sets, to urge Congress to exempt color TV sets from the excise tax, and to support a proposed research program in educational television.

The 1954 Electronic Parts Show at the Conrad Hilton Hotel here May 17th-20th has been planned to provide the maximum time for distributors to see the 397 booths and displays of 277 exhibitors, as well as to meet with their suppliers' key personnel. Advance regis-

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tration of distributors, which this year has reached record proportions, plus a system of confirmed appointments between distributors and suppliers give promise of a well-attended and mutually beneficial Show, Show President Harry A. Ehle, of International Resistance Co., Philadelphia, said.

A Conference Coordinating Committee has been established by all six trade associations within the Electronics Industry. The Committee was organized for the purpose of coordinating regional conferences run by sales representatives and to eliminate duplication of time, effort, and expense.

The Committee designated RUSS DIETHERT of Chicago, Illinois, national president of "THE REPRESENTATIVES" as its chairman, and S. L. BARAF of United Transformer Corporation of New York City as its co-chairman.

A free 90 day labor service and parts exchange privilege is the new service policy announced by Berlant Associates of Los Angeles, manufacturers of Concertone high fidelity tape recorders.

Elliot March, Sales Manager for TV Products, Springfield Gardens, New York, manufacturers of the TESCON antennas recently returned from a sales trip to the Mid-West. Mr. March accompanied a shipment of two trailer loads of "Big Joe" antennas sent to the Cameron Company, Rock Island, Illinois, who are the exclusive TESCON distributor in the Rock Island area.

A color television training school is being held here for 30 Admiral field engineers and distributor service engineers, Max Schinke, national service manager, has announced. Students are being taught the theory and fundamentals of color television, also how to install and service receivers.

More than 500 radio, television and electronics technicians from Texas and Louisiana recently attended the First Annual Sterling Spring Parts Show, sponsored by Sterling Radio Products Company of Houston and Beaumont. The show, first of its kind by any radio-television parts distributor in this area, featured displays and exhibits of over 50 manufacturers. Also on the program were speakers from Radio Corporation of America, the General Electric Company, Hickok Electronics Company, Sprague Electric Company and two local television station executives.

200 service dealers and their maintenance men turned out recently for an RMS & Television Accessory House sponsored forum in Providence, R. I., to welcome Station WNET, Channel 16, to the UHF airways.

ANSWER MAN

[from page 16]

cerning the antenna) and can easily be exchanged or taken to the shop for service.

In answer to your question about selenium rectifiers in a TV receiver indicating that the set employs a series filament circuit: it can be definitely stated that this is no indication. TV receivers may use selenium rectifiers and still have a small transformer to provide filament voltage for the tubes in a parallel arrangement.

SMELLO-VISION

[from page 52]

"odor burst" signal is injected at the front porch. See Fig. 1.

If we designate the odor signal as Eo,[2] it can be seen that in the overall picture, another *afc* section must be added to feed the additional synchronous detectors which are required for the Ey and the Eo signals.

All that remains to be done now is to convert odors at the studio to varying odor voltages which can modulate the video carrier at the transmitter and then reconvert the modulation envelope to corresponding odors at the receiver. This task is not as insurmountable as it may seem at first glance. Present research is proceeding along the following lines. At the transmitter is a series of selective odor absorbers, each one capable of absorbing its own characteristic odor. These absorbers are of chemical rather than electronic nature. The electrical resistance of the absorber varies in step with the amount of odor absorbed. Placing this absorber in a circuit would then produce a varying current which in

turn is used to produce the Eo modulating signal.

At the receiving end, after demodulation, the Eo signal is passed through a series of heating elements, where the varying current produces varying amounts of heat. The heat is then applied to a set of chemicals each of which gives off its own characteristic odor. The nature of the odor would depend on which particular chemical is heated and the intensity of the odor would of course depend on the amount of heat supplied.

At the present time, work is being done with five different and distinct odors. A matrixing system is used at both the transmitter and the receiver for the purpose of combing the odor signals at the transmitter and recovering the individual odor signals at the receiver output. A simplified block diagram of the overall system is shown in Fig. 2.

The next installment in this series will appear on April 1st, 1955.

[1]Remember Serutan.
[2]Eo stands for odor voltage.

ALL-BAND ANTENNA

[*from page* 53]

"C." Low band operation remains completely unimpaired.

However, this approach produced only two half-wave dipoles on the high band and, therefore, the next step was to tie another high band half-wave dipole to these same feed points. *Fig. 4* shows the current distribution that results from this tri-pole system.

