APRIL, 1951

Radio-Television SERVICE DEALER

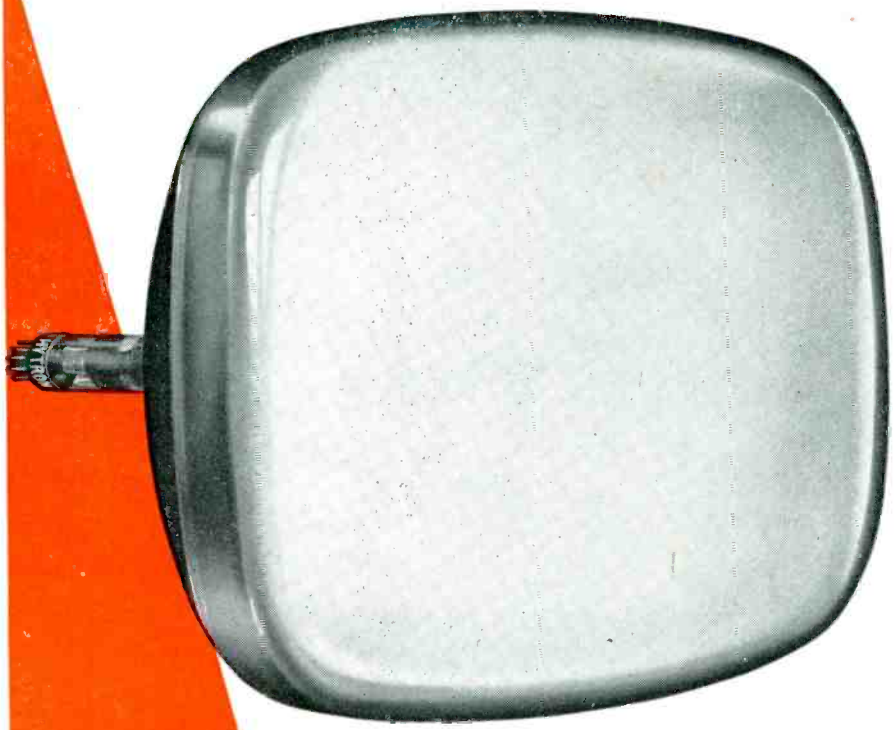
The Professional Radio-TVman's Magazine

IN THIS ISSUE:

AM-FM-TV-SOUND

Total Distribution Of This Issue: Over 30,000

NEW ELECTROSTATIC RECTANGULAR 20FP4



ANOTHER *HYTRON FIRST* FOR YOU

To its logically designed original *studio-matched* rectangular, Hytron now adds new advantages: the cobalt-and-copper savings of electrostatic focus.

The original Hytron electrostatic type 20FP4 eliminates the magnetic focus unit. Uses a single-field ion-trap magnet. Yet the 20FP4 gives you unsurpassed, clear, sharp pictures . . . despite economies in associated components enforced by defense needs.

Seeing is believing. Watch for this newest Hytron first from the world's most modern picture-tube plant. You'll be seeing it, buying it soon. You'll marvel at its sharp pictures, even at lower line voltages.

Again you'll say it pays to stay out front in picture tubes. It pays to insist on Hytron's original *studio-matched* rectangulars . . . choice of 9 out of 10 leading TV set makers.

MANUFACTURERS OF RECEIVING TUBES SINCE 1921

HYTRON

RADIO AND ELECTRONICS CORP.

HYTRON RADIO TUBES

MAIN OFFICE: SALEM, MASSACHUSETTS

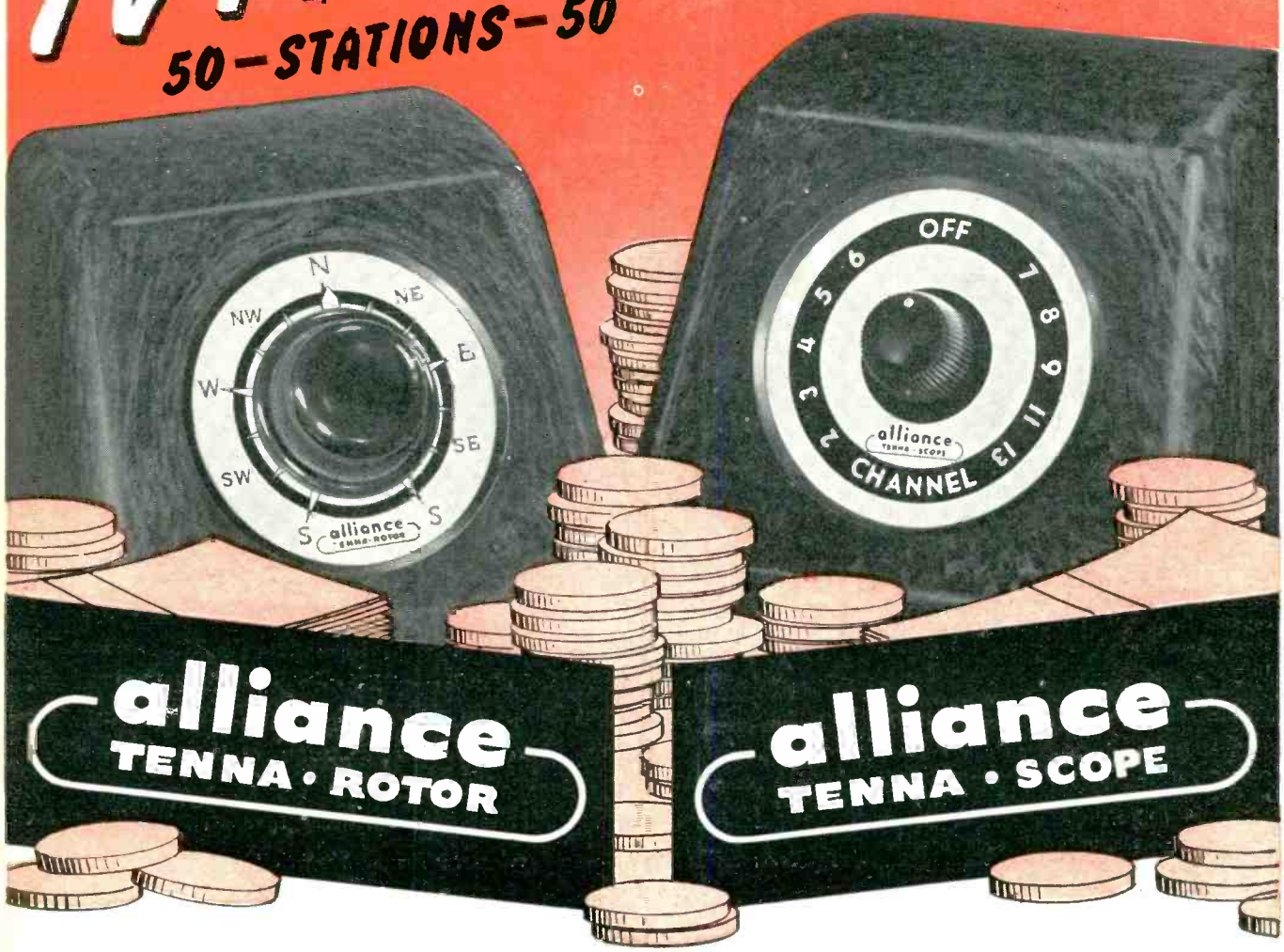
HAVE YOU GOT YOUR COPY?

The new 5th edition of the Hytron Reference Guide for Miniature Electron Tubes is out. See your Hytron jobber. Get your free copy of this old friend brought up to date today.

Play This Winning Combination OF

TV PROFIT MAKERS

50—STATIONS—50



MODEL HIR TENNA-ROTOR is the only fully automatic rotator. Just set it and forget it. Your antenna turns to the proper position and stops. North—East—South—West—direction indicator dial shows exact antenna position at all times. Extremely accurate!

THIS NEW TV BOOSTER features one simple control. Automatic on-off switch gives maximum, uniform high gain on all channels—quick to install. An excellent companion item to the Tenna-Rotor. The New Alliance Tenna-Scope!

NATION-WIDE TV ADVERTISING PRE-SELLS! Tenna-Rotor is the only TV accessory backed by a powerful, sustained television campaign—national in scope. Alliance Tenna-Rotor offers faster installation with 4-conductor "Zip" cable. Works in any weather. 1-year guarantee. U. L. approved.

ALLIANCE MANUFACTURING COMPANY • Alliance, Ohio

EDITORIAL

by S. R. COWAN

Re: Replacement Priority Rating

NPA's Regulation 4 Directive 1, issued Feb. 27th clearly states that servicemen needing replacement tubes, parts, etc., to keep in repair radio, electronic and communications equipment used by business establishments, institutions, etc., may rate such orders as DO-97, which jobbers may extend to manufacturers, and they in turn to material suppliers. However, servicemen may not rate orders DO-97 if the parts are needed as replacements in home, auto, or TV receivers. In other words, the Regulation 4 is intended to keep all essential and used-by-business electronic apparatus in working condition while civilian-owned radio gear enjoys no preferential priority rating whatever.

A vast number of our subscribers are engaged in so-called "essential" servicing, and Regulation 4 will be a tremendous boon to them. The rest of our subscribers, especially those who only do home and auto radio (and TV) servicing still must struggle along, trying to get replacement parts and tubes, without benefit of a "DO" rating. Their problems are acute, and only the "softening of the supply situation" due to the cut-back in TV production since the recent slump in sales has been of some consolation. Frankly, just as we campaigned during World War II, so will we campaign again, urging NPA to appreciate the fact that on the defense front it is vitally urgent that all home and auto radios must be kept in operable condition at all times, for now more than ever must the public be assured of uninterrupted means of radio communications.

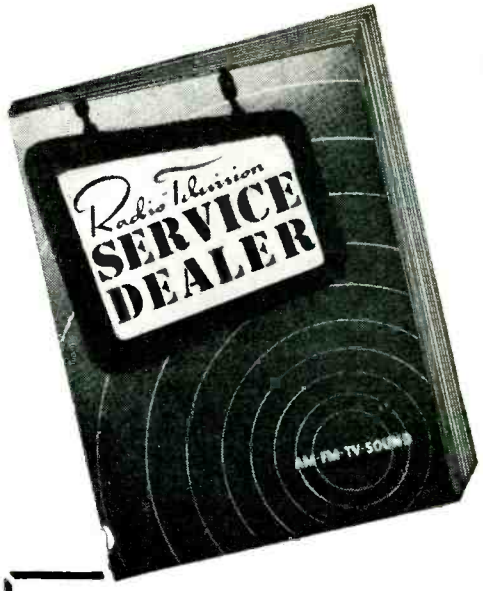
Happy to say, the several divisions of the Parts Mfgrs' Assns. are also working toward this end, and we hope that our combined efforts will result in there being some "good news" in the not too distant future.

About Licensing

Heretofore we have strenuously opposed each and every attempt made by politicians to foist on the service profession in their particular balliwick some sort of license proposal because in every such case so far the service profession was not represented on the commission or body that was sponsoring the regulation, and invariably the regulation would not have been fair to the men engaged in service work.

Now, in New York, after much deliberation and with the collaboration of the servicemen's association itself, a proposed form of license bill is about to be submitted to the Council for consideration, and because of the Bill's merit—plus supplementary state-wide legislation intended to eliminate other causes of complaint that are not ascribable to servicemen, being in the nature of retailers' shortcomings, —we are inclined to favor the passing of the Bill.

Full details about the License Bill that will have our unqualified support will soon be covered here.



Sanford R. Cowan
EDITOR & PUBLISHER

Samuel L. Marshall
MANAGING EDITOR

COWAN PUBLISHING CORP.
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NEW YORK 18, N. Y.

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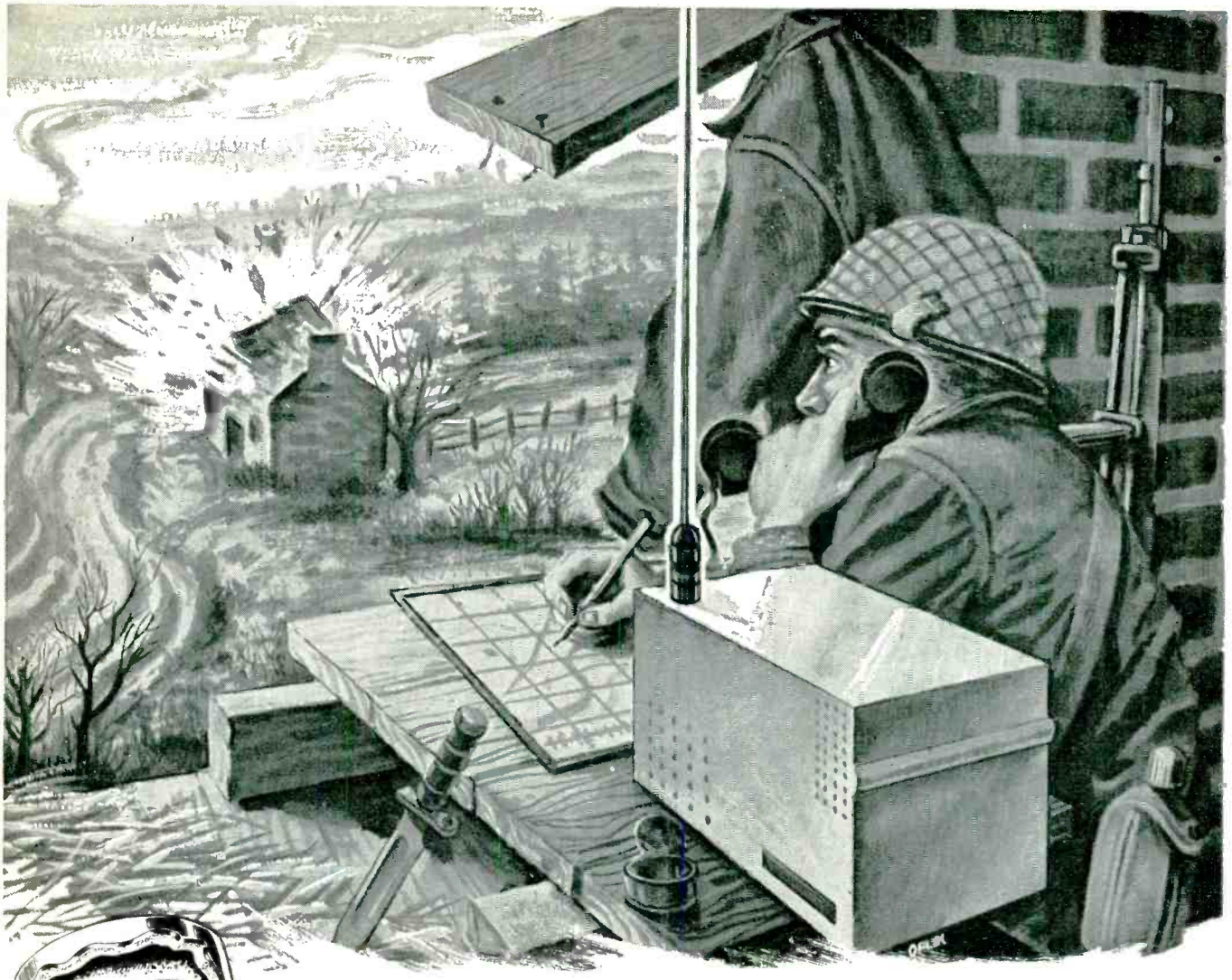


No Margin for Error Here...

★ The screeching wail of a fired missile as it rockets to its target strikes awe in the heart of every man. Sights are set . . . targets are tagged — and the gunner fires. The guiding hand behind the scenes is the man up front . . . it is he who indicates the position of the target. His radio message must get through to the gunners. His communications must be dependable . . . . must be in peak working order always. NO MARGIN FOR ERROR HERE! That is why his electronic devices have RADIART VIBRATORS specified for them. Reputation built up over the years for dependability and continued peak performmance has stemmed from superiority in engineering design and controlled manufacture. This same skill of design and manufacture is basic in every RADIART automotive vibrator – it pays to put this skill to work for you.

When It's Needed the Most . . . RADIART Quality Meets the Challenge

SUBSIDIARY OF

THE *RADIART* CORPORATION CLEVELAND 2, OHIO

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

TRADE FLASHES

A "press-time" digest of production, distribution, and merchandizing activities

RMA Statistics

Production of both radio and television receivers dropped in January below the monthly average of the last quarter of 1950, the Radio-Television Manufacturers Association reported recently. RTMA's estimates showed a drop of nine percent in radio production and a decrease of 21 percent in TV output as compared with the monthly average of the fourth quarter of last year.

