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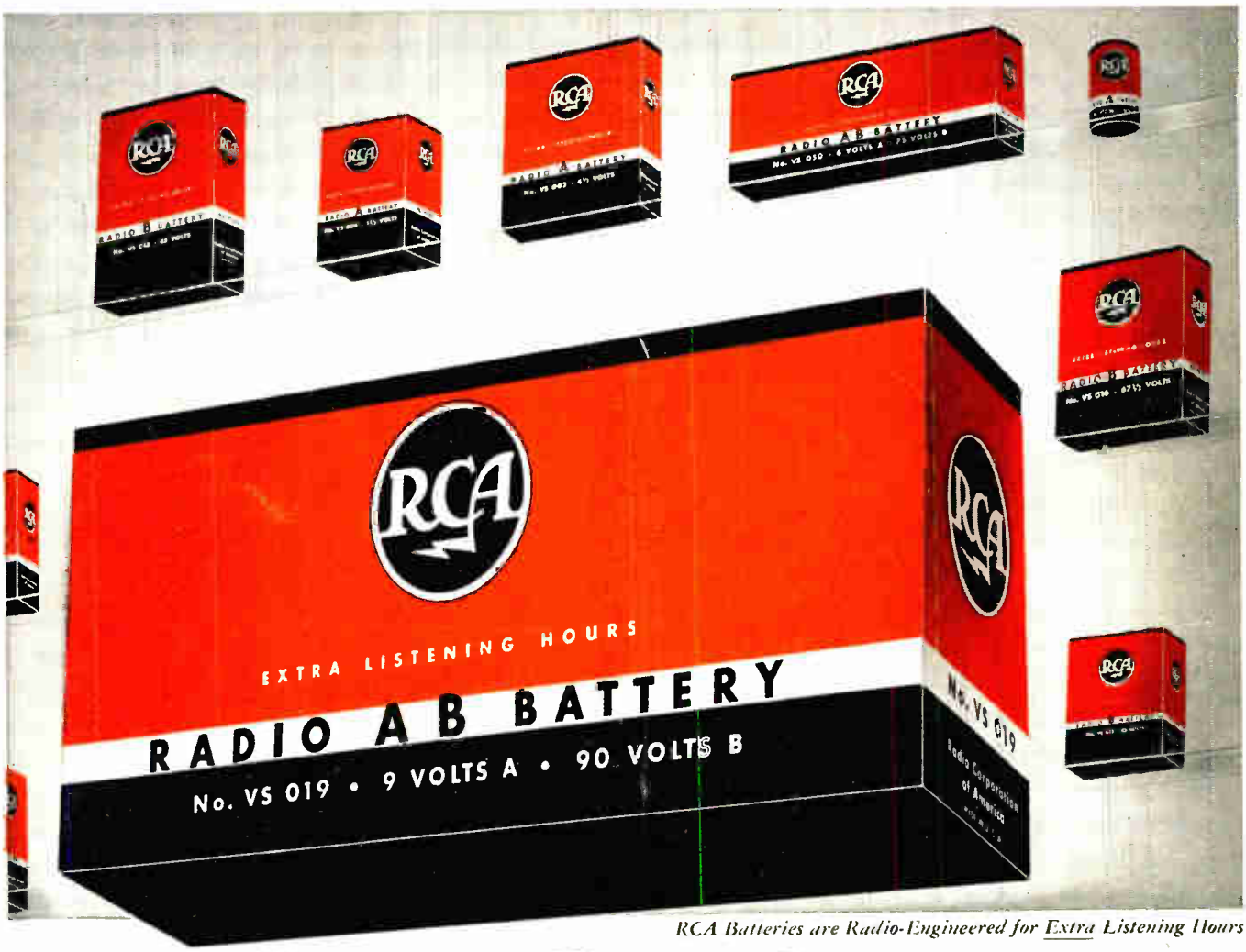

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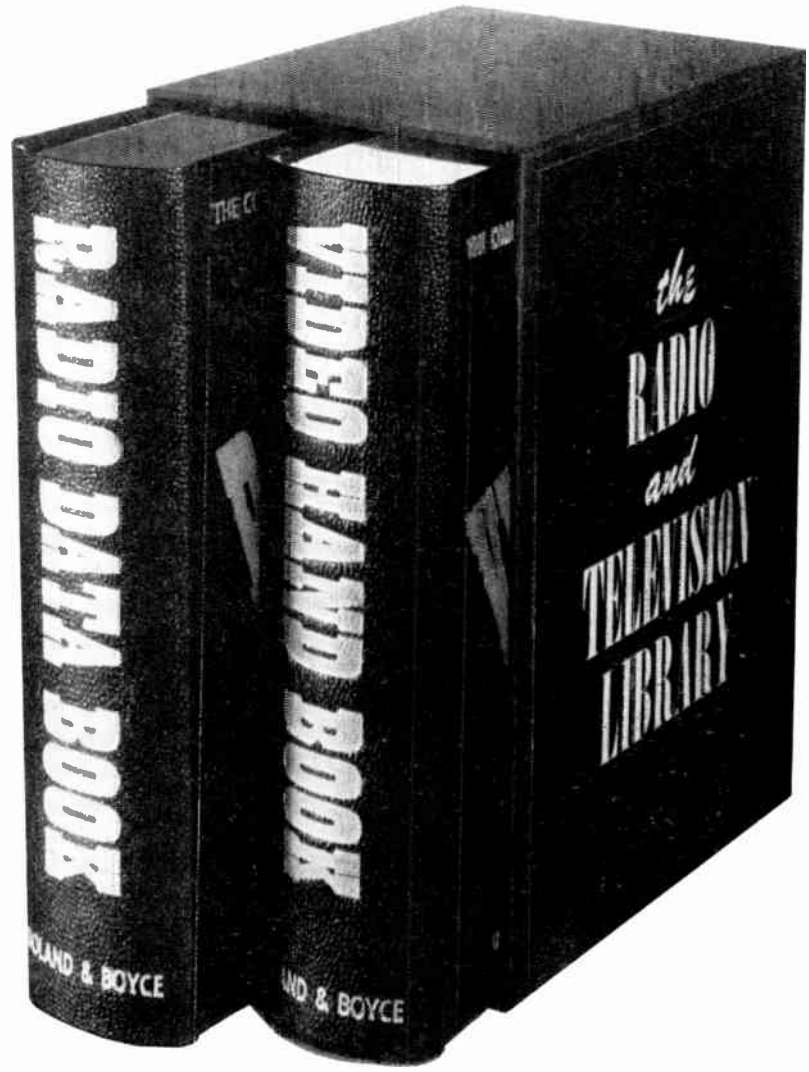

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Test Pointers

ON AC VOLTAGE MEASUREMENTS

In television servicing, the importance of distinguishing between RMS, peak, and peak-to-peak electrical values is not always realized.

RMS values, long in use by the electrical industry, provide a method of measuring ac current and voltage values so that the values obtained represent the same power in a pure resistive load as would be obtained with the same values of dc voltage and current.

Experienced technicians know that peak and peak-to-peak values are frequently more important in television circuits than are RMS values. Peak voltages operate to trigger discharge tubes, to control local-oscillator frequencies, to intensity-modulate the kinescope, and to perform other important functions. Peak-to-peak values are used to measure gain or loss in deflection, synchronizing, and video circuits.

The distinction between RMS, peak, and peak-to-peak values is illustrated in Fig. 1 for a sine wave. Fig. 2 illustrates one kind of a complex wave and shows how peaks above and below the reference line add up to give the peak-to-peak voltage. No RMS value is shown because the RMS value of a complex wave has little significance in service work.

Most service voltmeters are calibrated to indicate the RMS values of *sine* waves. From such values, the peak and peak-to-peak values of *sine waves* can be easily determined from the conversion factors given at the end of this article.

An oscilloscope provides the maximum amount of information because it displays the instantaneous voltage values at any point on the trace. Peak values above and below the reference line, and the peak-to-peak value, can be read directly from the trace.

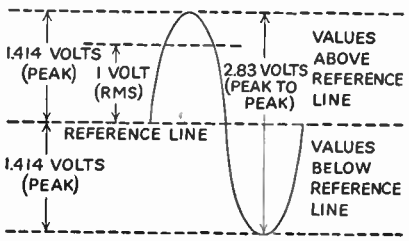

FIG. 1 PURE SINE WAVE

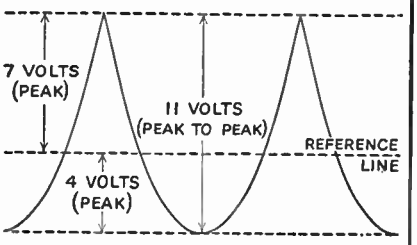

FIG. 2 COMPLEX WAVE

If the oscilloscope has been calibrated with a sine wave of known peak-to-peak voltage value, it is evident that a transparent graph screen can be used to determine the individual peak, peak-to-peak, or instantaneous voltage values of a complex waveform.

The factors given below show the relationships between RMS, peak, and peak-to-peak values of *sine waves:*

Given Values	Multiply Given Values by Factor to Obtain:		
	RMS Value	Peak Value	Peak-to-Peak Value
RMS	—	1.41	2.83
Peak	0.71	—	2
Peak-to-Peak	0.35	0.5	—

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Comments

Hue and Cry

COLOR television is back in the news again. The Federal Communications Commission announced conditions under which it will consider the adoption of a color television system.

Almost simultaneously, color television was being demonstrated at Atlantic City. The demonstration programs were transmitted by wire and point-to-point radio relay. The last time the adoption of a color television system was considered—in 1946—none was adopted because, in the Commission's opinion, no color television system had been demonstrated which promised full exploitation of the new medium. On the basis that only black-and-white television had been perfected to a point which made standardization possible, color was dropped. With the allocation of frequencies for commercial broadcasting, manufacturers, broadcasters, and the public alike turned their attention to black-and-white television. Since that time little has been heard of color. All the energies of the radio industry turned to the task of making television a profitable growing field.

Back in 1946 the industry split into groups for and against the adoption of color standards. Before the decision in favor of black-and-white was finally made, the question reached the proportions of a major controversy.

The recent color television demonstration was made using the CBS color system, which indicated that CBS is still interested. If the CBS system can be made to meet the FCC requirements, it will probably again be offered for the Commission's consideration.

Meanwhile, other segments of the industry have indicated that this is no time to be considering color. They feel that black-and-white must be given a chance to reach maturity before the industry can tackle a new field.

So it looks as though the old controversy will begin again. It's all part of progress and we are looking forward to future developments with interest.

Licensing Again

ATTEMPTS to enact laws which would require that technicians obtain a license in order to install and repair radio and television receivers are taking place in several cities.

We believe that the passage of such laws would be detrimental to both the public and the industry. We believe that benefits which the supporters of the licensing proposals tell us will follow their adoption can only be brought about by the industry itself. We do not believe that they can be created by the passage of laws.

One of the major purposes of the licensing proposals is the removal of the incompetent. This, in most cases, is to be accomplished by written examination. While written examinations are an excellent way to determine academic knowledge, they are, in our opinion, entirely inadequate when it comes to ascertaining the ability of a person in so practical a subject as radio repair. We have taken a few written exams ourselves and have always found this to be true. Written exams give those long on book learning and short on practical experience the advantage. We are not trying to belittle the importance of a thorough knowledge of theory. What we are trying to point out is that practical experience is just as important and cannot be determined by this method.

Laws won't solve the problems of the industry. We have got to solve them for ourselves.

JJR

Famous Sylvania Polymeter now available with new plus features for complete television service!

NEW POLYMETER TYPE 221— $99.50

- **Shielded ac probe lead—reduces stray field effect.**
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CHECK THESE OTHER OUTSTANDING FEATURES:

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The instrument has seven current scales—six of them reading in milliamperes and one reading in amperes. The specially engineered Sylvania Subminiature Tube contained in the RF Probe permits the exceptionally high frequency range of this instrument at a high input impedance and an unusually low input capacitance.

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Be sure to send your coupon today to receive full particulars on the new Sylvania Polymeter Type 221!

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Resistance Ohms	0-1000, 10,000, 100,000, 1 meg., 10 meg., 1000 meg.
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DC, AC, RF and Ohm scales utilize authentic Vacuum Tube Voltmeter Circuits resulting in extremely low load when measuring delicate circuits.

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RADIO INDUSTRY Newsletter

edited by
Joseph J. Roche

July 1, 1949

The FCC took a step toward lifting the freeze.
The Commission proposed to allocate the lower half of the UHF band (now experimental) for regular operation.
It will consider permitting the use of all channels for color if a system can be demonstrated which will permit reception in black and white on ordinary television receivers.
The Commission hopes to have a new allocation table ready in late fall.

These announcements received a mixed reception...hailed by some as the answer to lagging teleset sales...others expressed fear that the public might misinterpret them to mean that present sets will soon be obsolete.

Some worry resulted from the statement regarding color television. The Commission will permit color if...

(1) it can be received on an ordinary receiver with minor changes only.
(2) no more than the present 6 megacycle channel is required.

If the public interpreted this to mean that color is just around the corner, it might stop buying and take a wait-and-see attitude.
Actually the announcement offers assurance that present receivers will not be obsoleted in the near future.

Appropriately...color television was being demonstrated to members of the American Medical Association at Atlantic City...the equipment used was CBS designed...the system was essentially the same as that demonstrated by CBS several years ago. Regular telesets with adaptors were used. Channel requirements of the system are the same as those of present black and white television.

In an effort to clarify matters, the RMA pointed out that...

(1) present telesets will not be obsolete.
(2) present twelve channels are not adequate.
(3) present receivers can be easily converted to receive UHF channels.

* * * * * * *

RMA has appointed a committee to present "factual information on television to the public...government, and other interests."

Purpose of the committee is to educate the public with regards to such things

as the effects of FCC action...thereby eliminating the type of buyer confusion which is now hurting tele-set sales.

* * * * * * *

RMA got quite a bit of business done during the Parts Show.

Elected Avco's C. Cosgrove president, succeeding Max F. Balcom.
Appropriated $15,000 for the promotion of National Radio Week, Oct. 30-Nov. 5.
Authorized continuation of Town Meetings of Radio Technicians, and appointed a committee to make plans.
Received a letter from President Truman, congratulating it on its activities.
Heard Senator Capehart cite the freeze on new TV station licenses as one of the factors holding back the industry.
Appointed a committee to continue vigorous pressure to lift the freeze.

* * * * * * *

Sylvania will market a line of television receivers bearing the firm's name. Sales are to begin in the fall.

RCA plans to begin manufacture of television receivers in its new Bloomington, Indiana plant in August.

Hytron is making its first shipment of picture tubes. Production began in February.