Adding all the currents together, dipoles "A" and "D" cancel each other out and dipoles "B," "C" and "E" are in-phase. This new system still functioned as a half-wave dipole on the low band and at the same time achieved in-phase operation of the three sections on the high band. A better impedance match was obtained by using folded dipoles throughout the system. Furthermore, special quarter-wave transformer lines were designed in order to produce a 300 ohm impedance for high band operation.

In order to eliminate the rear lobe a screen reflector is used. The maximum potential gain of a straight bar reflector is approximately 3 db, and this can be achieved only for a very narrow band of frequencies. Therefore, a straight bar reflector could not function efficiently on both the high and low bands. A screen type reflector, however, is not frequently sensitive and has an optimum gain of approximately 7 db.

The size of the screen reflector was designed large enough to give efficient

reflection at the low band. This meant than its size was more than adequate for the high band.

Realizing the importance of preassembly in television antennas, this antenna was designed so that it could be folded in manufacture and opened up for installation in a few seconds. Gain figures and typical horizontal polar patterns for this antenna in the single, two bay, and four bay versions are shown in *Fig.* 5. The high band efficiency of

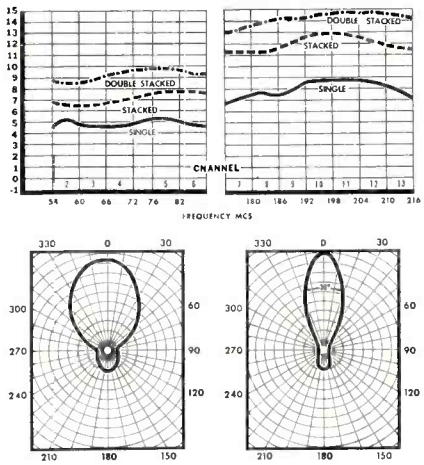

Fig. 5 (top)—Gain figures, new antenna in single, 2-bay, and 4-bay versions. (Bottom)—Horizontal polar patterns for the wide-band antenna.

this antenna stands out particularly in the two bay version which has gains in excess of 11 db across the entire band.

UHF Operation

Although this antenna was not designed for *uhf* operation, it is interesting to note that since it has been released, many are in use in areas where *uhf* is also received. Reports from the field indicate that this antenna gives excellent *uhf* reception in many installations.

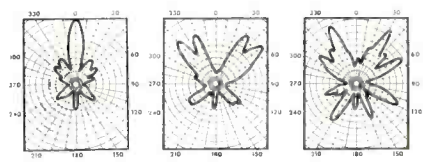

Fig. 6—Horizontal patterns on UHF.

Typical horizontal polar patterns on the *uhf* band are shown in *Fig.* 6. It can be seen that although there are many different lobes, good *uhf* performance can be achieved by orienting the antenna so that the signal is received by one of the stronger lobes.

Gains of up to 12 db can result at most *uhf* frequencies by careful orientation. In installations where a rotator is used this presents no particular problem.

TV INSTRUMENT CLINIC

[*from page 12*]

Q. Can a *dc* scope be used to check the waveform and modulation from a signal generator?

A. Yes. *Fig.* 3 shows the waveform and modulation characteristic of a signal generator when the frequency is sufficiently low to be applied directly to the vertical amplifier of the scope. At higher frequencies, a demodulator probe must be used; a typical modulation envelope is shown in *Fig.* 4, obtained by use of a crystal demodulator probe.

Q. If the output from the signal generator has a true sine waveform, will this be apparent when a test is made with a demodulator probe and a *dc* scope?

A. A demodulator probe, such as shown in *Fig.* 5, introduces no distortion into the pattern. The result of testing the output from a generator with reasonably good sine-wave modulation is shown in *Fig.* 6.

Q. Why is it that tests of TV signals made in weak-signal areas are not very useful?

A. The difficulty in observing waveshapes and measuring peak-to-peak voltage values in weak-signal areas is caused by the large random noise voltages which are present, as shown in Fig. 7. It is better practice to make use of generator signals rather than station signals to check circuits in fringe areas.

TV COLORIMETRY

[*from page 26*]

nous energy of each of the three primaries by the same factor.

3. The eye-brain combination can be thought to be made up of blue, red, and green receptors. Color information to the brain is effected by means of these receptors singly for red, green or blue, or in combination for other colors.

4. The primary illuminative or "additive" colors are red, green and blue. Their combined effects produce white.

5. The primary pigment or "subtractive" colors are yellow, cyan (blue-green) and magenta (blue-red). Their combined effects produce black.

