Radio SERVICE DEALER

JANUARY, 1950

IN THIS ISSUE:

AM-FM-TV-SOUND

The Professional Radioman's Magazine

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5 display assortments

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SMALL — LOW-COST STOCK
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EDITORIAL

by S. R. COWAN

Copycats

Three times in 1949 we either brought legal action or threatened to do so against contemporary publications which had the temerity to steal, or to phrase it more delicately, who had the gumption to plagiarize articles and material which had previously appeared in RADIO SERVICE DEALER during the same year. We won or settled all three cases. Two other cases in which we have started action for alleged plagiarisms are still pending.

It is gratifying to have published articles so fine that competitors feel it necessary to republish them. That our contemporaries are able to discern fine text is one thing, but having learned that it is costly to plagiarize, is another, and henceforth perhaps they will attempt to be more original. In any event, we can happily report that our Managing Editor has some more real "scoops" in preparation for you and soon these will appear exclusively (we hope) in "RSD".

The Annual Index

Hundreds of "RSD" subscribers, responding to our recent poll, favored having us publish an Annual Index of a year's issues in our January issue of the following year. Thus our "Index of 1949 Contents" appears in this issue. Some of our 1949 issues are completely sold out so new subscribers can not obtain complete files of back numbers. On occasion we advertise what back issues are still available.

In our questionnaire we also asked: "What articles published in *any* serviceman's journal during 1949 did you consider best and most helpful to you?" and the overwhelming first choice was none other than "RSD's" article "Checking Video & Synch Waveforms By CRO" which we published in January. Runner-up as second choice was also "RSD" text, to wit, our series "Legal Bombshell Hits TV Policies" and its sequel, "Legality of TV Policies Clarified" which appeared in "RSD" August and September issues respectively. Thanks fellows, for liking R.S.D.'s efforts.

Industrial Maintenance

Radio parts jobbers tell us that an ever-increasing percentage of their over-the-counter sales come from the industrial field; and that Service Dealers who have started to specialize in handling industrial electronic equipment service work on a fee basis are responsible for the trend. Uusually industrial electronic installations, which are kept at optimum efficiency at all times, require as many replacement tubes and parts as would a dozen conventional radio receivers. Service Dealers who have not already done so would be wise to scout around for potential industrial electronic maintenance jobs, most of which can be gotten on a year-around service fee basis.

Sanford R. Cowan
EDITOR & PUBLISHER

Samuel L. Marshall
MANAGING EDITOR

COWAN PUBLISHING Corp.
342 MADISON AVENUE
NEW YORK 17, N. Y.

MEMBER AUDIT BUREAU OF CIRCULATIONS

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Advertising Manager

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DAVID SALTMAN, Production Manager
BRANCH: J. C. GALLOWAY 816 W. 5th St., Los Angeles 13, Calif., Mutual 8335

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SYLVANIA'S EXTENSIVE NATIONAL ADVERTISING IS

Building business for *you* every minute!

Whistling sounds in your set really give reception a black eye. Get rid of unwanted noises now by calling the radio serviceman who displays the Sylvania sign. He'll make your set perform like new.

Does your radio give out with squeals and grunts? Then call the serviceman who displays the Sylvania sign. Because your radio needs expert care, the kind this fellow is trained to give.

If your television becomes a terrible vision, call the expert who displays the Sylvania service sign. He knows these complex sets inside out . . . has the "savvy" to make the delicate adjustments and repairs they sometimes need. He relies on super-keen Sylvania testing devices to detect and diagnose troubles accurately . . . Sylvania radio tubes, the proper television picture tubes and other custom parts to restore perfect sight and sound. Stop at the shop showing the Sylvania sign for top television and radio repairs.

SYLVANIA RADIO TUBES

PRODUCT OF SYLVANIA ELECTRIC PRODUCTS INC.

Sylvania ads especially prepared to *boost your service* are telling 15,500,000 people from coast to coast all about the *valuable service* and parts you're offering them. Readers of these magazines are attracted to the lively cartoon-type ads, three of which are reproduced above. They tell them to stop at the Sylvania sign of dependable service . . . for the best radio and television repairs at the fairest prices!

Hundreds of these readers are *your potential customers.* These humorous ads, running in the cream of the nation's publications, help assure you a *steady stream of new customers* and greater profit.

There's Still Time To Cash In On The First 1950 Sylvania Service Dealer Campaign—Write Sylvania Electric Products Inc., Advertising Dept. R1601, Emporium, Pa.

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; ELECTRIC LIGHT BULBS; PHOTOLAMPS

TRADE FLASHES

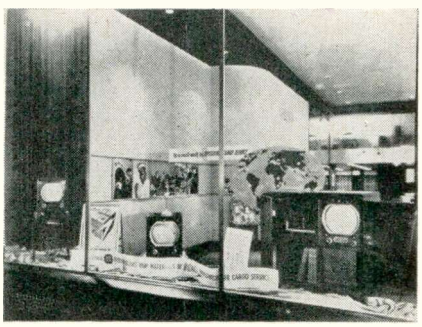
A "press-time" digest of production, distribution & merchandising activities

Sylvania's Educational Display

Sylvania Television and British Overseas Airways Corp., New York, are dramatizing the major role played by world trade in the television industry during this month in a BOAC window display showing Sylvania Television receivers and listing countries where the raw materials needed for video come from.

This display at 420 Madison Ave., BOAC New York office, depicts how raw materials from all over the world are needed to build a television set which now number more than 3,000,000 in the United States. Sylvania Television receives raw materials via BOAC Worldwide Air Cargo Service from all parts of the globe.

More than 15 countries contribute materials to make television possible. Among them are Canada which produces asbestos, cadium, calcium and carbon. The United States supplies barium, magnesium, borax, casium and steel. From Haiti comes bauxite; chromium from the Union of South



Africa; cobalt from Northern Rhodesia; copper from Chile; mercury from Italy; mica and throium from India; molybdenum and strontium from Mexico; platinum from South Africa; titanium from the Federated Malay States; tungsten from China; magnesium from the United Kingdom; rubber from Malaya and mahogany from Honduras.

1,000,000 TV Tuners

Mr. Glen E. Swanson, President of Standard Coil Products Company, Inc., of Chicago, Los Angeles, and Bangor, Michigan, announces that they have now manufactured one million TV tuners.

Pictured below on the right is Mr. Swanson receiving the millionth tuner from John R. Johnson, plant superintendent of the Los Angeles factory. "The Standard Tuner" is used by the majority of the outstanding TV set manufacturers. Forty per cent of the estimated TV sets produced this year in the United States will incorporate

"The Standard Tuner." It covers all 12 channels . . . gives higher sensitivity . . . quick interchanging of channel inductors . . . adaptable to U.H.F. "The Standard Tuner" is also available to the TV service man through his local jobber as a replacement unit.

Standard Coil Products Company, Inc., have enjoyed a remarkable growth. They began as a small radio coil manufacturer in 1935 in a loft over a store in Chicago and now have over 3,000 employees and five manufacturing plants located at Chicago, Los Angeles, and Bangor, Michigan. Production was started on the tuner in August, 1948, and now the 1,000,000th product has been turned out. In 15 months, sales have approached the $20,000,000 mark from a previous $2,000,000. Standard Coil takes pride in its ability to keep pace with the fastest moving industry the country has ever seen.

G. E. Swanson is President; R. E. Peterson, Vice-President; and J. O.

Burke, Secretary-Treasurer. They are the three men who originally started the business.

Clarostat Prexy Predictions

Victor Mucher, President of Clarostat Mfg Co., predicts: Bigger and better TV. That's what I see for 1950. Also a healthy radio set trade, because TV is simply not taking the place of AM entertainment but rather is a parallel proposition . . .

The critical requirements of TV have been reflected by more precise components. Considering that the average TV receiver has about six times as many parts as the average radio, the parts industry deserves a round of applause for the fine service records of the millions of TV sets in everyday use . . .

My considered estimate for 1950 TV set production is well over three million. Many new areas will be opened up with additional TV transmiters taking the air . . .

Close to two million TV sets are well over two years old. That means dimming picture tubes soon to be replaced. It means occasional replacement of the other tubes, because even one weak tube out of two or three dozen can mar the entertainment. Resistors and capacitors are apt to let go, while controls get noisy of flickery.

Attractive Viewing Salon

Television Viewing Salon, a feature of the New Appliance Display Center, completed by General Electric Supply Corporation, St. Louis, to kick-off its

1950 season of aggressive merchandising. Dealers and their retail consumers may see G-E Television demonstrated in modern settings and comfortable homelike atmosphere.

Raytheon Adds 16LP4 to Line

Raytheon announced the addition of type 16LP4 to the Raytheon television picture tube line.

The 16LP4 is a 16", glass envelope, direct-view picture tube used in television receivers. It employs magnetic deflection and focus and has an electron gun designed to be used with an external ion-trap magnet to prevent ion spot blemishes.

A high-efficiency screen coating in conjunction with a practically flat face provides pictures of high quality and good contrast even under high ambient-light conditions.

Air King Back Orders Grow

D. H. Cogan, President of Air King Products Company, Inc., Brooklyn, New York manufacturers of radios, wire recorders and television receivers announced that Air King was entering the year 1950 with back orders totaling more than ever before in the history of the company.

This back order log, in addition to several new and revolutionary television models that will be announced before the end of the year, has brought Air King's sales and production to the highest levels since the inception of the company in 1921.

Philco Service Aids

Three types of biconical television aerials, for installations requiring outdoor antennas, six handy alignment jigs for simplifying the servicing of Philco television receivers, and the Philco Model M-20 three-speed record

NEW SUPERIOR Hi-LO TV ANTENNA

by RADIART the Leader in The Antenna Field

$9.95 .....with 2 section 8 ft. electro-galvanized steel mast

Another pace setting development by ***Radiart!*** Here is the popular HI-LO antenna streamlined to a price that you would pay for just an ordinary single bay style. This type, the HL 4 series covers all TV channels 2 through 13. Its unidirectional pick-up helps to eliminate ghosts and other unwanted signals. It permits separate orientation of the high and low bays, allowing each to be set in the most favorable direction.

FEATURES INCLUDE:

- Speedy installation with pivoted dipoles
- Rigid and sturdy to defy the wind and elements
- Bakelite insulators — cadmium plated hardware
- Electro-galvanized steel masts

AVAILABLE IN THE FOLLOWING TYPES:

- High and Low Bays, 2 section 8 ft. mast . . . model HL 4S . . . $ 9.95
- HL 4S unit plus swivel base, guy ring, stand-off insulator and phasing line . . . . . model H-4 . . . . . 10.95
- High and Low Bays only . . . . . model H-4L 7.95
- High Bays only . . . . . model H4 . . . . . 2.75
- Low Bay only . . . . . model L4 . . . . . 5.75

Topping the Nation in Sales

RADIART TV CONICAL TYPE ANTENNAS

Our "Lazy X" line is HOT

. . . feature it for faster sales

IT'S RIGHT WHEN IT'S RADIART

THE RADIART CORPORATION
CLEVELAND 2, OHIO

Subsidiary of Cornell-Dubilier Electric Corp.

- VIBRATORS
- TV ANTENNAS
- POWER SUPPLIES
- AUTO AERIALS

changer and 45 rpm record adapter discs and non-slip driver are among the new products which are now being made available to the public through Philco dealers, according to Jack Cherry, sales manager, Accessory Division, Philco Corporation.

Detailed descriptions of these products, and an isolation probe used with the Philco Electronic Circuit Master, Model 7001, for measurements of grid-bias voltages in television and radio oscillator circuits, are provided on new product bulletins just released by the Philco Accessory Division.

Sheldon Breaks Ground

Ground was broken recently for another addition to the plant of Sheldon Electric Division of Allied Electric Products Inc., of Irvington, N. J.

This addition, when the latest production equipment has been installed in it, will make possible the stepping up of Sheldon "Telegenic" Picture Tube production to 2,500 daily. The plant and the equipment for it is scheduled to go into production by April 1, 1950 according to Nathan Chirelstein, president of Allied Elec-Products Inc.,this city.

Our Future Radiomen

Vocational schools throughout the country are in the process of training a vast army of potential technicians. This was witnessed in part by publisher S. R. Cowan who visited the George Westinghouse Vocational High School in Brooklyn, N. Y., and there saw young men being trained in a wide variety of operations, from simple soldering to TV alignment and servicing.

New RCA Contract Plan

In line with the trend toward lower prices for television receivers the RCA Service Co. announced the introduction of a special low-cost television owner contract to keep pace with this trend.

In announcing the new contract plan, C. N. Odorizzi, Vice President of the Radio Corp. of America, in charge of Service, declared that it will be of benefit to all service men.

The new Contract plan, he explained, will be available as an alternative choice for purchasers of RCA Victor television receivers who desire protection at a smaller initial cost than that required for the complete coverage contract. The latter covers installation, one year's parts and tube protection and unlimited service for annual fees beginning at $45 with a built-in antenna and $65 with a standard outdoor antenna for 10-inch sets.

The new alternative contract provides for complete installation, instruction of the customer, parts and tube protection, including the kinescope, for a year, unlimited service for 90 days, and, after that, a preferred flat rate of $5.75 per call for service-as-needed, with contract prices starting at $22.95 with a built-in antenna and $39.95 with an outdoor antenna for 10-inch sets.

Comparable charges for sets with larger tubes will be $24.95 and $44.95 for 12½-inch models, $29.95 and $49.95 for 16-inch models, and $39.95 and $59.95 for projection models. Prices will be slightly higher for combination instruments and outlying areas, but the preferred flat rate charge for service calls will be $5.75 for all models.

Mr. Odorizzi pointed out that this step by the RCA Service Company will also be of benefit to the entire television industry, including manufacturers, dealers and independent television service groups. The preferred flat rate per service call, he explained, will provide a standard of operation which has long been sought.

He cited as an example of this that

[*Continued on page 38*]

"The Standard Booster"

A New High Gain TV PREAMPLIFIER

For Studio-Clear Reception

Model B-50

"The Standard Booster" is attractively designed to blend with any TV set. One tube—single stage—trouble free operation—adaptable to either 300 or 75 ohm line.

Plus Profits for You

Boost Your TV Set Sales in Fringe Areas

"The Standard Booster" will give your TV set customers brighter, sharper pictures. Considerably higher gain . . . lower signal to noise ratio . . . 2 knob control . . . continuous tuning eliminates a switch from high to low channels . . . fully shielded . . . printed circuit for added stability.

Standard COIL PRODUCTS CO., INC.

CHICAGO • LOS ANGELES • BANGOR, MICHIGAN

Field Findings

A resume of Industry happenings here, there and everywhere

BY S. R. COWAN

THAT 1949 was a very prosperous year for all branches of the radio-TV industry is now a matter of record. Manufacturers of receivers, particularly TVsets, were still behind in deliveries at year-end; distributors and retailers had relatively low inventories. The service trade had a profitable year with much work still unfinished on the benches, while parts jobbers, as usual, carried very short inventories of the most in demand items. Too few jobbers function as they should, i.e., as local warehouses for the manufacturers whose lines they handle. This short-sighted policy by many jobbers continues to cause servicemen great trial because customers do not want to wait long to have sets repaired and the blame for a delay in getting a needed replacement part is placed on the service dealer whereas it should be placed on the delinquent jobber. To those jobbers who are kicking because their sales curve is down I would recommend self-examination of their inventories, because many dissatisfied service dealers have switched to mail-order buying,knowing they will get better delivery that way rather than through their local jobbers who has to write to a factory to replenish a depleted stock.

Record-Speed Issue Clarifying

Countless thousands of dollars in sales and service work were lost to radio retailers and service organizations during 1949 because of the public's reluctance to buy any type of record player while there was so much confusion about what speed, 33⅓, 45 or 78 would be "proper".

But, as the N.Y. Times so aptly put it recently, "The controversy of the speed of the phonograph record players moved one step nearer solution yesterday", and then went on to explain:

"RCA Victor announced that beginning in January 1950 it would offer for sale phonographs and radio-phonograph combinations equipped to play the long-playing disks manufactured up to now only by the company's rivals. A spokesman for Victor denied, however, that the company was planning to make records of its own to play 33⅓ revolutions a minute.

"Here, John — let me at those bugs you keep fussing about!"

"Officials of rival companies contradicted this, one of them declaring that Victor already was making long-playing records experimentally in its Bridgeport, Conn., factory.

"Victor demonstrated to its salesmen in Atlantic City, its 1950 combination equipped with two turntables. One of these plays the old, 78 rpm shellac records and the 33⅓ rpm long-playing disks. The other plays, and automatically changes, Victor's little vinylite, 45 rpm records made exclusively by that company.

"A spokesman for Columbia Records, Victor's largest competitor, commented that his company would welcome Victor into the long-playing field. He added that Columbia would even be willing to make 45 rpm records, which it does not like, if Victor would make 33⅓ rpm disks, thus ending the trade war."