General Electric plans to expand facilities at Electronics Park, include picture tube engineering and manufacturing. Plans calls for a million dollar plus expenditure.

Eimac is going to manufacture 16-inch picture tubes in a new Salt Lake plant.

* * * * * * *

Sales of picture tubes in the first quarter of 1949 were 300 percent above the same period last year.

Price reductions on picture tubes continue
General Electric cut its 10BP4 from 44.50 to 41.50; 10FP4 from 49.50 to 44.00; 12KP4 from 73.75 to 63.50.
DuMont reduced its 12QP4 from 64.25 to 52.25, 12JP4 to 50.
RCA lowered its prices on ten-inch tubes about 10%.
And Sylvania cut the price of its 12-1/2-inch tube for the second time in one month, new price is 20% down from the March 1949 figure.

Rauland Corp. has developed a new 16-inch metal funnel picture tube...designated 16EP4...it is two and a half inches shorter than the 16AP4...permits shallower cabinet.

Another new picture tube has been introduced by American Television Inc. It gives high contrast at comparatively low intensity, eliminating the possibility of eyestrain. The tube was exhibited at the Chicago show by Garod Radio Corp.

* * * * * * *

The bill requiring licensing of Illinois TV technicians has been defeated. Its defeat is largely the result of vigorous action by RMA and the Television Installation and Service Association of Chicago.

A similar bill is being considered by the Los Angeles City Council.

Television installation and service contracts are subject to New York State insurance laws...RMA advises that contracts be examined to avoid future difficulties.

71 television stations are now operating. 51 additional ones have construction permits, and 372 applications are awaiting the lifting of the freeze.

Second Annual National Television and Electric Living Show will be held in Chicago...dates: September 30 to October 9.

The first West Coast TV network hookup occurred in May when KFMB-TV, San Diego, picked up and rebroadcast a KTLA, Los Angeles program.

Comedian Bob Hope is new DuMont teleset distributor in Southern California. Firm name is Quality Electric Television Corp.

Majestc Radio and Television is being liquidated. Reason given...inability to enter television field.

Remember the Hytron service tool contest?...the company is now manufacturing two of the entries, a soldering aid and a tube lifter. Available at jobbers.

RCA is planning a series of slide-film lectures to acquaint service technicians with the workings of its 45-rpm changer...invitations will be issued by sponsoring distributors.

General Electric has prepared a television course which can be taken by mail or group study...consists of eight lessons on principles and techniques of television. Completion brings graduation certificate.

Coastwise Electronic's Henry Joseph continues to conduct TV clinic meetings coast to coast...they cover alignment, repair, service.

Philco has taken another step in its "Philco Parts for Philco Products" program...Philco distributors are operating the first units of a new fleet of "Mobile Merchandisers."

The fleet consists of especially equipped delivery trucks...each carrying large stock of radio parts...Units will be operated as stores on wheels, featuring special display racks, heating, and ventilation.

The Bent Distributing Co. of Jacksonville, Fla., tripled its parts volume in twelve months using this method. Plans call for an initial fleet of 100 trucks.

* * * * * * *

Television is now accounting for more than half the dollar volume of the industry...will equal more than a billion dollars by the end of the year.

Television receiver production...121,238 in January...118,938 in February ...182,361 in March...close to 1/2 million in the first quarter.

Philco is producing between 4,000 and 5,000 telesets a week.

FM-AM set production declined for the third month running.

Below list sales of tele-sets increased in many areas. Vim in New York offered a $200 trade-in allowance on any make or age radio-phono or TV receiver toward purchasing a new teleset...gave three-year installation and service guaranty.

All this wasn't hurting sales...telesets are being sold at a rate of 1,000 per day in metropolitan New York, according to the New York Sun.

Hallicrafters is showing a 15-inch console listing at $399.95.

Emerson offered a 12-1/2 inch teleset priced at $299.50.

Garod introduced a new line starting with a $199.95 10-inch table model.

Tele-tone topped them all with a 10-inch model listing at $179.95.

* * * * * * *

Motorola reported first-quarter earnings of $900,000...compared with $720,-000 for first quarter of 1948.

Stewart-Warner, on the other hand, showed a decline in net profit from $900,-000 in first quarter of '48 to $400,000 for the same period this year.

Crosley sales, as of April, were up 24% over the 1948 period...radio and TV sales for April were up 164% over April 1948.

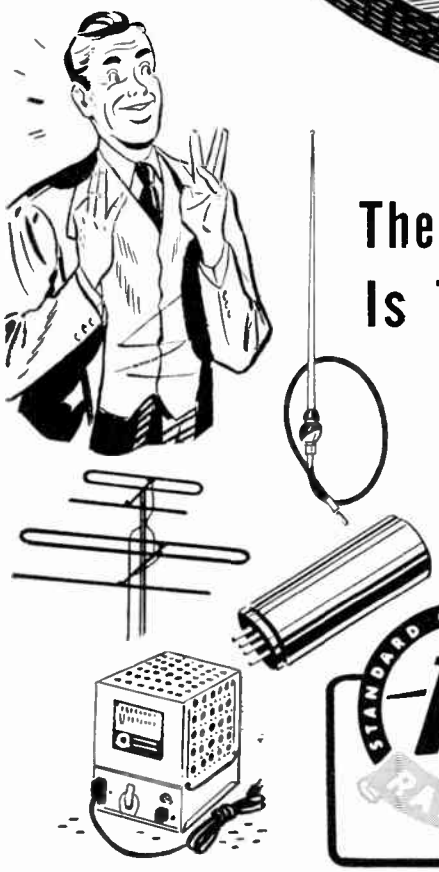
Sangamo's net income for the first quarter of this year was $424,662...down $130,000 from the same period last year.

* * * * * * *

Town Meeting of Radio Technicians held in Chicago recently has misplaced registration cards of people who turned in their lapel tags showing they had earned Certificates of Leadership...Those eligible are asked to send full name and address to Room 805, 21 East Van Buren Street, Chicago 5, Ill.

WILLIAM E. McFADDEN has been elected president of REPRESENTATIVES...WALTER JABLON of Espy has been elected president of the RADIO OLD TIMERS CLUB; P. L. JENSEN is V-P, HOWARD W. SAMS is secretary, and HERBERT W. CLOUGH is treasurer...EMIL J. MAGINOT appointed NATIONAL UNION RADIO'S Sales Manager in charge of distributor sales...ROBERT C. SPRAGUE of SPRAGUE ELECTRIC named chairman of RMA TOWN MEETING COMMITTEE...FRANK W. GUTHRIE appointed manager of RAULAND CORP...VICTOR J. ANDREW of the ANDREW CORP. received honorary degree of Doctor of Science from Wooster College...C. V. HAECHER was appointed Merchandise Display Manager of RCA VICTOR... WILFRED F. KELLEY, formerly of WESTERN ELECTRIC, has joined SYLVANIA ELECTRIC PRODUCTS distribution sales department...LESLIE J. WOODS appointed V-P director of Research and Engineering at PHILCO...HUGO SANDBERG chosen Assistant to President at OXFORD ELECTRIC CORP.

JOSEPH J. ROCHE
Editor



The Jobber Who Displays This Award... Is The Serviceman's *BEST FRIEND*

Radiart is proud of its many loyal and faithful jobbers. In recognition of jobbers throughout the nation who have handled Radiart products for five years or more, we are presenting them these plaque awards with a gold star for each five years of service. ***The jobber who features Radiart is the serviceman's best friend... because he is offering the serviceman the BEST electronic products of their kind.*** We thank our jobbers for their continued loyalty... and to all our jobbers... to every serviceman who depends on RADIART... this is our pledge for continued highest standards of manufacture that have made Radiart...

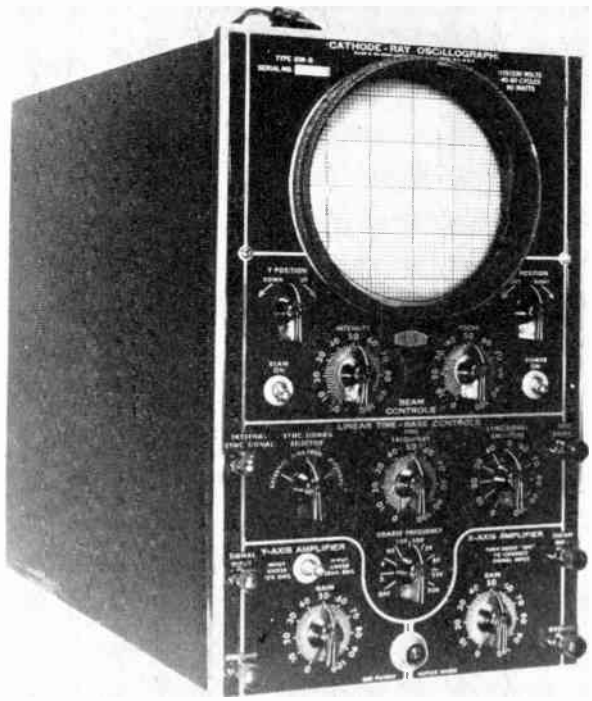
THE STANDARD OF COMPARISON

THE RADIART CORPORATION

CLEVELAND 2, OHIO

MANUFACTURERS OF THE FAMOUS RED SEAL VIBRATORS

Oscillograph characteristics to look for when purchasing the instrument.



THE cathode ray oscillograph is a comparatively recent addition to the service bench. Originally it was a very expensive piece of equipment used almost exclusively for laboratory research work. In the late thirties it was simplified to the point where it could be produced at a price which made it attractive to the service technician. Before the war it was a useful but not entirely necessary part of the test bench.

With the advent of television and frequency modulation, the oscillograph has become an absolutely necessary service instrument. Television has created a multitude of new uses for the oscillograph. Without this instrument, rapid, efficient troubleshooting and alignment of television receivers would be impossible.

Television has also placed much stricter requirements on the characteristics of the oscillograph. These new requirements in turn necessitate more complex and expensive construction.

In order to choose and use the cathode ray oscillograph intelligently, it is necessary to have a clear understanding of how the instrument operates. Before we can decide whether or not an oscillograph will be suitable for a particular use, we must first determine certain facts relating to its performance. These facts, usually referred to as the specifications of the instrument, require considerable interpretation. It is the purpose of this article to guide the reader in making such interpretations.

Circuits

First, let's review the operation and the circuits used in the ordinary low-priced, general purpose oscillograph with which most of us are familiar. Fig. 1 is a block diagram of such an instrument. This oscillograph has a single stage amplifier for the signal applied to the vertical plates and an almost identical amplifier for the signal applied to the horizontal plates. It is also equipped with a horizontal sawtooth sweep generator. In most instruments this consists of a gas triode in a sawtooth oscillator circuit. Low and high-voltage power supplies are also provided.

The purpose of the vertical deflection amplifier is to increase the amplitude of the signal, which we wish to observe, to a value which will cause sufficient deflection of the electron beam in the cathode ray tube. The amplifier is also equipped with an input attenuator to permit the user to adjust the gain of the amplifier so that signals of various amplitudes may be observed.

The horizontal amplifier is used to increase the amplitude of an external synchronizing signal to a value suitable for deflection of the electron beam horizontally. This amplifier is

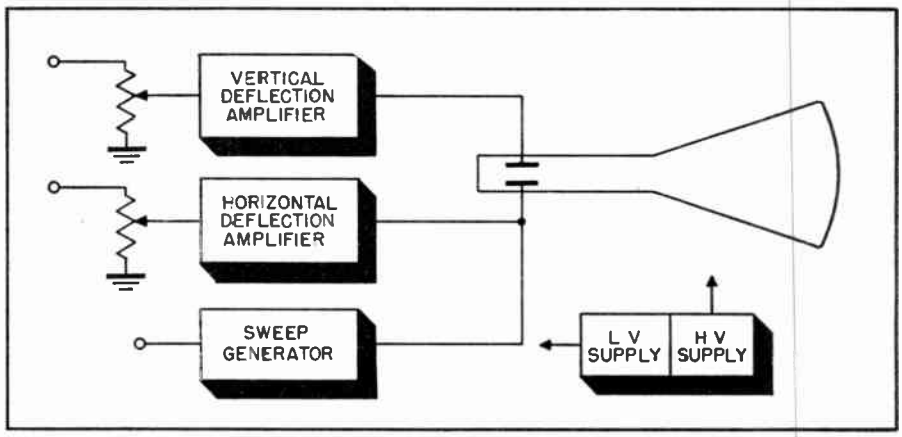


Fig. 1 Block diagram of a general purpose oscillograph. Such simplicity is a fairly recent development. Earlier instruments were considerably more complex (and expensive)

How to Choose an OSCILLOGRAPH

by
Joseph J. Roche

also provided with a variable gain control.

The sawtooth sweep generator is used when we wish to examine the characteristics of a signal with respect to time. When applied to the horizontal plates, it controls the movement of the electron beam so that it moves across the face of the tube from left to right at a constant rate. When the beam has reached the right side of the screen, the signal from the sweep generator returns it almost immediately to the left side to begin a new trace.

Now let's discuss the various characteristics which determine the usefulness of an oscillograph. Following this we shall examine the various circuits used in the instrument to see how many affect these characteristics.

Frequency Response

One of the most important characteristics of an oscillograph is the frequency response of its vertical and horizontal amplifiers. This characteristic is important because it determines the range of frequencies which can be studied with the instrument. As an example, assume that we wish to check the response of the video amplifier in a television receiver. This can be accomplished by feeding a 30-cycle and then a 200-kc square wave into the input of the amplifier and examining the shape of the waveform in its output with an oscillograph.

The video amplifier must have a response uniform from a few cycles to three or four megacycles. The reason that we can check its response with 30-cycle and 200-kc square waves is that a square wave contains many harmonics and subharmonics. If the response of the amplifier is not uniform over a wide range of frequencies, these harmonics and subharmonics will not be amplified equally. As a result, the square wave will be distorted in a characteristic manner. With a little experience, it is possible to tell the approximate response of the amplifier under test by examining the shape of the distorted waveform. Fig. 2 illustrates several wave shapes and what they indicate. *A* shows the square wave which is fed into the video amplifier and which will appear in its output if it has a sufficiently broad, uniform frequency response. *B* shows the square wave as it will appear in the output of a video amplifier which does not possess sufficient high-frequency response. *C* is an output waveform which indicates insufficient low-frequency response.