The Association's estimates, which include member and non-member companies, showed a decrease of one percent in radio production in January under the average for the entire year of 1950. TV production, however, was three percent above the 1950 average.

TV production in January totalled 639,455 sets compared with a fourth quarter monthly average of 811,866 and the 1950 average of 621,983 sets. RTMA's estimates showed a total of 1,203,591 radios produced in January compared with the monthly averages of 1,317,033 and 1,215,825, respectively, for the fourth quarter and year 1950.

A breakdown of the January radio production estimate showed 785,983 home sets, 70,809 portables, and 346,799 auto receivers.

Rectangular television picture tubes represented 78 percent of cathode ray tube sales to manufacturers of TV receivers in January, the Radio-Television Manufacturers Association reported. RTMA's report also showed that 93 percent of all TV picture tubes sold to set manufacturers were 16 inches or larger in size.

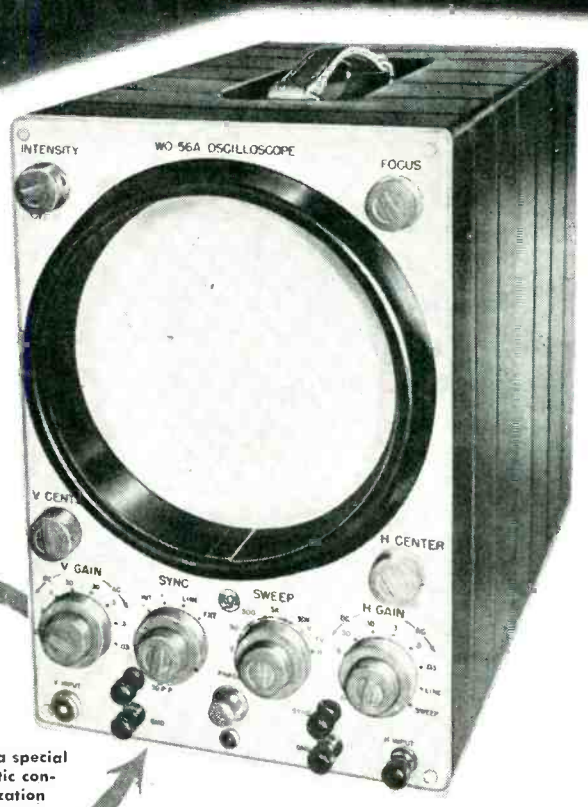
January sales to manufacturers totalled 580,317 units valued at $16,272,654. This compares with 436,252 tubes valued at $11,454,186 sold in the corresponding month of 1950 and 686,815 units valued at $20,639,246 in December.

Sales of radio receiving tubes in January increased substantially over the corresponding month of 1950 but dropped below sales in December.

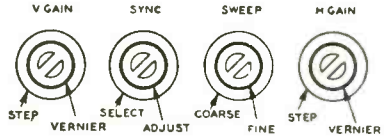
January sales of receiving tubes

The 7" TV scope for professionals

RCA WO-56A



DUAL CONTROLS FOR "COARSE" AND "FINE" ADJUSTMENTS



No hunting or fumbling for controls when adjusting Vertical Amplifier Gain, Sweep Frequency, Sync Injection, and Horizontal Amplifier Gain.

NEW!

The WO-56A has a special circuit for automatic control of synchronization over a wide range of input-signal levels.

Supplied with direct probe, low-capacitance probe, and ground cable.

FEATURING—

- Giant RCA 7JP1 cathode ray tube.
- Direct-coupled, 3-stage, push-pull, vertical and horizontal amplifiers.
- Frequency-compensated and voltage-calibrated attenuators on both amplifiers.
- A set of matched probes and cables.
- Panel source of 3 volts peak-to-peak calibrating voltage.
- Identical vertical and horizontal amplifiers with equal phase-shift characteristics.
- Retractable light shield for maximum visibility.
- New filter-type graph screen with finely ruled calibrations.
- Magnetic shield enclosing CR tube to minimize hum-pickup from internal and external fields.

SPECIFICATIONS—

- Vertical Deflection Sensitivity: 10.6 rms millivolts per inch.
- Frequency Response: Flat within −2 db from dc to 500 kc; within −6 db at 1 Mc; useful beyond 2 Mc.
- Input Capacitance: Less than 10 uuf with WG 216A Low-Capacitance Probe.
- Square-Wave Response: Zero tilt and overshoot using dc input position. Less than 2% tilt and overshoot using ac input position.
- Linear Sweep: 3 to 30,000 cps with fast retrace.
- Trace Expansion: 3 times screen diameter with corresponding centering control range.
- Power Supply: 105-125 volts 50/60 cycles; power consumption 65 watts.
- Size 13⅜" h, 9" w, 16⅛" d. Weight only 31 pounds (approx.).

ADVANCED SWEEP FACILITIES—

- Preset fixed sweep positions for vertical and horizontal television waveforms.
- Positive and negative syncing for easy lock-in of upright or inverted pulse waveforms.
- 60-cycle phase-controlled sweep and synchronizing.

Built for laboratory, factory, or shop use, the WO-56A combines the advantages of high-sensitivity and wide-frequency range in a *very small* instrument with a *large* cathode-ray tube.

Designed with the user in mind, this new 'scope can be depended upon to provide sharp, bright, large, and accurate pictures of minute voltage waveforms over the entire useful surface of the 7JP1 screen.

The amplifier selector switches are provided with both "AC" and "DC" positions so that measurements can be made with or without the effects of any dc component.

Square-wave reproduction is excellent, whether the application is low-frequency TV sweep-alignment or observation of high-frequency steep-fronted sync and deflection voltage waveforms.

A special sync-limiter circuit automatically maintains proper synchronization of the sweep oscillator over a wide range of input-signal levels without the need for manual adjustment of the sync-vernier control.

The excellent linearity and fast retrace of the sweep or time base are functions of the Potter-type oscillator. Undistorted reproduction of the sawtooth waveform is assured by use of a horizontal amplifier with a wide-band characteristic. The preset sweep positions provide rapid switching between vertical and horizontal TV waveforms.

Truly, the WO-56A is a most useful and practical instrument for everyday work in the fields of television, radio, ultra-sonics, audio, and a wide array of industrial applications.

For details, see your **RCA Distributor**, or write RCA. Commercial Engineering, Section 55DX, Harrison, N. J.

RADIO CORPORATION of AMERICA

TEST EQUIPMENT **HARRISON, N. J.**

totalled 37,042,303 compared with 22,272,024 in the same month of last year and 38,723,601 in December 1950.

A breakdown of the RTMA report showed 27,595,483 tubes sold for new sets in January; 8,083,078 or more than 30 percent for replacements; 1,165,171 exported; and 198,571 tubes sold to Government agencies during the month.

Mass. Retailers Oppose Licensing

Massachusetts TV retailers are uniformly opposed to state licenses of their sales and service operations, a survey of 1500 television retailers in the Commonwealth showed. It was conducted by the National Appliance and Radio Dealers Association at the request of Francis L. Monette, Lowell, Mass., member of NARDA Board of Directors, to determine dealer reaction to three proposed bills recently brought before the Massachusetts state legislature.

The legislation would license servicemen and retailers, set up examinations of servicemen and permit state agencies to set types of TV antennas and their prices.

NETSDA Meets In Phila.

A meeting of the National Electronic Technicians & Service Dealers Associations (NETSDA) was held at the Drake Hotel in Philadelphia, on Sunday, March 4. Representatives of 24 associations in 4 states were present to hear various members of the Industry wish them success in their new undertaking.

Sylvania Expands Again

Sylvania Electric Products Inc. will build a new plant in Burlington, Iowa, where radio receiving tubes will be made, it was announced by C. A. Haines, vice-president and general manager of operations for radio and picture tubes.

Plans call for construction of a one-story building, covering 100,000 square feet, to cost approximately $1,500,000 and employment of about 800 people to operate the plant, Mr. Haines reported.

This is the third time since the beginning of the year Sylvania has announced plans for a new plant. The Company recently acquired a site in Woburn, Mass., for a plant to manufacture electronic tubes and equipment for national defense, and purchased an option to buy a factory building in Wheeling, W. Va., to supply fluoresent lighting fixtures.

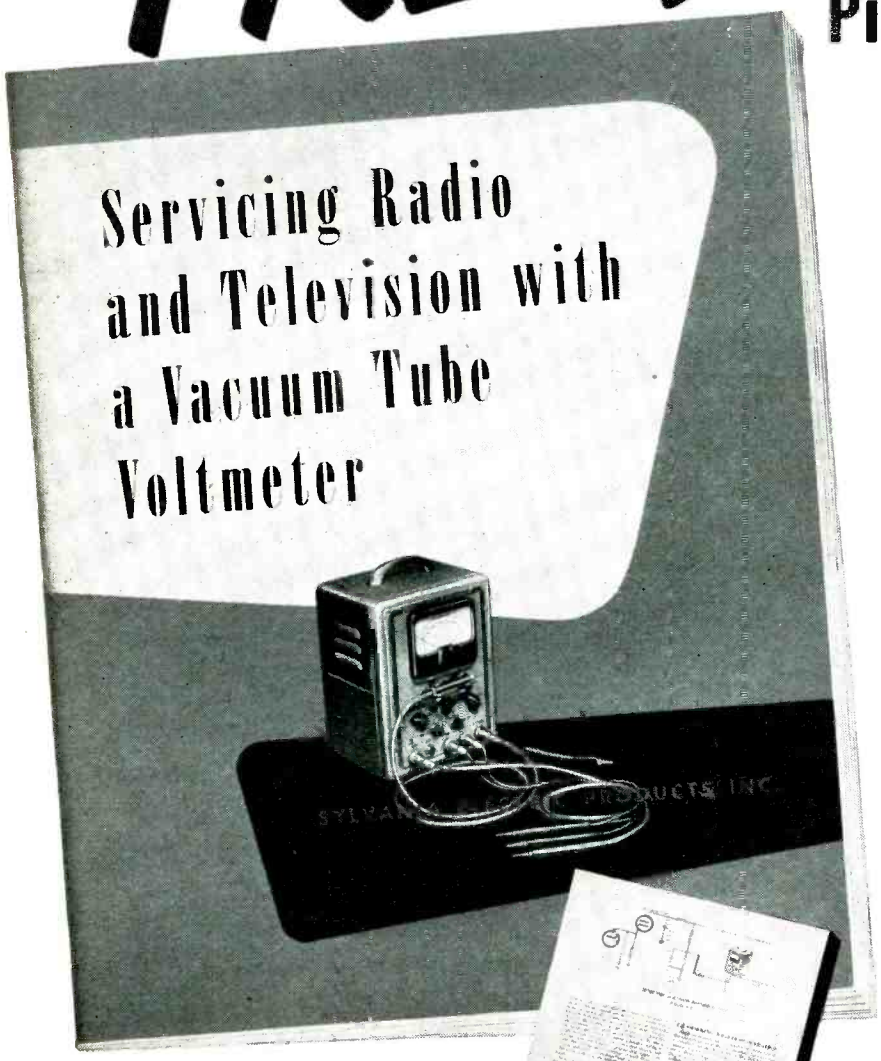
Preserving Batteries

Dry Cell flashlight batteries will last longer if stored in a refrigerator.

[*Continued on page 10*]

FREE!

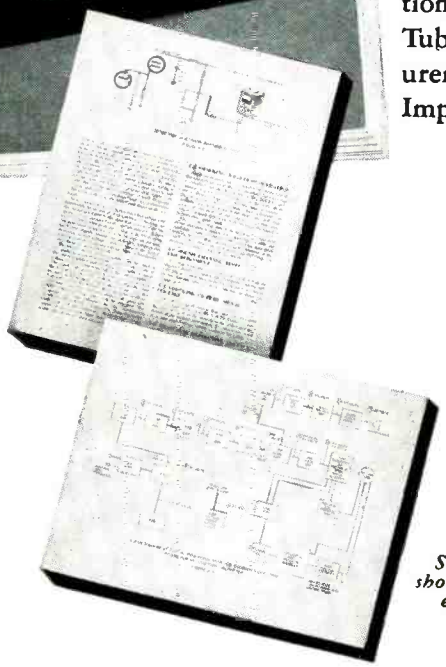
With purchase of ONE Sylvania Picture Tube



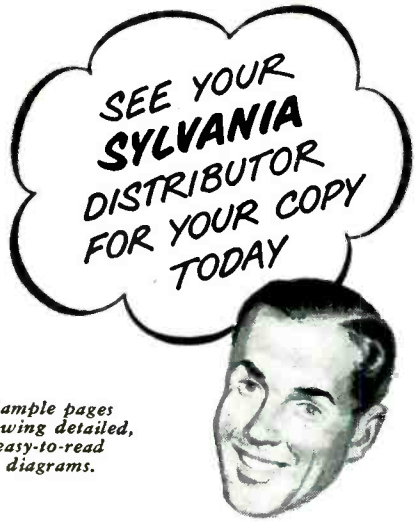
- 48 pages of pictures and diagrams.
- **COVERS RADIO SERVICING**—Signal Tracing, Alignment, AVC and AFC Checking, Measurement of Voltages, Signal Levels, Power Output, Bandwidth and much more.
- **COVERS TV SERVICING**—Signal Tracing, Bandwidth Measurements, Wavetrap Checking, Sound Channel Tests and Alignment, Low and High Voltage Checks, Signal and Deflection Voltage Measurements etc.
- **COVERS AUDIO AMPLIFIER SERVICING**—DC, AC, and Signal Level Measurements; Tone Control, Fidelity, and Gain Tests, Distortion, Power Output and Noise Level Measurements; Signal Tracing, Speaker Matching.
- Covers 19 Miscellaneous Applications of VTVM—Detecting Gassy Tubes, Checking Capacitors, Q Measurement, Turns Ratio Measurement, Impedance Checking.

ACT NOW! Offer good only April 1st to May 31st

Here's a book that will save you hours of service time every week. You'll be amazed how it will simplify everyday service problems. You can't buy this book! It comes to you FREE with the purchase of just one Sylvania TV Picture Tube from your regular Sylvania Distributor. That's all, simply buy a Sylvania Picture Tube, of any type, and your Distributor will give you a copy free. See or write him today.



Sample pages showing detailed, easy-to-read diagrams.



SYLVANIA ELECTRIC PRODUCTS INC. 1901-1951 50th ANNIVERSARY FIVE DECADES OF PROGRESS

SYLVANIA ELECTRIC

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

New Round Shaft

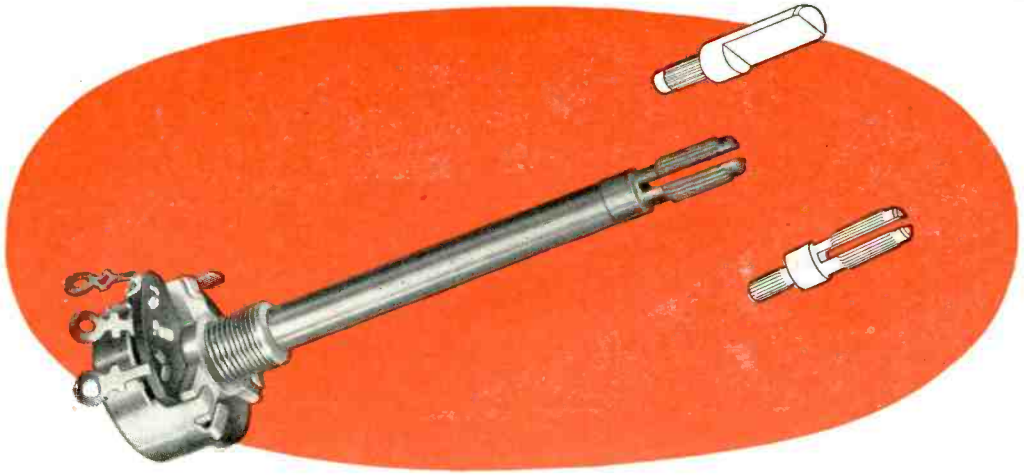
Saves Valuable

Single Section
Mallory Midgetrol

Now you can have the outstanding electrical characteristics of the *time-proved* Mallory Midgetrol . . . with two new time-saving features that make carbon control installation faster and simpler than ever before !