Since the Times story appeared we have been told on good authority that RCA really is making a run of 33⅓ rpm records, and that most receiver manufacturers are designing new lines that will include combinations capable of handling all three record speeds. It is particularly true of TV set makers. In fact, most TV set makers are expanding their production lines on big combinations, feeling that the public will invest in really fine instruments now, having been assured that color TV or other "tricks" are still only speculative, far-future potentialities.

TV Safety Precautions

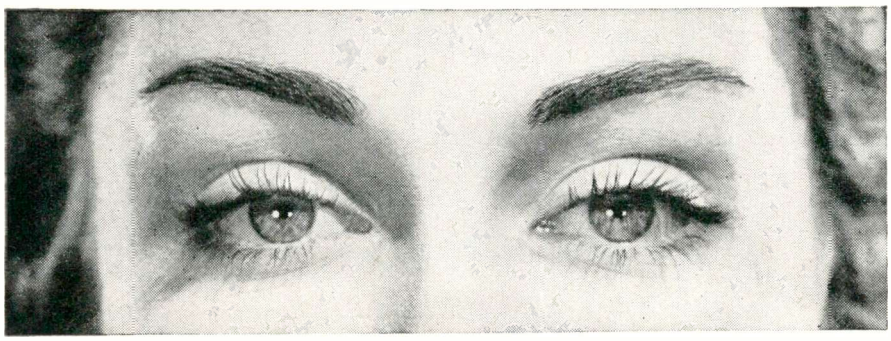
Despite repeated admonition to TV installers that it pays to take a little longer and do an original installation properly, particularly of the TV antenna, it seems that the lesson has not yet been learned by many of them. Immediately after the first 1949 winter snows had fallen, and sleet storms or heavy winds had hit communities reached by telecasts, reports and complaints started to pour in that "my TV antenna is down—hurry over and fix it!" These unnecessary call-backs cost the TV installers a small fortune in wasted time and effort. How much better it would have been had the installer been thorough enough so he braced and guy'd his TV rigs in the first place. Then, most of them would not have blown down at the first puff of strong wind. Also, had the installers used top-quality antennas instead of the cheapest things they could get, they would not have been plagued by bent or broken dipole rods. We say it again and again . . . . in TV don't try to skimp and save pennies. Do your jobs correctly the first time, use fine quality accessories and equipment because it pays and pays.

TV Legal Aspect

The Dallas, Col. Radio Sales & Service Ass'n, Inc. issues a monthly bulletin for its members called the "Dallas Radio & TV News". The December issue of this well edited association paper carries a piece that is so important we are taking the liberty of reprinting it in full, because it applies to practically every community in the country and will effect any TV installation being done for

[*Continued on page 36*]

How will they look to YOU a few years from now?



Your wife's eyes: What will you read in hers when she asks whether you can afford that modest cottage that's for sale?

Your boy's eyes: What will you see in his eyes the day he asks whether you can afford to send him to college?

Your own eyes: What will the mirror tell you about them when it's time to retire, and take things easier?

There's no better time than right now to sit back and think what *you* will see in your family's eyes a few years from now.

Whether they glow with happiness or turn aside with disappointment depends, to a very large extent, upon what you do *now*.

So plan *now* for that home you plan to buy eventually . . . set aside money *now* for his college education . . . plan *now* for the day you can retire.

Decide now to put part of your salary week after week, year after year in U. S. Savings Bonds, so that you will have the money for the *important* things you and your family want.

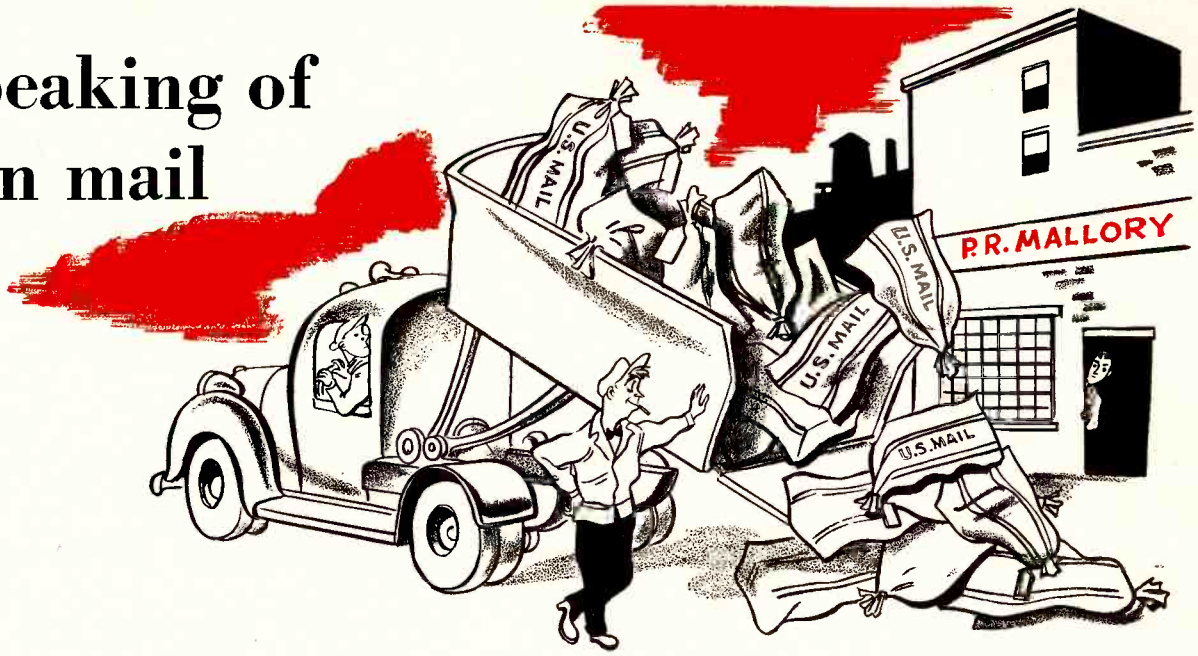
Insure your future by signing up on the Payroll Savings Plan where you work, or the Bond-A-Month Plan where you have a checking account. Chances are you won't miss the money now, but you certainly will a few short years from now if you haven't got it!!

P. S. Remember, too, that every $3 you invest now in U. S. Savings Bonds returns $4 to you in just ten short years.

Automatic saving is sure saving — U.S. SAVINGS BONDS

Contributed by this magazine in co-operation with the Magazine Publishers of America as a public service.

...speaking of fan mail



THE MALLORY MIDGETROL IS GETTING FAN MAIL FROM COAST TO COAST

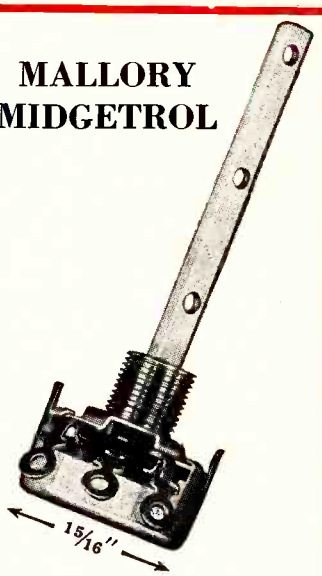
Run your eyes down the quotes below. They are convincing proof that the Mallory Midgetrol is a star performer with servicemen everywhere.

FAN MAIL FROM SERVICEMEN WHO KNOW!*

- "The Midgetrol is a life-saver in the radio repair business!"
- "The new Mallory Midgetrol is the handiest control I have seen."
- "I have been in the servicing game for 17 years now and this is really the first universal control I have ever seen."
- "Your many innovations make this the outstanding control."
- "I like it very much . . . the small size, the better shaft and the improved switch are all very good."
- "It is sure a time and space saver."
- "Thanks for Midgetrol. It's a sensation!"

*Actual quotations from a few of hundreds of unsolicited letters from servicemen.

MALLORY MIDGETROL



- *Fastest of all to install*
- *Saves time*
- *Saves trouble*
- *Saves money*
- *Easiest switch to attach*
- *Eliminates sawing and filing*
- *15/16" size fits all sets*

See your Mallory distributor today!

P.R. MALLORY & CO. Inc.

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

The Television WAVEFORM and its COMPONENTS

by SAMUEL L. MARSHALL

(From a forthcoming book, "Television Service Techniques")

Part 1

Television "know-how" is a serious challenge to the conscientious technician because it involves not just a new circuit or component that must be understood, but an entirely new batch of concepts that must be "sweated out" before they are mastered. It is true that many of these new concepts are not actually new in the generic sense of the word, nevertheless to the serviceman they are just as new and as difficult to comprehend as was a. v. c., a. f. c., etc., except that this time it is not "one" but many that he must wrestle with and master. In this series we will do our utmost to lighten this burden.

A good start in understanding TV is to know just what information is contained in the transmitted signal, and how this information got there. Many of the "new" concepts in TV, and many of the servicing procedures become more understandable with this knowledge. Let us then refer back to the source of this information, the transmitter, and follow the manner in which the overall signal is built up from its integral units. Knowing what is contained in the transmitted signal will, perhaps, enable us to understand more fully the purpose of the receiver in unscrambling this information.

Action of the Camera Tube

Figure 1-1 illustrates a simplified block diagram of a television transmitter, together with the waveforms developed in the various sections. The first unit we will analyze is the camera tube. To put it simply, the purpose of the camera tube is to transform light from a scene into electrical variations. In this analysis we will confine ourselves to a very simple type of camera tube in order to extract the most essential information; for we have much to learn and much more to cover.

In *Fig. 1-2* we illustrate an expanded view of the camera tube section of the transmitter. The object being televized is a triangle. Light from this triangle enters the camera tube through a series of lenses, and

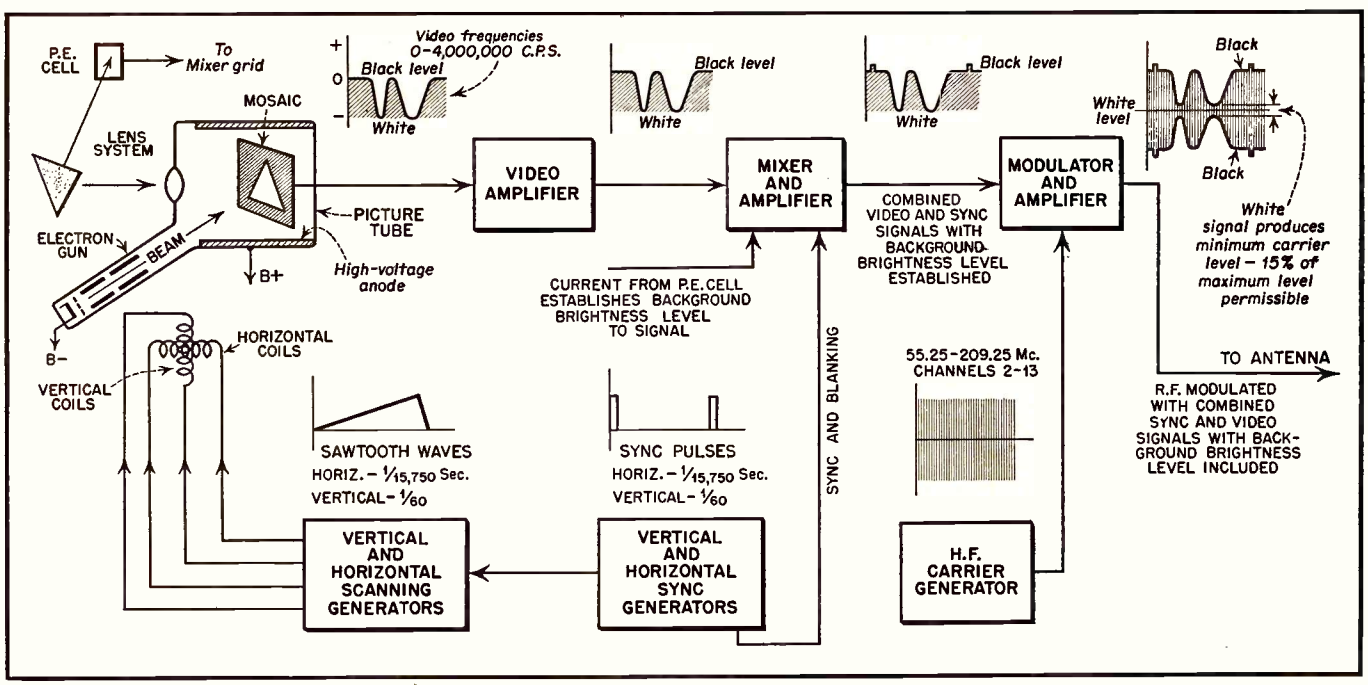


Fig. 1-1: Simplified block diagram of TV transmitter showing waveforms developed in each section.

falls as an inverted image on a device called a "mosaic". This mosaic consists of a mica sheet, one side of which contains millions of crystals of light-sensitive caesium-silver globules, each one insulated from all others, the other side of this mica sheet containing a conducting layer of graphite. Actually the mosaic can be compared to a condenser-block in which one end of the millions of small condensers contained within it are connected to a common terminal.

Light, entering the tube from the triangle being televized, causes each of the cells on which it falls to emit electrons and become positively charged. The electrons thus emitted are attracted to a metallized layer within the tube which is brought out to a high voltage terminal on the outside of the tube. This terminal may be grounded, in which case the cathode of the tube must have a high *negative* potential to ground. This is clearly shown in *Fig. 1-2*.

A positive charge on the photo-sensitive side of the mosaic results in a corresponding negative charge on the graphite back plate. This charge is proportional to the *total* light present in the entire scene, and does not reveal to us the actual variations of light and dark shadings in the various areas of the scene. It merely serves as the starting point in the development of the video signal which is about to begin.

To summarize the action up to this point: 1) Reflected light from the triangle to be televized falls on the mosaic through a series of lenses. 2) This light causes each light-struck cell to lose electrons and become positively charged, the sum of these positive charges being numerically equal to the total negative charge on the back plate of the mosaic. Thus, as shown in *Fig. 1-3*, we have assumed

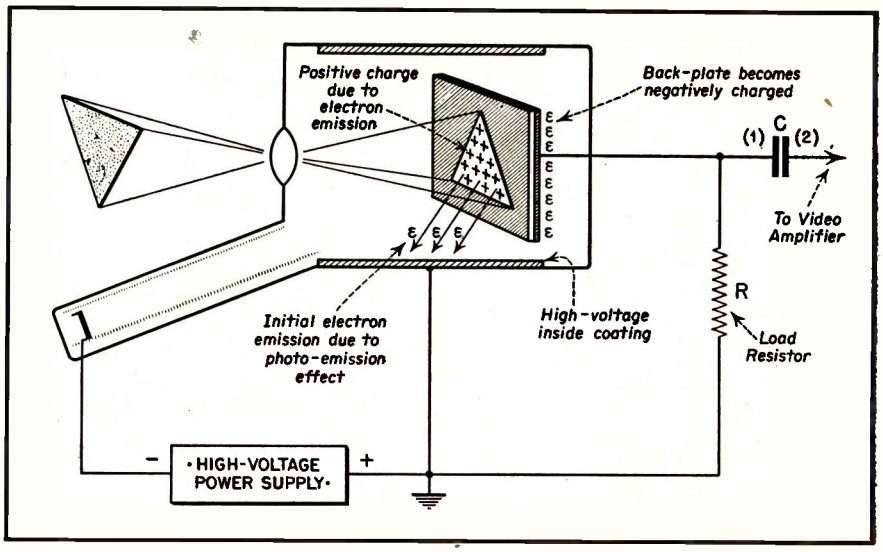


Fig. 1-2: Expanded view of camera tube video circuit.

a triangle in which, for the sake of simplicity of explanation, ten unit cell areas lie along each side, so that the total number of unit cells is 55. If each cell throws off 1 electron, the total negative charge on the back plate is 55 units.

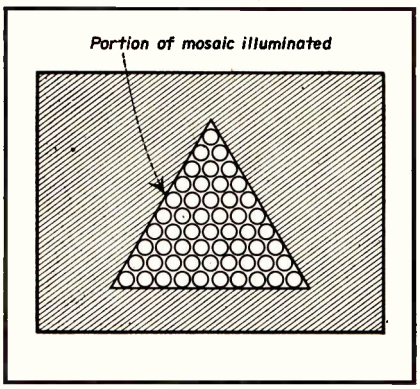


Fig. 1-3: Expanded view of mosaic showing unit area of cell clusters or elements. For the triangle scanned there are 55 of these unit areas.