In using this method of checking the response of a video amplifier, we have assumed that no distortion of the square wave was introduced by the vertical amplifier in the oscillo-

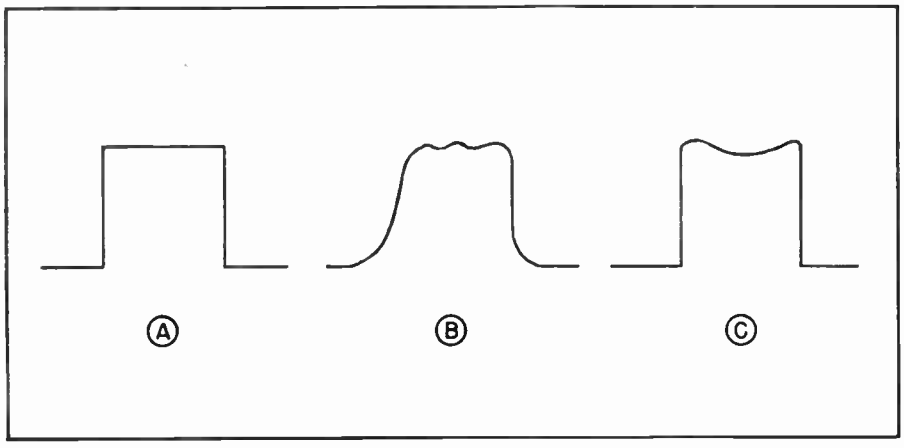


Fig. 2 *A*, undistorted square wave; *B*, square wave distorted by amplifier lacking high-frequency response; C, square wave distorted, amplifier lacks low-frequency response

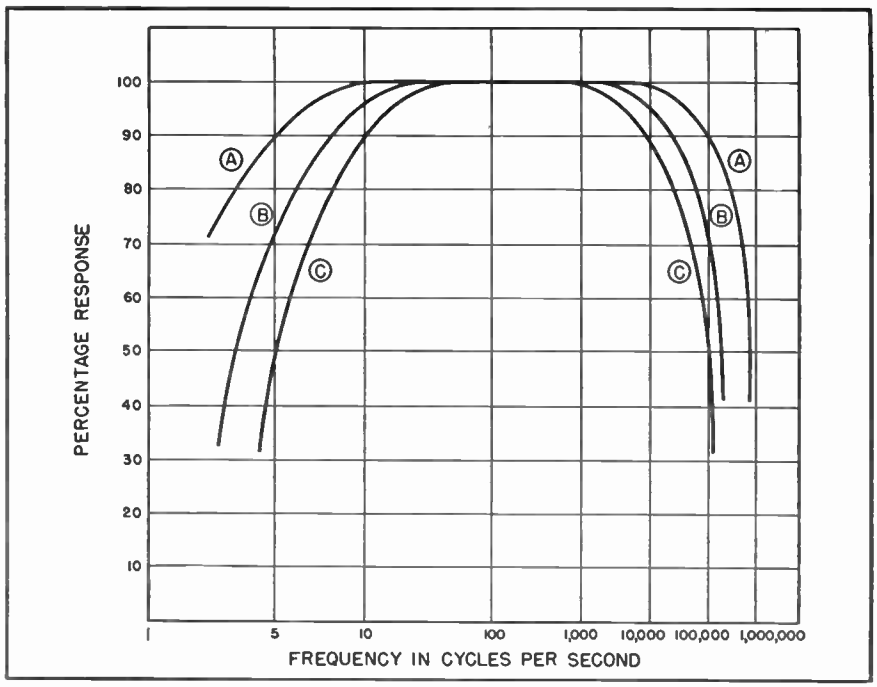


Fig. 3 Response curves of 3 different oscillographs with the same extremes of frequency response, but varying in response between the upper and the lower frequency limits

graph. This is not always the case. If the response of the vertical amplifier in the instrument is not sufficiently broad and uniform, the amplifier will distort the square wave in the same manner as does the video amplifier in the television receiver. As a result, it will be either impossible to tell whether or not the amplifier under test is causing the distortion, or the amplifier under test may be blamed for distortion which it is not causing.

Response Specifications

This is just one instance in which an oscillograph which does not have sufficient low and high-frequency response can give misleading information.

The frequency response characteristics of an oscillograph are usually specified in one of two ways. The response is specified as uniform between two frequency extremes with a specified percentage or number of db. Simply giving two frequencies, such as 2 cycles to 200 kc, and stating that the instrument is flat between the two frequencies, is not sufficient. Such information is misleading. Here is an example which illustrates the point.

Fig. 3 shows three response curves. Assume that they are the response curves of three different oscillographs. The response of oscillograph *A* could be stated as uniform within 10% from 5 cycles to 100 kc. The response of oscillograph *B* could be stated as uniform within 30% between 5 cycles and 100 kc. The response of oscillograph *C* could be stated as uniform within 50% between 5 cycles and 100 kc. It is apparent from the above that the extremes of frequency response do not give sufficient information so that we can determine the usefulness of an oscillograph. We must, in addition, know how much the response varies between the upper and lower frequency limits.

The response of oscillograph amplifiers is invariably expressed with respect to sine wave input. This is important because, as we learned earlier, there is a great deal of difference between the square wave and since wave response of any amplifier. It requires an amplifier with sine wave response uniform to more than 2 megacycles to faithfully reproduce a 100 kc square wave.

In addition to adequate frequency response, the amplifier in an oscillograph must have comparatively uniform delay time. If the delay time of an amplifier is not uniform for all frequencies in its pass band, the amplifier will distort signals which have components of several different frequencies. If a square wave is fed into an amplifier which does not have uniform time delay, it will be distorted and appear as shown in Fig. 4.

Unequal delay time causes a phase shift between components of different frequencies and for this reason the term phase shift is often used when referring to this characteristic of oscillographs.

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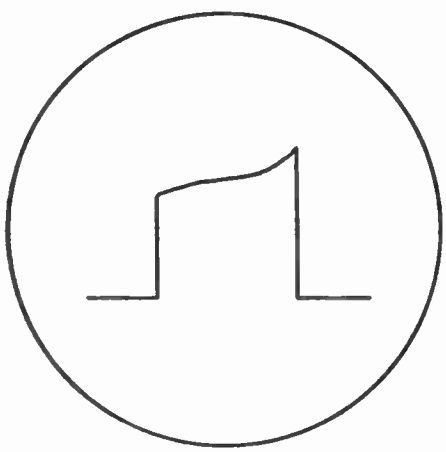
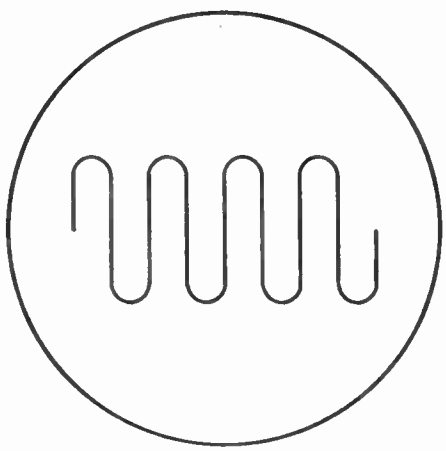


Fig. 4 This square wave is being distorted by an amplifier having unequal phase shift



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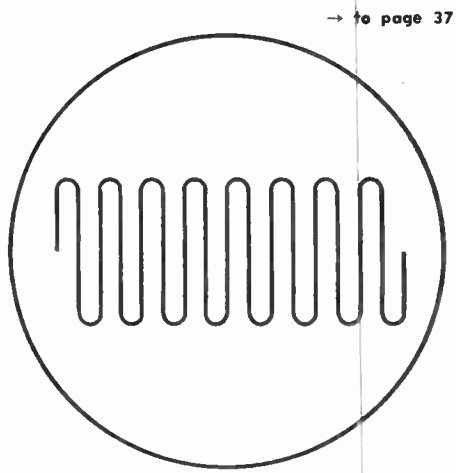

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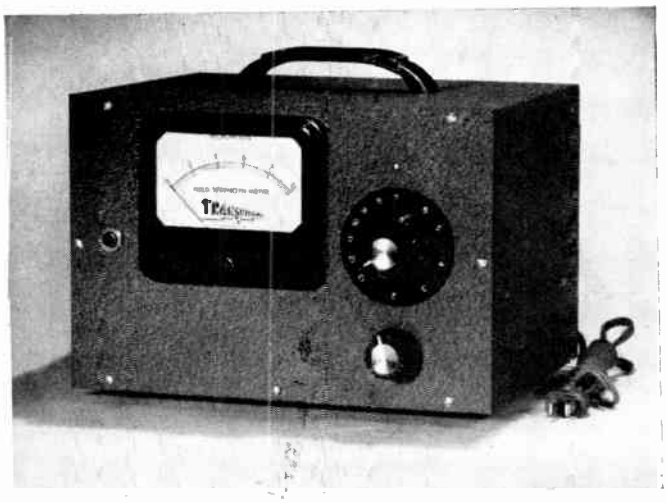
Fig. 5 *A*, pattern obtained on oscillograph screen with 100 kc signal on the vertical plates, 25 kc sawtooth sweep. *B*, pattern obtained with a 200 kc signal, and 25 kc sweep

FIELD STRENGTH METER



by I. I. Gross

How it works, what it does, where it is used.

THE various problems encountered in television receiver installation have given rise to a number of service instruments designed to facilitate the work of the technician and to help him solve his installation and service difficulties. One such instrument is the FSM-1 Field Strength Meter, manufactured by Transvision, Inc. This instrument measures the relative microvolt signal strength at the receiver on all twelve television channels, and can thus be used as an alternative to a test receiver when making an installation. The meter can be put to other uses, which will be discussed below.

Circuit Design

The FSM-1 Field Strength Meter consists of a twelve-channel tuner, a calibrated signal level indicator, a sound output jack, and a self contained power supply. It is housed in a steel cabinet provided with a baggage grip. The gross weight of the instrument is a little over thirteen pounds.

A schematic diagram of the unit is shown in Fig. 1. The twelve-channel tuner, with a standard 300-ohm input, is followed by two high-gain i-f amplifiers, a crystal detector, an audio amplifier, and the indicating meter. Signals fed into the tuner from the antenna system are selected according to the position of the channel switch and the fine tuning control. The output of the 12-channel selector unit passes to the i-f amplifiers V1 and V2 (6AK5 and 6AU6 pentodes), which are tuned to approximately 26.4 Mc, the video i-f frequency. The amplifiers are designed for relatively narrow band-pass, resulting in higher gain.

The i-f amplifiers are followed by a crystal detector (1N34), which rectifies the i-f signals supplying voltage for the indicating meter and the audio amplifier V3 (6AU6). The

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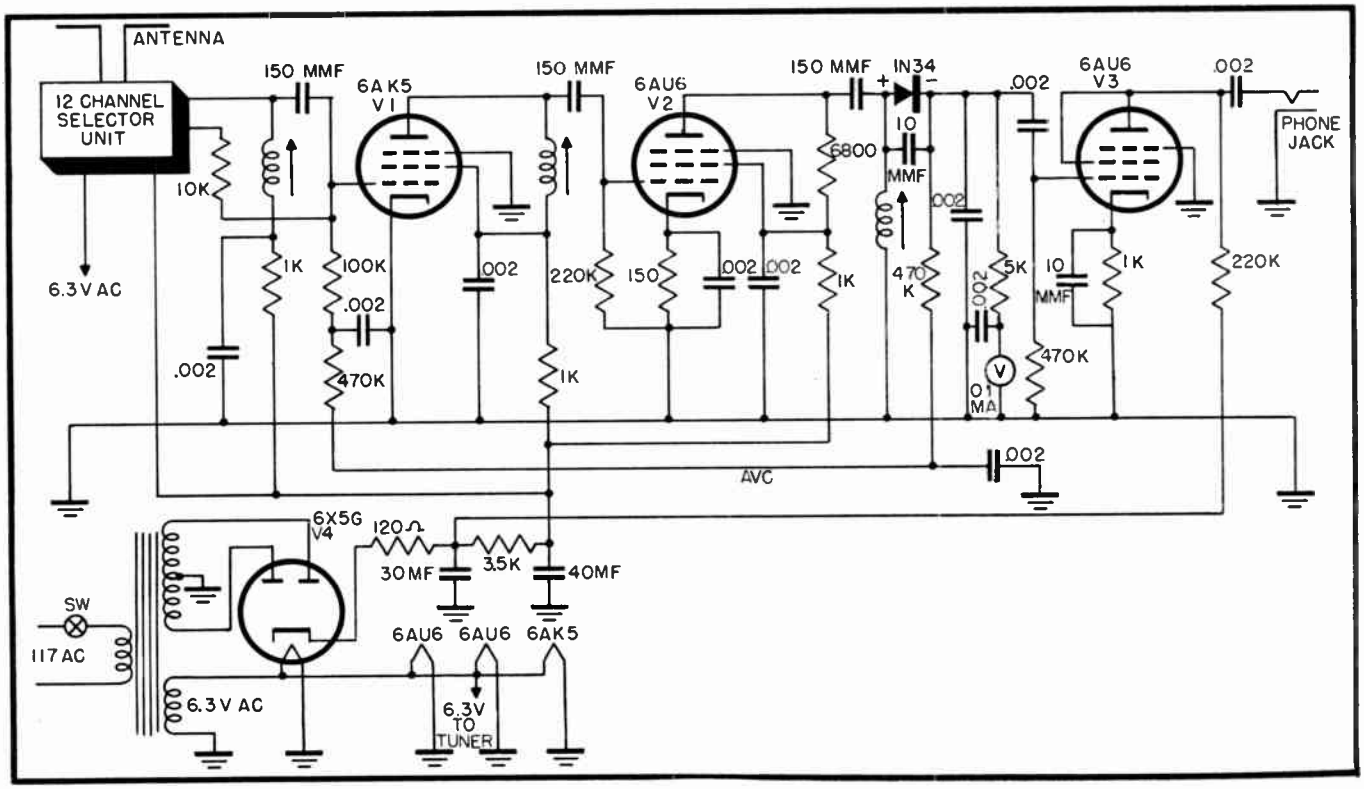

Fig. 1 Schematic diagram of Transvision's field strength meter. Amplifiers designed for narrow band pass result in high gain

PROJECTION TELEVISION SYSTEMS

by Martin Clifford

What makes them work and how they are serviced

THE main difference between a direct-view television receiver and a projection set lies in the optical system used in the latter. Although all of the optical systems in projection television today are based on the same fundamental principles, each of the systems—such as used by RCA, Philco, and Norelco (Protelgram) are sufficiently different to require a study of the various characteristics.

A projection set might theoretically be constructed from any direct view system. All we would have to do would be to put a lens in front of a direct view picture tube and then focus the picture on some kind of screen, just as shown in Fig. 1. If we should try this, however, we would unfortunately run into a number of problems. The lens would have to be of great size—much larger than the face of the tube; a large amount of valuable light would never even reach the lens and consequently would be of no use to us; and finally, the entire system would be so bulky that it would be out of the question to think of putting it into a cabinet.