This sturdy 15/16" control is supplied with a *permanently fixed, tubular brass shaft.* It is easily cut to required length. It can be adapted for split-knurl or flatted type knobs in a few seconds by inserting one of the two steel shaft-ends packaged with every Mallory Midgetrol. It has been designed to give you utmost convenience—without sacrificing the important advantage of a stable, permanently secured shaft.

In addition, switch attachment is made simple and sure by positive indexing and a design that permits secure locking in position without removing the control housing.



The Mallory Midgetrol gives you fast, sure, simple installation—with electrical characteristics specially engineered for critical applications in both television and radio. Precision-controlled carbon element assures smooth tapers, quiet operation, accurate resistance values and less drift in TV sets.

Make Sure! Make it Mallory!

Mallory Midgetrol*

Installation Time

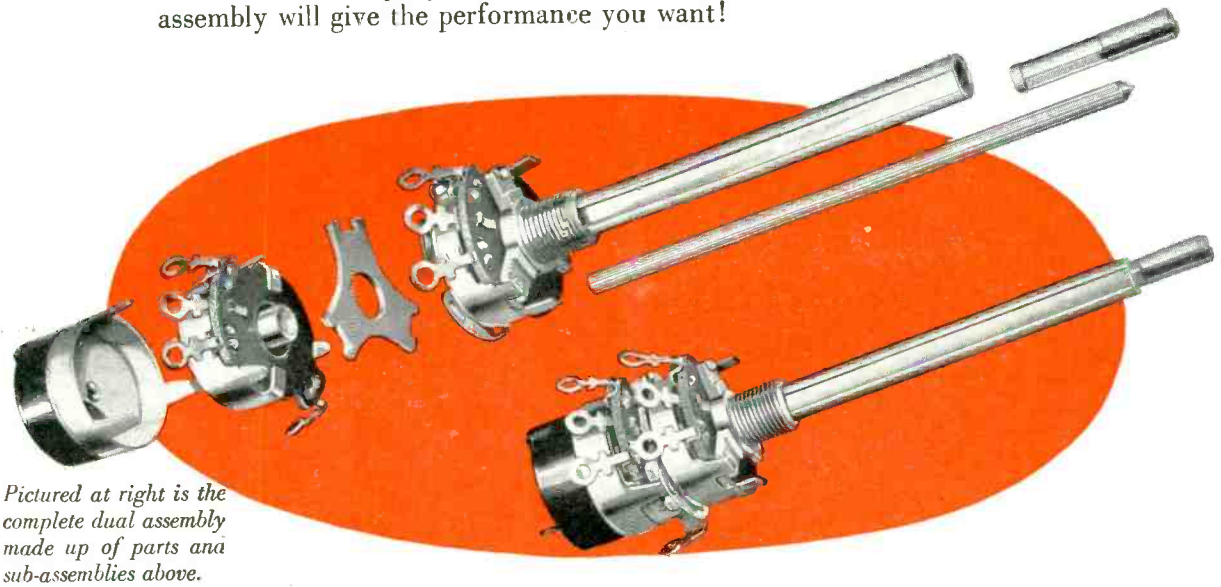
Dual Concentric Mallory Midgetrol

This revolutionary new control can be assembled in five easy steps, in less than five minutes—makes it possible for you to match a wide range of combinations immediately from convenient distributor stocks, and without the high "time" costs involved in more complex assembly operations.

The "exploded" view below illustrates the parts and assembled control sections supplied with each control. Extremely simple, brief instructions show you how to assemble them quickly and surely—without soldering—with only the simplest of tools.

As with the single Mallory Midgetrol, an AC Switch can be attached quickly—with no question of proper position, without removing the control housing.

The control is so designed that both front and rear sections are *factory-assembled and carefully inspected.* You can be sure that your final dual assembly will give the performance you want!



Pictured at right is the complete dual assembly made up of parts and sub-assemblies above.

P.R. MALLORY & CO. Inc

MALLORY

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

*Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

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

Check with your Mallory Distributor right now about this important contribution to better, more profitable service work.

Recommended in the 2nd Edition Mallory Television Service Encyclopedia. Get your copy today!

**Trade Mark*

TRADE FLASHES

[*from page 6*]

This conservation precaution, suggested by the reduced production of batteries for civilian use, was sounded by one of the largest manufacturers whose facilities are being rapidly geared to defense production.

Because heat and low humidity deteriorate dry cell batteries, consumers can keep surplus batteries best by storing them in a refrigerator, preferably in a container but not tightly sealed, according to W. S. Allen, general manager of the Electrical Division of Olin Industries, Inc., New Haven, Connecticut, producers of Winchester-Bond batteries.

A battery should never be used immediately after removal from refrigerated storage but should be allowed to "thaw out" in order to give maximum power.

Sheldon Lowers Tube Prices

TV set manufacturers who have watched the cost of many component parts rising continuously got the good news recently that Sheldon Electric Co. is passing along a manufacturer's savings on picture tubes.

Sheldon, world-famous makers of "Telegenic" Picture Tubes, has just installed the most modern in-line exhaust unit in the industry. This is its second. Sheldon has also installed the longest radiant heating oven in the world designed for screen baking.

Sheldon, a division of Allied Electric Products Inc., announced, that this additional equipment will enable it to produce between 4,000 and 5,000 rectangular, glass-metal and round "Telegenic" Picture Tubes a day.

G. E. Award Winners

Kenneth Fowler and Harold B. Lippert of the G.E. Electronics Department here have received their company's highest honor, Charles A. Coffin Awards, for their preparation of "Television Principles and Practice," the G.E. technical publication for TV service men.

The men were jointly cited for their "outstanding vision and persistence in preparing for pubication the text of an effective television service course."

RCA "Pool of Ideas"

Confidence that the television service industry could, by pooling its ingenuity, effect measures necessary to see it through the critical months ahead in the face of the twin problems of availability of qualified service technicians, installation materials,

SAVE CRITICAL MATERIALS!

Sheldon ELECTROSTATIC FOCUS*

"Telegenic" Picture Tubes

ARE NOW AVAILABLE

FOR PROMPT DELIVERY

SHELDON ELECTRIC CO.

A Division of ***ALLIED ELECTRIC PRODUCTS INC.***

68-98 Coit Street, Irvington 11, N. J.

Branch Offices & Warehouses: **CHICAGO 7, ILL., 426 S. Clinton St. • LOS ANGELES 26, CAL., 1755 Glendale Blvd.**

*** GET COMPLETE DATA! MAIL COUPON TODAY**

Sheldon Electric Company, 68-98 Coit Street, Irvington 11, New Jersey A

Send me
- ☐ Complete data on Sheldon Electrostatic Picture Tubes
- ☐ Television Mis-Information No. 4 with its feature story on Color.
- ☐ Tube Characteristics & Dimensions Chart
- ☐ Bulletin T-2 on "Ion Burns—and How to Prevent Them".

(They're FREE—but please print your name)

Name..... Title.....

Company .....

Street .....

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

SHELDON TELEVISION PICTURE TUBES • CATHODE RAY TUBES • FLUORESCENT LAMP STARTERS AND LAMPHOLDERS • SHELDON REFLECTOR & INFRA-RED LAMPS PHOTOFLOOD & PHOTOSPOT LAMPS • SPRING-ACTION PLUGS • TAP-MASTER EXTENSION CORD SETS & CUBE TAPS • RECTIFIER BULBS

*** SEE IT AT BOOTH 201, PARTS DISTRIBUTOR SHOW, STEVENS HOTEL, CHICAGO, MAY 21-23**

and replacement parts and tubes was expressed recently by E. C. Cahill, President of the RCA Service Co.

As a contribution to the "pool of ideas", the RCA Service Co. will soon make available to the servicing industry a comprehensive conservation and alternate materials program related wholly to installation and servicing of television receivers, Mr. Cahill disclosed.

The supplementary report will contain a compilation of the most commonly used parts and tubes in installing and servicing television sets. A comprehensive cross index indicates the many alternate parts and tubes which can be used when so-called standard components are not readily available.

In the manpower field, Mr. Cahill disclosed, the industry's technicians and servicing agencies will soon be able to obtain, for applications to their own training programs, a specialized, field-tested Television Home Study Course. Developed jointly by the RCA Service Company and RCA Institutes, Inc., for use in training RCA service technicians, the course has been re-edited and broadened by the RCA Institutes' engineers according to General George L. Van Deusen, President of RCA Institutes to provide engineering data and servicing information about all major makes of television receivers.

Mr. Cahill declared that the RCA Service Company will continue to make available the one-year Factory Service Contract as well as the lower-cost limited contract. It will also provide service on a time-and-materials basis to those RCA Victor television set owners who prefer this type of service.

In addition to its own training program, the RCA Service Company, through its established Television Service Clinics, will continue to make available latest engineering and service data to dealers and technicians who service RCA Victor sets. More than 500 of these clinics were conducted last year, with a total attendance of over 35,000 technicians he said.

Gabriel Co. Acquires Workshop Associates

Concluding several months of negotiations, John H. Briggs, president of The Gabriel Company of Cleveland, Ohio, and Gardiner G. Greene, president of The Workshop Associates, Incorporated of Needham, Massachusetts, today jointly announced that an agreement had been reached whereby The Workshop Associates will be-

[*Continued on page 37*]

SYNC PULSES

by San D'Arcy

Electro-static types of picture tubes, and correspondingly revised circuits, would circumvent the extreme shortage of cobalt-contained magnets which has given the TV industry fits. As a matter of fact, now-a-days, you'll find many $300 and $400 list TVsets coming off production lines with 3" and 3½" speakers. It's too bad that the public is being asked to accept such inferior quality merchandise. It would be so much better if manufacturers simply resolved to make less units, without reducing their products' quality. After all, once these "cheapened" sets get out in the field their owners will blame the service fraternity for their inferior performance and high break-down factor. Having seen some of the "junk being used on some TVset production lines now-a-days we emphatically urge all servicemen and service firms to shy away from offering any long-term service contracts.

Conserve Critical Materials *is the slogan, embodied in the form of a shield, which Dr. Burton Browne, nationally known advertising man of Chicago, has offered to all manufacturers for unrestricted use. Never was a theme more timely. So far only a few metals and materials have been classified as "scarce"—but remember, it is planned by the War Mobilization Board to put almost all materials on an allocation basis on or about July 1st, and from then on the going will really get rough. By the very nature of our work, professional servicemen maintain existing equipments in operable conditions by use of replacements which use but little materials and this represents a tremendous saving over the amount of materials needed to build new apparatus. Until we get into an all-out shooting war all classifications of service work should be given a priority rating status in preference to unrestricted civilian production of non-essential and luxury items.*

Shortages of certain types of tubes, particularly 6AK5's and 6J6's have given TVmen heartaches—and poor customer relationships—these past few months. In all parts of the country where there is TV there are many sets out of use for upwards of 5 to 6 weeks at a stretch simply because tubes needed as replacements are not obtainable from any jobber or tube manufacturer. Servicemen are not to blame for this sad state of affairs but it's hard to convince a TVset owner because all he knows is that new TVsets are in plentiful supply, and "if there are enough tubes for new set production there's no reason why there shouldn't be tubes for old TVset owners" according to his means of logic.

Civilian Defense *agencies are in every instance urging all participants, such as Air Raid Wardens, etc., and the general public, to obtain at once, if they do not already have same, at least one portable battery operated receiver in top-top condition and a set of flashlights with spare batteries in the event of an emergency. The suggestion should be heeded, and it is incumbent upon all Service Dealers to try to convince their neighbors to act at once. Besides affording a tremendous amout of busness for Service Dealers it is a basic tenet that an ounce of prevention is worth a pound of cure.*

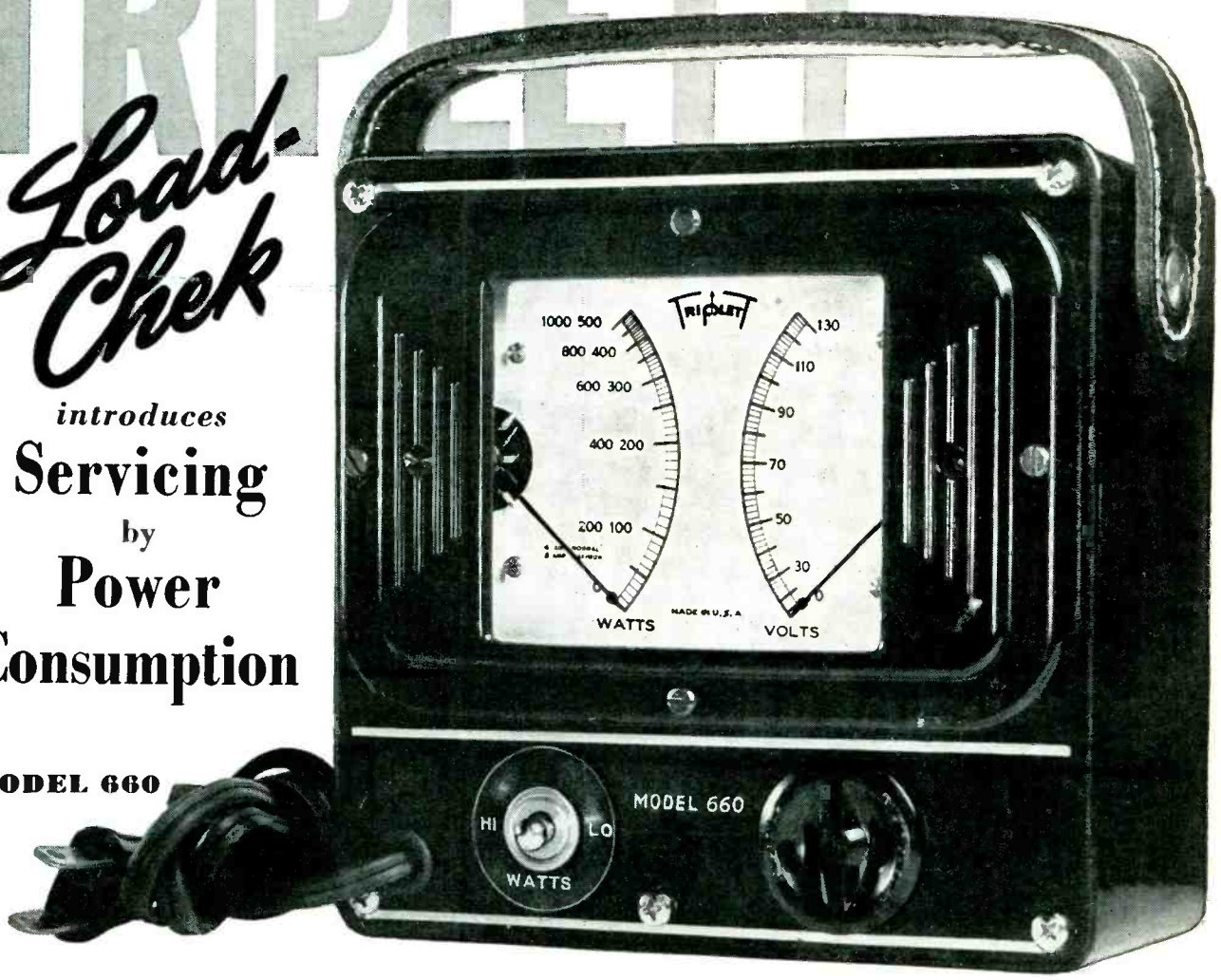
TRIPLETT

Load-Chek

introduces

Servicing by Power Consumption

MODEL 660



LOAD-CHEK *for the first time* makes it possible for every technician to utilize what is perhaps the simplest and quickest of all service methods—Servicing by Power Consumption Measurements.

Power consumption measurement has long been proved by auto-radio servicemen as a rapid method of localizing troubles in auto radios. But Triplett's new LOAD-CHEK is the *first* Wattmeter to be produced *at moderate cost*, and with the *proper ranges*, to bring this short-cut method within the reach of *every* radio and TV service man.

Basis of the LOAD-CHEK method is the tag or label on every radio and TV chassis which shows the normal power consumption. The following examples are only two of many time-saving uses of this new instrument.

LOCATING A SHORT—The chassis tag may show a normal consumption of 225 Watts. Simply plug the power cord of the chassis into LOAD-CHEK (there are no loose ends to connect or be in the way). Note the reading—which should be possibly 350 Watts. By removing the rectifier tube you can determine at once which side of the tube the short is on. With a soldering iron and long-nosed pliers you can check through the chassis, locate and correct the trouble without having to lay down tools or to cheek with lead wires!