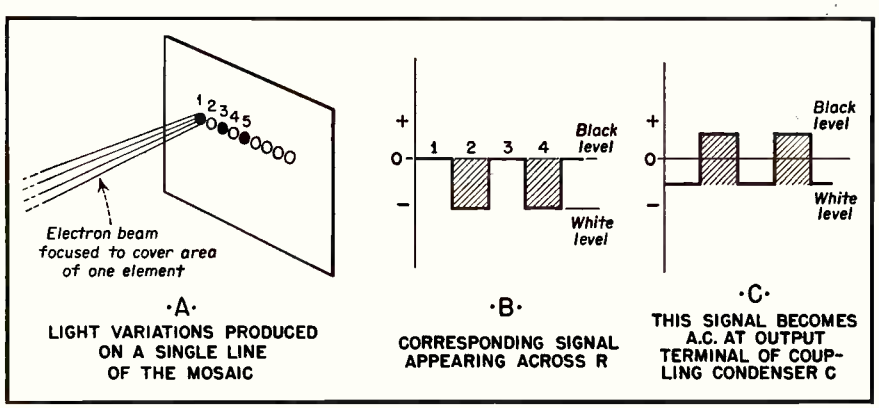


Fig. 1-4: How a-c signal is produced by light variation between two elements.

Video Frequencies and Their Development

Video frequencies in TV are analogous to audio frequencies in AM. The video signal which is developed in this instance results from the following sequences of events. First, a beam of electrons from an "electron gun" in the camera tube is made to scan or travel across the mosaic, just as the eye scans the page of a book as it moves across and down the page. Upon striking a light-struck, positively-charged element the beam neutralizes this charge permitting an equal negative charge on the back plate to be released. This negative charges proceeds down the load resistor, *R*, to ground.

We will now see how this passage of electrons through *R* sets up a video signal in this resistor. Let us assume an alternate black and white series of areas as shown in *Fig. 1-4A*. Observe that elements *2* and *4 on* the mosaic are white, and elements 1, 3, and 5, are black. The corresponding signal developed across *R* has the waveform shown in *Fig. 1-4B*, each bright element causing a flow of electrons from the back plate through *R* to ground. Recalling that during the scanning process each bright element releases an electron which proceeds down the load resistor in one direction only, we can see why the scanned signal is a pulsating d.c. as shown in *Fig. 1-4b*. However, the signal at the output side of the coupling condenser, *C*, shown in *Fig. 1-4c* becomes a.c., because a condenser passes only those signals that vary in amplitude. The position of the zero axis line is such

[*Continued on page 34*]

THE 'SCOPE *as a modern* SERVICE TOOL

by **MATTHEW MANDL**

PART 2

In this second and concluding installment the author explains in greater detail the operation of the 'scope and its applications in a variety of testing operations.

THE value of the oscilloscope in servicing lies in its versatility. In the hands of a competent technician, it is at once a voltmeter, a signal-tracer, or a signal analyzer. Without it, the alignment of television receivers would become a troublesome, hit-miss affair and proper tracking would be such a long drawn-out affair that few would relish its undertaking. With an oscilloscope, however, the procedure becomes much more simple and sure, with satisfactory results a foregone conclusion. These same advantageous factors, of course, apply to FM and AM servicing as well as TV, while for laboratory and design work the 'scope has long been recognized as an invaluable adjunct for analysis of circuit performance.

Signal Observation

For normal use, where a waveform is applied to the vertical input terminals for observation on the screen, internal sweep is used and nothing is connected to the horizontal input terminals. As detailed in the previous article, the internal saw-tooth sweep thus scans the beam across the face of the tube, while the vertical deflection plates cause the beam to move up and down the face of the tube with an amplitude change corresponding to the signal being injected into the scope. In this manner we get a visual indication of the type signal under test.

Briefly, the procedure for signal observation is as follows: The oscilloscope is turned on and allowed to warm up for a few minutes. Internal sweep is turned on, and the horizontal and vertical positioning controls are adjusted until a horizontal line appears on the screen. The intensity and focus controls are then regulated to give a fine line trace. Make sure the internal sweep is turned on, for without internal sweep a bright, intense spot may appear on the screen. *An intense spot of light should always be avoided,* as it will damage the phosphorous coating material on the inner face of the tube.

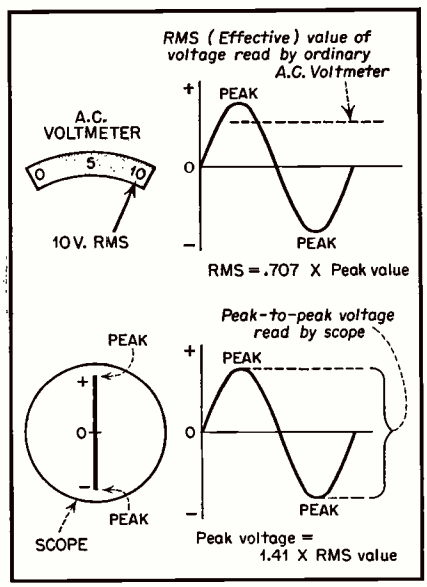


Fig. 1. Relatiionships between r.m.s., maximum, and peak-to-peak values of an a-c signal.

The test probe cable is connected to the vertical input terminals, with the outer shield conductor attached to the ground terminal. The probes are then placed across the signal source to be observed, and the coarse frequency adjusted until single line trace is obtained. If necessary, the vertical amplifier control should be adjusted until the signal under observation is of proper height for comfortable viewing. Also adjust the horizontal amplifier control for desired spread of signal along the horizontal axis.

For a single line trace which remains stationary on the screen, the fine frequency control must be adjusted, as well the sync control. These two controls, in conjunction with the coarse frequency control, are important with respect to getting a single line trace of the signal to be observed. Multiple criss-cross lines are meaningless for analysis and indicate the need for re-adjustment of the frequency controls.

With most oscilloscopes the coarse frequency control selects one of several timing capacitor values. The particular setting of the coarse frequency control, therefore, regulates the basic sweep rate of the saw-tooth horizontal oscillator. The fine frequency control, on the other hand, is a variable resistor in series with the coarse frequency capacitor in use. It changes the saw-tooth frequency *gradually* as it is rotated, and its range is such that it usually overlaps the coarse frequency control settings, which are in steps.

The "sync control" is another variable resistor, but this particular one

controls the amount of synchronizing voltage fed to the grid of the gas-tube oscillator tube used for horizontal sweep. This control functions best when it is set as far counter-clockwise as possible while still getting a locked-in picture on the screen, for over-synchronization may cause distortion in the linear increase of the saw-tooth waveform from the horizontal oscillator.

Many scopes have provisions for internal or external synchronization, and are provided with a switch for selecting one or the other. On "Internal" a small portion of the signal voltage which is being applied to the vertical input terminals is applied to the grid of the horizontal oscillator.

Thus, the sync. control will synchronize the horizontal oscillator frequency with the signal on the vertical input at the latter's fundamental frequency. It will also lock in at submultiple frequencies, such as ½f, ⅓f, or ¼f. On "External" the sync. input terminals are connected to the synchronization control circuit, allowing use of an external signal for sync purposes.

Other Front Panel Controls

Provisions are also made so that the internal sweep can be shut off and an external sweep applied to the horizontal plates. This is useful where sine wave sweeps are desired instead of the internal saw-tooth sweep. This is particularly useful when sweep generators which utilize sine-wave sweep are used for aligning purposes. By applying a portion of such sweep voltage to the horizontal input terminals of the 'scope a single "band-pass" type pattern is secured. Thus, the characteristics of the i-f response may be studied and by use of suitable markers, the set can be properly aligned.

Most modern 'scopes also have available on the front panel a 60 cps terminal which can be connected to the horizontal input terminals. When this is done, and the internal sweep shut off, the 60 cps becomes the sweep frequency. This, also, is useful for alignment and also during calibration of audio oscillators and other devices.

The 'Scope as a Voltmeter

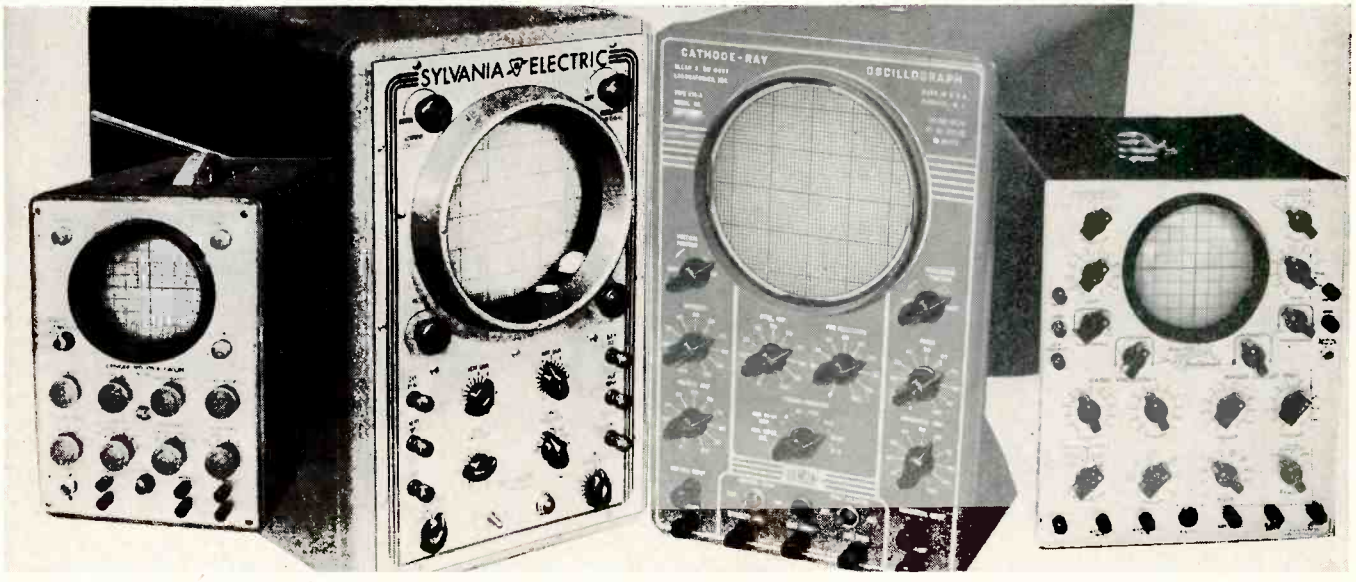
The oscilloscope can be calibrated rather easily to read peak to peak voltages of a-c frequencies far above the 60 cps, r-m-s limit of the ordinary multitester type voltmeter. A celluloid screen, marked off with horizontal and vertical lines in graph formation, is placed over the face of the scope and becomes the reference for calibration of the scope as an a-c voltmeter. An ordinary a-c voltmeter of known accuracy is used for calibration. This voltmeter is applied to a 60 cps signal from the a-c terminal on the scope front, or from the secondary of a power transformer, or other a-c source. If, for instance, the voltage is 10, this same voltage is applied to the input terminals of the scope, with the internal sweep shut off. This will give a vertical line of proportions depending on the setting of the vertical amplifier control. For instance, if the vertical control is adjusted to give a line as high as two squares, this line then represents a peak to peak value of voltage, the r-m-s value of which is 10 volts. If we know the r-m-s value of voltage, we can find the peak by the following calculation:

Peak value = r.m.s. x 1.41

Thus, the peak value of the 10 volt r.m.s. we read would be 14.1 volts. Peak to peak, however, would be 28.2 volts, as indicated in *Fig. 1*. The scope, now, will read other voltages accurately so long as the vertical amplifier control is left untouched. Not only will it read other values, up to the maximum of the tube face, but it will read voltage of other frequencies with substantial accuracy depending on the frequency response of the vertical amplifiers of the scope. Thus, if the vertical amplifier of the scope has a flat response to 30 kc, the calibrated scope will now read frequencies up to this limit with an accuracy far above ordinary meters. With ordinary meters the reactance of the coil in the movement increases with frequency, giving rise to increasing inaccuracy with frequency.

For higher voltage readings each square could represent 20 volts, or any value which is calibrated by adjustment of the vertical amplifier control.

The calibrated scope is useful in measuring peak to peak voltages of the vertical and horizontal sweep circuits in television sets, where 60 and 15,750 cps. are encountered. Many service manuals which show scope patterns for trouble-shooting television receivers indicate the peak to peak voltages to expect for various scope patterns. Audio voltages, too, lend themselves to measurement with such a calibrated instrument, for again the ordinary a-c meter would not be reliable for frequencies above 60 cps. With the addition of the transparent graph screen, the oscilloscope is now an oscillograph with a linear voltage response for a wide range of frequencies.



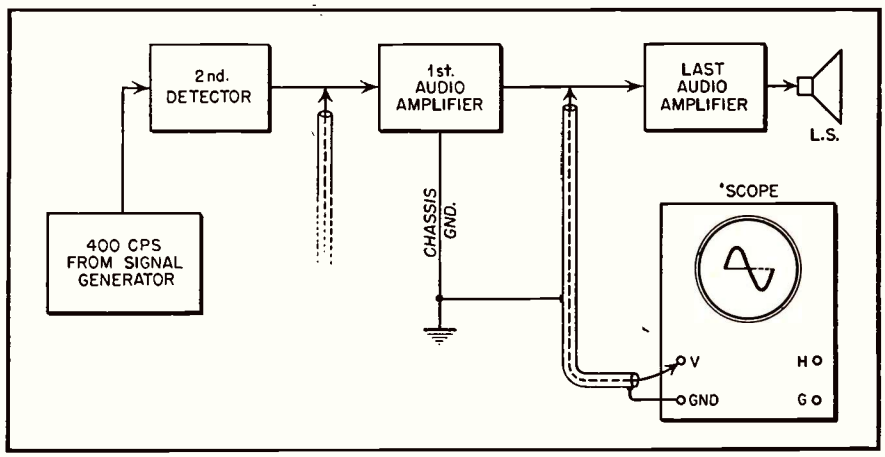


Fig. 2. Connections for using 'scope as a signal tracing aid.

Signal Tracing with Scope

The oscilloscope is ideal for signal tracing purposes, for its screen offers a visual means of determining the presence or absence of an expected signal. *Figure 2* shows a typical method for signal tracing in audio amplifier stages. An audible frequency a-c voltage is impressed across the input circuit of the first stage, and the probes of the scope progressively moved from one stage to another. When the 400 cps pattern does not appear on the screen, the dead or defective stage has been localized.

The same procedures can be applied to the audio sections of television receivers, as well as the vertical and horizontal sweep circuits. Inasmuch as vertical sweep is 60 cps in a TV receiver, and the horizontal sweep is 15,750, the scope is working well within its frequency limits, for even the most inexpensive scope will pass these frequencies. Thus, the probes of the scope may be used to trace these sweep frequencies from the sync clipper to the oscillators and right through the sweep amplifiers to locate a defective stage.

Furthermore, the presence of signals from the 2nd video detector right on through the video amplifiers can be traced with an ordinary scope. While it is true that a high-priced scope would be necessary to reproduce fine picture detail which might run as high as 4 mc, an inexpensive scope will suffice for signal tracing, for again the horizontal and vertical sync pulses are of frequencies well within the range of an ordinary scope. In signal tracing, of course, we are not interested so much in signal analysis as we are in finding out whether or not the signal is getting through the stages all right. This can readily be ascertained by moving the scope probes from the 2nd video detector stage, right through the video amps to the picture tube grid. The above is based on the assumption that a signal is present at the video detector. Naturally of course, signal tracing the video amplifiers would not be attempted if

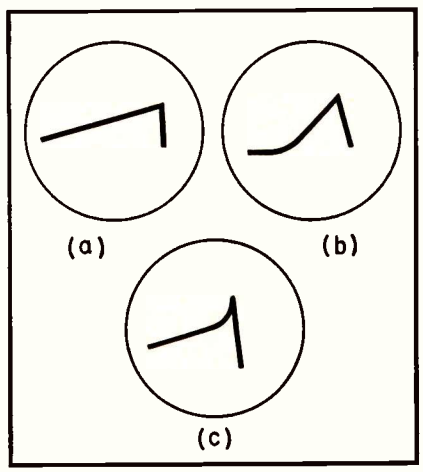


Fig. 3. Illustrating how the 'scope will give visual indication of non-linearity in TV sweep circuits. A linear, straight-line rise in the saw-tooth voltage is shown at Fig. 3a. In Figs. 3b and 3c the non-linear characteristics will distort the TV picture.

the suspected trouble may lie in the video i-f stages, or in the r-f stages. Since, however, video amplifiers are nothing more than audio amplifiers with an extended range, we can inject the same 400 cps note into these stages as we did with signal tracing the AM set. This does away with depending on a signal source from the previous stages.

The use of a scope in the rf-mixer-if stages requires special equipment, though signal tracing can still be accomplished without picking off the signal from a stage containing high frequency voltages. For instance, the scope can be connected across the load resistor of the 2nd video detector and left in this position. The modulated i-f frequency from a signal generator can then be progressively injected into each stage, working toward the mixer end. When the signal fails to get through a particular stage and appear on the scope, the defective circuit will be found.