In order to overcome the difficulties involved in the construction of an optical system such as just described, three of this country's well-known manufacturers—RCA, Philco, and North American Philips—have borrowed an optical system from people who have been using optics for a long time: the astronomers. This system, called the Schmidt optical system, is used in every projection set made today, although used in a different manner by the respective manufacturers.

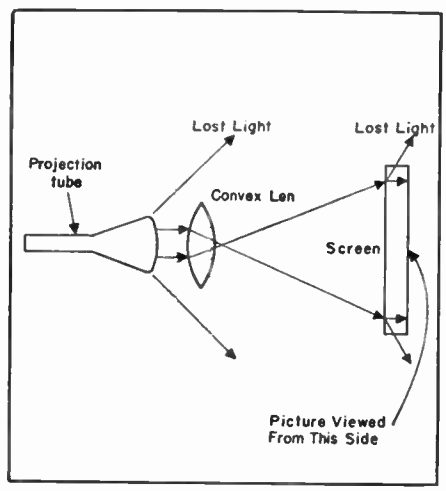

Fig. 1 How a projection system could theoretically be constructed. Notice large lens

The RCA System

In Fig. 2 we see the reflective optical system as used in the RCA 648 PTK. The projection tube which is used is a 5TP4, requiring 27 kilovolts. Deflection is obtained electromagnetically in the usual manner through the use of vertical and horizontal deflection coils. Focus is electrostatic. In this particular projection system, as in all others, the projection tube is the sole source of light, none of which may be wasted if a brilliant image is to be obtained. Half of the light in any picture tube is usually lost through reflection to the interior of the tube. To avoid this loss of light, the phosphor on the 5TP4 is backed by an aluminized film of microscopic thinness.

Electrons coming from the gun pass right through this film and strike the screen. The light which is emitted by the electron beam striking the screen cannot pass back into the picture tube, but is entirely reflected forward. In addition to preventing the passage of light back into the picture tube, the aluminum backing is useful in preventing the burning of the phosphor by ions (ion spot).

A mirror system is used to throw

the image from the 5TP4 onto the screen. As shown in the illustration, the projection tube faces a curved mirror. The curved mirror reflects the light through corrector lenses to a plane mirror, set at approximately forty-five degrees. This plane mirror sends the light onto the screen. In order not to reflect any light back to the face of the projection tube, the center portion of the curved mirror is painted black.

Ordinary mirrors with which we are familiar have the reflective surface at the back of the mirror. Any light thrown on such a mirror and reflected by it must travel through the glass twice—once going toward the reflective surface at the rear and once in coming away from or being reflected by it. Just as sound being reflected can cause audio distortion problems, so can light traveling through glass give picture distortion and loss of picture strength.

In order to avoid picture distortion (such as a doube image, or ghost, for example) both mirrors in the RCA optical system are front surfaced. The corrector lenses are used to focus the light on the plane mirror, which then throws the picture on the screen.

The screen is not made of glass, but of a "sandwich" of two sheets of Lucite plastic. Between these two sheets is placed a material which diffuses the light and helps minimize interference patterns. The back sheet of plastic has a fresnel lens. The fresnel lens is molded into the rear surface of the plastic screen. The purpose of this lens is to concentrate the light into a narrow viewing angle. On the outer side of the front sheet of the Plastic screen are many fine vertical ribs, molded into the surface. These ribs increase the horizontal viewing angle.

The design of the screen is such that it gives a greater gain than that obtained from a ground glass type. With the RCA screen, the picture will not seem as brilliant when viewed from an extreme angle; but this is not objectionable, since viewing the picture from an extreme angle (as sitting way on the side in a motion picture theater) will cause the picture to seem fore-shortened anyway.

Care of Lens and Mirrors

The corrector lens is not made of glass, but of a soft plastic material, and is very easily scratched. Improper handling, including rubbing it with a cloth, may mar it. Cleaning fluids should be avoided, since the chemicals in the fluid may eat away the lens.

A small, soft camel-hair brush of good quality should be used to clean the back of the screen, the front of the plane mirror and the curved or spherical mirror. If dust collects on the curved mirror, use the camel-hair brush to sweep it onto the unused portion, or black center, of the mirror. The dust then can be picked up with a tacky substance, such as a piece of cellulose tape. Since the mirrors are surfaced on the front and not on the rear, they can easily be damaged.

The optical system (except the plane mirror and screen) comes in an adjustable housing, called an optical barrel. The barrel is equipped with vertical, horizontal, and lateral adjusting screws so that it may be properly set. There are also screw adjustments for proper focusing and setting of the corrector lens.

Not only should the screen of the 5TP4 projection tube be clean, but there should be no fingermarks on the tube envelope. Since there is a grounded coating on the neck of the tube and high voltage near the screen, it is quite possible for fingermarks to produce a leakage path.

The Philco Model

In the Philco Model 48-2500 projection television receiver the picture tube used is a four-inch diameter TP-400A. The voltage necessary to produce a brilliant image is about

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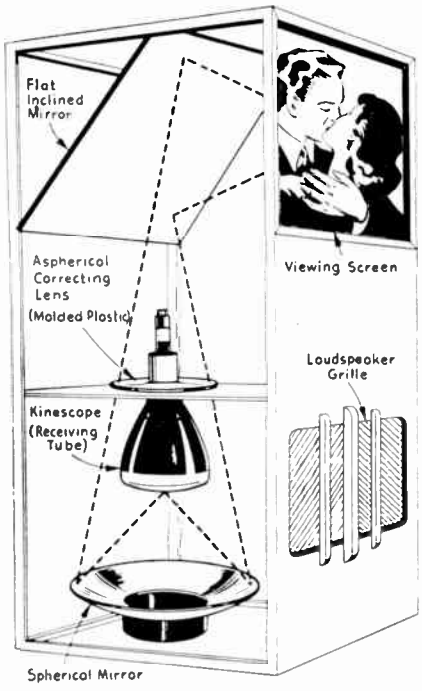

Fig. 2 Optical system in RCA Model 648 PTK. Light goes from tube to curved mirror, to correcting lens, to plain mirror to screen

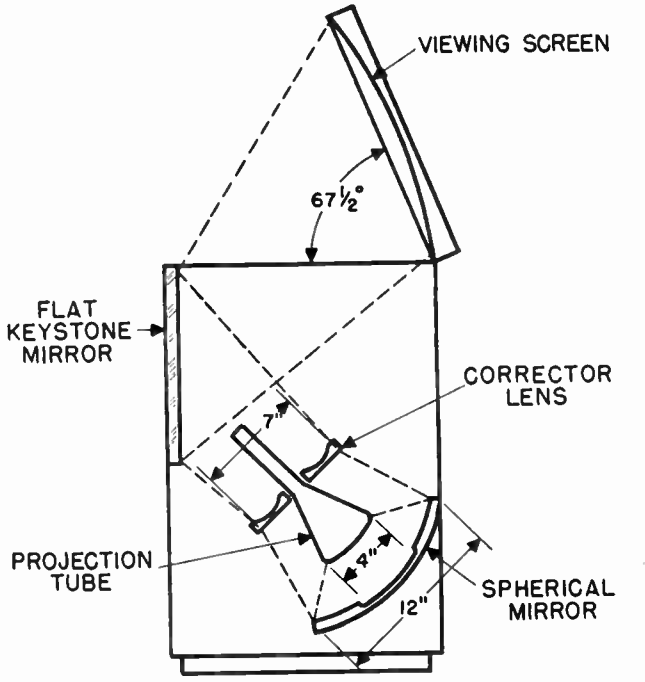

Fig. 3 Philco projection television system, using modified Schmidt optical system, is characterized by its micro-lens screen

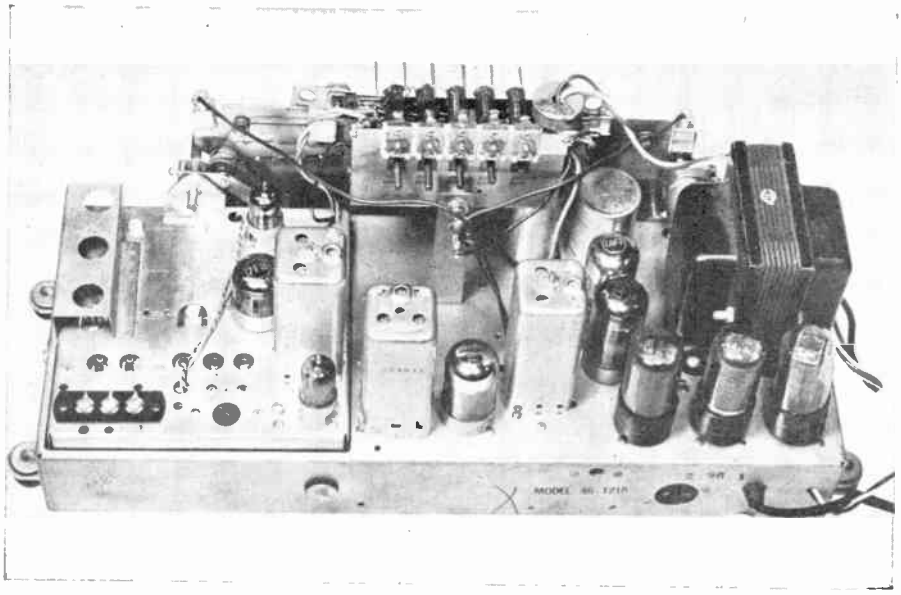

Fig. 1 Conventional appearing i-f transformer in Philco Model 47-1230, discriminator transformer having two holes in top of can from which trimmer adjustments are made

F-M

PART II

EVEN though the emphasis these days is all on television, the f-m receiver and the f-m receiving system are still continuing their development, and there is little doubt that eventually most, if not all, radio broadcasting and reception will be of the the f-m type. Meanwhile, servicing problem involving radio receivers are now divided among a-m broadcast, combination a-m/f-m, and straight f-m receivers.

F-M receiver alignment problems differ in some respects from those experienced in the a-m type. In the previous article of this series (RADIO MAINTENANCE, *June 1949*), the general differences were discussed. This article will consider the actual conditions in some of the types of f-m and combination f-m/a-m receivers now in use.

Deciding whether alignment is necessary

F-M receivers are critical with respect to alignment, especially as to the discriminator circuit. The care required for adjustment and the apparatus setup involved for complete visual alignment make it important that the need for alignment be definitely established before the operation is started. As described in the last article, certain conditions are often confused with the need for alignment, making for the expenditure of unnecessary effort and time on checking alignment which was already perfect. Some of these conditions are:

1. Poor antenna system: This makes for a weak signal at the receiver's antenna terminals and consequent distortion.

2. Any other defects in the front end which cause a weak i-f signal in the limiter-detector circuits, also resulting in distortion.

3. Interference effects: Contrary to the belief held by some, all squeals and whistles are not due to poor alignment in f-m receivers, any more than they are in a-m receivers.

Therefore, proper measures should be taken to be sure that the receiver actually needs alignment before the time required for this operation is invested.

Complete alignment is not always necessary

Although a complete alignment job on an f-m receiver involves a rigid procedure and visual observation of the response curve on an oscillograph, minor adjustments can often be made by the experienced service

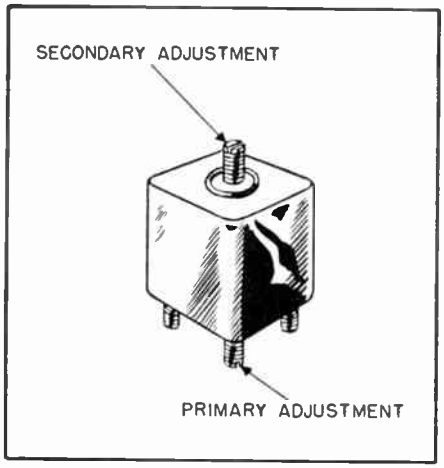

Fig. 2 Discriminator transformer, tuning slugs project above and below the chassis

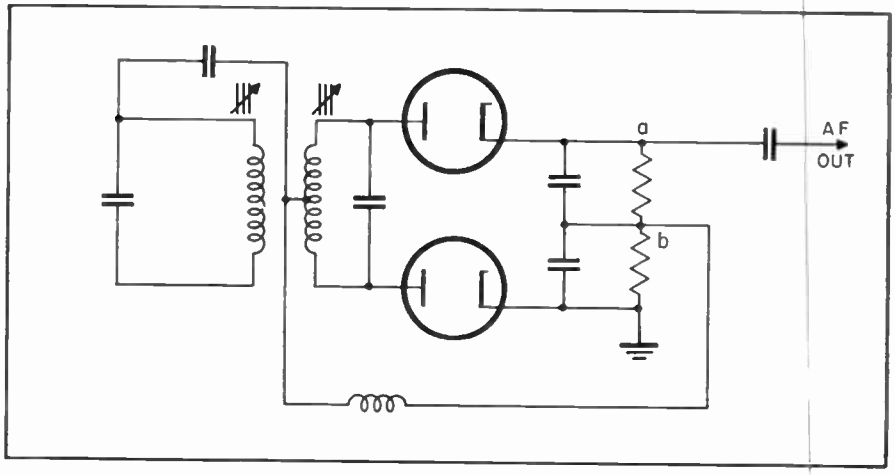

Fig. 3 Shown here is basic discriminator circuit, with points referred to in text for connecting the oscillograph and v.t.v.m. for making alignment by the static approach

RECEIVER ALIGNMENT

There are a number of points which the technician should consider when aligning the f-m receiver, and there are some shortcuts to aid him. Both are discussed here.

by J. Richard Johnson

technician without such involved procedures. Many times a slight adjustment of one particular trimmer or slug will clear up trouble just as easily as any thorough alignment operation.

The technician should trace misalignment troubles in the same way in which he traces other types of troubles. For instance, if the signal appears generally weak, or if only the strongest signals are received properly, misalignment in the front end or the i-f section is suggested. If the dial readings are very inaccurate, the oscillator alignment is obviously out. F-M i-f transformers will generally not detune far from the designated intermediate frequency, so that such detuning cannot usually be blamed on the i-f alignment. If it is difficult to tune in even strong stations with clarity, the discriminator or other detector is indicated as being out of alignment.

The technician should also keep in mind that in most f-m receivers the alignment is affected, at least to some extent, by the tube capacitances. The alignment of a stage in which a tube has been replaced should therefore be carefully checked before the receiver is returned to the customer. The tolerances in the inter-electrode capacitances can often throw a receiver completely out of alignment. In this case, however, the alignment can be kept to one adjustment and the complete, thorough, but time-consuming process of complete alignment is not necessary. Occasionally adjacent circuits will require "touching up," but even then the procedure is relatively simple.