REPLACING BURNED OUT RESISTORS—With the chassis to be repaired plugged into a LOAD-CHEK MODEL 660, note the wattage reading with the burned out resistor circuit open. Now replace the resistor. Should the increase in watts be greater than that of the resistor rating being installed, it indicates that an extra load has caused the trouble which has not been cleared.

LOAD-CHEK is made-to-order for the busy service man and can help stop costly "come back" repair jobs. It's a profit-maker because it's a Time-Saver. And at its moderate cost LOAD-CHEK can be standard equipment on *every* service bench. *By all means*, inspect this versatile instrument at your distributor and place your order, for under present conditions we must fill all orders on a basis of "First Come, First Served."

SEE MODEL 660 LOAD-CHEK AT YOUR DISTRIBUTOR'S

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

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FILTERS

for AMATEUR TVI

by **MACK SEYBOLD, W2RY1**

(Tube Department, Radio Corp. of America, Harrison, N. J.)

When scientific progress and production facilities bring new services to the public, interesting problems usually arise. Sometimes these problems are purely technical, and sometimes they are predominantly social. The advent of television has brought forth a reasonable share of difficulties, and one particular problem has arisen—that of amateur radio interference to television reception—which has encompassed both technical and social aspects.

SOLUTION to most of the problems involved in the elimination of TV interference caused by radio amateur transmitters have often been found by amateurs with aid of the professional TV technician, and their results have been applied successfully throughout several television coverage areas. The development and successful application of low-pass and high-pass filters have been a major contribution of the amateur to the art of interference elimination. Other types of interference to television reception can also be eliminated by the application of filters, but this article will be limited to the amateur phases of the problem.

Amateur transmitters are located in residential districts and, generally, are in close proximity to a number of neighboring television receivers. It is this proximity that aggravates the interference condition, both technically and socially. As a matter of fact, the amateur has acquired a public-relations job as well as a laboratory development program. A front-office plus work-bench approach has been found necessary because corrective measures must be taken at the receivers as well as at the transmitters involved.

Harmonic Radiation

If we look at the interference problem from the standpoint of the amateur transmitter, harmonic radiation appears to be the cause of most of the difficulties. This condition exists because many of the television channels have pass bands that are harmonically related to one or more of the amateur bands. What has been considered, in the past, as normal harmonic radiation from a well-designed transmitter, is more than sufficient to wipe a picture completely off the screen of a near-by television receiver.

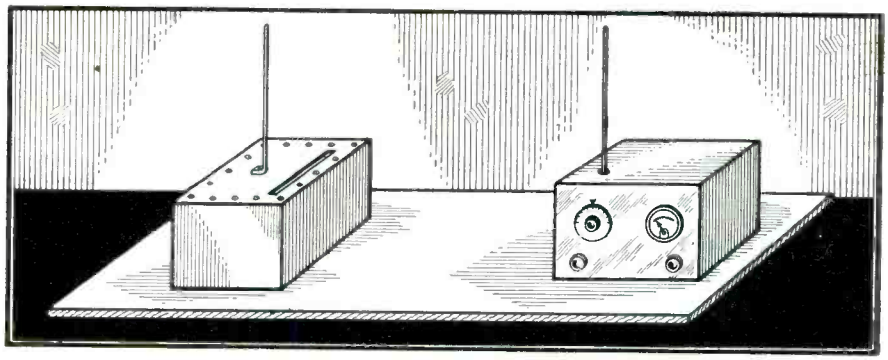


Fig. 1. Sketch of the equipment utilized to study transmitter shielding. A calibrated receiver was used to record the signals available for various types of openings in an aluminum box which contained a battery-operated oscillator.

Varying degrees of this interference phenomenon exist in any given installation, but the limiting case is approached when an extraneous signal is introduced near a picture carrier, and the ratio of the two voltages is approximately 100:1. In other words, when the interfering signal is 40 db below the level of the picture carrier, the threshold of interference is reached, and the beat-note pattern produced is just visible at close range. It is apparent that where a television carrier produces a 500-uv signal at the receiver terminals, a local amateur transmitter radiating a harmonic near the same frequency must not produce more than a 5-uv signal at the receiver terminals if cross-hatching is to be avoided. The same amateur transmitter might produce a fundamental-frequency signal of 0.5 volt at the same receiver location, so there would have to be at least a 100,000:1 ratio between the amateur fundamental and the particular harmonic being produced. A 100-db attenuation of the offending harmonic would be required if an interference-free picture is to be available.

Harmonic suppression in this order of magnitude has been attained in a number of amateur transmitters, not only for one particular harmonic, but for all harmonics between 50 and 250

megacycles. Before the techniques used to produce such a transmitter are discussed, however, let us examine the effect of a "perfect" transmitter upon a near-by television receiver.

Receiver Rejection

Whenever the amateur transmitter and the television receiver are within several-hundred feet of each other, the amateur-band signal is capable of developing a relatively high r-f voltage on the receiving-antenna system. If a transmitter had absolutely no harmonic radiation and was operated on any one of the low-frequency amateur assignments, a near-by television receiver that could not reject the amateur fundamental would suffer one or more of the following ailments: blocking, video i-f or video-amplifier pick-up, heterodyning, production of new harmonics of the amateur fundamental, and other phenomena characteristic of non-linear systems. Picture quality in a receiver thus disposed may vary from a slight cross-hatching on only one or two channels to a condition where the pictures are completely wiped out on all channels.

The visible effects of interference that are due to the inability of the receiver to reject strong low-frequency signals appear in many instances to be identical to those produced by harmonic radiation from an amateur transmitter. Therefore it is sometimes difficult for an amateur to convince the owner of a television receiver being interfered with that correction of the difficulty may not only involve work on the transmitter but also on the receiver. Obviously before an amateur can participate whole-heartedly in a discussion of steps to correct conditions at a receiver he must be reasonably certain that his transmitter is free of harmonics.

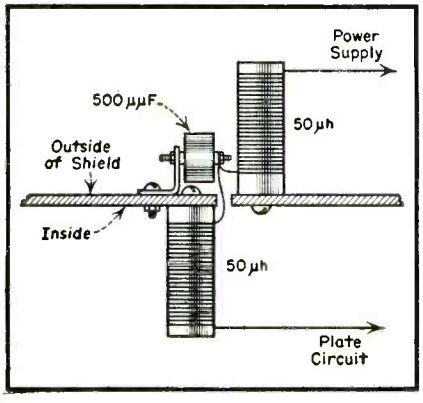


Fig. 2. Supply-line filter for high-voltage leads. For low-voltage lines, a silver-button mica capacitor can be used to advantage in place of the ceramic capacitor shown in the drawing. The capacitor illustrated is of the type used in television receiver kick-back high-voltage supplies.

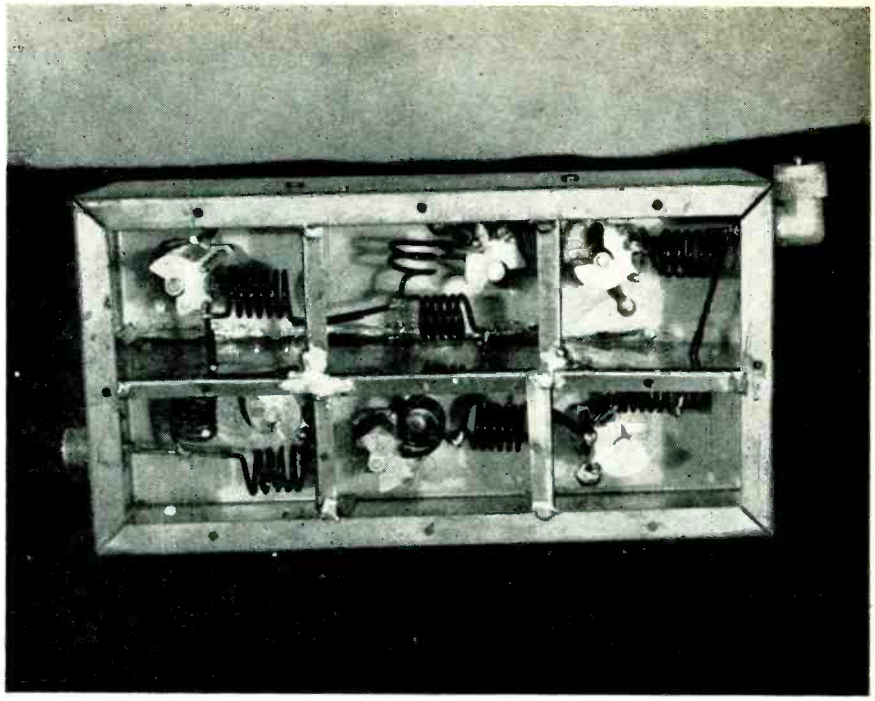


Fig. 3. Six-section low-pass filter for 52-ohm line. The box and lid are steel and the partitions are made of brass. The coils are air-wound #12 copper wire, and the capacitors are regular APC's.

Shielding the Transmitter

It has been found that the most fool-proof approach to a harmonic-free transmitter is to shield completely the entire r-f assembly of the transmitter. Such construction not only minimizes direct radiation from transmitter components, but it eliminates the mechanisms by which signals are coupled to external supply lines which, in turn, can radiate. These coupling paths, even at frequencies as low as 50 megacycles, have been found to be amazingly small in size for the amount of damage they can do to a television picture. *Figure 1* shows how equipment was set up to study the signals available from a ¼ wavelength radiator placed at various points on the top of a battery-operated oscillator shield which had one slot 5 inches long and ½ inch wide. Many types of openings that are normally found in transmitter cases were studied with this equipment, and from the data obtained, requirements for shielding were established.

Because of the slot-type of coupling path, conventional louvres, meter holes, and dial-face cut-outs are not advisable. It has been found that even a 3-inch crack only a few thousandths of an inch wide can couple energy to an external wire. Complete shielding means electrically tight joints and bonded copper screen emplacements for ventilation.

Supply leads for power and control circuits must all be filtered at the points where they leave the r-f shield. Numerous circuits have been utilized for this filtering operation, but one of the simplest and yet one of the most effective arrangements is shown in *Fig. 2*. A by-pass capacitor with extremely short leads is used to present a low-reactance path to the shield for signals above 50 megacycles. The external and internal lines connected to the capacitor are maintained as high-reactance circuits by means of the 50-microhenry chokes. This type of filter is easy to install, and does not require deviation from normal chassis-wiring technique. Supply-line filters for potentials below 500 volts can use silver-button mica capacitors instead of the high-voltage ceramic shown in the drawing.

After the transmitter has been constructed so that no radiation in the television-frequency range can be detected when lengths of wire are connected to the outside of the shield at numerous points, the transmitter is ready to have a low-pass filter placed in the transmission line to the antenna.

Low-Pass Filters

There are three major items that have been involved in the successful application of low-pass filters to amateur transmitters. These items are:

1. Shielding of the transmitter to prevent coupling of harmonics to the transmission line.

DETERMINATION OF "m" AND "K"

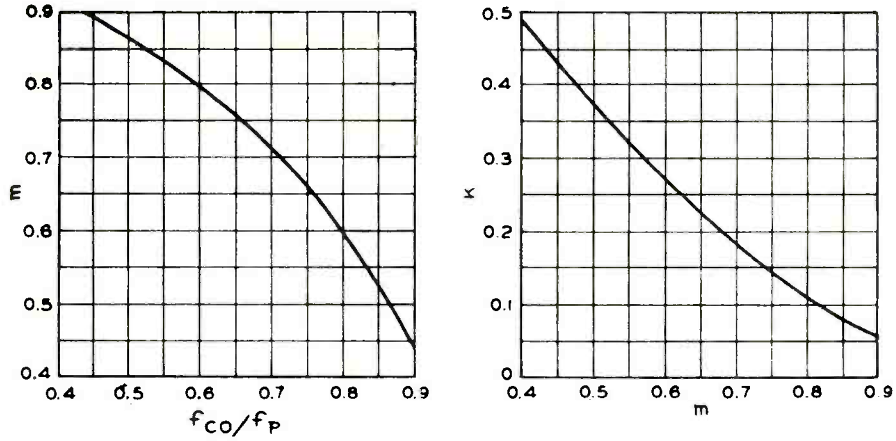


Fig. 5A. (L) Determination of "m" for each intermediate section. Divide the design cutoff frequency, f_{co}, by the frequency, f_p, at which the section is to attenuate markedly, and use the resultant number on the horizontal axis of the graph to determine "m".

Fig. 5B. (R) After determining "m" for the section, use this value of "m" to locate the value of "K" on the second curve.

2. Development of a mechanical design for a filter that is not too difficult to construct with hand tools, but which will still permit reasonably efficient operation of the filter in the attenuation and pass bands.

3. Presentation of design information and equations in simplified form so that the amateur can quickly and easily determine the values of components to fit the conditions of his particular installation.

The first item—complete shielding—can be circumvented somewhat in some locations where television signals are strong and if certain precautions are taken in positioning the transmission-line fitting, or by the application of plate traps and other devices to minimize the generation of harmonics. Maximum control of harmonics, however, is attained with complete shielding.

Shielding is definitely required to minimize radiation from the components of a low-pass filter. A metal case is used to house the components, and internal partitions are utilized to reduce the coupling between sections. Air-padder capacitors or high-voltage ceramics are used in the capacitive branches of the filter, and coils made of #12 copper wire function well in the inductive branches. A steel chassis, 2 x 5 x 9 inches, with partitions soldered to the walls and bottom and bolted to the lid is sufficiently large to house a six-section filter and can be made with basic tools - hand saw, screw driver, pliers, hand drill, and soldering iron. *Fig. 3* is a photograph of a six-section low-pass filter.

When a transmission line is operated at a standing-wave ratio of 3:1 or better, very little loss is encountered in one of these filters throughout the range from 1.7 to 30 megacycles. Above 45 megacycles, attenuation is sufficient to reduce harmonic radiation to levels incapable of creating interference.

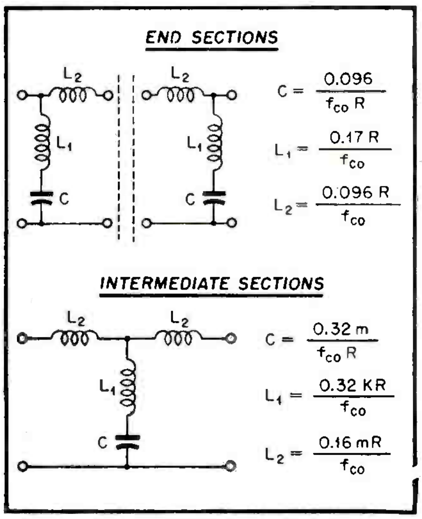


Fig. 4. Formulas are for components in a low-pass filter. Any number of intermediate sections may be inserted between the two end sections, but from one to four are generally employed. L and C are expressed as henrys and farads. R is the characteristic resistance of the transmission line. f_{co}, in cycles per second, is the design cutoff frequency for the entire filter. The matching factor "m" is obtained from Fig. 5A, and K is given in Fig. 5B.

Design Considerations

Most of the filters in use by amateurs have series-derived, m-type sections. These units require fewer purchased components than the shunt-derived types, and the theoretical attenuation per section for both types is identical. In time, behavior differences between the two types may indicate which should be chosen, but thus far economy has been the deciding factor.

In order to minimize the paper work in designing filters and to reduce the chances for arithmetical error, the equations for designing filters have been simplified to the point where known values can be "plugged in" to the equation, and a quick multiplication and division brings forth a direct value for a specific component.

Figure 4 shows the circuits and simplified formulas for the end sections and the intermediate sections. The end sections have a value of "m" equal to 0.6, and the value of "m" for the intermediate sections is obtained from *Fig. 5A*. The function $\frac{1-m^2}{4m}$ is also required for intermediate sections, but this expression has been written into the equations as "K", the values of which can be obtained from *Fig. 5B*.