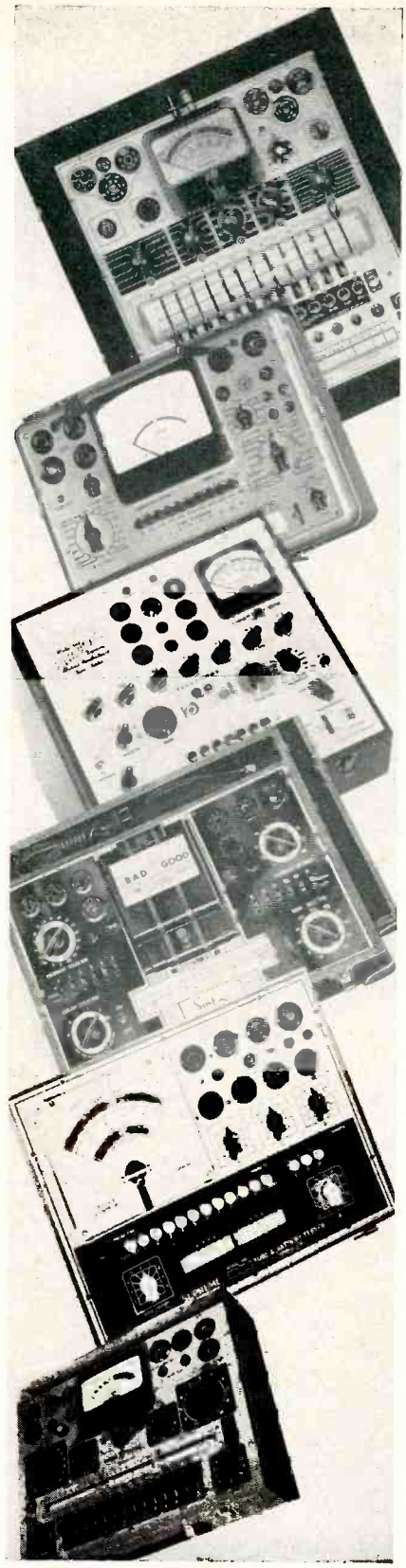
Waveform Analysis

Since the oscilloscope shows us what the signal actually looks like, it becomes a handy device for indicating the type of distortion present in a signal under observation. Since the type of waveform which is secured from a particular circuit in a given TV receiver may vary to a considerable extent between various manufactured sets, it is impossible to illustrate typical patterns. The service manual for the receiver under test should be consulted, for they usually give the type of scope pattern to be expected from their clipper circuits, vertical and horizontal oscillators, amplifiers and other stages. Any radical deviation from these waveforms indicates the need for a further analysis of the stages in order to locate the defective tubes, resistors or capacitors which are causing the trouble.

The saw-tooth sweep circuits, for instance, should indicate a linear rise in the slope of the saw-tooth. A slow initial rise or a slow ending rise, will invariably disturb the linearity of the image on the TV picture tube, and adjustments should be made accordingly. (See *Fig. 3*)

With a little practise, and a general knowledge of scope function, the operator soon becomes proficient in the use of this device during trouble shooting. With repeated use, he also becomes familiar with the limitations and possibilities of his own scope, so that he can often perform tests with it that an inexperienced man would find impossible even with the best scope available.

While a high priced scope, with its many added features is very desirable, most of the ordinary trouble shooting and signal tracing procedures can be accomplished with the cheaper oscilloscopes. Of far greater importance is the man working the controls of the scope—he is the primary limiting factor in its usefulness.



TUBE CHECKERS

by **WILLIAM R. WELLMAN**

Tube checkers and their relative merits have been a controversial subject for a long time. Many servicemen reading the varied claims of manufacturers are still in the dark as to their relative merits. In this article the author attempts to categorize and explain the operation of the three basic types of instruments encompassing most checkers.

THE average tube checker is called upon to perform the following tests:

(*a*) Filament or heater continuity, (*b*) Heater to cathode leakage, (*c*) Leakage or shorts between other electrodes, (*d*) Quality or merit, (*e*) Open electrodes.

In addition, some checkers also have provisions for use as a volt-ohm-milliammeter, condenser leakage tester, and battery tester.

When we consider the tests listed above, we find that in most cases (*a*), (*b*), and (*c*) are in reality the same test applied in different ways. In other words, heater to cathode leakage tests and heater continuity tests are really short tests.

Short and Leakage Tests

In the usual checker, a short test is made by connecting the desired electrode (say the plate) to one terminal of a voltage source. The opposite terminal of this voltage source is then connected through a neon glow lamp, or other suitable short indicator to one side of the tube filament or heater. Glowing of the lamp then indicates a short or excessive leakage.

Bear in mind that in most checkers each tube socket pin is provided with a switch. This is usually a single pole, three-position affair, and operation of the switch will connect the electrode to the plate, will connect it to one side of the heater or filament or will allow it to remain unconnected. In this way, any one electrode (or any combination of electrodes) may be connected together or connected to one side of the heater.

Look at *Fig. 1*, which is a much simplified version of the leakage short test used in many instruments. Note the plate and the cathode are connected to switches as already outlined. By throwing the cathode switch to the "*D*" position, that electrode is connected to one filament terminal. One side of the neon lamp circuit is already wired to this terminal. Then, by throwing the plate, grid, screen or suppressor switches to the "U" position, those electrodes are connected to the free end of the transformer winding, T_2, used to supply the neon lamp. If a short or excessive leakage exists between electrodes, it will be indicated by glowing of the neon lamp

In checking heater or filament continuity, the terminals of the heater are, of course, connected to opposite ends of the neon test circuit. To check heater to cathode leakage, the short test is merely applied between these electrodes.

Quality Tests

Quality or merit tests which determine the ability of the tube to perform its specific function, or functions, are of three distinct types: (*a*) emission tests, (*b*) transconductance (mutual conductance) tests and (*c*) Dynamic tests.

Emission Checkers

The emission test is about the simplest of all the quality tests, and this is the reason why checkers of this type are in wide use in the servicing industry. This does not mean, however, that this test is the best or the most reliable. In making an emission test,

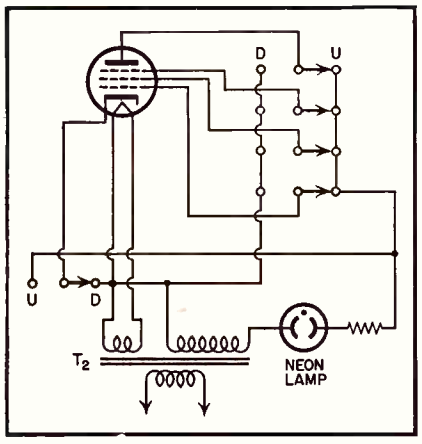


Fig. 1. Simplified schematic of short-leakage test.

all of the active electrodes are tied together. It is understood that this is exclusive of the heater and cathode. A voltage, usually a.c., is applied between cathode and the remaining electrodes. Note, (see *Fig. 2*) that the applied voltage is not necessarilly the actual value at which the tube is to be operated. With the filament or heater at operating temperature, a milliammeter is used to measure the current flowing between cathode and the remaining electrodes. A tester of this type thus measures the ability of the cathode to emit electrons. The basic circuit used in many emission type checkers is shown in *Fig. 2*. The potentiometer P_1 is used to provide a degree of electrode voltage control; this is necessary because of the wide variation in electrode currents among the various tube types. Ordinarily, this control is calibrated and the tube tester chart specifies the correct setting for a particular type.

You will observe that each of the electrodes tied together in the diagram is provided with a switch. These switches are the three-position switches mentioned under short testing. Open electrodes are detected by throwing each switch to the open or disconnect position while observing the action of the plate milliammeter. If the electrode is open, there should be a noticeable drop in the reading.

In the usual emission checker, rapid determination of tube quality is made possible by calibrating the plate milliammeter to give some such indication as "Good", "Weak" and "Replace". Using calibrations of this type, plus coloring the three areas of the meter scale, makes the instrument suitable for counter work, or, in other cases where it is likely to come under the observation of the customer.

It is plain that because of its construction, operating a tube checker under conditions of widely varying line voltage would seriously affect the indications. For this reason the line potentiometer P_2 is used. See *Fig. 2*. Since this potentiometer is connected across part of the lower transformer primary, adjusting it will vary the secondary voltages. *Fig. 3* illustrates the "Line Check" circuit used in some checkers. The plate milliammeter scale bears a reference mark to which the pointer must be set by operating the line potentiometer. Just as long as this setting is held, the voltages applied to the tube will be correct. Because the milliammeter is a d-c instrument, the transformer voltage must be changed to d.c., this being

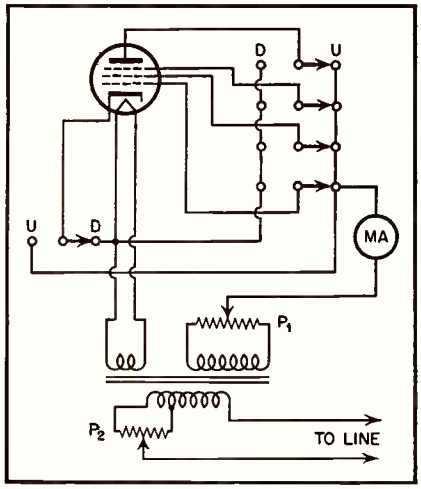


Fig. 2. Basic circuit of emission checker.

done by the copper-oxide rectifier, X, in the drawing. It should be mentioned that the several functions of "Line Check", "Short Check" and "Quality Check" are made available by means of a selector switch.

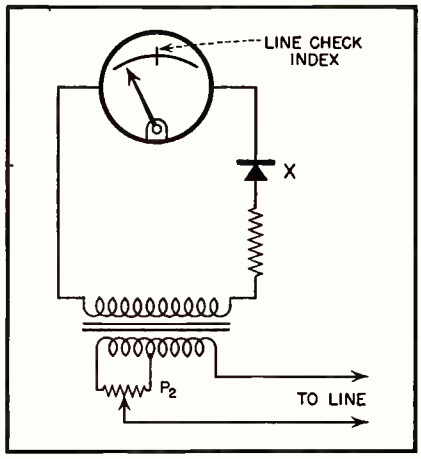


Fig. 3. Circuit used for "Line" check.

The factory method used to calibrate an emission checker checker may be used by the service man in determining correct settings for a tube not listed on the charts accompanying the instrument. It is necessary to have a number of known good tubes of the types under test. These are placed in the proper socket and the switches thrown to make the necessary electrode connections. The voltage control is then adjusted to give areading in the "Good" area of the meter. This procedure is then repeated for all the tubes; after which the settings of the voltage control are averaged and this is the proper adjustment for testing tubes of that type.

Transconductance Tube Checkers

Transconductance, also called Mutual Conductance, is defined as the ratio of the change in plate current to the change in grid voltage producing it. As an example, a grid signal or change, of 1 volt, resulting in a change of plate current of 1 milli-

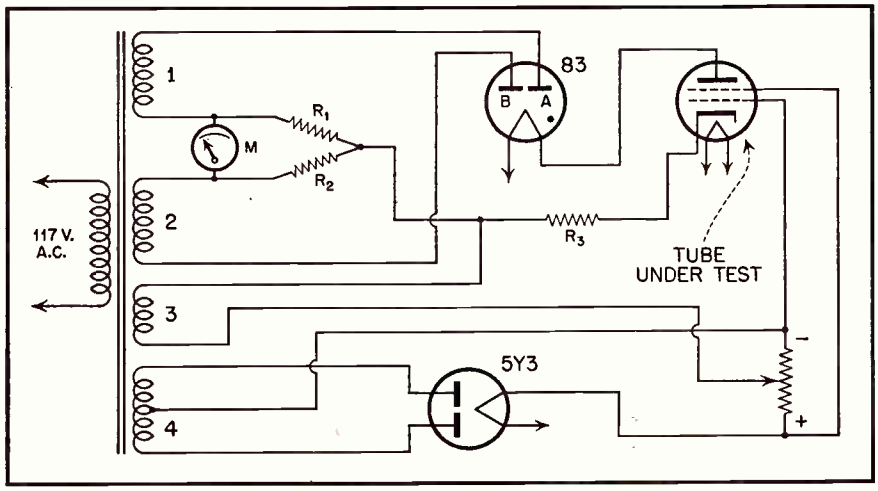


Fig. 4. Basic circuit of Mutual Conductance tube tester.

ampere equals mutual conductance of 1000 micromhos.

The ability to successfully measure true mutual conductance depends largely on the success with which the changing plate current is separated and measured. For laboratory use this can be done with rather elaborate circuits, and separately excited dynamometer meters, but with high accuracy.

As an example of one method for doing this successfully in a reasonably priced servicemen's tube tester, we will pick one particular make, and examine the method whereby this dynamic mutual conductance is measured.

Figure 4 is an extremely simplified basic diagram of the essential parts only, which are used in the measurement of mutual conductance. All else in this particular circuit has been eliminated for the sake of simplicity.

Note first, that all transformer windings have a common core. This is important, as it keeps all voltages and currents in phase.

Referring to *Fig. 4*, the meter *M*, which has a scale directly calibrated in micromhos, in ranges of 3,000, 6,000 and 15,000, is basically a d-c milliameter.

The type 83 mercury vapor rectifier tube supplies rectified voltage for the plate. The type 5Y3 rectifier tube supplies rectified voltage for the screen grid, and the control grid.

As mentioned before, a dynamic mutual conductance tube tester, must measure the changing plate current for a predetermined changing grid voltage. To see how this is done, let's track the electrons through the circuit.

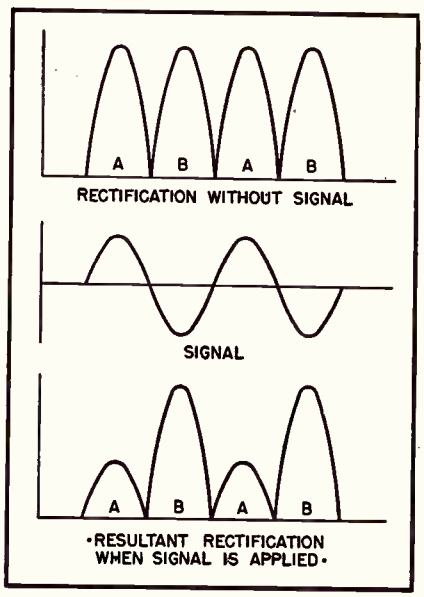


Fig. 5. Characteristic waveform of rectifier developed in checker.

Tracing the electron path through the circuit, we find that as the top of winding No. 1 goes positive, the bottom of winding No. 2 becomes negative. As a result, the electrons leave the cathode of the tube under test, and are attracted toward the diode *A* of the 83 tube. The complete path for the electron stream at that instant is through winding *No. 1*, through *R1*, and back to the cathode. This develops a voltage across *R1* and tends to swing the meter pointer. The inertia of the meter however, prevents the pointer from moving before the 60 cycle a.c. reverses.

This reversal makes the top of winding *No. 1* negative, and the bottom of *No. 2* positive, sending the electron stream through winding *No. 2*, and cathode *B* of the 83 tube, developing a voltage across *R2* at this instant.

Since *R1* and *R2* are equal, the voltage is the same in each instance, but

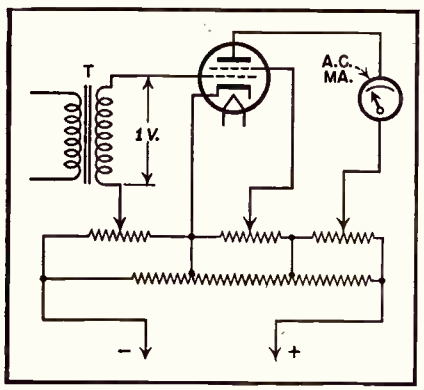


Fig. 6. Circuit for measuring dynamic transconductance.

in the opposite direction. Each voltage tends to swing the meter in the opposite direction, but since the reversals are too fast for the meter movement, the average deflection is zero. This however, is the case with no signal voltage applied to the grid.

Now look at winding *No. 3*, in *Fig. 4*. This winding, being on the same core as winding *No. 1* and *No. 2* must have the top positive at the same instant as the top of winding *No. 1* is positive. This winding supplies the changing grid voltage or signal to the grid of the tube under test.

As a result, a negative voltage appears on the grid of the tube under test, at the instant when the *A* diode of the 83 tube is conducting. This will reduce the current drawn through coil *No. 1* and drop the voltage across *R1*.