Discriminator alignment

Discriminators ordinarily have a balanced transformer which couples the signal to them from the limiter stage. The balance of this transformer is the most critical adjustment in the alignment procedure. Fig. 1 shows the chassis of the Philco Model 47-1230 receiver, indicating the discriminator transformer. This type of transformer has the primary and secondary trimmers accessible through holes in the top of the can. Another type is that found in the Pilotuner. In this type, powdered iron or brass slugs are used to tune the coils, and the adjusting screws project horizontally from the side of the can. Fig. 2 shows still another type, which is popular in both f-m receivers and the sound sections

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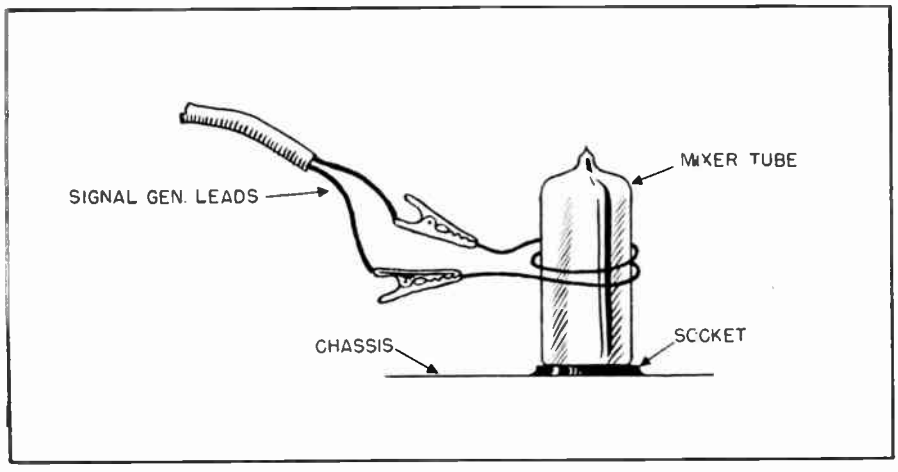


Fig. 4 Convenient method of coupling i-f signal to the receiver. Often even a loop may not be necessary and signal can be coupled merely by proximity to the mixer tube

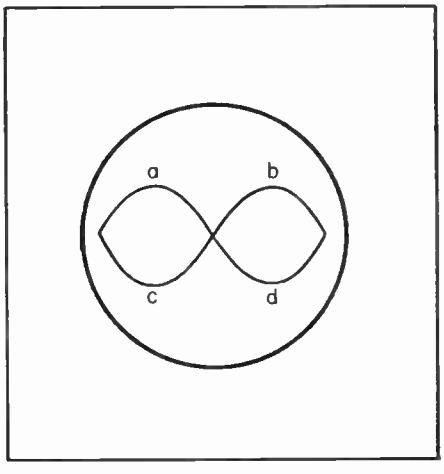


Fig. 5 Oscillograph pattern which is obtained during proper visual discriminator alignment

How to display products more effectively

by Victor M. Turner
Advertising Manager, Radio Maintenance

WINDOW and interior displays are the most important factors in the physical appearance of your shop and salesroom.

While it is true that a modern, efficient design in the plan and construction of your store is important to proper sales and service shop operation, the best efforts of architects and builders can be cancelled by poor displays and decorations. But if you have an old shop which is awkwardly laid out and poorly proportioned, much can be done to offset its structural shortcomings through the use of product displays and window arrangements. A new customer gets his first, and very often decisive impression of the character of your work and business ability from these things. Presenting a good "personality" in your window and interior display is a necessary part of your advertising program.

Letting the Customer Choose

The proper approach to product display is very important. It is basically very simple, although often lost in the more complicated details of display planning. In later articles we shall discuss these details of display planning fully. In this preliminary discussion, however, we shall confine ourselves to the more basic ideas underlying successful window and interior display.

One basic display plan, which has proved very successful, incorporates the idea of "self-service," where all items for sale are placed within reach of the customer. The numerous super-markets which have sprung up during the last few years are an outstanding example of this technique. Almost any business selling small items can increase sales with this technique.

There are several instincts in human nature to which this approach appeals. One is the "desire for ownership," aroused by merely seeing the object close at hand and attractively packaged or displayed. Another is "impulse buying," a tendency to purchase an object not in immediate need but "which will be bought later anyway, so we might as well get it now." This type of buying has greatly increased through the self-service technique. One radio sales and service shop in particular has increased record sales by 64% by displaying albums and individually packaged records *face out*, making the colorful covers sell themselves in each case.

After several years of testing this

Fig. 1 This store front does little to bring the customer inside. The window wall reaches up to the ceiling and blocks his view of the shop, the window display does not lead him to the door, and little of the interior can be seen by him through the door

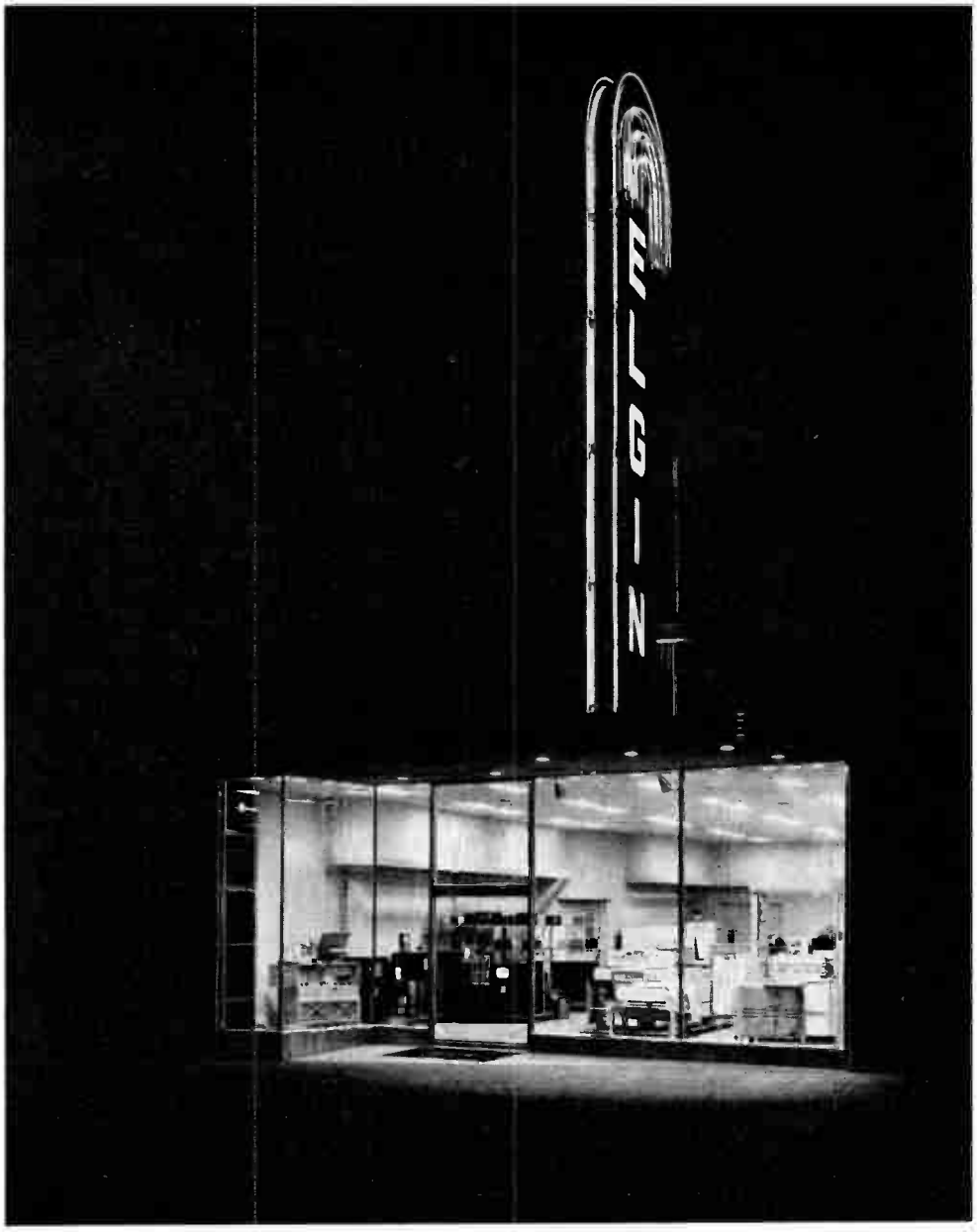
Use a few simple techniques, see your business improve.

display method, retailers have found that the customer himself is the store's best salesman, providing the product is easily seen and examined.

Not only has this system worked for stores selling small items, it has also been successfull applied by organizations specializing in radio and television receiver sales. Drawing on the experiences of these successful shops, we can come to a number of conclusions.

The customer should be given full opportunity to examine the sets at his leisure. He will, of course, require the services of a salesman in order to get complete information on and finally purchase the receiver; but every opportunity should be given to him to "shop around" the store at will.

This is one of the most important points to be stressed in discussing



An excellent example of the use of glass and light for an attractive store front. Notice how modern effect is achieved. (Photograph courtesy Pittsburgh Plate Glass Co.)

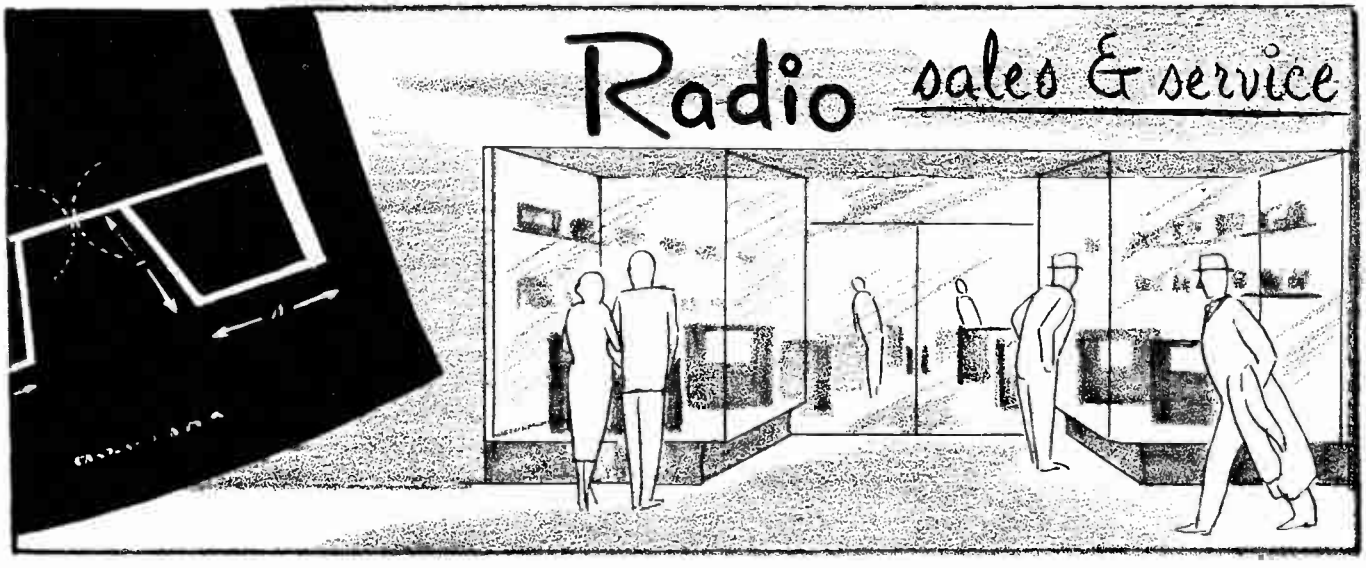


Fig. 2 Notice how this store front leads the customer from the windows to the vestibule where he faces a glass door through which he can see inside the shop. The display on the inside constitutes a logical continuation of the merchandise in the window

product display—setting out the merchandise within easy reach of the customer. This is one of the objects of modern merchandising and should govern every action on the part of the dealer when arranging his display.

This technique begins at the window. The window should be constructed so that the display leads the customer into the shop. The old system of having the window a separate display that has no connection with the entrance of the shop should be avoided. An arrangement such as shown in Fig. 1 does not invite the customer into the store—he simply looks in the window and moves on. He may even have mentally selected an item which he wishes to purchase, but the entrance appeal was missing, so he will probably buy it at another time in another store.

Looking through the glass

An ideal store front is one which has a vestibule formed by the show window, leading in from the street to glass doors through which the full interior of the shop can be seen. The customer can then see more of what you have for sale on the inside of the shop and will be tempted to go in and look. Such an arrangement is shown in Fig. 2.

If a shop is constructed on the conventional style—a large single show window with a door on one side, or two windows with the entrance between them—this "walk-right-in" effect can still be achieved by having the majority of window display material below the customer's eye level, so that he can look *over* it into the shop. A window with a solid wall clear to the ceiling in back of the display will not have this inviting effect, especially if the entrance is small. As much of the shop's interior as possible should be visible through the window. For this reason, a glass door entrance is best. Curtains or blinds on the door should never be drawn unless to indicate that the shop is closed.

Note the picture in the heading of this article and in Fig. 3, where the entire fronts of the stores are of glass and the interiors are actually one big window display. The use of large areas of glass is not only modern in effect but has a valuable functional advantage in drawing the customer inside to the objects so invitingly exhibited. And the "modern look" is definitely a must in retailing. In a recent survey of top architects, 90% gave modern design in store fronts as most successful. Customers may or may not hold to tradition in their residential preferences, but they demand the stores they patronize to be as up-to-date as the products sold therein.

It is good practice to put prices on all the products in the window, large enough to be easily read from the outside. Very often a window shopper wants to know this all-important factor, but does not want to go inside and ask. The average person is embarrassed at the thought of asking, or he is afraid it is too much for his means if the item looks very desirable to him and is unmarked. It is wrong to assume that an item *is* too high-priced to stand up under a tag without an explanatory sales talk. If a person can afford to buy it, he may or may not think the price is high; but the mere fact that the price is plainly shown will not frighten him away. On the contrary, he is likely to imagine the price to be higher than it really is if he has to guess at it.

Too much in the way of posters and cardboard displays in the window will detract from rather than add to the product. It is good practice to have explanatory cards or selling aids, but the overall effect—when taking in the window as a whole—should be one of a group of products rather than a group of cardboard displays.

Looking through the door

When the customer has found an attractive window which arouses his interest, and he can plainly see through to the store's interior, he should be able to see an arrangement of more receivers or appliances in the front part of the store. He will then proceed inside and browse around some more. He is hoping no salesman will pounce on him until he's had a chance to look over the display.