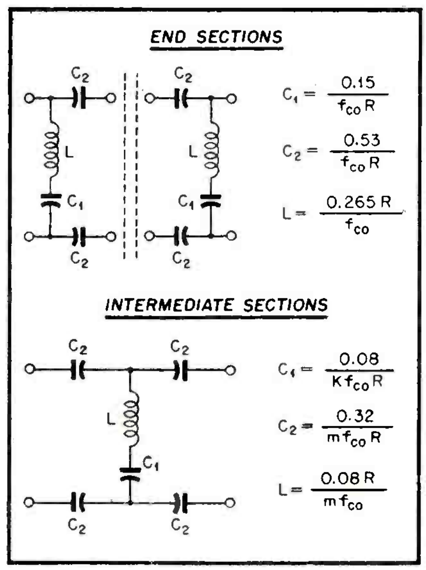


Fig. 6. Formulas for series-derived high-pass filter for television receivers. The method of calculation is the same as for the low-pass filter. The only difference is that in determining "m" from the graph, Fig. 5A, divide the attenuation-peak frequency, f_p, by the cutoff frequency, f_{co}, and use that value on the horizontal axis of the curve instead of $\frac{f_{co}}{f_p}$.

With all reasonable simplification of filter and transmitter design, and with as many "unknowns" as possible removed from the variables involved in harmonic control, the amateur still has a big job in applying present knowledge to the improvement of his transmitter. It is not something that can be accomplished in "just a few evenings of work"; it requires many hours of patient effort. It requires cold cash, too, for sheet metal, heavy copper screen, solder, and component parts.

After the hard work has been completed, however, and the transmitter no longer radiates harmonics, the amateur is happily conscious of the fact that he has produced a superior piece of equipment. His television-interference job is theoretically finished, but in reality there is usually additional work that must be done at the receiver end of the interference combination.

Work at the Receiver

A wide variety of conditions exist at receiver locations, both from an electrical and a cooperative standpoint. Corrective measures taken at the receiver require cooperation with service organizations, advice on technical matters, production-line methods for the construction of high-pass filters, non-technical dissertations on non-linear systems and heterodyning, and a great deal of tact.

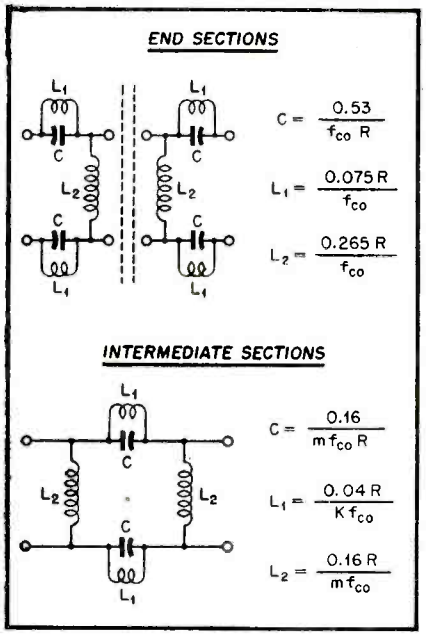


Fig. 7. Shunt-derived high-pass filter sections. The directions for calculating are the same as for series-derived sections, and construction of the two types is similar. Small mica capacitors can be used for the nearest available value of C, and the coils can be made of #28 cotton-covered wire and set at the correct inductance values with beeswax. Shielding of the high-pass filters has not been found necessary in most cases.

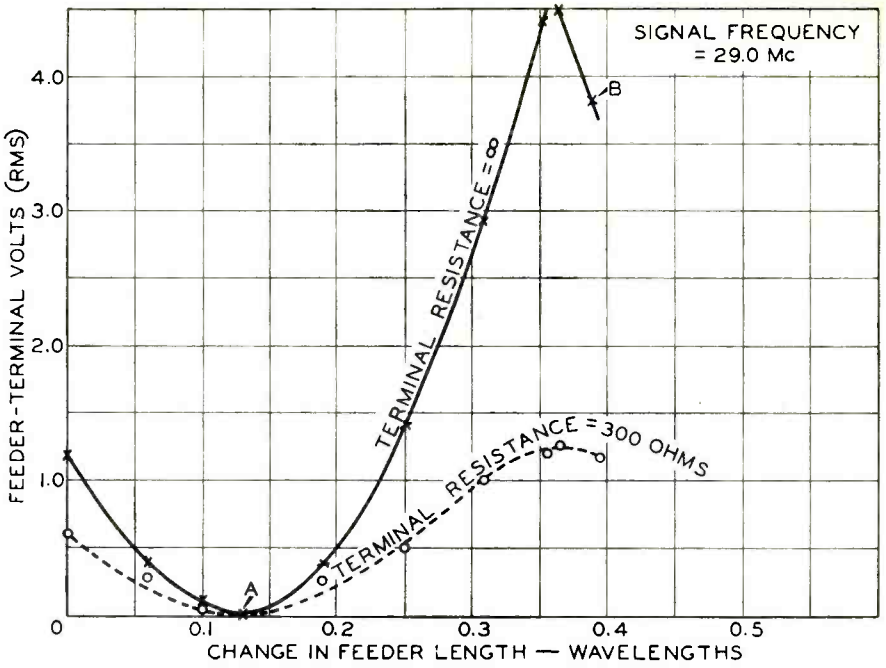


Fig. 8. Voltages available at a television set when different lengths of TV feeder are used. The signal measured was from a 10-meter transmitting antenna located 70 feet from the TV receiver. The TV feeder was varied in length from 45 to 60 feet to obtain the data shown.

Actually, the best preparation is to possess a good high-class filter or a set of tuned traps to make a quick installation at the receiver which exhibits interference, so that a demonstration can be made of the marked improvement that is possible when the amateur fundamental is rejected.

Television receivers in the field vary in low-frequency rejection capabilities. Some have an untuned input circuit; others have a tuned r-f stage and a built-in high-pass filter. In most cases, a tuned trap in each leg of the receiver transmission line at the set terminals will eliminate the amateur fundamental, but traps are satisfactory only if the amateur operates on one narrow range of frequencies. If he is operating on a number of bands, or at numerous points in any given band, traps are inadequate. Most amateurs have equipment on several bands, and all are free to fire up a new transmitter on any band at any time, so an efficient high-class filter is the obvious solution to receiver rejection problems.

High-Pass Filters

The more remote receivers that evidence only a moderate amount of interference can be corrected by installing simple filters containing two series-derived, m-type sections. Where more marked interference is encountered, three or four sections may be found necessary

In some of the tests that have been run where the transmitting and receiving equipment were but a few feet apart, a filter composed of four shunt-derived Π sections was found to be the most effective in rejecting 20-, 11-, and 10-meter signals. A comparable series-derived filter theoretically has the same attenuation characteristics, but it doesn't reject quite as well under these particular conditions. A study of these filters is in progress but, in the meantime, simplified equations have been prepared, and a number of the filters have been built by amateurs and have been installed at the input terminals of their neighbor's television sets. *Figure 6* shows the simplified formulas for series-derived high-pass configurations. All of the filters discussed in this article have been developed from the basic equations presented in T.E. Shea's textbook, "Transmission Networks and Wave Filters". *Figure 7* shows the simplified shunt-derived data. Graphs for "m" aind "K" in the intermediate sections of the low-pass filters are also used for the constants in the high-pass filter formulas.

There are some instances where r.f. has been found to enter the receiver on the 110-volt line. Chokes inserted in the power cord right at the set

[*Continued on page 46*]

How To Use

SWEEP GENERATORS

PART 2

by **MATTHEW MANDL**

In this final installment the author describes the purpose and operation of the marker, and outlines various procedures and precautions that must be followed in order to obtain a proper set of curves on the oscilloscope.

THE important place that the sweep generator has in modern television servicing lies in the fact that it is the one means of enabling the technician to produce an actual visual indication of amplifier response. This means that aligning, tracking, signal tracing and other applications of the sweep generator take the procedures out of the haphazard class because constant observation of performance is obtainable.

The sweep generator alone, however, is inadequate to fulfill the strict frequency requirements encountered in television and FM work, and for precise results it is necessary that a marker generator be employed to act as frequency indicating guideposts along the response curve traced out on the oscilloscope screen.

The marker generator is, in reality, nothing more than a single generator of the same variety used in radio servicing. The essential differences, however, between the two are that the marker generator has a frequency range much higher to cover the necessary VHF television bands, and that its accuracy must be of a much higher order than the one used for radio servicing. When such a marker generator is coupled into the same amplifier stages as the sweep generator, the heterodyning action of the narrow frequency marker generator will put a "niche" or "pip" type of mark along the response curve. This slight irregularity in the response curve tells us what the frequency at this point is. (See *Fig. 1*)

If the frequency of the marker generator is set at a higher level, the marker pip will move along the curve to give an indication of where the new frequency setting of the generator corresponds to the proper frequency along the response curve. In this manner various points along the curve can be evaluated in terms of frequency and thus the characteristics of the response curve can be changed until the marker points indicate perfect alignment. At those places where the trap circuits of the receiver are giving spots of decreased gain, the marker indication will be much smaller in amplitude than on the normal portion of the response curve.

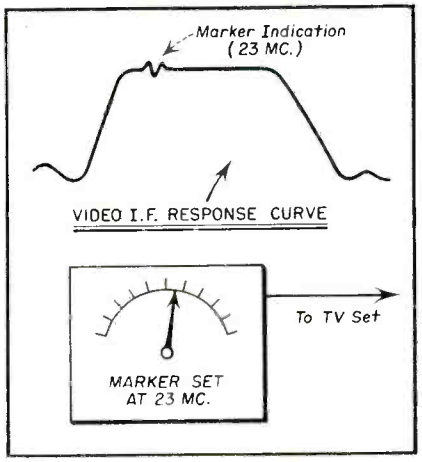


Fig. 1. A marker connected up with a sweep generator results in a pip on the swept curve.

Types of Markers

Marker generators may be separate units, or they can be incorporated into the sweep generator proper. If a separate marker is employed it can be attached to the same point at which the sweep generator is feeding a signal into the circuit under adjustment. To prevent interaction between the two, however, it is better to inject the marker signal at a place other than where the sweep signal is being inserted—preferably a stage ahead of the sweep generator. Undue circuit loading is thus avoided and the amplitude of the marker signal—which should always be low—can be controlled more readily. Excessive marker signal amplitude will break up the response curve and give incorrect band-pass indications.

Grid-dip meters, absorption wavemeters, and other resonant circuits can be employed to give marker indications on the response curves traced out on the oscilloscope screen, though the least troublesome type for external use is an accurately calibrated marker generator.

The types of markers which are incorporated within sweep generators may be the variable frequency type like the external marker generator, or the crystal type. By use of several quartz crystals ground to accurate frequency, stationary marker pips can be inserted on the response curve to give indication of the frequency points corresponding to crystal frequency or harmonics thereof. Thus a 10 mc crystal would give marker indications at 10 mc, at 20 mc (2nd harmonic) and at 30 mc. Another fundamental marker indication on 1 mc would show pips at 1 mc intervals throughout the response curve. A typical front panel layout for a sweep generator employing internal marking is shown in *Fig. 2*. This also has a jack so that an external marker can be used, besides a jack into which various frequency crystals can be plugged for marker usage. While manufactured models

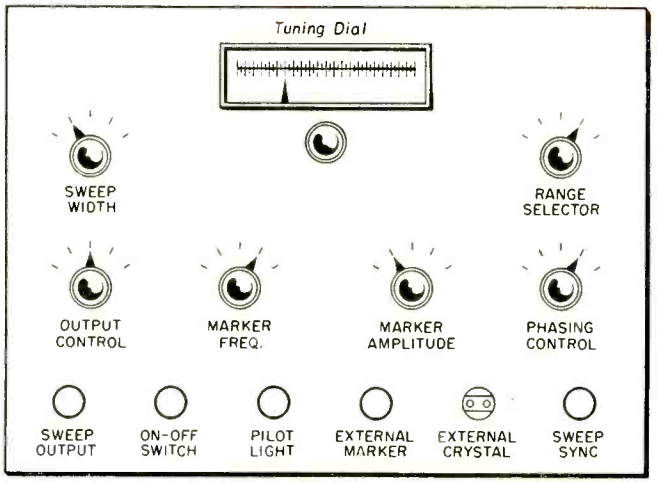


Fig. 2. (Left) Typical panel controls of sweep generator with internal marker.

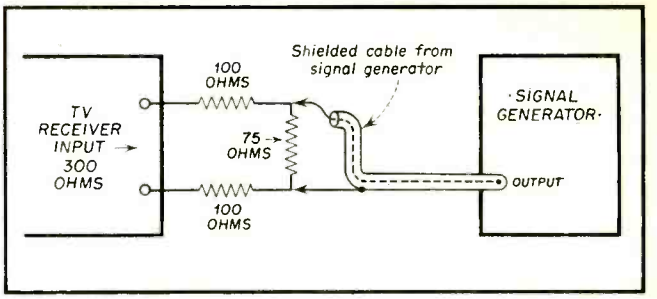


Fig. 3. (Above) Matching low ohm unbalanced output of generator to balanced receiver input.

will have variations in the placement of such controls, the basic types illustrated will be found in general use.

Precautions when using Sweep Marker & 'Scope

Inasmuch as front ends of TV sets as well as i-f systems differ to a considerable extent among the various manufacturers, no two receivers are aligned in exacty the same sequence of procedures, through general rules do apply. When undertaking tracking or alignment of TV or FM receivers it is always best to refer to the detailed steps given in the service manual for the receiver in question. Many a technician has found however, that even though he uses the manufacturer's service notes and follows each step as detailed, final results are far from satisfactory, and none of the equipment seems to perform in the expected manner. This is due, to a great extent, because a number of important factors are overlooked which are not always mentioned in the service notes for lack of space.

These factors all hinge around the more than ordinary precautions which must be observed when working at the very high frequencies encountered in television and FM servicing. Because of these high frequencies, all leads must be as short as possible to minimize losses and shielded wire must be used when interconnecting sweep marker and 'scope in order to avoid the affects of stray fields. Even a few inches of unshielded cable at the 'scope or sweep generator is sufficient to upset expected results.

Lack of proper bonding between the units is also detrimental to best results, because a floating ground of a sweep or 'scope will seriously affect performance. Besides this, the fields of local oscillator coils can also feed into the 'scope to influence the final pattern and give false indications of response curves. For these reasons tracking and alignment of TV or FM sets becomes a much more painstaking procedure than that employed in radio alignment and the proper use of sweep generators and associated equipment goes beyond the step-by-step aligning procedures which merely give points of hook-up and stage sequence methods.

Since the alignment procedures for various sets differ, but the precautions apply to any alignment or tracking procedures involving sweep and marker generators, it will be found worthwhile to keep the following points in mind when using such equipment.

1. Do not attach an unbalanced output connector from a sweep generator or marker generator to a balanced input of a TV receiver. If the TV receiver input is a 73 ohm unbalanced affair (one terminal at ground potential) the generator cable may be connected directly. If the input to the receiver is a balanced 300 ohm type, use the resistor network shown in *Fig. 3.* This will match the 75 ohm cable to the 300 ohm input, and also satisfy the balanced input requirement.

For impedance differences other than those shown, different values of resistors can be used. Make sure the generator cable is connected across a resistance value equal to its output impedance, and the receiver "sees" a resistance equal to its input design.

2. Do not attempt tracking of a television receiver front end if you do not have better than average equipment. *Figure 4* illustrates how the sweep generator and the oscilloscope are connected for tracking the r-f—mixer—oscillator stages. This is the recommended procedure of many manufacturers, but this requires a sweep generator with high output and a 'scope with better than average sensitivity. A cheaper variety of 'scope having poor sensitivity will give no indication whatsoever when connected to the mixer grid, since the amplitude of the signals here is very small. The 10,000 ohm isolating resistor should be used in series with the 'scope lead so that the latter will not load down the mixer grid input.

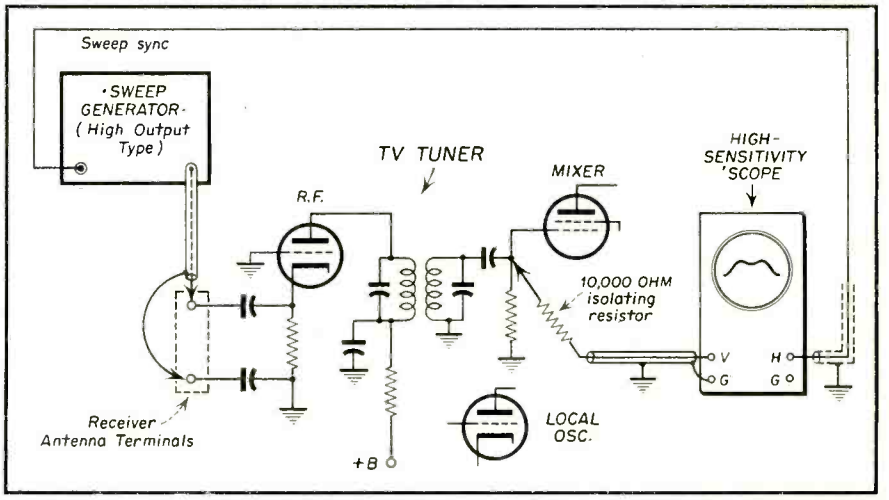


Fig. 4. Sweep generator and 'scope connections for checking alignment of TV tuner.