On the reversal however, when winding *No. 2* is positive, the signal

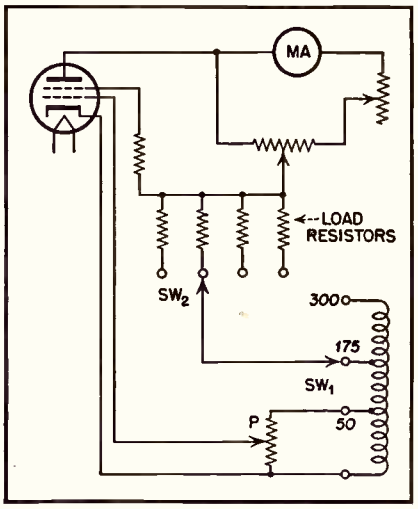


Fig. 7. Basic circuit of Electronamic Checker.

voltage to the grid is still positive, and results in increased current being drawn through coil *No. 2*. This develops a higher voltage across *R2*.

This unbalance in voltages across *R1* and *R2* will cause a current to flow through the meter and consequently deflect the pointer according to the change in plate current drawn by the tube.

This will be made still clearer by reference to *Fig. 5*. In this figure, we see at the top, the characteristic full wave rectifier form, showing the current flowing through the two diodes *A* and *B*. In the center is the signal which is being applied. At the bottom is the resultant diode current wave form; the difference in the two peaks being the changing plate current of the tube under test. This can also be demonstrated very easily by placing a small resistor in the circuit as shown by *R3* and connecting an oscilliscope across it. The pattern on the screen will be shown as in the last curve in *Fig. 5*.

Since this change in plate current is directly proportional to the mutual conductance of the tube under test, the dial of the meter can be directly calibrated in micomhos, the true measure of dynamic mutual conductance.

Dynamic Checkers

Fundamentally, dynamic checking of a tube means checking it under operating conditions. Primarily, this implies the use of an a-c grid voltage. Furthermore, as in the case of the static transconductance checker, the electrode voltages must approximate those applied in actual service. All service men are aware that the sim-

[*Continued on page 39*]

TELEVISION
Signal Tracing
with
LIGHTNING SPEED

by **MARVIN KAPLAN**

(Chief Engineer, Oak Ridge Products)

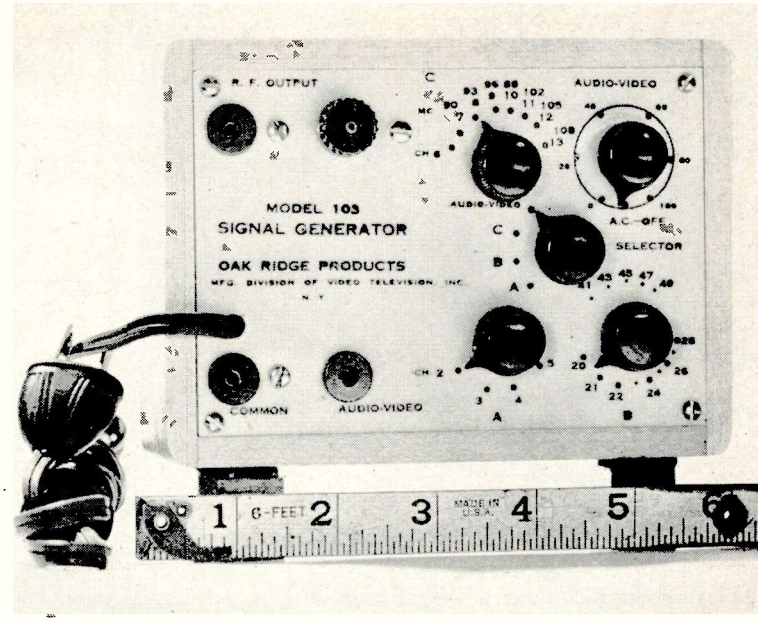


Fig. 1. Front view of Model 103 signal generator.

Small portable test units for TV servicing in the field are most welcome accessories to the outside serviceman. This is particularly true in establishments catering to the "contract" trade where pulling a receiver represents a substantial cost. In this article the author describes the operation and applications of a unit of this type.

UP to the present time the major drawbacks of television servicing in the field has been the lack of a scientific method of troubleshooting in conjunction with good miniature portable test instruments.

This article will describe a fast, modern method of signal tracing for locating any failure between the Antenna and C. R. T. or Loudspeaker of a television receiver in less than two minutes. The Model 103 miniature Signal Generator was primarily designed to fill all the requirements for Signal Tracing in the customer's home.

This instrument consists of a master Oscillator, 500 cycle Modulator, 3 separate-frequency bands, a 500 cycle signal with attenuator, a Modulation On-Off switch, and a self contained power supply. (*Figure 2.*)

The master oscillator contains a stable r-f grounded plate circuit with a unique switching arrangement for connecting either of three tuned circuits to its grid without any interaction between coils. Selection of any coil also shorts out the remaining coils. On all bands the Modulation is supplied by a 500 cycle signal, by merely turning a switch. Band *A* has a variable tuning range from 54 to 82 mc, with calibration points on the sound carrier frequencies of Channels *2* to *5*. Band *B* has a calibrated variable tuning range of 20 to 28 mc, with the second harmonic of 40 to 56 mc to cover the present and new R.M.A. television i-f frequencies for sound and picture. Band *C* has a variable tuning range of 85 to 109 mc to cover Channel *6* and the entire FM band, and second harmonic of 170 to 218 mc for Channels *7* to *13*. The Audio-Video position provides a 500 cycle audio note with attenuator. In addition a switch is available for either c.w. or Modulation operation on any of the bands. (*Figures 1* and *2.*)

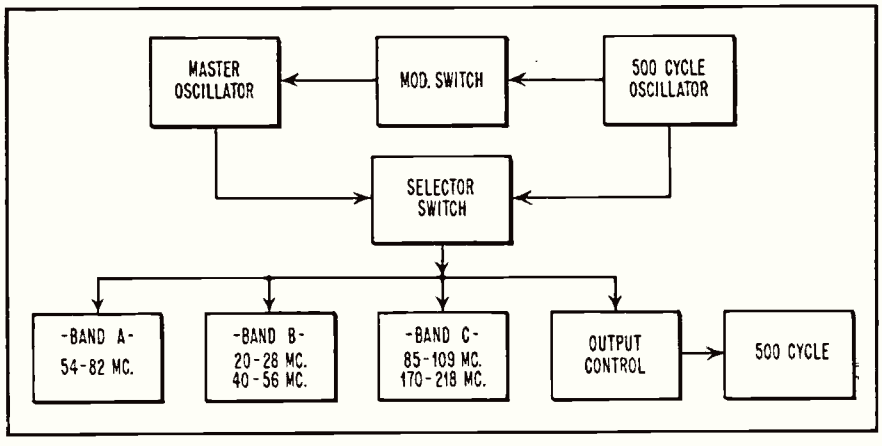


Fig. 2. Block diagram of Model 103 signal generator.

In this article all signal tracing begins at the Antenna terminals and progresses a stage at a time up to the C. R. T. and loudspeaker. This progression is used because in many cases it is possible to isolate a signal failure in certain sections of a television receiver without removing the chassis from the cabinet.

It will be noted in *Fig. 3* that a television receiver broken down into sections pertaining to signal reception, consists of a number of frequency discriminating stages. These stages are R. F. Osc., Mixer (1st Det.), Video I.F. Amp., Sound I.F. Amp., Video and Sound Det., Video and Sound Amp. Therefore, if a particular signal is fed into any of these stages it is obvious that a failure peculiar only to that one stage can be isolated very quickly.

R-F Sections

In order to ascertain whether intermittent, poor or no reception is caused by the r-f section of a television receiver, an r-f signal from the test oscillator, is fed into the *Ant.* ter-

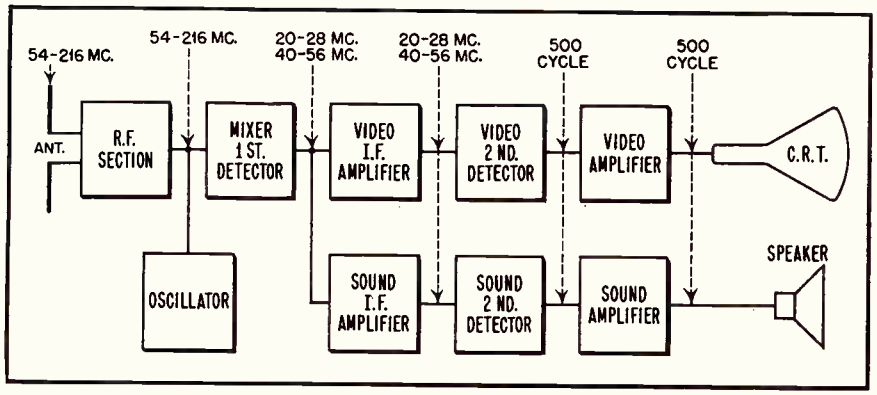


Fig. 3. Block diagram of conventional TV receiver.

minals. If the receiver is not at fault, a steady sound note will be heard in the loudspeaker and constant dark black bars will appear on the C. R. T. screen. This condition will indicate that the receiver from the *Ant.* terminals to the speaker and C. R. T. is operating normally and that the faulty trouble is most likely in the antenna or antenna wiring to the set. Any Channel on the receiver can be tested by merely tuning the test oscillator to the corresponding r-f frequency on its dials. FM receivers can be checked in the same manner by using the FM band on the Generator corresponding to the dial calibrations of the receiver.

Oscallator Section

Because of the heterodyne principle in modern television receivers, it is essential that the receiver oscillator beat against the incoming r-f signal from the station in order to produce an i-f signal. If an r-f signal is fed into the *Ant.* terminal of the set and neither picture bars nor a test note is heard, it is assumed that only stages common to picture and sound can cause this condition. Use the test generator without Modulation, tuned to the Osc. frequency of the set. (Osc. frequency is generally the sum of the incoming r-f signal plus the i-f frequency of the sound or picture). Substitute this signal for the Osc. in the receiver. If the r-f, i-f, and mixer sections of the set are operating normally, the test generator will be able to tune in picture and sound of any Channel on the air at the time. Hence, it is possible to isolate a defective Osc. stage in a very short time. The test generator signal is connected to the grid of the MIXER tube.

Video or Sound I-F Sections

The previous tests will indicate whether the signal failure was in the r-f or Osc. sections, or in a stage beyond the mixer to either the C.R.T. or loudspeaker. Assuming that the sound, in our previous tests, was normally received, our trouble could then be isolated to a point between the 1st Video i-f tube and the C.R.T. On the other hand, if the picture bars were received normally in the previous tests, the trouble would be located between the 1st sound i-f tube and the loudspeaker. Thus, by tuning the generator to either of the two i-f frequencies, with Modulation, it is only necessary to probe from grid to plate of each i-f tube up to the 2nd detector, to isolate the defective stage. In the case of a faulty sound i-f section, it is only necessary to listen for the point where the loud test note is heard to locate the trouble. In the video i-f sections it is only necessary to probe until dark black bars appear on the C. R. T. screen.

Mixer Section

By using the process of elimination after testing the r-f Osc., and i-f stages, a defective stage is easily located. Naturally if a signal can be received from the i-f points to the C. R. T. or loudspeaker the mixer is the usual faulty section.

Video or Audio Amplifier Sections

It can be seen from the foregoing procedure that if our video or sound trouble is still not located, our failure lies between the sound or video 2nd det., and loudspeaker or C. R. T. By switching the generator to the Audio-Video position a 500 cycle signal is supplied to connect to the output of the 2nd det. tube and to successive points from grid to plate, and coupling condensers of each amplifier tube up to the loudspeaker or C. R. T. At this point it is only a matter of seconds to isolate a defective stage caused by a defective tube, condenser, loudspeaker, transformer, peaking coil, etc

Second Detectors

By using the process of elimination, it is very easy to locate a faulty detector stage. If an i-f signal will not pass through the i-f stages up to the input to the detector tube, but an Audio-Video signal will be seen or heard on the C. R. T. or loudspeaker from the detector, the trouble must be in the detector stage.

Sound and Adjacent Channel Traps

The frequency of a sound trap is always the same as the sound i.f. in the receiver. By feeding an i-f signal into the 1st video i-f tube or the plate of the mixer tube and tuning the test oscillator for the maximum sound response, the sound trap frequency is automatically known by looking at the calibration on the front panel of the generator. At the same time that the test note is heard in the loudspeaker, black bars will appear on the C. R. T. screen. By tuning the sound traps for minimum bars, sound will be trapped out of the video i.f. Hence by turning the test oscillator's i-f tuning knob to a point at least 6 mc higher than the previous sound trap reading, the adjacent channel trap can be adjusted for minimum bars on the C. R. T. screen and thus trap out adj. channel interference in the video i.f.

Intercarrier Systems

The only major difference between the Inter-Carrier System and the Conventional system is in the arrangement of the i-f amplifiers. In the Inter-Carrier television sets, the video and sound i-f coils use common amplifier tubes, but all stages before the i-f section and all stages from the 2nd det. stages to the C. R. T. and loudspeaker are the same as in Conventional television receivers. Therefore any signal tracing or trap alignment to be done would be fed by the respective audio or video i-f signal from the 103 into the 1st i.f. and each succeeding i.f. Amplifier tubes which operate with two separate tuned circuits. One tuned circuit for video, the other for sound.

Summary

It can be seen from the previous progressive steps of signal tracing, that a failure can be isolated very scientifically and in a very short time. It is only necessary for a serviceman to have a working knowledge of the layout of television receivers and tube sockets in order to inject and follow an r-f, osc., i-f or audio signal from the antenna terminals to the loudspeaker or C. R. T. of any television receiver.

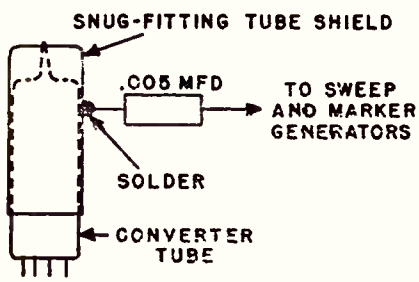
SHOP NOTES

Write up any "tricks-of-the-trade" in radio servicing that you have discovered. We pay from $1 to $5 for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor".

Westinghouse-Coupling Sweep and Marker Generators to Receiver

When using a sweep generator, marker generator and oscilloscope to check the i-f response curves of a television receiver, it is sometimes difficult to obtain the correct balance between sweep ouput and marker output. This is particularly true when the ranges of the individual attenuators are limited. For best results, the amplitude of the applied sweep voltage as well as that of the marker voltage must be adjusted to a fairly critical level.

The coupling method shown below provides additional control of the sweep and marker voltages. By sliding the tube shield up or down on the



Method of coupling

tube, the capacitance between the shield and the tube elements is varied, and the coupling can be adjusted as desired. Another advantage of this method is that it is not necessary to make a direct connection to the circuit under test; simply slide the tube shield over the converter tube.

Any tube shield can be used provided that it fits the tube snugly and does not ground to the chassis. A suitable shield can be constructed by squeezing a Westinghouse V-6090-2 tube shield together until it fits the tube snugly.

Belmont BRC 18DX21A and 7DX21—

The dynamic limiter circuit used in BRC Chassis 18DX21A and 7DX21 was designed to reduce noise, external interference, and other objectional effects expected in television reception.

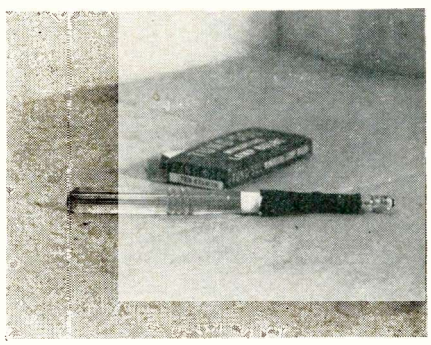
It was later discovered that the noise and other effects were not as noticeable as expected and the dynamic limiter circuit could be eliminated. Since the dynamic limiter introduces a loss, an increase of audio sensitivity of approximately three times is now obtained.

All that is necessary to make this change is to remove the 1000 mmf capacitor (C116) connected from terminal 2 of transformer T-8 to pin 6 of the 19T8 (tube 4). If not convenient to realign the transformer T-8, then add a 10 mmf capacitor from terminal 1 to terminal 2 of transformer T-8 Addition of the 10 mmf capacitor will compensate for the disturbing of the alignment of the ratio detector transmormer (T-8) caused by removing C116.

Pilot Lamp Tool

In many instances the replacement of miniature pilot lamps in radios and amplifiers is most difficult, on account of being located midst closely spaced components. In some cases it is necessary to remove the chassis from the cabinet.

A simple and inexpensive tool can be made that will almost eliminate this difficulty entirely. The materials needed to make this tool are a cheap eight inch screw-driver, a rubber type electric iron cord support, which may be obtained from most any electric



Pilot lamp tool

repair shop, and a small quantity of rubber to metal cement.