In order to make certain he *does* wander inside, all merchandise should be in the foreground, and the sales counter, service department, *and* the salesman should be in the rear. Nothing will deter the exploring customer more from entering than an idle sales clerk or two lolling about amid the displays, looking hopefully at the door.

- ***The EASIER the product can be seen, the MORE will be sold.***
- ***The MORE products are displayed, the MORE will be sold.***
- ***Increasing the area of the store interior VISIBLE FROM THE OUTSIDE will increase sales.***
- ***Encouraging CUSTOMER BROWSING and SELF SERVICE will result in increased sales.***
- ***A Television receiver is in itself an unbeatable display—let it work for you!***

The consoles should all be accessible on the floor of the shop and connected, ready for playing, with records on the turntables of the record players. If the shop is large enough, separate, glass-partitioned rooms for the different price classes of consoles are a good idea. In this way, more than one radio can be playing at the same time without one interfering too much with the others. These rooms should be clearly vis-

Fig. 3 A shopper looking into this store can see all the merchandise for sale. Note that this store front is arranged in such a manner that the interior of the store becomes the window display. (Photograph courtesy Libbey-Owens-Ford Glass Co.)

ible with open doorways, and the products easily seen from the main salesroom. The table models can be most practically arranged on shelves that are not too high, running around the walls.

A very excellent idea adopted by one retailer to good effect is a "television theater," supplied with comfortable chairs, where television programs are constantly turned on. Customers can come in and sit down whenever they wish, stay as long as they desire, and are not disturbed by the sales staff while watching programs.

If any of these displays or rooms are on a second floor, or in the basement, a prominent sign should be posted at the stairway, informing the newcomers of this fact and inviting them to look around.

The whole idea of this display technique is obvious. It permits the potential customer to become acquainted with the products by himself. He will look at many more items than if he had to ask to be shown; and while looking at them in peace, he is selling himself on the item as no sales clerk ever could. By this we don't mean that the salesman should keep away entirely, but that he should casually enter the scene when he sees that the customer has had a chance to make himself at home. It is at this point that the salesman will be very welcome as the customer will have a few questions to ask and will feel like talking about the product.

Show your Wares

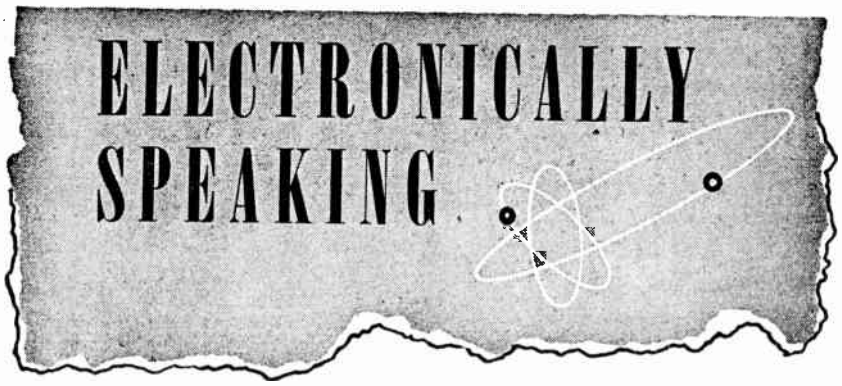
But the display arrangement should be such as to lead the customer around without his having to ask where a certain type of product may be found. The display must do a complete job of "showing-the-customer-around." He should never have to ask for something and have it brought out to him from behind the counter or the stockroom. *All* the models for sale must be on display. This is not only for the benefit of the customer, but also of the business itself, since a greater number of people can be served by the sales staff when the customer can do his own preliminary looking around.

The service department may or may not have a separate entrance from the street (in a large store it's a good idea to have this extra entrance) but it too should not be shut away. The men working on sets with arrays of impressive test equipment give the customer confidence in the repair work. Service income will increase considerably by having a modern, efficient repair department in full view of the customer.

The entire display room and service department should be brightly illuminated at all times. If the store is not brightly lit in the daytime, people on the outside cannot see in, and a dark interior is never inviting.

One more attraction that the advent of television has brought along is the impressive antenna. A line of antennas on the roof of your building or a tall stacked array visible far up and down the street is a natural for arousing interest in what has given us display material heretofore undreamed of—let us make the most of it.

ELECTRONICALLY SPEAKING



by Isidor I. Gross

Never Say Die. CBS, defeated some years ago in its original attempt to have a system of color television approved by the FCC, was stirring again. This time, instead of putting its case before the Commission, it went ahead, produced some color television shows over private circuits (which need no FCC allocation).

Birth of a Baby. Opening gun of the campaign was a demonstration of a caesarean birth, sent via a closed wire circuit from the University of Pennsylvania hospital to a nearby auditorium. This was the first time a surgical operation had been shown in color television.

Calling all Doctors. A week later, color television was demonstrated to the physicians assembled at the annual convention of the American Medical Association (AMA) in Atlantic City with another transmission from the operating table. This demonstration was transmitted by regular broadcast methods, proved wire transmission unnecessary.

Discs. The image was viewed on a conventional television receiver, with an extremely simple converter placed in front of it (the equipment was supplied by Zenith and Webster-Chicago). The converter, consisting of three rapidly rotating colored discs was synchronized with a similar instrument at the transmitting site, produced a color picture through rapid filtering processes, with an assist from persistence of vision. Bandwidth needed for the system was identical with that used in black-and-white transmissions.

What next? Reception was a huge success: so was the publicity for CBS. Not only were doctors spreading the word, but millions of readers saw pictures of the telecast in Life magazine. CBS was beginning to build up a public demand for color television, was fulfilling FCC conditions re bandwidth and adaptability, was expected to press its case, now more vigorously than ever, before the Commission. Clearly the system used by CBS fit snugly into the specifications issued by the FCC. CBS may still have its last laugh.

The Sigh of Relief. CBS was not the only one to welcome the FCC policy announcement. Most of the television manufacturing industry also greeted it with relief. Commented president Allen B. DuMont: "I am extremely gratified to see the FCC initiate the first concrete action of removing the last deterrent to full scale nationwide television on a truly competitive basis. The Commission's attitude with regard to color is the only possible intelligent approach. This color proposal eliminates the fear of obsolesence. The FCC undoubtedly realizes that each day's delay in reaching a final solution to this problem postpones the opportunity for employment for hundreds of thousands of people in this potential multi-billion television industry."

Barometer Steady? In New York City, the Federal Reserve System reported dollar sales of home goods down nine percent in first three months of this year from same period in 1948, found television sales keeping high levels because of aggressive sales promotion and price reductions. The big stores were pushing their merchandise very vigorously, featuring lower-priced sets, offering trade-in allowances, running tremendous volumes of ads in the daily press. The small dealer-service technician on the other hand was unable to follow along, began to feel the tightening market.

Whistling in the Dark. According to one source, however, teleset price drops had about reached bottom. Tele-tone's S. W. Gross predicted leveling off prices, attributed earlier price sags primarily to increased production, reduced component costs.

Going Down. This prediction, however, was not borne out by developments. Teleset prices continued downward, showed no sign of stopping. G-E reduced seven of its models from $20 to $100 in the early part of June, was joined by Wald Radio which cut one of its 12½" consolettes by forty dollars.

And Still Going. Andrea joined the slide, reduced one table model of its new line by $110, other models by as much as $160 and $200 compared with last year's prices.

Wrong Bait? Even lowered prices failed to tempt the customer in many areas. Cities with only one TV station were beginning to notice decided drops in receiver sales, were looking for competitive telecasting to come to the rescue. On the West Coast, opening of a new station revived lagging interest, sent sales volume up. The public seemed to be willing to pay the price, provided it could get something for it.

High on a Windy Hill. The Washington Evening Star's TV station WMAL-TV, using Raytheon microwave television relay equipment, brought the Winchester, Va. Apple Blossom Festival to D. C. video viewers. The microwave relay was established between a fire outlook tower atop Signal Mountain, near Winchester, and the station transmitter on American University Campus, constituted the longest single microwave relay for a public telecast so far.

International Set. A number of foreign visitors attended the seventh Television Technical Training Program held at the RCA Camden plant during May, indicating the growth of interest in television in Canada, South America, and Europe.

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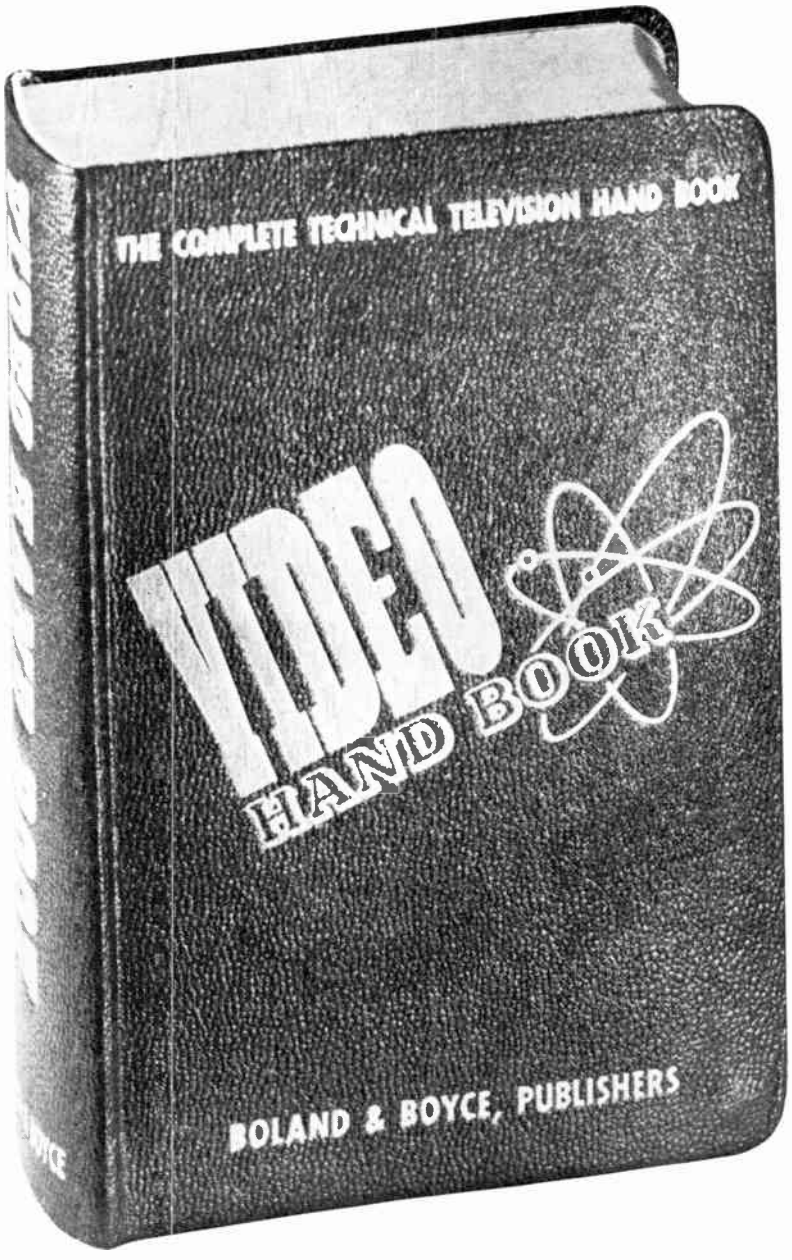

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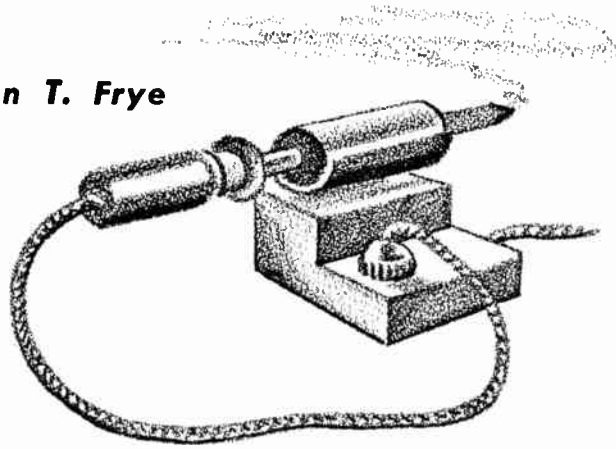
OVER THE BENCH

By John T. Frye



THERE is one question that I can depend on to crop up in my mail at least once a week. It is: "What system of trouble-shooting do you use and recommend?" Some of the questioners go ahead to list several methods and request that I rewrite the list in my order of preferences. Most lists contain voltage measurement, resistance measurement, signal tracing, signal injection, signal substitution, stage isolation, etc. Some contain fancy names that I honestly never heard of.

These letters always depress me a bit, for they make me feel that I have not made sufficiently clear one of my fundamental convictions about radio servicing: the best serviceman is the one whose technique is the most flexible, whose knowledge and methods can adapt themselves to the quick solution of any electronic problem.

Obviously, such a serviceman must have at his ready command all of the "systems," but he is not married to any of them. Each system, to him, is just another service tool; and he selects a particular one to do the job at hand just as he chooses between the multimeter, vtvm, or 'scope.

The thing that you have to keep clearly in mind is that the one idea in radio servicing is to locate and to repair the trouble with the least possible effort and in the least possible time. All of the well-known systems will eventually locate the trouble if they are carefully carried out; but it will take some much longer than others, depending on the particular fault being sought.

Now don't go telling me that if you knew what kind of trouble you were looking for, you would not need to select a trouble-shooting method to find it! You do not, of course, know what the trouble is; but you always have, if you are any kind of a serviceman at all, a suspicion as to where it might be. The thing to do, then, is to select the trouble-shooting method that will confirm to relieve that suspicions in the minimum amount of time. Let's take some examples:

Suppose I have a set in which the rectifier plates turn cherry-red as soon as I turn it on. First I use my looking-at-the-rectifier system; then I employ my resistance-measurement method to see where the low-resistance short is. Or suppose my smelling-a-hot-resistor method makes me suspect a shorted by-pass. Resistance-measurement is the quickest way to see if I am right.

On the other hand, suppose that the radio has no "pep." The volume is down; stations tune broadly; and the tracking is a little off. These things should make you suspect that the i-fs are badly out of alignment, and this theory can be checked quickly without removing the chassis from the cabinet, in most cases, by injecting the i-f signal.

Had the volume been low without the other accompanying symptoms mentioned above, and if the tubes had all been found to be good, it would not be out of line to suspect a low screen voltage. The voltage-measurement method would be the quickest way to test this.