6. The basic characteristics or attributes by which white or colored light may be identified are hue (color)

brightness (intensity), and saturation (purity).

7. A color chart which is used to identify a color as to its hue and saturation is the CIE chromaticity diagram which has been adopted as its standard by the NTSC.

8. The percentage of red, green and blue signals that make up a "reference" white signal is: 59% green, 30% red, 11% blue.

9. Physiological limitations of the human eye-brain combination whereby it is unable to distinguish color detail as well as brightness detail dictates that large color areas require three-color transmission; smaller areas require two-color transmission; and very small areas require only black and white transmission.

KEY TEST POINTS

[from page 34]

peak voltage fed to the next stage would be increased, driving the next stage incorrectly.

Picture Pulling

If the sync pulses are not being clipped properly in the sync clipper or separator and amplifier stages, blanking and video information will pass through these stages, when it should be blocked. This will cause the sides of the picture to be modulated either in the middle or at the top and bottom depending upon the picture information being televised.

There is usually one stage in the sync section, the separator stage, that uses low plate voltage. In this stage most of the sync clipping is performed and it is important that the plate voltage be just about correct. An increase in the plate voltage will permit the video information to pass through and cause modulation of the picture sides. A decrease in plate voltage will cause the sync pulses to be of insufficient amplitude.

Therefore, if the picture is pulled, determine if the trouble is being caused in the i-f and video amplifier stages or the sync clipper stage as previously discussed. If the pulling is occuring in the sync stages, particularly check the plate voltage on the clipper stages.

Integrating Networks

The integrating network can be signal traced with an output meter. In each section of the network a reduction in voltage will be experienced, as the output meter is moved in the circuits towards the vertical oscillator circuit. The integrating network can also be signal traced using a *dc* meter. DC voltages will be present at the various points along the integrating network if the vertical pulses are present.

Advertising Index

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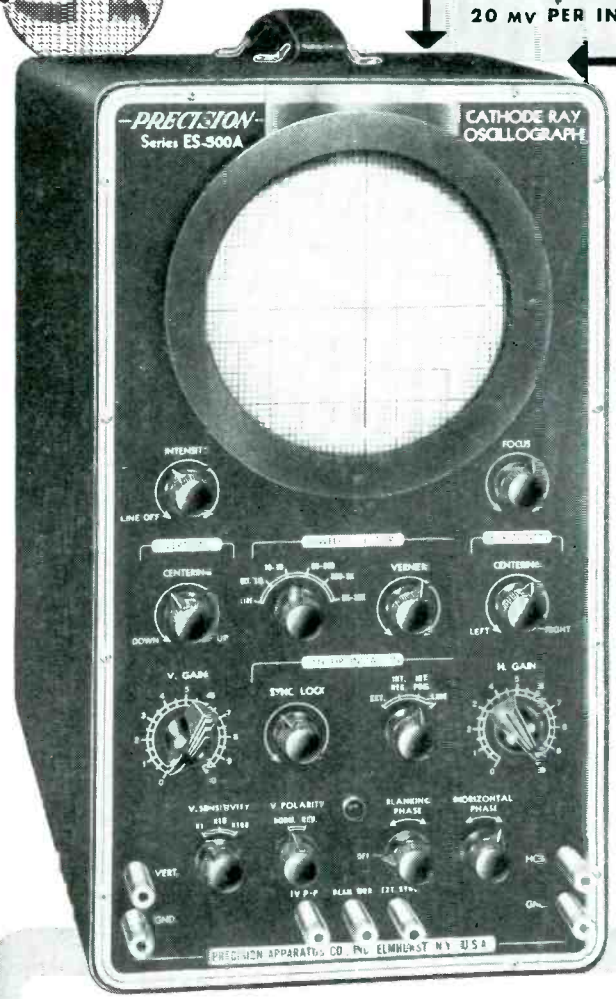
20 MV PER INCH "V" SENSITIVITY — 150 MV PER INCH "H" SENSITIVITY



SERIES ES-500-A affords the ultimate in performance, visibility and operational flexibility at moderate cost. *PRECISION* engineers have incorporated every necessary feature which they found to be required to meet the needs of the rapidly advancing art of electronics, A.M., F.M., and TV.