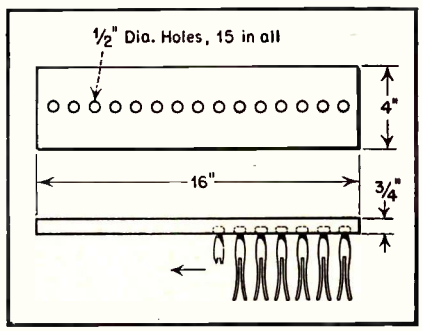
Saw or grind off the bit of the driver to the diameter of its shaft. Cut a section from the rubber cord support about three inches long, measuring from the outer or small end. Insert the driver shaft, after applying a small quantity of cement, into the rubber support about two and one half inches leaving the small end of the taper toward the end of the tool. Allow the cement to dry thoroughly and the tool is ready for use.

This tool can be used with either the screw or bayonet type pilot lamps.

Submitted by:
John C. Malocsay
Box 184
Denver 1, Colo.

Handy Test Lead Rock

Here is a very handy rack to keep test leads and miscellaneous testing wires at one's reach and in good order at all times. Take a piece of board 16" long, 4" wide and ¾" thick. Divide lengthwise by inches. Drill ½" holes



Handy test lead rack

at every inch, ¼" deep. To assemble merely dip the clothespins heads in the glue and insert in the ½" holes. You will find that by tapping lightly you will have a very close fit and a solid one. This arrangement is very handy and attractive. It can be finished natural or painted a desired color. The test leads wires can be inserted between the clothespins prongs; larger wires between the clothespins or hung over them. It is really a combination rack to accommodate all the test wires one uses. The materials required are:

1 board 16" x 4" x ¾"
15 clothespins
Glue
Nails, screws or hooks to hang on wall.

Submitted by:
D. A. Duquet
Waterville,
Maine

Tele-Tone TV Model 149-B,

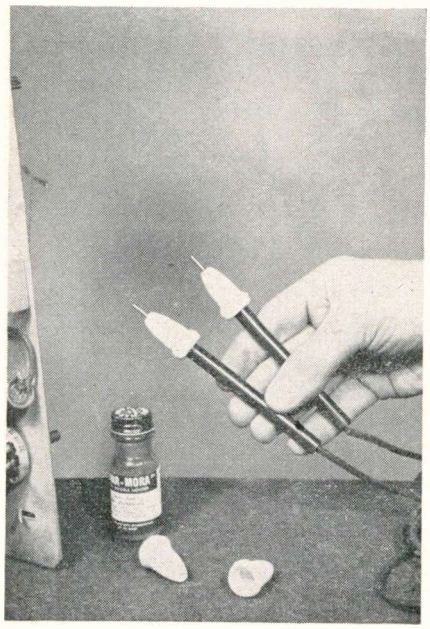
On weak signals this model gives a fuzzy picture due to the 4.5 Mc. beat signal used for inter-carrier sound getting into the picture circuits. This can be cured by connecting a small mica or ceramic condenser from pin #3 of V-10, the 6AL5 ratio detector, to the chassis. This prevents

the signal from feeding through the filament wiring to other parts of the circuit and removes all traces of the beat pattern.

Submitted by:
Walter N. Pike,
Chesapeake Beach,
Maryland.

Plastic Test Prods

Plastic cord pulls are available at chain stores and are about the proper size to fit over most test prod tips. Since the type pulls illustrated are tapered it is easy to cut off a small



Plastic test prods

section of the end of each pull and force over the test prod insulator. Cement may be used if the pulls do not fit as tightly as desired.

Submitted by:
H. Leeper,
1346 Barrett Ct., NW
Canton, 3, Ohio

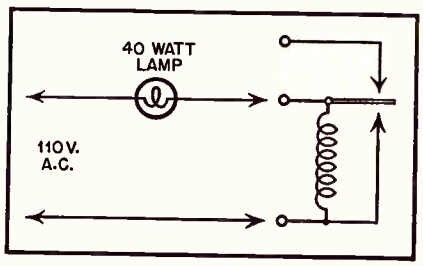
Philco Models 46-1203, 48-1262-
Distortion, instability, poor sensitivity

This can be a most elusive trouble in these models because the symptoms do not seem to fit the remedy. When first encountering this trouble a great deal of perspiration was lost in tracking the culprit down. The set played perfectly for the first few minutes after turning it on but then progressively began to weaken and distort. A check of the "B" voltage proved that it was low but to determine why was the problem at hand. The voltage was correct across one doubling filter but across the other it was practically nothing. At first we suspected the filter but it checked o.k. Then we checked the circuit and found that the only possible other cause would be a cathode to filament short in one of the tubes. It proved to be the 7B7 i-f amp. tube. In the 48-1262 the 50x6 plate became a cherry red on the radio but on phono the set worked o.k. This was because on phono the cathode of the 7B7 is switched out of the circuit. The simplified schematic indicates how this trouble can occur in full wave voltage doubler circuits.

Submitted by:
Wayne Lemons
Buffalo, Missouri

"Starting" stuck vibrators

New vibrators which have been kept in stock a long time, especially in coastal areas, frequently will not start when installed in the set. This trouble is caused by a thin film of corrosion on the contacts, which may be removed by the following method.



Method of repairing "stuck" vibrators

Connect the coil connections of the vibrator to the 110VAC line with a 40 watt lamp in series. Let the vibrator buzz in this manner for about five seconds and it should work when plugged into the set.

Submitted by:
Spears Radio Service
Clearwater,
Florida

Philco-Sweep Generator Attenuators

When a television receiver is aligned, the input signal should be attenuated so that the output at the Align Test jack is not more than 2 volts, peak-to-peak, and the output at the AFC Test jack is not more than ½ volt, peak-to-peak. When a Megasweep or similar type sweep generator is used, the amount of attenuation provided by the generator is not sufficient while aligning the first and second video i-f stages.

An attenuator for a signal generator with a 70-ohm output may be constructed as follows:

1. Obtain a discarded vibrator can to house the attenuator. This can should be of the type that has a shoulder and crimping to hold the base in place.

2. Carefully remove the crimping around the base of the vibrator, and remove the base and all vibrator components.

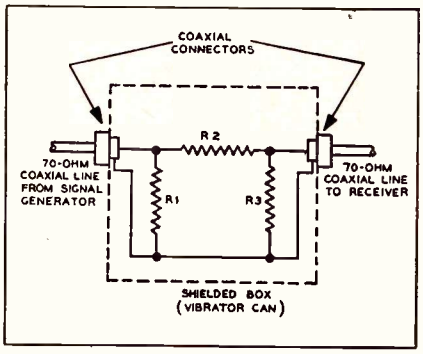


Fig. 1. Attenuator circuit.

3. Obtain a metal washer the same size as the discarded base. Drill holes in the washer and the closed end of the vibrator can so that coaxial connectors may be mounted.

4. Install coaxial connectors in the holes, and wire the unit as shown in *Fig. 1.* Use resistors of the values given in the attenuator chart. These resistors must be of carbon composition construction. Cut open one of each group to verify construction. Normally, the three attenuator combinations shown in the chart, in addition to the sweep generator attenuator, provide an adequate range of attenuation. If more attenuation is required, connect two attenuators in series.

ATTENUATION		RESISTOR VALUES	
VOLTAGE DIFFERENCE	ATTENUATION IN DB	R1 AND R3	R2
3 to 1	-10	135 ohms	106 ohms
10 to 1	-20	86 ohms	347 ohms
100 to 1	-40	73 ohms	3548 ohms

Attenuator Chart

5. Place the washer on the open end of the vibrator can and crimp over the edges of the can. Solder over the crimping to insure good electrical contact.

Philco Television Service Bulletin 49T2

Selenium Tester

For some shops the testing of the selenium rectifiers can be quite a problem. Particularly is this so when a set owner brings in one which he, himself, has removed from the receiver and wants checked. There are, and will be more, men who have had some experience fixing radios in the armed forces. This is something with which the radio servicer is going to be confronted with more and more. And then there is the ten-

[*Continued on page 35*]

Small Ad
DOLLAR SAVERS

by EARNEST W. FAIR

Successful service shops are those in which good business practices are followed. One of these practices is effective advertising. In this article the author has compiled a number of what he choses to call, "Dollar Savers" with respect to good advertising techniques. We think that they're an effective capsule in this respect.

EVERY radio repair shop owner knows that small ads offer the best opportunity for promotion of his business within the budget he can afford to set up. Those who have tried to use large space at periodic intervals have seldom found it profitable to stretch their budget in this manner. Advertising must be consistent if it is to be successful.

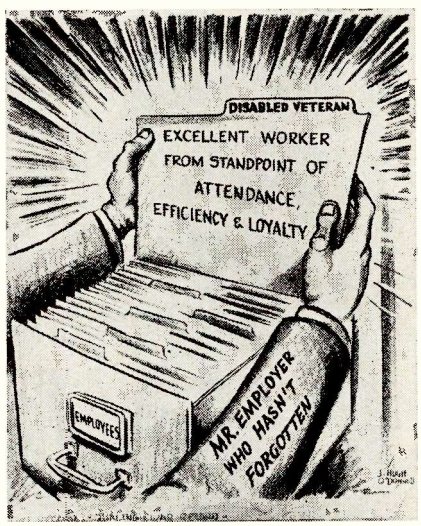
The small ad offers one the opportunity to be a consistent advertiser. But there are many pitfalls in the use of these small ads. Dollars can be speedily wasted by lack of careful planning.

In the paragraphs to follow are a number of suggestions taken from the experience-stories of radio repair shop owners in every section of the country; men who have used small advertisements with continued success. Most of these have been learned the "hard way".

1. Be consistent. Spotty use of advertising seldom pays off; it is the day-to-day pounding away that establishes the name and services of a radio repair shop. When the budget has been set up it should be so divided that the amount of space to be used in each insertion will permit as frequent insertions as possible. Most radio repair shop owners set aside two percent of their gross for such advertising.

2 Pick Best Days of the Week. Each radio repair shop owner knows his own territory or his own city best. Good planning requires a thorough study to show when most people are near his radio repair shop or when the opportunity for their being nearby is greatest. Those are the days which are MUST days for his advertising.

3. Make the ads different from others. Ordinarily, small ads are "buried" the easiest because of the multiplicity of them in the average publication. To prevent this it is good policy to deviate from standard forms



with small illustrations of an unusual nature or clever catch-line.

4. Use illustrations but don't buy them! An illustration is excellent in an average small advertisement. The least expensive way to secure them is to use the mat service provided free for advertisers by almost every newspaper. These contain thousands of unusual small cuts which can be adapted to an eye-catching idea for our advertisement.

5. Buy A schedule. Advertising should be a regular routine of one's business; just like the rent or the utility bill. Rates are always cheaper on long contracts, more expensive on a day-to-day basis.

6. Be brief and to the point. It is never wise to seek to tell a story in a small advertisement. Messages which are curt and to the point make an advertisement of much more effectiveness, particularly when small space is being used.

7. Design for plenty of white space. No major advertiser crowds his space with copy and pictures—there's always ample white space to set the layout off and attract attention. The average small ad appearing in newspapers today is, on the contrary, loaded with type. White space sets any size ad off from others on the same page; gets more attention.

8. Use a signature plate. People remember names of firms better when they are written out in an unusual type or a signature. These cost very little. Mats can be made from the original cut and one actual cut made to last many months.

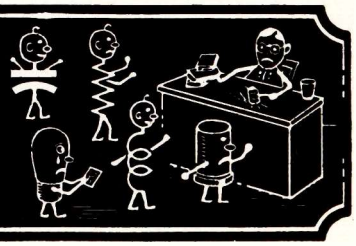
9. Get good positions. Newspaper ad offices are like any other business establishment and on this matter of position on the page it's the man who insists on attention to his advertisement who gets the best position. A buried ad is worthless; keep ad salesmen from burying small ads always.

10. Give your small ad a purpose. Just using space has been proved to be costly. A small ad should seek to sell the name of the firm, an idea, a special offer or something unusual about its business. Small ads are excellent for this purpose.

11. Vary copy frequently. Most newspapers make special rates for

[*Continued on page 37*]

CIRCUIT COURT



Airline Model 64BR-7810A

This instrument is one of a few which have been designed to operate from a 6 volt battery of the regular 117 volt line. It is an audio amplifier with three input channels and push-pull 6L6GA output. A phono motor and pickup are mounted on the top of the case. One of the input circuits comprises a fader for use with two high impedance phono sources. This portion of the circuit is not shown in the diagrams presented on this page.

The most unusual portion of the interesting circuit is the part which powers the tubes regardless of which source is used. The switching is done by the use of a properly connected plug, it also having leads for the 117 volt line or 6 volt battery. Thus, when he primary cable is attached, all interior circuits are appropriately made for that type of operation.

The plug terminal arrangement and socket layout are not shown, but the actual schematic connections resulting from plug insertion are indicated in the accompanying diagram shown in *Fig.* 1 above. Notice that the power supply makes available d-c voltage outputs of 325 and 360 volts. The unused winding is the vibrator winding, the operation of which will be shortly explained. Notice the 47 ohm resistor connected to ground.

The power transformer has four windings. The high voltage secondary operates the same on a.c. or d.c. An OZ4 rectifier is used to supply a maximum d.c. of 360 volts. The only other common winding is the one used as the 117 volt primary on a.c. The phono motor, which operates across the line on a.c., is powered by the 117 volt winding during d.c. operation, but a 125 ohm resistor and 4 μf capacitor correct the waveform developed by the vibrator and limit the power to that required by the motor. The circuit for d-c operation of this unit is shown below in *Fig.* 2.

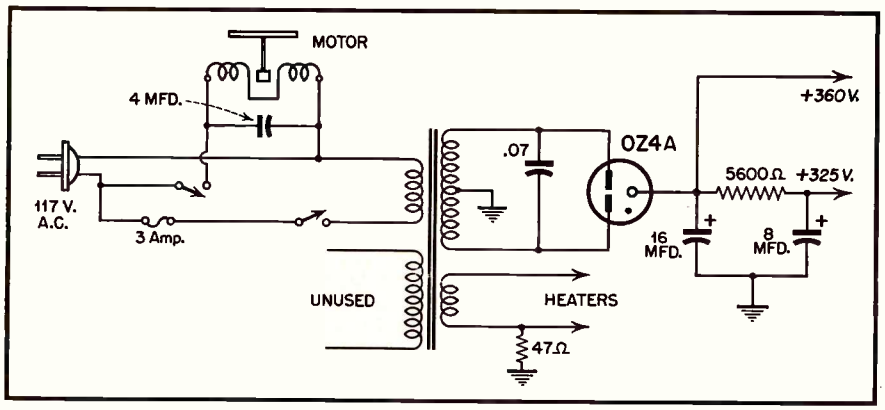


Fig. 1. Circuit diagram of power supply of Airline Model 64 BR-7801A in a-c operating condition. Vibrator winding in this mode of operation is unused.

During d.c. operation, the 6 volt source lights the tube heaters and actuates a vibrator. The pulsed voltage is applied to a 6.1 volt winding. The fourth winding is not used. The latter winding, it will be recalled, is used only on a-c operation.

When operated on a.c., the vibrator winding is not connected but the fourth winding, a 6.3 volt coil, supplies heater voltage. The various windings for d-c and a-c operation are thrown in and out of the circuit by the action of the plug.

It should be noted that the vibrator system is designed to work at a frequency of 60 cycles. This is not true of many car radio vibrator systems and should be kept in mind when substitution of components is considered.

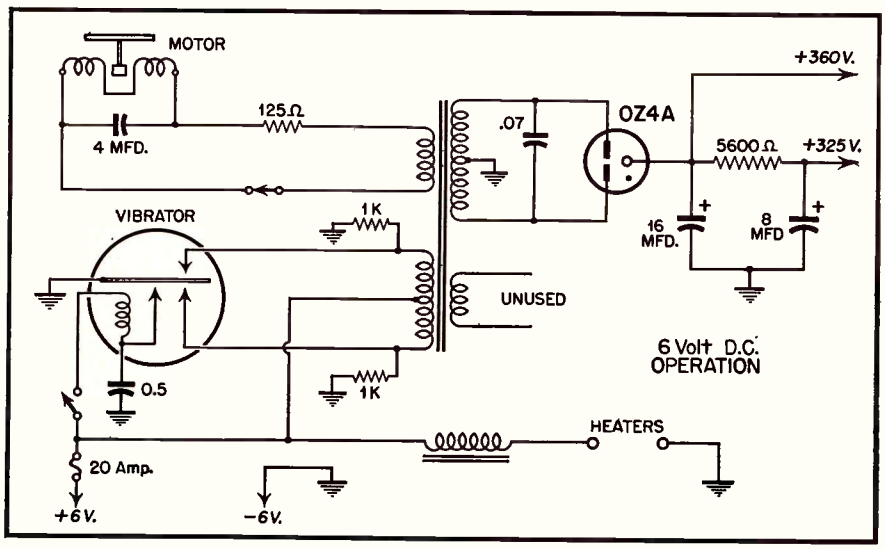
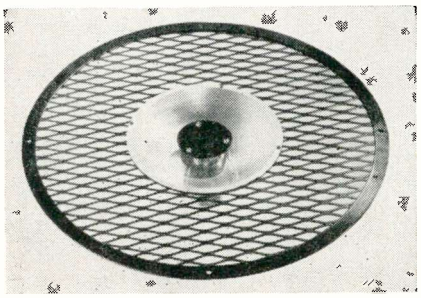


Fig. 2. Circuit diagram of power supply of Airline audio amplifier in d-c operating condition. Heater winding is now disconnected from the circuit.