I could go on and on, but I hope these examples are enough to make my point: in almost every case an ailing radio will give you a wealth of clues pointing toward what is the matter with it. All you have to do is to be sufficiently observant to recognize them for what they are. The correct interpretation of these hints will save you hours and hours of plodding adherence to some set and rigid procedure. The brain is much, much quicker than the hand; and the more of the trouble-shooting that you can do in your head, the quicker will you have the set off the bench.

I rather suspect that the reason back of trying to find some magic "system" for locating trouble is pure laziness. Thinking takes more effort than performing a series of near-automatic tests, even though it is quicker; and I have heard some servicemen boast that they can service radios while they are thinking about what they did the night before. They probably can, but I am convinced they could service many more in the same length of time if they would concentrate on what they were trying to do.

Some of you fellows who received your training in the service are thinking that you were taught to follow a set procedure there and that the gov-

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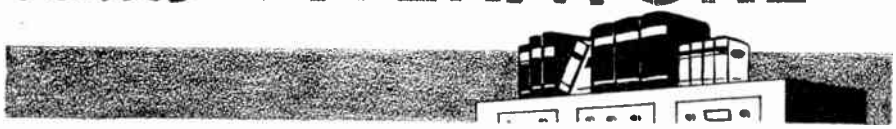
trade LITERATURE



Video Handbook, *By* MORTON G. SCHERAGA *and* JOSEPH J. ROCHE *(Boland & Boyce, Inc.) 892 pages, $5.00*

This handbook constitutes an effort to gather together in one volume all pertinent information on the technical aspects of television transmission, reception and servicing, as of today. From a chapter on the history and future of television, and a review of fundamentals, the authors proceed to a discussion of receiver operation and circuits, transmitting station equipment and operation, and television antenna systems. The last third of the volume is devoted to an analysis of a number of modern television receivers and a thorough discussion of installation and servicing procedures. Particularly helpful is a 40-page section dealing with a detailed and illustrated analysis of test patterns. Other sections of the book are concerned with test instruments, their requirements and specifications; receiver construction, and terms. The authors also devote one section of the handbook to television show programming and production. Indexed.

The Recording and Reproduction of Sound, *by* OLIVER READ *(Howard W. Sams & Co., Inc.) 304 pages, $5.00*

This handbook was written by the editor of Radio and Television News. The volume evolves its subject from a history of sound and the behavior of sound waves to a coverage of all basic media for making recordings. Also treated in the volume are such subjects as: auxiliary equipment, acoustical systems, amplifiers and their applications.

Philco Home Radio Yearbook *(Philco Corporation), $2.75*

This yearbook provides in one volume information previously contained in separate radio manuals, plus some additional material. It covers servicing of all Philco 1946 and 1947 models, including home radios, radio phonographs, and portables. Contains the Philco trouble shooting procedure, alignment procedures, base views, schematic diagrams, circuit descriptions, drive cord drawings. Indexed.

Radio Component Handbook, *(Philco Corporation, 200 pages, $2.50*

This book, of interest to technicians, is being made available through Philco distributors. It contains data tables, charts, curves and other material, not heretofore published, on transformers, electrolytic capacitors, variable and fixed capacitors, insulating materials and components, speakers, switches, tubes, and metallic rectifiers. Many of the components considered in this volume are used in television receivers.

Catalogs and Pamphlets

Dealers' Condensed Catalog. American Phenolic Corporation, Chicago 50, Ill., (Amphenol) has available, free upon request, a 6-page flier catalog, listing its line of antennas, transmission lines, connectors, and sockets.

Jiffy Checking. This is the name of a six-page folder put out by Aerovox Corporation, New Bedford, Mass., listing specifications and operating procedures for its capacitance and resistance bridge. Tells what can be accomplished with the instrument. Free on request.

Test Equipment Catalog. A new catalog giving complete specifications, charts, and photographs of electronic measuring equipment, quartz and germanium crystals, is being offered by the Specialty Division of the General Electric Co., at Electronics Park, Syracuse, N. Y. All test equipment manufactured by the Electronics department is listed, including power supplies, oscillographs, r-f capacitometer, square wave generator, scalers, and an industrial tube analyzer.

Converter Catalog. Carter Motor Co., 2644 N. Maplewood Ave., Chicago 47, Ill, has issued a 16 page catalog, giving details of operation, specifications, and applications for its d-c to a-c converter.

Television Service Encyclopedia. This a companion piece to the Radio Service Encyclopedia, also published by Mallory. This volume presents replacement parts info on more than 100 tv sets, also includes data on boosters and pre-amplifiers. Priced at 15c, obtainable from Mallory distributors.

Vibrator Guide. Mallory has also published a new edition of its vibrator guide, a forty-page book containing about 230 more listings than the previous edition. Sections in the book include: alphabetical listing of radio and vibrator power supplies, installation notes, buffer capacitor reference circuits, auto radio service notes, how to build a vibrator, and others. 15 cents a copy, either from Mallory distributors or from P.R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

Transformer Catalog. Merit Coil & Transformer Corp., 4427 N. Clark St., Chicago 40, Ill., has released its new catalog No. 4911; incorporates all television transformers into Merit's regular line, each tv replacement marked with a star for easy finding. Fully illustrated.

Stancor Catalog. Standard Transformer Corporation, 3580 Elston Ave., Chicago 18, Ill., has issued its 1949 catalog. Includes electrical and physical specifications and list prices for over 400 items, among them: audio transformers, power transformers, chokes. Found in it are also charts listing transmitting and rectifier tubes, driver modulator combinations, matched power supplies, and detailed dimensional drawings of all Stancor transformers. Free upon request.

Publication for Dealers. DuMont has inaugurated monthly publication of "Dealergram," for franchised DuMont Dealers, consists of 4 pages of video news items.

F-M Receiver Alignment

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of television receivers. In this type, the coils of the transformer are both wound on the same form. One tuning slug is inserted in each end of the vertical coil form. The primary coil tuning screw projects from the top of the can and the secondary coil tuning screw projects from the bottom. With this type it is necessary to make one adjustment from the top of the chassis and the other from under the chassis.

The degree to which discriminator alignment adjustment is critical depends upon the receiver involved. In some receivers a fairly good adjustment can be obtained by ear. This method is not recommended, however, since the ear is not sufficiently sensitive to catch imperfections during a short test, and many times the program material is of a type which does not provide maximum deviation. It has been previously pointed out that discriminator adjustments which give good performance on deviations somewhat less than 75 kc may produce considerable distortion when the deviation increases to that value. "Rough" touching up of the discriminator is quite likely to take place when modulation peaks are not a maximum. Later, when full deviation does take place, distortion may result.

Although the visual method is best all around, discriminators can be aligned by a static approach. In other words, by adjusting an a-m signal generator to the *exact intermediate frequency*, coupling it to the receiver, and adjusting the discriminator secondary tuning for zero voltage across ground and point *a* in Fig. 3. The primary tuning is then adjusted for maximum voltage between *b* and ground, or between *a* and *b*. These latter voltages should be the same and a maximum when the primary circuit is at resonance. All the voltages across the load resistors are d-c and are most accurately read with a v.t.v.m., although a sensitive meter of any kind will do.

Coupling methods

It is not important that the signal generator be coupled at any particular point in the circuit. Any convenient method of providing enough pickup to provide a usable signal in the aligned circuit *without affecting that circuit* is satisfactory. Coupling methods which do not involve any direct contact are naturally the most convenient. One such method is suggested in Fig. 4. A loop is fashioned from a piece of insulated wire, large enough to fit over the perimeter of the mixer tube and containing two or three turns. The ends of the loop are connected to the signal generator leads. When the loop is slipped over the mixer tube (glass type, of course), sufficient coupling is present between the elements of the mixer tube and the loop to provide a usable signal for i-f alignment.

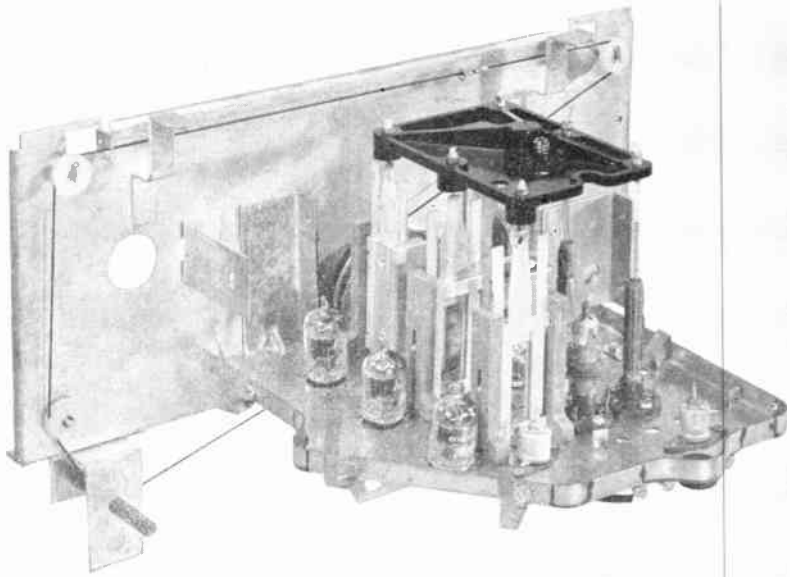


Fig. 6 Tuning assembly utilizing General Electric "guillotine" tuner. Adjusting screws for r-f, mixer, and oscillator tuned circuits alignment can be seen on top of assembly

Many times it will not be necessary to make a loop. Just laying the ends of the signal generator leads down near the input circuits will often provide sufficient pickup, if the circuits are somewhere near alignment to start with, which is ordinarily true in service work.

The i-f section and the limiter and discriminator circuits should all be aligned with exatly the same signal generator setting, no matter which one is done first.

In receivers using a limiter state, the limiter grid resistor voltage provides a convenient indication of the alignment of the i-f stages which precede the limiter.

When the visual method of alignment is used for the discriminator, the criss-cross pattern of Fig. 5 is obtained by using a sweep signal generator with a sweep range of several hundred kilocycles, which is coupled into the receiver in any convenient way. An oscillograph is then connected across the a-f output terminals of the discriminator (point *a* to ground in Fig. 3). The oscillograph sweep frequency is set for twice the signal generator sweep frequency (which is usually 60 cycles), to obtain this criss-cross pattern. The primary tuning is then adjusted for maximum height and depth of the peaks (*a* , *b*, *c*, and *d*,). The secondary tuning is adjusted for best centering of the cross-over point between the peaks.

Ratio detector alignment

When a ratio detector is used, the i-f section can be aligned by using the voltage across the load resistor, since this voltage is proportional to the strength of the i-f output signal. The visual alignment of the ratio detector itself is the same as for the discriminator, except that a battery of 1½ or 3 volts is connected across the load resistor to stabilize the voltage there during adjustment.

Front end adjustments

When the detector and i-f sections have been aligned and it is certain that the proper i-f resonant frequency has been achieved, the front end alignment can then be checked. F-M receiver oscillator alignment and tracking are exactly the same in principle as for a-m broadcast receivers. However, oscillator "pulling" is

→ to following page

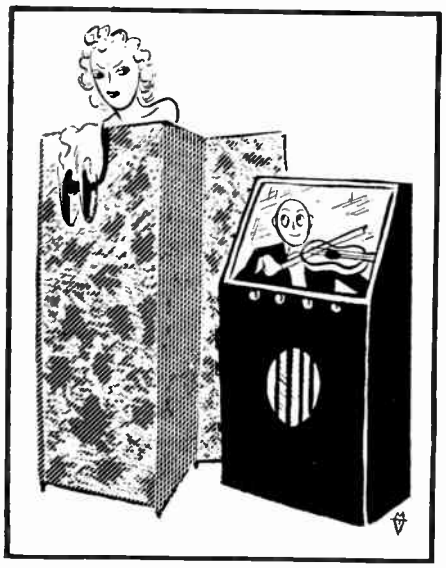
F-M Receiver Alignment Part II

→ from preceding page

sometimes a problem, so that it is advisable to rock the dial back and forth to check low and high-frequency settings. As in a-m receivers, a high frequency (usually about 106-108 Mc) for trimmer adjustment and a low frequency (88-90 Mc) for padder (iron or brass slug) adjustment are specified in service literature.

Some f-m receivers, especially of the tuner variety, make use of variations in tuning elements which may appear strange because of their difference in physical construction from conventional tuning components. One such arrangement is shown in Fig. 6, which illustrates the General Electric "guillotine" tuner, described in an earlier article of this series (RADIO MAINTENANCE, *September 1948*). The illustration shows the adjusting screws at the top of the assembly which are used to align and track the r-f, mixer, and oscillator tuned circuits.

For tuning of the r-f input stage, it may often be found helpful to connect a 300-ohm resistor across the antenna terminals and couple the generator very loosely, either by proximity or through a very small capacitor (say 5 mmf). This ensures that the load at the antenna terminals is proper, which is important to correct alignment in some receivers.



Over the Bench

→ from page 28

ernment men should know what they were doing. I have no quarrel with them, but let me point out that the conditions were different. When you are servicing many units of identical pieces of equipment, a rigid procedure can be established that will reveal the maximum number of faults in the least possible time, for you can base your procedure on *observed probability* of breakdown; but in servicing, you seldom have the same model on the bench twice in succession. Just finding the same check points on different models require no little time and head scratching.

Now do not get the idea that I am arguing against method and system in your work and am coming out in favor of haphazard testing. That is the *last* thing I want you to think. The religious following of *any* system is better than that. What I am trying to say is that your system should be big enough and flexible enough that it embraces all of the other systems as useful parts of itself.

What I am talking against is the apparent effort of some radio men to replace the thinking, intelligent brain with a mechanical series of set operations. That is no good, fellows. The only system is one that makes you use your brain more, not less.

Down through the ages men have wasted a lot of time trying to find a "simple" way to do a complicated thing. Remember how the old boys worked trying to discover a "philosopher's stone" that would transmute other metals into gold? That would have been much easier than mining gold, they thought; but their descendants are still obtaining gold from the earth. Remember, too, how the early medical men kept looking for a single magic "elixir" that would cure *all* of the ills to which human flesh is prey? Well, we have more remedies today than we ever had before, and they are still coming.

Let's take a lesson from this and work toward using everything we know in our servicing and quit trying to find an easy substitute for thinking. Believe me, we shall be better servicemen for it!

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Field Strength Meter

→ from page 17

indicating meter is bypassed for i.f., and sufficient level is fed into the audio amplifier to provide the desired sound output at the headphones. Part of the output of the crystal detector circuit is employed to supply voltage for automatic volume control (AVC). For this reason, the meter scale reads logarithmically. Automatic volume control permits a wide range of input signal levels to be read without the necessity of meter switching and multiplier circuits. The a-v-c voltage also protects the meter from accidental burnouts, caused by excessively strong input signals.