With a high output sweep and a good 'scope, the sweep frequency injected into the input of the r-f stage will give voltage variations across the grid circuit of the mixer tube and thus trace a pattern on the 'scope screen. Slightly more gain can be realized by connecting the scope to either the screen or plate of the mixer tube, though a high sensitivity 'scope will still be found a necessity.

3. When aligning video or FM i-f stages, the general hookup is similar to that shown in *Fig. 5.* Two precautions should be observed here: Use an isolating capacitor in series with the sweep generator so that bias voltages will not be shunted by the generator. A capacitor across 'scope output as shown in the illustration helps reduce pick-up of spurious signals.

4. If possible, remove the local oscillator tube in the tuner before attempting i-f alignment, so that radiation of the oscillator frequency will not leak into the 'scope circuit and cause a fuzzy and distorted pattern. Removal of the horizontal and vertical sweep oscillator tubes will also be found helpful in reducing undesired interference with the proper formation of the desired response curve.

5. Remember that your marker generator is really a single signal generator, and as such is the perfect instrument for aligning "stagger-tuned" i-f stages if you are sure it is accurately calibrated. Use the marker as shown in *Fig. 6* for trap and i-f alignment of a stagger-tuned system; then check over-all response with sweep and 'scope as shown in *Fig. 5.*

6. Do not attempt any aligning unless you are sure your marker generator is accurate. Make periodic checks of its frequency against known standards such as accurate crystals or the broadcast frequency standards sent out by the Bureau of Standards.

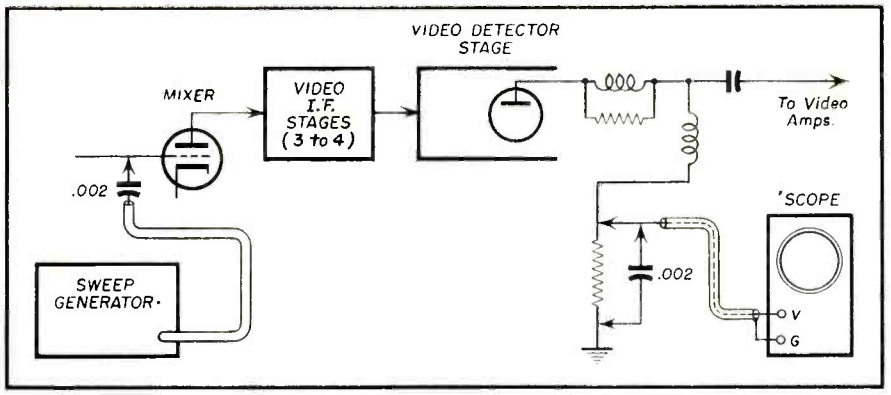


Fig. 5. Isolating and by-pass capacitors aid in proper sweep and 'scope performance in the alignment operation of a TV receiver.

An inaccurate marker may cause the final alignment to be worse than it was originally and will result in the loss of many man-hours of time.

7. While the grounding of all test equipment is almost a necessity for good results, precautions must be observed with respect to "hot" chassis. Check to see whether or not the receiver is a transformer type, or if the load resistor across which you connect the 'scope is actually at ground level. Serious shorts and damage can be avoided by remembering to investigate before hooking up equipment.

8. When using the "sweep sync" output of the sweep generator to sweep the horizontal trace of the oscilloscope, make sure you shut off the internal sweep of the 'scope. Do not, however, shut off the horizontal sweep amplifier, for this is still necessary even though our sweep voltage is secured from the sweep generator.

9. Watch out for over-loads from both sweep generator and marker. Many an attempted aligning job fails because the operator does not decrease the amplitude of the injected signals. Too much sweep signal will over-load the amplifier stages and cause the resultant pattern to be highly distorted. Keep the output as low as possible while still getting a good picture on the 'scope. Adjust the vertical amplifier of the scope to increase pattern height. Too much output from the marker will also result in severe distortion of the pattern and this generator's output should also be keep just high enough to give a small pip on the response curve

10. Make sure your equipment has been turned on from 15 to 20 minutes before being put to actual use. In this manner you are assured that the frequencies will not shift while you are using the equipment.

11. Do not minimize the necessity for trap adjustments even though the receiver is used in a signal area where adjacent channel reception is impossible. Improper setting of traps may result in trapping out frequencies which are part of the desired response curve.

12. Make sure you satisfy the bias adjustment requirements set by the manufacturer during alignment or tracking procedures. The r-f and video i-f stages should have their bias set at between 3 or 4 volts, to represent average signal conditions.

Too low a bias value will give more than normal amplifier gain for alignment purposes and may result in oscillation during the tracking or adjustment procedures. With most of the modern receivers utilizing some form of a.g.c. the bias may have to be set by an external battery. Here, again, the amount of bias for a particular receiver will be found in the service notes issued by the manufacturer.

13. As with all aligning, whether radio, FM or television, as the gain of the stages is increased the scope pattern (output level at detector) increases. If the receiver had been badly out of alignment, the 'scope

[*Continued on page 45*]

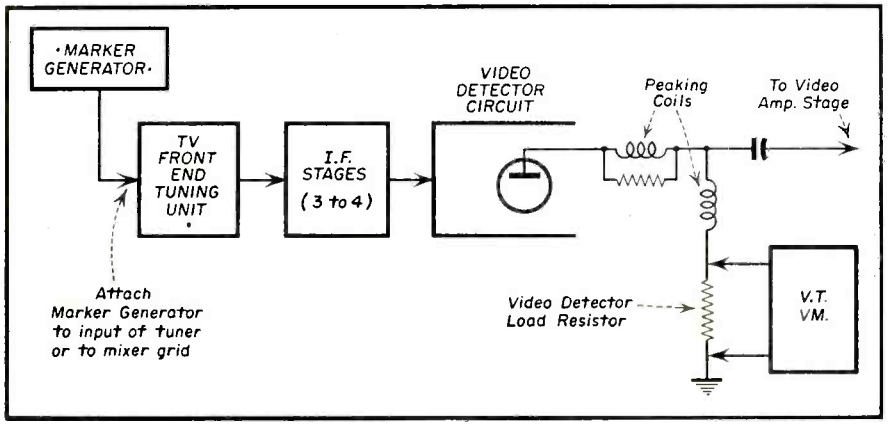


Fig. 6. Use of marker to check for trap and i-f alignment in stagger-tuned system.

MEN OF RADIO

PART 2 **by WILLIAM R. WELLMAN**

Continuing his biographical sketches of the "Men of Radio", together with the discoveries for which they gained fame, the author discusses the work of James Clerk Maxwell and his prediction of the existence of electric waves, Hertz and his proof of their existence, and Branley and his discovery of the Coherer. The editor welcomes your reaction to this series.

IN the previous article in this series, some of the earlier attempts at wireless communication—those prior to 1880—were reviewed. Only one of these had been even an approach to signaling by means of electric waves; at the time the experiment was performed, it had not yet been clearly demonstrated that waves capable of being radiated through space even existed. A small group of scientists, however, believed that such waves really existed and would one day be put to practical use. One of the leading proponents of this idea was Maxwell.

James Clerk Maxwell

James Clerk Maxwell, physicist and writer, was born in Edinburgh, Scotland on November 11, 1831. As a youngster he was rather precocious. His preference for scientific and mathematical study rather than play attracted the attention and ridicule of his friends who regarded him as a bit eccentric and nicknamed him "Dafty".

Is was not until Maxwell began his college work that he gave real evidence of remarkable powers of concentration and scientific thought. He completed his work at the University of Edinburgh and graduated from Cambridge in 1854. After a few years as professor at a college in Aberdeen and at Kings College in London he joined the Cambridge faculty as professor of experimental physics. His research work extended into the fields of heat, principles of dynamics and kinetic theory of gases.

Early in his life he developed an inquiring turn of mind which led him to speculate about many natural phenomena that were often taken for granted by the scientists of his day. One subject of his speculation was the nature and propogation of light. How

Heinrich Rudolph Hertz
(1857-1894)

did light travel from one point to another? Through what kind of medium did it travel? Maxwell asserted that light traveled with a wave-like motion and went on to develop mathematical formulas to prove his theories. He went further and stated that electricity and light were both electromagnetic; that they were just different manifestations of the same thing. In support of this idea, he called attention to the fact that both traveled at the same speed—about 186,000 miles per second.

Although not a shred of evidence had been found to prove the existence of electrical waves, Maxwell stated that such waves existed, that when discovered they would be found to have a wavelength greater than light waves and that, like light waves, they would be capable of reflection and refraction.

Maxwell's theories remain classics of scientific thought, although they remained unsubstantiated for years after his death, in 1879. By this time, scientists had begun to suspect that electricity was not always a simple, one-directional flow of current. Professor Joseph Henry, an American, had clearly demonstrated that the discharge of a Leyden jar was oscillatory; that is to say, the discharge consisted of a series of current surges in alternate directions. But the final proof of Maxwell's theories, and with it the discovery of radio waves, key to modern communication and entertainment, was the work of Hertz.

Heinrich Rudolph Hertz

Heinrich Rudolph Hertz, who not only discovered radio waves but invented the first practical method of generating them, is probably less well-known than any other great figure in radio, at least insofar as his life outside the laboratory is concerned. This is probably due to the fact that he was very shy and retiring and shunned ostentation and all forms of publicity.

Born on February 22, 1857 in Hamburg, Hertz was the eldest son of thoughtful, considerate parents who were intensely interested in his future. Rather early in life he selected civil engineering as a profession, despite the fact that while still in high school he had developed a passion for pure science. Fortunately, his studies were interrupted by compulsory military service. While still in the army, he had time to think over his choice of a career and decided that he had made a mistake. He had made up his mind that he could be completely happy only in scientific investigation and he discussed the matter with his parents. They agreed that his future happiness in a profession was of paramount importance, and approved the change in his studies.

Although the course of study selected by young Hertz was very heavy in mathematics and physics, he did not entirely ignore the older, classical type of education then on the way to obsolescence in Germany. He learned to speak both French and English well, and H. Bonfort, in a sketch of Hertz's life published in the Journal of the Smithsonian Institution shortly after the scientist's death, noted that he was regarded as a charming conversationalist whether speaking German, French or English. At one time he became interested in the study of Arabic and learned the rudiments of Arabic speech within a short time. He could also read Italian well enough to enjoy classics in that language.

While studying at Munich and Berlin he worked under two of the most famous scientists of that period—Kirchoff and Von Helmholtz. The name of Kirchoff is familiar to most electrical and radio technicians because of his investigations into the laws of current flow; Von Helmholtz conducted extensive research in electricity and optics and invented the ophthalmoscope, an instrument now in universal use in examination of the eye.

Von Helmholtz soon recognized Hertz's superior ability and made him his assistant; it s quite likely that it was he who first implanted in the young scientist's mind the idea of studying electrical waves. Von Helmholtz knew that the Berlin Academy of Science had offered a prize for original research in this field and suggested that Hertz might find it a particularly interesting problem.

The actual work did not begin immediately however; young Hertz had first to establish himself in a position where the facilities of a large, well-equipped laboratory would be made available to him. He accepted a position as an unsalaried professor at the University of Kiel, and during his stay there began seriously to consider Maxwell's theories. He kept a diary, and an entry made under date of January 27, 1884 shows that the train of thought which eventually led to his great discovery had already begun: "Thought about electromagnetic waves. Reflected on electromagnetic theory of light." Although this and other notations show that he was giving serious thought to the problem, actual experimentation did not begin until some time later.

His ability as a college instructor had by this time attracted the attention of German educators, and very soon he was offered, and accepted, a position as full professor at the Polytechnic Institute of Karlsruhe. His stay there was probably the happiest period of his short life. Not only were the surroundings congenial, but an acquaintance with the daughter of a colleague, Professor Doll, ripened into love and culminated into a happy marriage.

First Experiments

Hertz's earliest experiments in electromagnetics began when, according to the most authoritative sources, he set up and used a pair of Knochenhauer spirals for a laboratory demonstration. The demonstration was probably routine, and involved the use of two pancake-shaped coils of flat metal ribbon, wound in spiral form; the ends of the coils were terminated by small brass balls. He arranged the two spirals on a vertical stand so that their faces were parallel and close to each other.

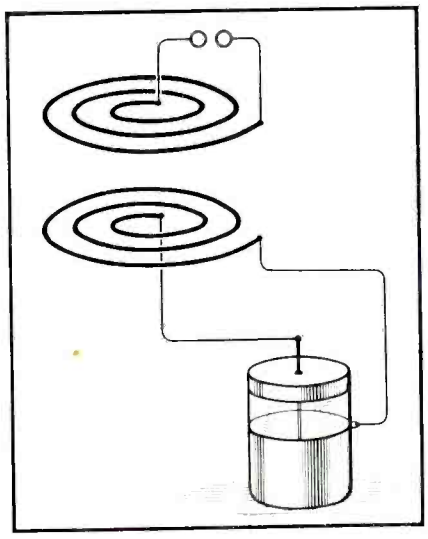


Fig. 1. Circuit used by Hertz to demonstrate electric waves.

When Hertz connected a charged Leyden jar to the terminals of one coil, he was startled to see a spark pass between the free ends of the second coil. The arrangement of his apparatus during this historic experiment was probably similar to that illustrated in *Fig. 1.*

The effect he obtained was not spectacular, for the separation between the spark terminals was not very great; one had to observe closely, because the spark was of short duration and barely visible. But Hertz was impressed by two circumstances: first, there was no apparent physical connection between the two coils, and from this he reasoned that the spark was the result of some kind of invisible wave or vibration passing between the first coil and the second. Clearly, these waves were not light, since there was no visible evidence of its passage, but perhaps they were related to light—the waves described by Maxwell. The second important point was the hope offered for future experiments in the field; although the manifestation was slight, it was true that the original Lelden jar discharge was equally slight.

Further research showed that he had indeed discovered electromagnetic waves—Hertzian waves, to give them their correct designation—but even then their discoverer apparently did not realize the full implication of his findings, nor was he completely satisfied with the results. He did not visualize his discovery as the basis of a new method of communication and the foundation of a vast group of industries. One Herr Huber felt that perhaps the waves could be used to convey messages and wrote to Hertz asking his views. In his reply, Hertz patiently explained that in his opinion the idea was not practicable because the sending and receiving antennas, in order to resonate to the wavelengths that would have to be employed, would be of immense physical size.

While on the subject of wavelength, it is worth noting that in the course of his work Hertz accomplished a great deal in the field of short-wave generation and propagation. Some of his papers described the investigation of waves as short as thirty centimeters, a short-wave operation even when judged by modern standards.

Observations of Resonance

As his investigation progressed, new apparatus to meet his needs was developed. He soon found that the duration of the received oscillation was too short for satisfactory observation. For a method of generating a more sustained wave he turned to the induction coil, perfected by Daniel Ruhmkorff. Next, he observed that improved results were obtained when the transmitting and receiving apparatus were "in tune", or resonance. This was accomplished, in some early experiments, by replacing the Leyden jar with an open spark gap, but later the apparatus that is usually described in science textbooks was evolved. While experimenting with this equipment he discovered the resonant properties of the di-polar, or Hertzian antenna, the forerunner of modern FM and TV aerials. He used two copper rods, each about three feet long; these were placed end to end just like the two elements of a simple FM antenna. The inner ends of the rods were separated a short distance, forming a spark gap. At the outer end of each rod there was a copper sphere, slightly less than a foot in diameter. *Figure 2 shows* the general arrangement of apparatus. Tuning

was accomplished by varying the length of rod, the diameter of the sphere, or both. Meanwhile, the receiver had been changed also, and now consisted of a simple circle of wire, broken at one point. Located in this break was a micrometer spark gap with a screw for adjustment. The receiver was brought into resonance with the oscillator by changing the diameter of the circular loop of wire.

The popular conception of Hertz's work credits him merely with the discovery of radio waves; actually he went much further than this. He not only discovered radio waves, but developed a practicable method of generating them that was used by Marconi and his contemporaries. He proved the truth of Maxwell's theories by measuring the waves, by reflecting them from large metal mirrors and by bending, or refracting them with prisms made of pitch.