NEW PRODUCTS

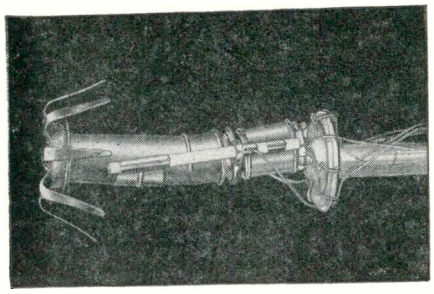
HIGH-FREQUENCY TWEETER

The Masco model HFT-100 high frequency tweeter is designed to meet the high quality standard required by providing wide range frequency response in the upper register. When used in conjunction with the average cone speaker wide range response is obtained



from the lowest response of the cone speaker to better than 15,000 cycles provided by the HFT-100 high frequency tweeter.

The High Frequency Tweeter is manufactured by Mark Simpson Manufacturing Co., Inc., 32-28 — 49th St., Long Island City 3, N. Y.

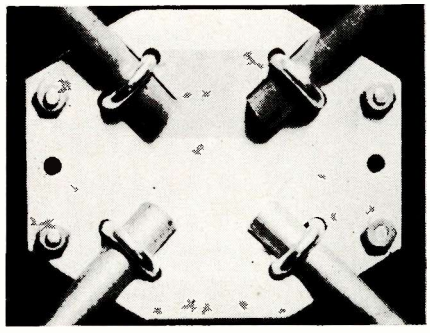


GUNT-GUN ION TRAP

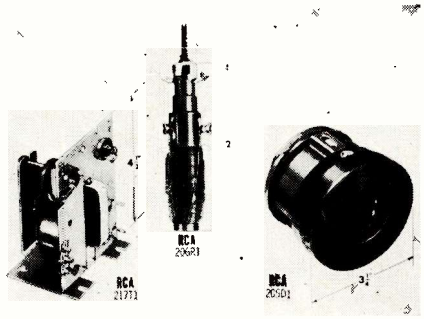
Better pictorial resolution as well as greater simplicity and economy, is claimed for the bent-gun ion trap featured by current Du Mont TV tubes in the 12½", 15½", 16" and 19" sizes.

STEATITE CENTER

The Circle "X" Antenna Corporation, Perth Amboy, New Jersey announced that it has revised its center block construction by switching from a plastic center to a high frequency steatite center.



Steatite is the material used for insulators in high voltage work. It completely eliminates any electrical loss at the center even when wet. This improvement will increase the general TV receptive qualities of the Circle "X".



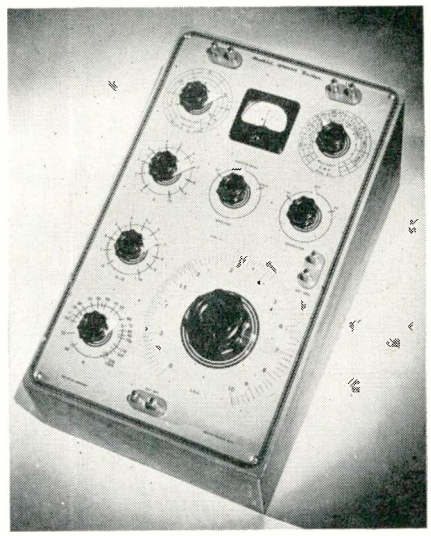
TV COMPONENTS

Four new components have recently been offered by Tube Dep't., Radio Corp. of America, Harrison, N. J., to equipment manufacturers for use in 10-inch and 12-inch television receivers having deflection systems which are designed to use the new highly efficient, horizontal-deflection amplifier tube 6AU5-GT and the new, high-voltage rectifier tube 1V2.

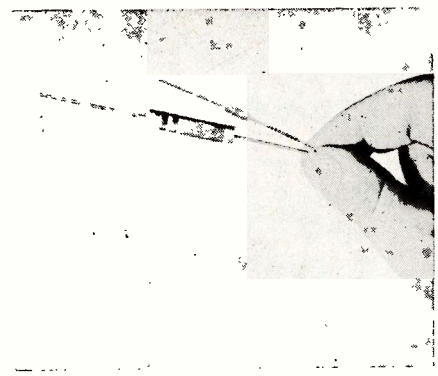
These new components, coordinated in design to operate efficiently with each other and with the 6AU5-GT and 1V2, are as follows: Deflecting Yoke, Type 205D1; Width Control, Type 206R1; Horizontal Linearity Control, Type 207R1 (not shown); and Horizontal-Deflection-Output and High-Voltage-Transformer, Type 217T1.

IMPEDANGE BRIDGE KIT

The Heath Company, Benton Harbor, Michigan introduces a new Heathkit Impedance Bridge Kit of laboratory quality. General Radio main calibrated control. General Radio 1000 cycle hummer, Mallory ceramic switches with 60 degree indexing, 200 micro-amp zero center galvanometer and ½ of 1% ceramic non-inductive decade resistors are included in



the list of high standard parts. Measures inductance from 10 microhenries to 100 henries capacitance from .00001 MFD to 1000 MFD. Resistance from .01 ohms to 10 megohms. Dissipation factor from .001 to 1. "Q" from 1 to 1000. Internal 6 volt battery for resistance and hummer operation. Circuit utilizes Wheatstone, Hay and Maxwell circuits for various measurements.



MINIATURE RESISTORS

Rounding out the popular line of IRC BT Insulated Resistors, two new miniature units were announced today by International Resistance Company, Phila., Pa. Like previous Advanced Type BT's, both set new standards of performance for insulated fixed composition units.

Biggest feature of these newcomers is their small size. BTR has a body length of only 13/32" and a diameter of 3/32", while BTB has a body length of 1-¼" and a diameter of ¼".

NEW TUBES

Sylvania Electric Products Inc., 500 Fifth Ave., N. Y. 18, N. Y., announces 2 new tubes. The first, shown at the left is a new miniature pentagrid converter tube, designed especially

for use in compact, light-weight portable radio receivers, where high operating efficiency at low plate voltages is desired. This tube, type 1L6, is supplied with a 1.4 volt d-c filament cathode rated at 50 milliamperes. Operated from a 90 volt B supply, its plate current is only 0.50 milliamperes.

The second is a new high vacuum rectifier. This tube, lock-in type 7X6, is supplied with a 6.3 volt heater rated at 1.2 amperes. Maximum rated output of 150 milliamperes and separate cathode leads make the 7X6 suitable for a wide range of radio, electronic and television power supply circuits.

LAB TYPE VOM

The Triplett Electrical Inst. Co., Bluffton, Ohio, announces their new 630-A Volt-Ohm-Mil-Ammeter, a laboratory-type instrument with mirrored, hand-drawn scales and greater accuracy made possible through the use of special ½% resistors, each mounted in its own compartment. The long scales on the large 5½" instrument are hand-drawn for greater meter accuracy. Mirror scale and distinct scale markings provide greater reading accuracy.

Six D.C. Volt ranges from 0 to 6000, at

[*Continued on page 32*]

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Receiver Circuits

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BATTERY OPERATION

CATHODE RAY TUBES

CHARTS

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(See "*Circuit Court*")

Audio

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BATTERY

CIRCUIT COURT

(Also see ("*Frequency Modulation*")

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TEST EQUIPMENT

TEST EQUIPMENT

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Audio Oscillators

Frequency & Wave Meters

High Voltage Probes

Impedance Bridge

Kilovolters

Marker Generators

Multimeters

Oscilloscopes

RADIO SERVICE DEALER

1949 INDEX

TRANSFORMER COUPLING

TUBES -- Receiver

New Types & Applications

TUNERS

NEW PRODUCTS

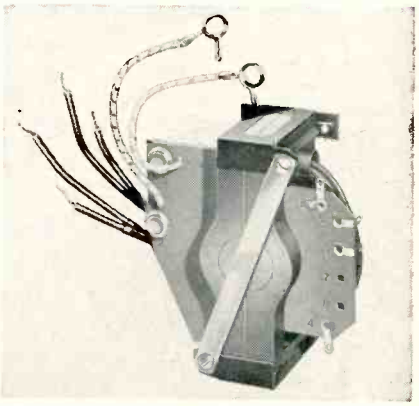
[*from page 27*]

20,000 Ohms/Volt; Six A.C. Volt ranges from rent ranges; Decibels; Output; and Resistance ranges from 0 to 100 Megohms, (Compensated 0 to 6000, at 5,000 Ohms/Volt. Five D.C. Cur- for greatest accuracy).

TV HORIZONTAL TRANSFORMERS

The addition of three horizontal deflection output and high voltage transformers to the Stancor line of television replacement transformers has been announced by Standard Transformer Corporation, 3850 Elston Ave., Chicago, Ill.

Included are the A-8119, an exact duplicate of RCA Type 211T5, for use with the 16AP4



and similar kinescopes; the A-8127, an exact duplicate of RCA Type 211T3, for use with the 10BP4, and the A-8128, designed to fill the need for a transformer between the 10" and 16" sizes and also for use in converting a smaller receiver to a 16" receiver.

Complete description and prices available in Bulletin DBI-354.

NEW TV ANTENNA BRACKETS

General Cement (G-C) announces two Universal Mounting Brackets to make Television Aerial Installation easier.

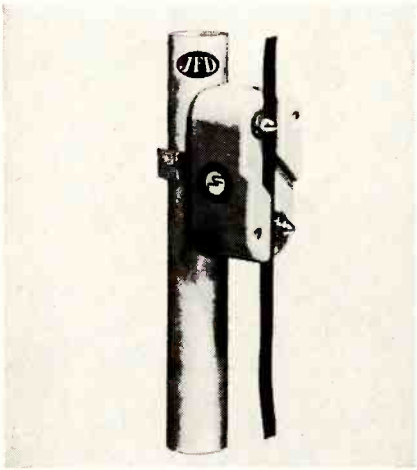
The No. 8000 is a universal hinged mast bracket that can be used at any angle. Antenna can be assembled in downward position and then swung up. Only two bolts are necessary to tighten the mast in position. It is made of aircraft aluminum.

The No. 8001 Chimney Mount is also universal. It is made of aluminum aircraft and both brackets can be spread to any width desired. These brackets can also be mounted

on gables, corners, or flat surfaces. Holes are provided for universal mounting. Both types will hold masts up to 1⅜" diameter.

LIGHTNING ARRESTER

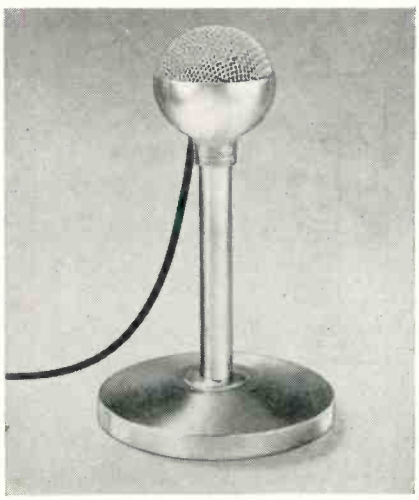
The JFD Manufacturing Co., Inc. of 6101-16th Ave., Brooklyn, New York is now distributing their new "safeTVguard" Twin Lead Lightning



Arrester designed to protect valuable television parts against dangerous lighttning and static charges. It is Underwriters' Laboratories approved for outdoor-indoor use.

OMNI-DIRECTIONAL MICROPHONE

The "Spherex"—a new, fine quality, high output, low cost, omni-directional crystal microphone—has recently been announced by Electro-Voice, Inc., Buchanan, Michigan. A product of E-V research—the "Sperex" is



engineered and designed for economical use in conference recordng, round table discussions, home recording, amateur radio, public address and similar applications. Picks up speech or music from any and all directions—reproduces it faithfully.

TV WAVEFORM

(*from page 14*)

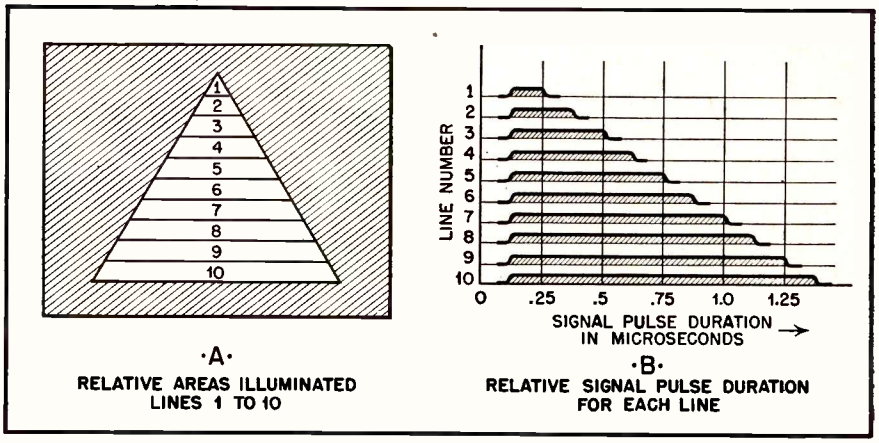


Fig. 1-5: How video signal pulse duration or wavelength increases as area of illuminated line is increased. Smallest illuminated area produces sharp pulse of highest frequency.

that the areas of the signal above and below this axis are equal.

Notice that it takes four alternate black and white areas to form two complete cycles. We have assumed an extreme case where the alternate black and white areas formed are actually the element areas themselves. The video frequency that is generated in this case is a maximum and is equal to the total number of elements scanned per second, divided by 2.

Reference to *Fig. 1-5* shows how the duration of the electron pulse and therefore the video frequency varies as the beam scans the triangular image on the iconoscope from line *1* to line *10*. Notice that the pulse is sharpest at line *1* and broadest at line *10*. Thus, the triangle, which is assumed to contain 1 element at the apex and 10 elements at the base, develops the highest video frequency as it scans line *1* and the lowest viedo frequency as it scans line *10*. The video frequency wave form indicated in *Fig. 1-1* corresponds to the scanning of a line containing 2 light struck areas, the second line containing twice as many elements as the first.

Video Frequency Limits

Modern transmitting standards specify that a given scene, or "frame", be scanned 525 times per second. Another requirement is that the ratio of the width to the height of the scanned frame be 4/3. This is called the "aspect ratio", and is further illustrated in *Fig. 1-6*. Assuming that the dimensions of each line are such that the focused beam area fits snugly into the vertical limits of the line as shown in *Fig. 1-5*, and with the knowledge that the width of the line is 4/3 times the height of the picture, the total number of elements that may be *theoretically* accomodated in a line is:

$$525 \times 4/3 = 700$$

The total number of elements in an entire frame would then be:

$$525 \times 700 = 367{,}500$$

Add to this a third transmission requirement—that each frame be scanned 30 times per second, we obtain as the total number of elements scanned in one second:

$$30 \times 367{,}500 = 11{,}025{,}000 \text{ elements scanned per second.}$$

Using this value the maximum video frequency would be:

$$11{,}025{,}000/\ 2 = 5{,}512{,}500 \text{ cycles per second.}$$

However, although 525 lines are scanned per frame, part of this scanning time must be devoted to returning the beam back to the top after it has reached the bottom of the mosaic. Furthermore, certain effects of beam overlapping and losses occur which

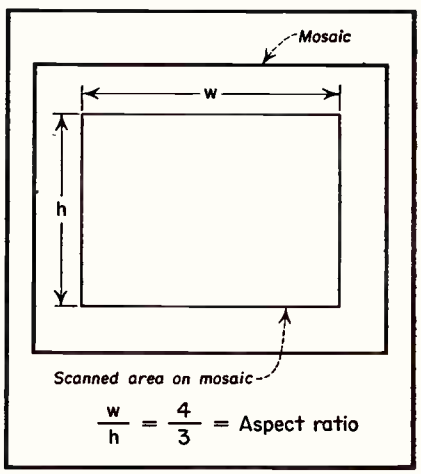


Fig. 1-6: Aspect ratio

also reduces the effective number of elements scanned both vertically and horizontally. Therefore, the maximum video frequency obtained is somewhat less than 5,512,500 cps. Actually, a video frequency of 4 mc is about the highest obtained. Referring to the block diagram in *Fig. 1-1*, this is the video signal which is fed into the section marked, VIDEO AMPLIFIER.