SUMMARY OF IMPORTANT FEATURES

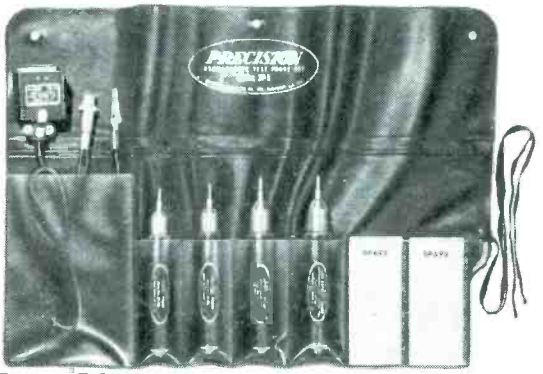
- ★ **Push-Pull Vertical Amplifier — High Sensitivity, Wide Range, Voltage Regulated.** 20 millivolts (.02v.) per inch deflection sensitivity. 10 cycles to 1 MC. response. 2 megohms input resistance. Approx. 22 mmf. input capacity.
- ★ **Compensated Vertical Input Step Attenuator**—X1, X10, X100.
- ★ **Direct Peak to Peak Voltage Checks** thru use of internal, semi-square wave, regulated voltage calibrator.
- ★ **Vertical Phase-Reversing Switch.** Non-frequency discriminating.
- ★ **Push-Pull, Extended Range, Horizontal Amplifier**—150 Millivolts (.15 v.) per inch deflection sensitivity. 10 cycles to 1 MC response at full gain. 1/2 megohm, approx. 20 mmf. input.
- ★ **Linear Multi-Vibrator Sweep Circuit**—10 cycles to 30 KC.
- ★ **Amplitude Controlled, Four Way Synch. Selection:** Internal Positive, Internal Negative, External and Line.
- ★ **"Z" Axis Modulation** input facility for blanking, timing, etc.
- ★ **Internal, Phasable 60 cycle Beam Blanking** for elimination of alignment retrace; clean display of synch. pulses, etc.
- ★ **Sweep Phasing Control** for sinusoidal line sweep usage.
- ★ **Direct Horizontal and Vertical Plate Connections.**
- ★ **High Intensity CR Patterns** through use of adequate high voltage power supply with separate 2X2 rectifier.
- ★ **The Circuit and Tube Complement:** 6C4 "V" cathode follower. 6CB6 "V" amplifier. 6C4 "V" inverter. Push-Pull 6J6's "V" driver. 7N7 "H" amplifier and inverter. Push-Pull 6AU6's "H" driver. 7N7 Multi-vibrator, linear sweep oscillator. 5Y3 low voltage rectifier. 2X2 high potential rectifier. VR-150 regulator. 5CP1/A CR Tube.
- ★ **Four-Way, Lab-Type Input Terminals**—Take banana plugs, phone tips, bare wire or spade lugs. Matches SP-5 Probe Set cable connector.
- ★ **Light Shield and cross-ruled Mask,** removable and rotatable.
- ★ **Extra Heavy-Duty Construction and components.**
- ★ **Heavy Gauge, Etched-Anodized, No-Glare, Aluminum Panel.**
- ★ **Fully Licensed under Western Electric Co. patents.**

Series ES-500A: In louvered, black-ripple, heavy gauge steel case. Size 8¼" x 14½" x 18". Complete with light shield, calibrating mask and comprehensive instruction manual..... **NET PRICE $173.70**

Series SP-5 — OSCILLOSCOPE TEST PROBE SET

FOR TV SIGNAL TRACING, ALIGNMENT, TROUBLE SHOOTING AND WAVEFORM ANALYSIS

- ★ **Specifically engineered for use** with *PRECISION* Cathode Ray Oscilloscopes, Series ES-500 and ES-50CA.
- ★ **Includes four of the most important uses probes** for general purpose, as well as specialized use:
  1. HIGH IMPEDANCE—LOW CAPACITY PROBE
  2. SIGNAL TRACING—CRYSTAL PROBE
  3. RESISTIVE—ISOLATING PROBE
  4. SHIELDED—DIRECT PROBE
- ★ **Each probe is specifically engineered** for efficient application to the special test problems requiring its use.
- ★ **Distinctively colored heads** and individual labeling permit positive identification of each probe.
- ★ **A single, universal, coaxial cable** accommodates each probe through a quick-change, self-shielding connector.
- ★ **A specially-designed, shielded plug** provides for positive cable attachment to the ES-500 and ES-500A Vertical input posts.
- ★ **Each probe head terminates in a patented clip-on tip** which frees both hands of the operator.



Series SP-5, in custom-designed, vinyl-plastic, carrying case, complete with four probe heads, universal coaxial cable, and detailed operating instructions. **NET PRICE $23.50**

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