When he was sure that he had amassed enough information on the new waves he began the preparation of a series of magnificent papers on the subject. The climax of his career came when he was asked to describe his work before the Congress of German Naturalists assembled at the University of Heidelberg. The reaction to his historic lecture was astounding, not only because of his discoveries but also because of his sincerity and modesty. Here was a man who had made one of the outstanding discoveries of his age, yet was modest enough to say: "I am not able to show you in how many ways the path was prepared for my experiment, and how near several other experimenters came to performing the same experiments themselves." There is little doubt that one of the "other experimenters" referred to by Hertz was Sir Oliver Lodge, who himself had come close to making the great discovery.

Now only 32 years old, Hertz was soon recognized as one of Europe's leading scientists and began to reap a long series of honors and awards. The list was topped by the famous Rumford Medal of the British Royal Society. Hertz might have had his choice of academic posts at any one of Germany's famous universities, but accepted an offer from the University of Bonn, where he became head of the physics department. Had he lived to see the wonder of wireless become a commercial reality, he undoubtedly would have continued to take a leading part in its development. Unfortunately this was not to be; in 1892 he contracted an infection that forced him to take a prolonged leave of absence from his duties. Several operations followed by a long rest apparently put him on the road to recovery, but in the latter part of 1893 he suffered a relapse and the end came on January 1, 1894. Although he had accomplished a great deal in his short life, it is certain that from his point of view, his work had just begun.

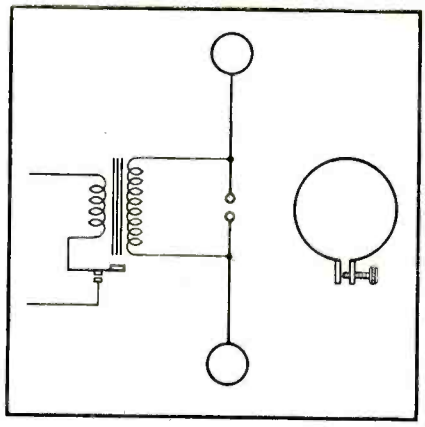


Fig. 2. Circuit used by Hertz to demonstrate resonance.

When the time came to apply radio to commercial needs, Hertz's transmitting apparatus was used in essentially its original form; in fact, the electric spark remained the sole usable method of generating radio waves for a number of years. Marconi's work which consisted, to some extent, of perfecting existing apparatus and coordinating the various units (transmitter, receiver and antenna) into a workable system, depended upon the Hertzian oscillator as a source of waves, but Hertz's antenna was neglected and remained a laboratory curiosity for some time. Furthermore, Marconi soon learned (as Hertz probably had suspected) that the Hertz receiving apparatus was far too insensitive, and abandoned it after a few early trials.

Branly's Coherer

Meanwhile, between the Hertz experiments and the Marconi trials, a device had been developed which was destined to have a profound effect upon the future of the art. The inventor of the device, Edouard Branly, professor of physics at the Catholic Institute in Paris, had become interested in physiology, especially in the study of nerve structure. He was fascinated by the observation that a nerve consisted of a mass of closely packed fibers, and may have had some idea of developing the electrical counterpart of such a structure; at any rate, his research led to an investigation of the properties of fine particles when massed together. The subject had been given some attention by earlier scientists, and one of these had successfully used finely powdered carbon in a lightning protector for telegraph lines. When a tube filled with carbon dust was connected between the elevated telegraph wire and the earth, it offered a high resistance to the flow of direct current, but an alternating current, such as that resulting from lightning discharge, lowered the resistance. In this way, the lightning discharge was diverted to ground without harming the telegraph instruments.

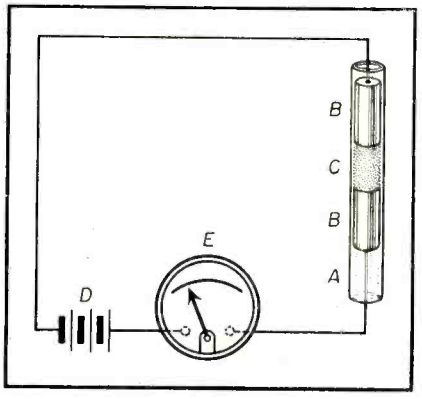


Fig. 3. Basic principles of Branley's coherer.

Branly found that a mass of carbon or metal particles would act in this peculiar manner while under the influence of an induction coil spark as well as when exposed to lightning discharges. He further learned that the effect was the result of a clinging together, or cohesion, of the particles. In 1891 Branly described his work to the French Academy of Science; the apparatus he used resembled that shown in *Fig. 3*. A small-bore glass tube, *A*, was fitted with two metal plugs, *B*. In the narrow gap between the two plugs, a small quantity of iron filings, *C* was placed. The tube was connected in series with a battery, *D*, and a sensitive galvanometer, *E*. Under ordinary conditions, the galvanometer gave no indication of current flow, but when Branly closed the primary circuit of an induction coil placed about 75 feet distant from the tube, the needle of the galvanometer was deflected. The packed filings, however, would not automatically separate, or "decohere" after the coil ceased to operate, but could be restored to normal condition by tapping or shaking the tube.

Branly's discovery was extensively used in lecture work by Sir Oliver Lodge who was thoroughly familiar with Heinrich Hertz's work; Branly may not have been aware that the induction coil generated Hertzian waves, but Lodge certainly was. He used the Branly and Hertz equipment in send-

[*Continued on page 46*]

LOOKING FOR

Trouble?

No. 3

by Cyrus Glickstein

(Instructor, American Radio Institute)

An interesting service job involving a variety of test operations on the sound strip of a Philco Model 50-T-1404 receiver is discussed and analyzed in this installment. Note the service techniques described.

THE receiver is on the bench and the quiz consists of following the actual steps in servicing as far as possible. Receiver is a Philco, Model 50-T1404, a-c transformer set, split-sound.

Object of the game is to service along step by step. This is done by giving the answer to each question before going on to the next question.

1. Set is turned on. Picture on Channel 4 is normal. Sound is very low. Volume control is all the way up. Turning it down cuts out sound. Fine tuning can't bring sound up any more. Rotating fine tuning in either direction makes it disappear.

On the basis of the above information from the screen and loud-speaker, which statement is correct?

(a) Trouble is indicated in the front end—oscillator frequency is probably off slightly.

(b) There is trouble in either the antenna or transmission line

(c) Trouble most likely is in the sound strip (anywhere from sound take-off point to the loud-speaker)

(d) Sound should be checked on other channels.

2. A check is made on all channels. In each case it is found that the picture is O.K. and sound is weak. On this basis, it is decided that the trouble is in the audio strip (sound I.F.'s, ratio detector, AF amplifiers, loud-speakers) All tubes in the sound strip are changed. No difference.

Next step in cases like this usually is:

(a) Disturbance (screw-driver and similar) tests on the grids of

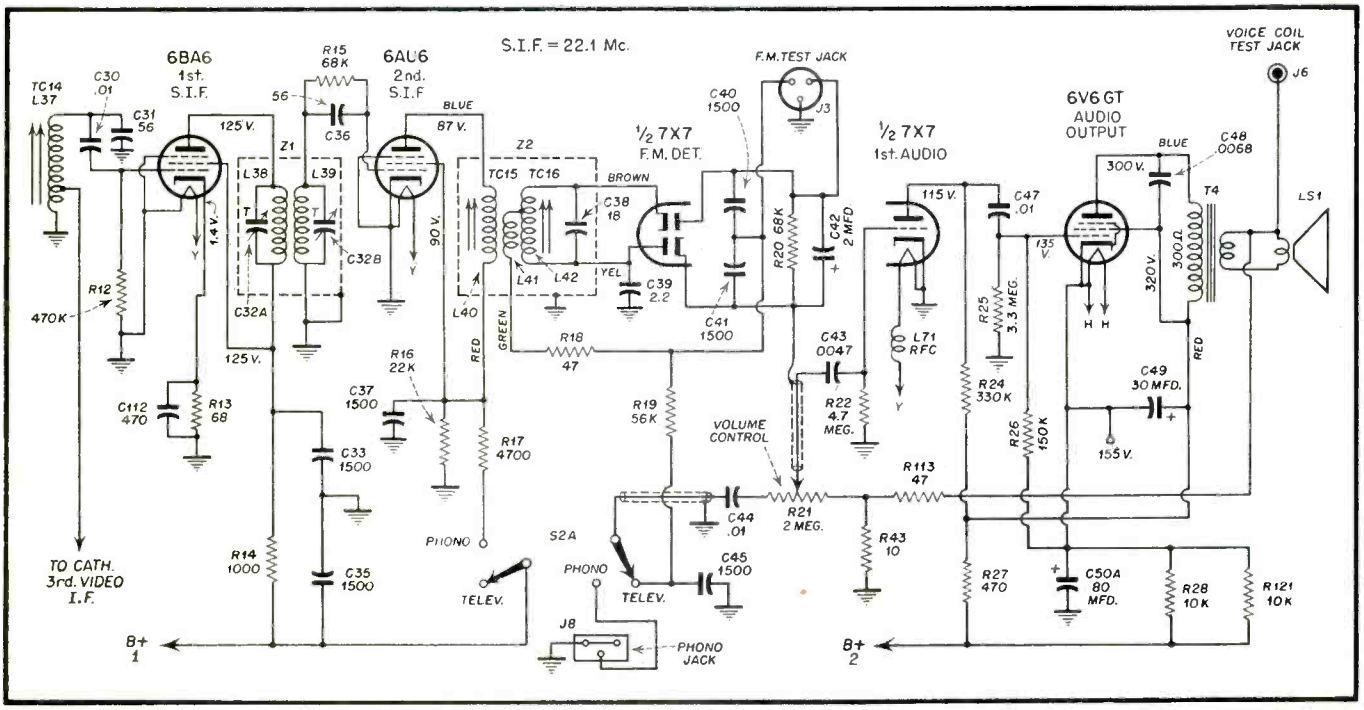


Fig. 1. Sound strip of Philco Model 50-T1404 receiver.

various stages.

(b) Signal injection—Using signal generator; starting at grid of last stage and going forward to check by ear how well each stage passes signal.

(c) Signal tracer, starting at 1st sound i-f grid and going toward last stage.

(d) All of the above are equally good.

3. In this case, disturbance tests were tried first. However, a finger on the volume control did not seem to give as loud a hum as is heard on some sets, though it was not definitely weak. Screw-driver scratches on i-f grids were not very loud but were inconclusive concerning which was the weak stage. It was decided to check the gain of each stage.

To check gain:

(a) Use signal generator and ear.

(b) Use signal generator and output meter in plate of P.A. stage

(c) Use signal generator and a-c meter off voice coil

(d) Any of the above can be used with equal accuracy.

4. Gain checks were performed on the last two stages. An audio signal from a generator was first fed directly to a VTVM on the a-c scale in order to check the output of the generator. The attenuator of the generator was adjusted until the meter read ½ volt. The generator is then set aside for a moment before being hooked to the grid of the P.A. The next step is to connect the VTVM, still on the a-c range, in series with a 0.1 μf condenser to the plate of the P.A. The meter was then read to make sure there was no output from noise, a station, etc. to interfere with the check. (If necessary, the oscillator tube or second sound i-f tube is taken out or the channel selector switched to an unused channel to remove a noise source). If there is any small noise voltage remaining, this amount is deducted from all readings.

The signal generator was then put on the grid of the P.A., with the attenuator control not being moved from the previous setting. (The generator lead was attached in series with a 0.1 μf condenser because of the positive voltage on the grid —See *Fig. 1*) The VTVM read 8 v. Since the input was ½ v., this represents a gain of 16. (Output voltage is 16 times higher than input voltage).

Without moving generator lead, the attenuator was reduced until the reading was again ½ v. Then the signal generator lead was moved to the grid of the 1st audio stage, pin 3, 7X7. The output meter remained where it was. Meter now read 26 v. Since the ½ v. signal at the grid of the P.A. became a 26 v. signal when the generator was moved back one stage, the gain of the 1st audio stage is 26 or 52.

.5

On the basis of the above:

(a) P.A. stage is weak and further checks are necessary there.

(b) 1st audio stage is weak and further checks are necessary on that stage.

(c) Both stages are weak.

(d) Neither is weak and further checks should be made in the preceding circuits.

5. Gain check was continued for the ratio detector and the sound i-f stages. A 22.1 mc unmodulated signal was fed into the grid of the 2nd sound i.f., 6AU6. The VTVM was put on the negative volts range and the lead placed on the full load point of the ratio detector, pin 6, 7X7. The negative voltage reading was normal, based on past experience with the amount of output of this generator. The generator output was turned down and the new reading of the VTVM noted. The hot generator lead was then switched to the grid of the 1st sound i-f stage, 6BA6. VTVM remained at full load. Negative reading barely increased, indicating no gain through the 1st sound i-f stage.

"Furthermore, I want you to stop listening to the radio when you go out on a job!"

To check whether the tuned circuits in this state were aligned properly, the generator was fed to the grid of the 3rd *video* i.f. and *TC14, C-32B* were trimmed up. All were correctly peaked, since any rotation in each case reduced the negative voltage at full load.

Voltage and resistance readings were taken on the 6BA6, 1st sound I.F. stage: (Each pin to ground)

	Voltage	Resistance
Cathode	1 v	60
Control grid	0	.5 Meg.
Screen grid	118	13.5 K
Suppressor grid	0	0
Plate	118	13.5 K

(B+ to ground normally reads 12.5 K)

on the basis of the above readings and checks, the most likely trouble is:

Since voltage and resistance read-

(a) Leaky cathode by-pass condenser *C-112*.

(b) Open trimmer condenser in the plate tuned circuit, *C-32A*

(c) Open by-pass and decoupling condenser in screen, *C-33*

(d) Leaky *C-35* (off bottom of screen and plate decoupling resistor *R-14*)

ANSWERS & DISCUSSION

ANSWER 1-d

In cases of low or no output of sound (and same applies to video), no clear-cut conclusion is possible as to the defective section until pertinent controls are checked: the volume control rotated to maximum (or contrast control at maximum in case of pix); a check made to see if turning it down affects operation accordingly; and the fine tuning rotated to point of optimum performance. Furthermore this situation should be checked on all channels.

On the basis of low sound on one channel no definite conclusion is possible since there are several possibilities—any of the first three choices in question 1. The situation is then checked on other channels to determine which of these is the most likely possibility. If sound is low on all channels with pix O.K., the sound strip is most probably at fault. If sound is good on all channels except one, there can be either antenna-transmission line trouble or front end trouble.

ANSWER 2-a

Most servicemen at this point would probably prefer disturbance tests, since they are quick and can generally indicate useful information when hunting for a dead or very weak stage. Touching the finger to the top of the volume control should give a fairly loud 60 cycle hum if the two audio amplifier stages are operating normally. Scratching the sound i-f grids with a screw-driver should give definite, rather loud clicks in the speaker if these stages are operating well.

Signal injection using a generator and ear employs the same procedure as disturbance tests and gives about the same information. It is most use-

[*Continued on page 43*]

Converting Sound I. F. *to* INTERCARRIER

by **DANIEL LERNER**

(Supervisor, Television Service, Philco Corp., Phila.)

This article describes the conversion of a conventional sound i-f system to an intercarrier (4. 5 mc) system on two Philco receivers in order to minimize the effects of FM sound interference in the vicinity of a powerful FM station. The counterpart of this problem may occur anywhere in the U. S. A.