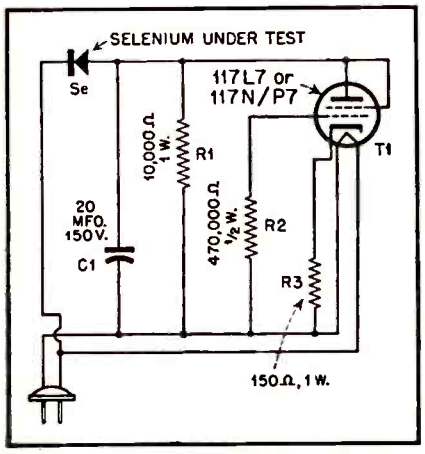
As a final thought in this section it might be pointed out that a completely bright or black picture results in essentially a d-c video signal; that is, one which produces no signal variation at the output terminal of the coupling condenser, *C*. However, as we shall shortly explain, certain pulses or interruptions occur in the scanning process every sixtieth of a second, so that the lower frequency limit of the overall video signal must extend to a value well below this figure. In practice, a theoretical video frequency range between 30-4,000,000 cps is considered good design.

SHOP NOTES

[*from page 24*]

dency among set owners to shop around for the cheapest way to get their sets serviced.

Since most portables now-a-days, and a number of five and six tube table radios, use seleniums, the servicer is going to find this testing a worrysome difficulty if he isn't prepared for it.



Circuit diagram of selenium tester

The author found it expedient and more than practical to devise a means of testing seleniums which far surpasses the conventional "test under load" while the set is turned on. The input filter may be partially open, thus giving a false reading.

The answer was considerably aided by the simple and inexpensive tester

shown in *Fig. 1.* It will be noted that a 117L7 is used in this instance for the loading tube, although any 117 volt rectifier-pentode tube may be used. This is to save the use of a line resister, thus cutting down on heat where it is not wanted in a small space. The average shop has one or more of these tubes around with the rectifier section out, and the pentode still good.

You will notice that the plate and screen are tied together, and the input grid is returned through the conventional 470K, ¼ watt resister. The cathode is fed through the usual 150 ohm cathode bleeder, but the plate supply is bled through a 10K, 1-watt resister. This resister is important in that it controls the load of the selenium being tested. The usual 20 μf loading condenser is also used in this circuit.

The average portable has four tubes (many containing five) so we must have an equivalent load on the selenium being tested in order that the voltage drop be the same. The five tube portables draw about 67 mils, including the filament string.

There are several brands of table radios with selenium rectifiers which have a plate supply drain of over a 100 mils. Since we are dealing with portables in this instance, we will not delve into the heavier duty tester required for the larger seleniums.

For this simple tester, a six-prong socket is used—preferably an Amphenol, because it has little slots winging out from the pin holes—to plug the lugs of the selenium into.

Make sure that the positive lugs and the negative ones are always fitted into the corresponding holes, otherwise the selenium will be ruined. Mark three of the socket holes with red paint or ink to identify the positive. Leave the other three holes unmarked. By using the six-prong socket, it will be no trick to fit the various types of seleniums into the proper holes without forcing the lugs too much.

A common continuity checker is then connected to a pair of test jacks brought out for the purpose. If the selenium shows anything less than a hundred volts maximum output, its output is too low and should be replaced. There may be differences in the output in various localities where the 110 supply varies more or less.

The case for mounting this tester in is small and compact, preferably a discarded wireless record player oscillator case, or any similar case that can be obtained from your wholesaler for less than a dollar.

The other parts are usually found around any shop. They are as follows:

1 six-prong molded socket
1 octal socket for the tube
1 20μf loading condenser
1 470,000, ¼ watt resister
1 10,000, 1 watt resister
1 150 ohm, 1 watt resister
1 a-c cord
1 117L7 or 117N/P7
2 pin jacks for test leads

Submitted by:
J. F. Shane
Spokane, Wash.

FIELD FINDINGS

[*from page 10*]

a fee. Here is the article referred to: *LIGHTNING ARRESTORS*: The primary purpose of this device from the standpoint of insurance companies and Fire Underwriters is to protect the structure on which the antenna is installed from lightning and fire damage. Where contents of a home or building are insured against fire and lightning damage, the Fire Underwriters consider that insurance requirements have been met IF an

UNDERWRITERS APPROVED lightning arrestor is properly installed on the antenna system. It is our understanding that some sets have been struck by lightning and with considerable damage resulting. So, be sure and install an arrestor when you put that TV antenna up.

The point brought out here is that Insurance Companies may refuse to pay for damages done by fire to a house, or a TV set itself, started by lightning hitting a TV antenna that did not have an Underwriter Approved lightning arrestor. Our legal counsel gives us further advice that eventually insurance firms may incorporate as a standard clause in their policies that an UP lightning arrestor MUST be included as a part of the TV antenna installation, and failure to do this may eventuate in the installer himself being held liable for damages accruing from such a fire as well as denial of liability on the part of the insurance company under its policy.

Now, with all the power at our command, we urge all TV installers to take this matter seriously. The legal aspects of TV are still in the formative stage so it is better to be safe rather than sorry.

And, as a passing thought, because TV is leading us into such a complex maze of legal technicalities, with different cities and towns originating their own interpretations of laws and regulations, and with such things as electrical requirements to contend with, it is no wonder that once again a trend has sprung up in the radio-TV servicing field toward the favoring of having the profession controlled by some licensing method.

DOLLAR SAVERS

[*from page 25*]

small ads when copy is unchanged over a long period of time. That's a good way to save a few advertising dollars but if the idea remains in use too long it is wasting money. Generally a month's time should be the absolute limit; change of copy weekly has been proven to be much better.

12. Get near important ads if possible. There are certain types of advertisements in newspapers which have as high a reader interest as the news columns; department store layouts, for example. A small ad placed near one of these will have much better chance of being read by a maximum number of people.

13. Pick the newspaper carefully. Generally speaking, individual news-

papers have group followings in their cities. Make certain that the paper being used is the one with widest possible circulation among the group of people who are to be reached by your small ad.

14. Tie in small ads with other advertising. The theme of small ads should be carried into sign advertising within the radio repair shop, direct mail and wherever and whenever possible.

15. Use an occasional large ad in the series. When business has been exceptionally good, boost the ad budget with use of larger space but pick the day of the week when an idea can be put over with maximum effectiveness and carry through the same theme and signature of the small ad series.

16. Keep away from familiar type faces. Ordinarily, if no other instructions are given, small ads are set in type styles and faces carrying a great deal of similiarity. An off-the-beaten-track type style helps focus more attention on our small ad.

17. Watch seasons carefully. Seasons of the year offer good opportunity for different ideas in small ads; changes should be made to conform with such seasons, holidays or events being held in one's community.

18. Call attention to these small ads. Cutting out a small ad and pasting it on a large cardboard, which in turn can be placed in the window or at the cash register, will help to secure more interest in the idea being pushed in one's small ad.

TRADE FLASHES

[*from page 8*]

the RCA Service Company now makes available a library copy of Service notes and service information, at no charge, to all service associations and service publications. This is in addition to widespread distribution of individual copies of these notes through RCA Victor dstributors to dealers, independent service men and service technicians.

As another example, he cited, the RCA Service Company's recognition of the need for the wider dissemination of more information on television servicing among all service men. In a move to bring this about, Mr. Oddorizzi announced the organization of a lecture series, starting in February. RCA Service Company engineers will conduct these informational meetings throughout the year in every television market. These meetings, to take place in the evening, for the convenience of

$1.00 to $5.00 PAID for "SHOP NOTES"

Write up any "kinks" or "tricks-of-the-trade" in radio servicing that you have discovered. We will pay from $1 to $5 for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor," RADIO SERVICE DEALER, 342 Madison Ave., New York 17, N. Y. Unused manuscripts cannot be returned unless accompanied by stamped and addressed return envelope.

independent service men as well as RCA Victor dealers, will be held under the auspices of RCA Victor distributors.

Electronic Blackboard

For a long time the efficiency of electronic training programs has been hampered by the lack of sufficiently large display of oscilloscope waveforms. Just released for civilian use by permission of the U.S. Navy, the new T-602 Projection Oscilloscope, manufactured by Television Equipment Corporation, 238 William Street, New York 7, N. Y., provides an excellent solution to this problem.

TUBE CHECKERS

[*from page 20*]

plest method of checking a tube dynamically is to insert it in a receiver socket and observe its performance either by comparing the audible signal obtained with that produced by a normal tube or by visual observation of the signal reading on an output meter. This procedure is usually inconvenient; indeed in many cases it is impossible due to the large number of types in current use.

*There are several types of dynamic testers on the market, and we shall have to limit our discussion to a bare outline of the principles involved. Referring to *Fig. 6*, you will find a simplified diagram showing the method of measuring dynamic transconductance. Suitable voltages are applied to the grid, screen and plate. These voltages are controlled by the potentiometers shown in the sketch, and voltmeters are used for reading the values. An a-c milliammeter of the dynamometer type is connected in the plate circuit. A small a-c voltage is now applied to the grid by means of the transformer *T*. Application of this voltage will result in a reading of the plate meter; the normal current will not be indicated because the meter reads only the a-c component. If the a-c grid voltage is 1 volt, the transconductance is equal to the plate current multiplied by 1,000. In another version of this type of checker, a 5 kc signal is applied to the grid, and a filter is used to remove all but the 5 kc component from the plate current.

In one dynamic tester an a-c voltage is applied to the grid; this voltage is controlled by the potentiometer, P in the drawing of *Figure 7*. The

*See R.S.D. Dec. 1947—"The Electronamic Tester."

switch Sw_1 controls the magnitude of the applied electrode voltages, and Sw_2 connects the appropriate load resistor into the plate circuit. Note that a.c. is applied to all electrodes. Now, if the electrodes voltages are properly phased, the tube under test is swept through a path of operation which covers a wide range of plate family characteristic curves. Its performance is not measured, for instance, at one value of grid voltage but over a wide range of such values from a very low value to a value approaching overload. The d-c meter in the plate circuit averages all of the values obtained and gives an overall measure of the merit of the tube.

To use the phraseology of another manufacturer,*

"This checker places proper relative voltages on all elements of the tube under test, then applies a signal to the grid and measures the effect of this signal on the plate current, as indicated on the meter. Circuit constants are arranged by switching, so that each tube type is working into a plate load which is adapted to its type, and enough current is drawn to reject poor tubes and yet not damage good tubes, unless they are left under test for an excessive period of time.

'This test, then, measures first the emission of the tube and by means of the AC signal on the grid, reads the change in plate current resulting from a change in grid voltage, which is directly proportional to mutual conductance. Thus we get a reading which is proportional to the emission of the tube (its most essential characteristic); to mutual conductance, and which is influenced by other tube characteristics such as leakage, gas plate resistance, power output, etc. On the average we get coordination of 85% between tubes picked out on this tube checker and readings taken on laboratory bridges."

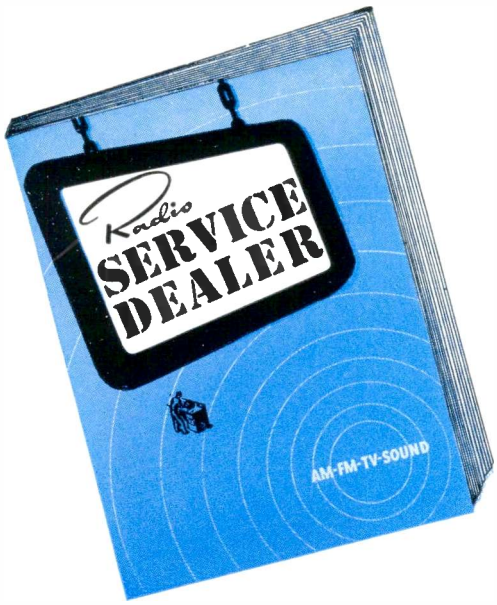
Editor's Note

There is no tube checker made that will give an absolute check of all variables of a tube. An inexpensive tube checker may give a 90% check of a tube; a moderately priced "service-type" checker-95%; and the most expensive type of laboratory checker about 98%.

In the final analysis, the true test of a tube's quality is the operation of the tube in the receiver itself. Therefore, we arrive at the interesting conclusion that, as a tube checker, a receiver is worth many thousands of dollars, which is what a laboratory type of tube tester is worth.

* J. H. Canning—Sylvania

AD INDEX



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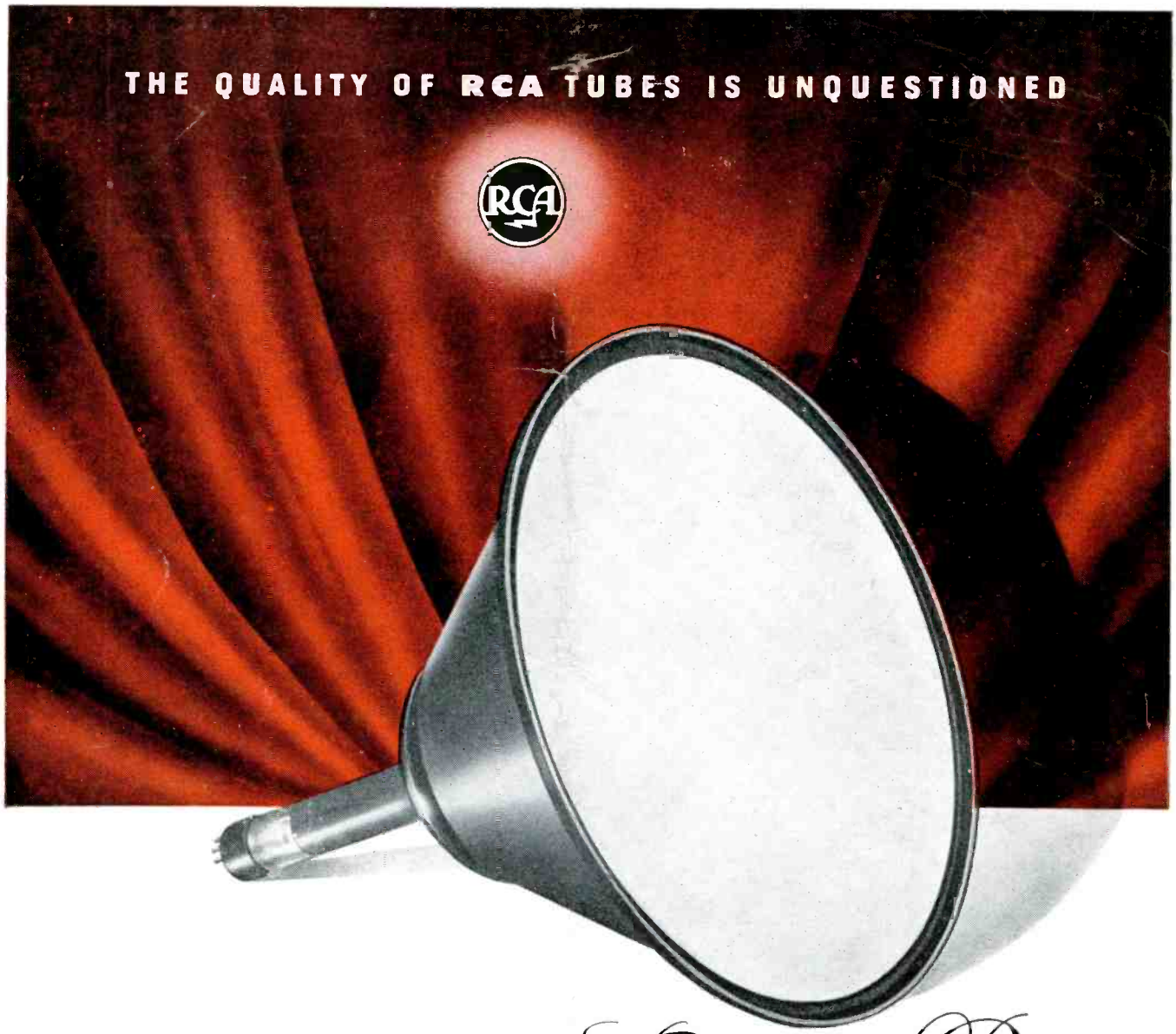

ANOTHER MILESTONE IN *Television Progress*

...the new RCA-16GP4 short metal-cone kinescope with "Filterglass" face plate

UNCEASING RESEARCH in television tubes by RCA engineers is responsible for the development of the new, short 16GP4 metal kinescope.

This 16-inch-diameter tube is actually 5/16" shorter than the 10BP4 . . . nearly 5" shorter than the 16AP4. Thus, greater flexibility and compactness is made possible in receiver and cabinet design.

Also, a superior picture is realized from the RCA "Filterglass" face plate. Picture contrast is improved by minimizing the effects of reflected room light, and of light reflections within the face plate itself.

RCA's engineering leadership adds *value beyond price* to the RCA tubes you sell. And you benefit directly from this *continued* research by the new enterprises which it creates.

Always keep in touch with your RCA Tube Distributor

RCA **RADIO CORPORATION of AMERICA**
ELECTRON TUBES HARRISON, N. J.