Regulated d-c voltages for the tuner and the i-f stages are provided by a full-wave rectifier, V4, feeding a choke input filter. All tube heaters are supplied by the low voltage secondary on the power transformer.

Operation

In order to operate the instrument, the power plug is connected to an a-c outlet (105-125 volts, 50-60 cycles) and the 300-ohm line from the antenna is connected to points 1 and 2 on the terminal strip at the rear of the cabinet. The unit is turned on by rotating the bottom control knob on the front panel, and requires thirty seconds to warm up.

In order to measure relative picture signal strength, the channel selector (the larger of the two knobs on the front panel) is turned to the desired channel, and the smaller knob is rotated back and forth until maximum meter reading is obtained.

Each unit is supplied with an individually calibrated chart which lists microvolt values for the various meter readings and is attached to one side of the instrument. As each meter is individually calibrated at the factory, values on the charts vary somewhat from one unit to another. When maximum meter reading is obtained, the corresponding microvolt value is ascertained from the chart. This process can be repeated for all stations in the technicians service area. Generally speaking a minimum signal level of 250 microvolts is required for satisfactory clarity, signal-to-noise ratio, and the elimination of ghosts on the screen. If the meter shows an input signal level of 250 microvolts or more, reception will probably be satisfactory.

The meter does not furnish a picture. What it measures is the carrier of the signal, rather than the modulation level as seen on the picture tube.

Uses

One of the most frequent uses of the instrument is in the localization of installation trouble. The technician, called to service a faulty receiver can, through the meter, determine quickly whether the trouble is due to the signal received or whether it is located in the receiver itself.

The unit can also be used to advantage in the orientation of antennas. In this respect it is superior to a test receiver, since varying intensities of the actual picture received on the test receiver sometimes lead to confusion as to when the best antenna position has been obtained. At an actual installation, the channel selector switch is set to the station which provides the weakest signal, and the antenna is then oriented until maximum meter reading is obtained.

Not only may the meter be used in service work and the orientation of antennas during time of installation, but it can equally well be employed in deciding which of a number of antenna systems has the greatest merit for a particular location. The technician can accumulate these data by running tests of various antennas, either from his shop, or from strategic locations in his area. These tests can be run for all stations operating in the area, and for a number of different antenna systems; and the results will form valuable reference data for future jobs.

Once the antenna installation has been made, standing waves on the transmission line may result in reduced strength at the receiver input terminals. Standing waves are brought about by several factors not always easily controllable. Impedance mismatch between antenna and lead-in, or between receiver input and lead-in, are probably the most frequent causes. These standing waves are produced by addition and cancellation (in-phase and out-of-phase relationship) between received and reflected waves along the transmis-

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Oscillograph

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Before leaving the subject of frequency response, one other point is worth noting. The response characteristics of an oscillograph are usually determined with the gain control in maximum position. In many instances the design of the gain control is such that it will modify the overall frequency response of the instrument when it is moved from this position. Consequently, it is important that the gain control be designed so that it does not appreciably affect the frequency response characteristics of the instrument. Typical gain control and amplifier circuits will be discussed later.

Sensitivity Characteristics

In addition to frequency response, several other characteristics are important. One of these is the sensitivity of the instrument. Sensitivity is important because it determines the minimum signal amplitude which will give a useful deflection of the electron beam. If we assume that we wish to examine a signal with an amplitude of 0.5 volts, it is necessary that we use an oscillograph whose sensitivity is such that a signal of this amplitude will cause the spot on the face of the cathode ray tube to be deflected at least one inch. If the signal does not cause this much deflection, the pattern formed on the face of the tube will be too small to be easily observed and a more sensitive oscillograph must be used.

The sensitivity of an oscillograph is usually referred to in terms of the instrument's deflection sensitivity. Deflection sensitivity is generally stated in rms volts per inch, or rms volts per millimeter. The overall deflection sensitivity of an oscillograph is the result of the deflection sensitivity of the cathode ray tube plus the gain of the deflection amplifiers. Manufacturers often give the deflection sensitivity for signals connected directly to the deflection plates of the cathode ray tube and the deflection sensitivity with the signal connected to the vertical and the horizontal deflection amplifiers. A typical instrument might have the following specifications:

Signal to deflection plates:
horizontal—23 rms volts per inch
horizontal—23 rms volts per inch
Through Amplifier:
vertical—0.10 rms volts per inch
horizontal—0.60 rms volts per inch

The importance of deflection sensitivity is realized when we consider the sensitivity required for a typical use of an oscillograph. To align the video i-f amplifiers in a television receiver individually, an oscillograph with a sensitivity of 25 millivolts is necessary. If an instrument with lower sensitivity is used, the pattern on the face of the cathode ray tube, with the gain control advanced all the way, will not be sufficiently large to indicate the effects of adjustments to the stage under test. All uses to which an oscillograph can be put require some minimum sensitivity. It is therefore necessary to know the deflection sensitivity of an instrument before we can determine whether or not it will be satisfactory for a particular application.

Input Impedance

Another important characteristic of oscillographs is the input impedance of their deflection amplifiers. Input impedance is important because it determines what effect the connecting of the instrument to a circuit will have upon the operation of the circuit. When an oscillograph is connected, say, to a high-frequency resonant circuit the tuning of the circuit is changed by the input impedance of the instrument in the same manner it would be if a small auxiliary capacitor were shunted across the circuit. The lower the input impedance of the oscillograph, the greater will be the change in tuning.

Input impedance is expressed in micromicrofarads and megohms. An instrument with an input impedance of one megohm in parallel with 20 mmf will have the same shunting effect on a circuit as would be obtained by connecting a 20 mmf capacitor and a 1 megohm resistor across the circuit.

Another important oscillograph characteristic is the range and linearity of the sawtooth sweep available. In order to examine the waveform of a signal with respect to time, a linear sawtooth horizontal deflection voltage is necessary. If the maximum sawtooth frequency available is 25 kc, waveforms with frequencies up to 100 kc can be examined. Fig. 5 shows the pattern which will be obtained on the screen of an oscillograph when a 100 kc sine wave is fed to the vertical deflection amplifier and the sweep is set at 25 kc. Four cycles of the signal to be observed appear. If the signal under observation had a frequency of 200 kc, eight cycles would appear. This number would be too great to permit convenient observation.

These are not all of the characteristics of the oscillograph which determine its usefulness. However, they are the most important ones. In the next issue we will discuss the various circuits used in oscillographs and how they affect the characteristics of the instrument.

Field Strength Meter

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sion line. They are usually more pronounced on the higher frequency channels.

The field strength meter can be used in remedying this condition. The meter is connected to the transmission line at the receiver end, and the meter reading from one of the higher frequency stations is taken. A small piece of tinfoil (such as found in a package of cigarettes) is wound around the transmission line at the receiver. The tin foil is then moved along the line until the meter reads maximum, and is fastened in that position. If low input signal level is obtained from other high-frequency stations, the process can be repeated with a second piece of tinfoil.

The unit has provision on the front panel for use of an earphone with which it is possible to receive both the video signal and the actual sound carrier for a particular channel. It is possible to pick up interference within a given point by means of the phones, by tuning the venier tuner through its range.

Projection Television

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twenty kilovolts. A decrease in anode voltage of only 10 percent will seriously reduce image brightness. Since the picture is going to be considerably enlarged, the focus adjustment will be found to be fairly critical.

Philco projection television, a diagram of which appears in Fig. 3, like the RCA type, makes use of a modified Schmidt optical system. The picture tube is pointed at a spherical mirror which collects all the light and reflects it onto a flat mirror. The flat mirror, in turn, sends the light along to a micro-lens screen. The curved mirror, which resembles a rather large heavy saucer, is made of molded glass. This type of mirror, like RCA's, has its reflecting surface on the front.

If you find it necessary to handle this mirror, hold it by the rear surface which is not coated, or by the edges. Touching the front surface with your fingers will cause the surface to become corroded and discolored, making the projected image spotty in its light distribution. Since the flat mirror is also front-coated, it should be treated with the same care. Any warping of the flat mirror, or strain on it, preventing an absolutely flat surface, will result in a picture on the screen which is not in focus from all viewing positions.

The corrector lens has a flat surface on one side and a curved surface on the other. The flat side faces the spherical mirror while the curved side faces the flat mirror. Since the spherical mirror introduces a focus error, the corrector lens is designed in such a way that it produces proper focus of the picture on the flat mirror.

In next month's article we shall continue our discussion of projection television systems, completing our analysis of the Philco receiver and concluding with an investigation of the North American Philips model.

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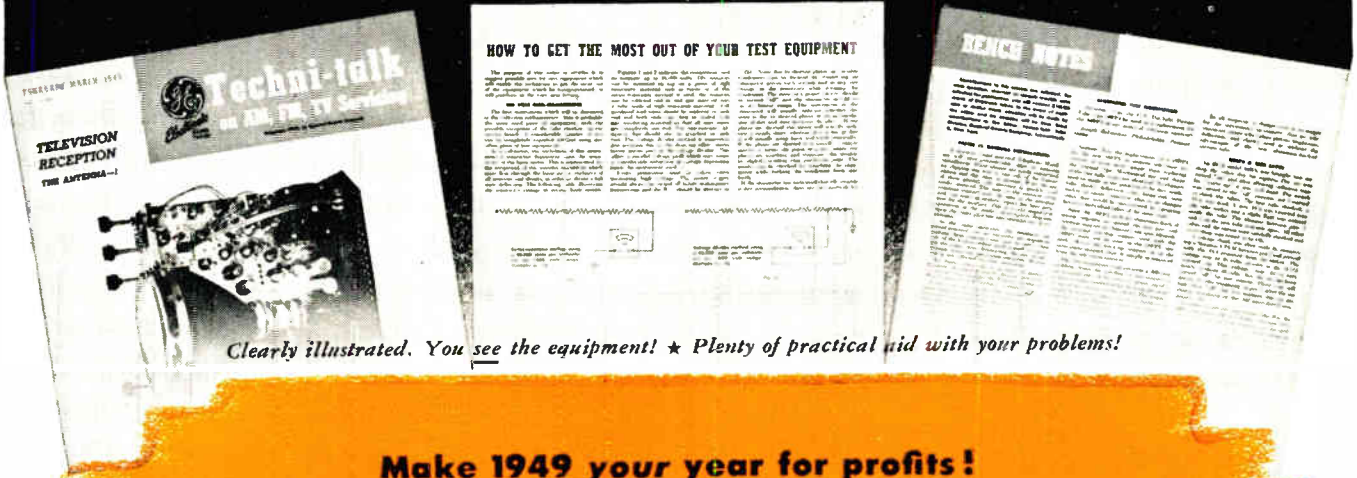

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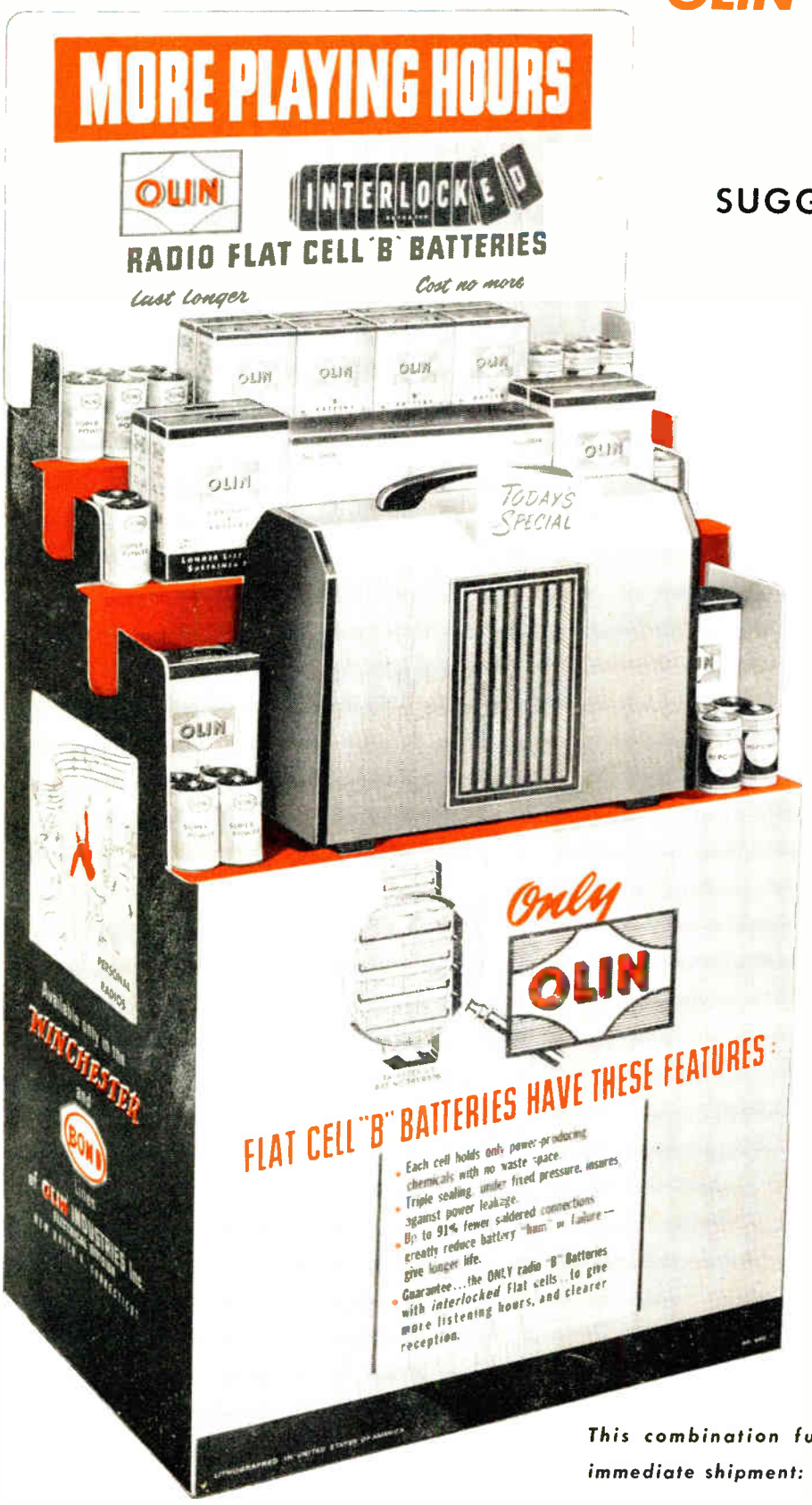

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