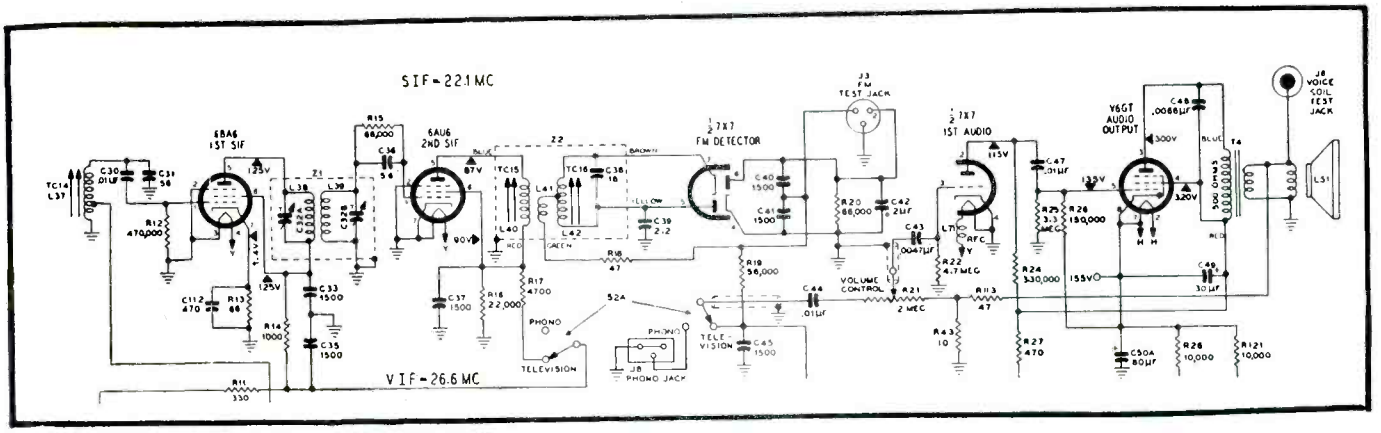


Fig. 1. Sound strip of Philco 50-T1400 Code 121, and 50-T1432 Code 121.

IN Pleasantville, N.J., many cases of sound interference were reported on Channel 10. The interference was due to a very powerful FM station. Upon investigation it was determined that the second harmonic of the FM station was causing the interference. The interfering signal was so strong that attemps to trap it out in the antenna lead in and receiver input circuit proved futile. The interference was noticed as very strong sound bars in the picture in addition to bursts of sound from the station. Since Channel 10 as received in this area is relatively weak, attempts to build up the received television signal met with little success. It was definitely determined that the sound interference occurred close to the sound carrier of Channel 10 (197.75 mc.).

At first it was decided that reducing the bandpass of the sound i-f tuned circuits would produce a sharp enough (high "Q") sound response to eliminate the interference. This was tried, and the interference was minimized, but the tuning of the fine tuning control had become so critical that customer operation would be very impractical.

It was finally decided to change the sound i-f system to an intercarrier (4.5 mc) type. The theory behind this change is as follows:

1. The sound i.f. at 22.1 mc is relatively broad due to the loading effect of the tubes and circuit constants at this relatively high frequency.

2. At 4.5 mc the loading effect is much less, and therefore a much narrower sound i-f response can be obtained.

3. Since the sound in an intercarrier system depends only upon the beat between the picture and sound carriers, the ease of tuning is much greater with intercarrier sound.

4. When an intercarrier system is used, the customer can tune out any picture interference that is apparent (sound bars) without losing the accompanying station sound.

The models on which the tests were conducted were the Philco Models 50-T1400 Code 121 and 50-T1432 Code 121. These sets use a conventional sound i-f system with a sound i-f carrier of 22.1 mc. *Figure 1* shows the original sound strip of the above receivers. The following is the exact procedure that was used to perform the conversation:

Procedure

1. Referring to *Fig. 1* remove 22.1 mc discriminator, *Z2* and 1st SIF transformer *Z1*. Clip off the coupling condenser *C30* from the 1st SIF grid. Disconnect *R37*, the 3rd VIF cathode resistor, from the 22.1 mc trap, L37 and ground it. Clip off the discrimi-

[*Continued on page 43*]

SLOGANS

That Sell Radio Service

by **ERNEST W. FAIR**

A good slogan is an effective means of quickly identifying the name of your establishment with the slogan.

NO matter how good our radio repair service may be or how superior it is to that of competition we must sell those ideas to our customers and prospective customers.

Slogans accomplish this purpose effectively. Cleverly composed, they stick in people's minds. Their brevity often puts over a big idea in a small number of words.

In the paragraphs to follow are many selling sentences and slogans used by radio repair shops in every section of these United States. All effectively work to build business for these shops. The ideas these well chosen words present sell the services of these shops . . . stick in people's minds until they need such service and keep our regular customers sold on our business and its services.

"We Can Fix It"—Economy, Chattanooga, Tenn.

"Ask For Our Radio Specialist"—Cook, Chattanooga.

"Our Radio Service Is Unquestioned"—Hall, Chattanooga.

"Equipped To Serve You"—Windham, Chattanooga.

"After 20,000 Radio Repairs We Suggest the Best"—George's, Davenport, Iowa.

"Radio Repairing Is Our Specialty —Not A Sideline"— United, Davenport.

"All Work Positively Guaranteed" —Augusta Electronics, Augusta, Ga.

"Honest and Efficient"—Jewel's Albert Lea, Minn.

"Prompt, Efficient and Courteous" —Radio Shop, Bryan, Tex.

"Bring It to Us or Call Us"—McElroy, El Dorado, Ark.

"Where A Dollar Does Its Duty"—Carroll's Iowa City, Iowa.

"Let Us Solve Your Radio Problems"—Johnson, Burlington, Iowa.

"This one costs more, but it has a built in radio!"

"If It Uses Vacuum Tubes, It Is Our Business"— Radio-Electronics, Hastings, Nebr.

"You Can Renew Your Radio Enjoyment Too"—Edelen, Shreveport, La.

"Is Your Radio Sick?"—Radio Hospital, Shreveport.

"Our Business Is Sound"—Roberts, Shreveport.

"We Appreciate Our Customers and Friends And Are Doing Our Best"— Wade's Paris, Texas.

"When Your Radio Won't Swing— Give David White A Ring"—David White, Pine Bluff, Ark.

"Good Service Keeps Our Business"—Endresen, Duluth, Minn.

"A Guarantee That Counts"— Kruegerr, Norfolk, Nebr.

"Your Radio Should Meet Us For We Know Your Radio"—Klingenberg, Enid, Okla.

"Bring Us Your Radio Troubles"— Markwells, Champaign, Ill.

"Long Established—Honest—Reliable"—Crawford, Hibbing, Minn.

"If It Uses Tubes—We'll Repair It"—Central, Lincoln, Nebr.

"Our Service Costs You Less Because It Takes Our Experts Less Time to Do Your Work"—General, Lincoln, Nebr.

"Let Us Solve Your Radio Problems"— Clack, Borger, Tex.

"You Can Have Confidence In Our Work"—Krenzler, Houston, Tex.

"Only Skilled Hands Touch The Radio We Repair For You"—Economy, Houston.

"Every Job Backed By Our Reputation"— Goggan, Houston.

"We Are Here To Serve You—Our Friend & Customer"—DeFord, Kansas City, Mo.

"In Radio Service As In Everything, There Is Always One That Is Best"—Hunt, Kansas City.

"It's No Gamble to Bring Your Radio To Us"— Pair-O-Dice Radio Shop, Kansas City.

"Faster Service If You Bring It In-Cheaper, Too"— A-One, Fort Worth, Tex.

"Honest Work At Reasonable Prices"—McDonald, Fort Worth.

"We Have Yet To See The Radio We Can't Fix"—Smith, Fort Worth.

"We Make 'Em Talk"—Hampton, Alabama City, Ala.

"Service You'll Appreciate"—Electrics, Atlanta, Ga.

"Service With a Conscience"— Kimes, Atlanta.

"The Best Is Always The Cheapest"—Mauldin, Atlanta.

"Just Call Us—We'll Do the Rest" —Radio Clinic, Atlanta.

"We Stand Behind Our Repairs"— A & A, Dallas, Tex.

"We Are Satisfied When You Are" —Anderson, Dallas.

"Radio Service The Modern Way" —Electronics, Wichita, Kansas.

[*Continued on page 40*]

TUBE TOPICS

by JAMES COREY

A new regular department devoted to presenting up-to-the-minute information to the Radio-TV Service Dealer on tube replacements and substitutions of all types, including picture tubes.

SOME servicemen in considering the matter of tube substitutions seem to believe that they have no right to make changes in a receiver in order to effect a repair. Consequently they feel they must use an adapter in preference to changing a socket as has been suggested in these columns. While adapters are handy devices, space very often will not permit their use and in other instances ready-made adapters are not available. Making an adapter is generally more time-consuming than re-wiring or even changing a socket, while in the case of substitutions for miniature tubes, adapters are not at all practical.

The serviceman should take the attitude that the customer has commissioned him to repair the radio or TV set. What the serviceman does to effect the repair and satisfactory operation of the set is his (the serviceman's) decision, provided that he satisfactorily accomplishes repair within the estimate given. The customer is not in a position to decide what should or should not be done, any more than a surgeon's patient should direct how the operation be performed. Further the serviceman has every right to charge for the time and materials to effect a substitution when the required tube is not available; and if a more expensive tube type is required because of the substitution, there is every right to make a full charge for it. This is the procedure followed in other lines of business and no serviceman can be criticized when the matter is handled in an honest manner.

About "Tube Topics", Al Marchione of Buffalo, N. Y. has this to say:

Dear Sirs:

As a TV serviceman and subscriber to Radio-TV Service Dealer I would like to commend the magazine and James Corey for your changes of tubes mentioned in "Tube Topics". I think more of the this type of material would be very beneficial to me and many others.

Al Marchione

6SG7, 6SG7GT & 12SG7

These are medium-high transconductance semi-remote cut-off r-f pentodes having about twice the transconductance of the 6SK7. In circuits or locations where a lower value of transconductance is adequate, types 6SK7, 6SK7GT, 12SK7 or 12SK7GT will make a satisfactory substitute. In fact in one of the a-c/d-c models using a 12SG7, it would require accurate measurements to detect any change in performance when a 12SK7 or 12SK7GT is substituted. In the -SG7 the cathode and G-3 are internally connected and tied to both pins 3 and 5. When substituting type -SK7 the serviceman should make sure that both pins 3 and 5 on the socket are tied together. In sets using the -SG7 at 125 or 150 volts on the screen a higher value of screen resistor is in order to reduce the value to 100 volts for an -SK7. See *Fig. 1.*

Typical characteristics are listed below for reference.

6SD7GT

Type 6SD7GT is not far different from type 6SG7GT. It has a somewhat more remote cut-off characteristic and in that respect is more similar to the 6SK7GT which it replaced in certain auto radio set designs. In to type 6K6GT. The latter tube will available. The basing of the 6SG7GT will perform almost as well with the 6SK7GT. Its characteristics have been tabulated below for comparison. Also the 6SDGT and 6SG7 or GT are so nearly alke as to be interchangeable of one or the other is general a set calling for the 6SD7GT and 6SK7GT are alike.

41

Type 41, scarce in many localities is an output pentode identical electrical replace the 41 by means of only a socket change. In addition, type 38,

[*Continued on page 41*]

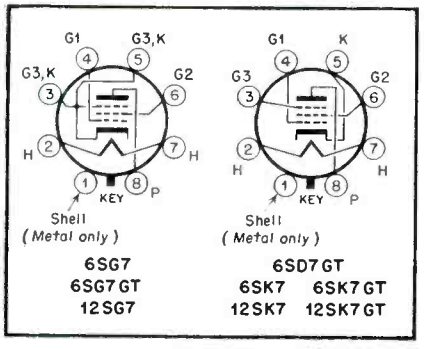


Fig. 1. 6SG7 and 6SD7GT Type Socket Connections

	6SG7 6SG7GT 12SG7			6SK7 6SK7GT 12SK7 & 12SK7GT		6SD7GT	
Plate potential	100	250	250	100	250	250	volts
Screen potential	100	125	150	100	100	125	volts
Grid bias	-1	-1	-2.5	-1	-3	-2	volts
Plate current	8.2	11.8	9.2	13	9.2	9.5	Ma.
Transconductance	4100	4700	4000	2350	2000	4250	microhmos
Cut-off bias	-11.5	-14	-17.5	-35	-35	-27	volts

6SG7, 6SK7 and 6SD7GT Type characteristics

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".

Tube Shortage Rewiring

When wiring for rectifier tubes, I suggest connecting certain pins together, thus increasing the number of tubes that may be used. See *Fig. 1.*

Submitted by
Arthur R. Skold
Seattle, Wash.

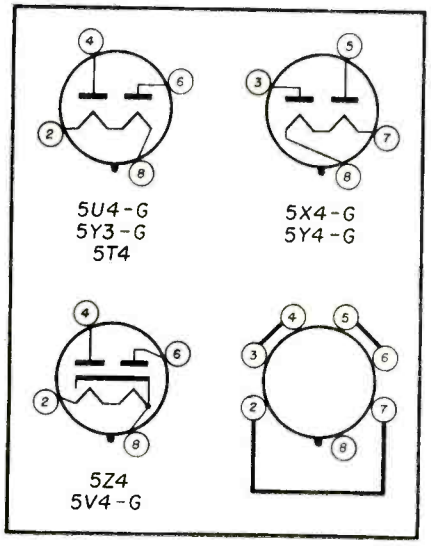


Fig. 1. Tube base rewiring.

R-F Probe

Anyone wanting a detector probe for checking r-f circuits without interrupting an intermittant condition can construct one in a few moments for about one dollar. (See *Fig. 2*)

Every good service bench should have an audio amplifier as standard equipment for checking record players, crystals, speakers, etc. This probe will work very well with any medium powered amplifier. Tests can be made from preselector grid to the voice coil in easy steps. Be sure to observe polarity of Sylvania IN34A.

Submitted by
Martin Bostrom, Jr.
Bellingham, Wash.

Bar Solder Holder

In radio work it is sometimes necessary to use a heavy soldering iron and bar solder. Everytime I have done this I needed the use of two hands and was always searching for the solder bar. So I made up this little holder which can be attached any place on the wall or on the beach and will always be at one's reach. It is made by flattening one half of a piece of ½ inch copper tubing in a vise and drilling a couple holes for screws. The whole thing can be done in five minutes. Make one and see how useful it is. See *Fig. 3.*

Submitted by
Donald A. Duquet
Winslow, Maine

Stromberg-Carlson
How To Change a TS-10 To a TV-12

The TS-10 television receiver is actually a TV-12 with a 10-inch picture tube and with slight changes it can be easily converted to take the 12-inch tube when they again become available. The additional parts needed are these:

1. 162059 12JP4 Picture Tube.
2. 113033 Tube Bracket.
3. 113034 Anode Connector.
4. 154037 12" Tube Mask.
5. 110282 220 mmf 1500v Capacitor (C287) across the secondary of the horizontal output transformer T-204 (Pins 4 & 5).

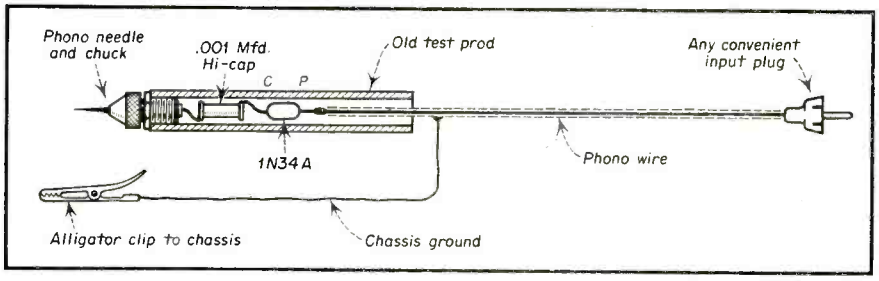


Fig. 2. R-F Probe details

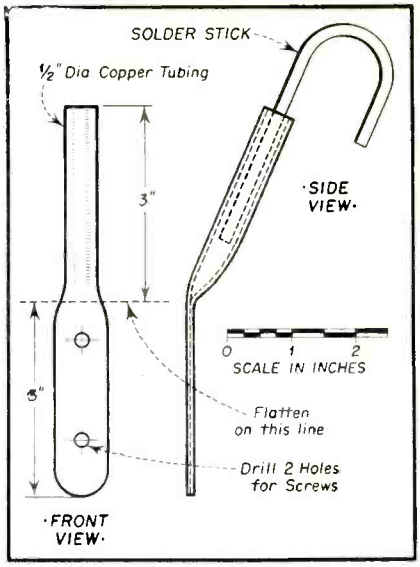


Fig. 3. Bar Solder Holder

The parts to remove include the 10BP4 tube, wooden spacer under the tube, anode connector, and the 10-inch mask.

For the 12-inch tube to fit snugly into its cradle, the wooden spacer under the front of the tube will have to be removed. Then the lower support will have to be moved back one set of holes (visible on the chassis). To make room for the larger tube, the focus and deflection coils will have to be moved back on the bracket. There is a set of holes provided on the chassis for the new tube bracket.

Circuit changes consist of removing the shorting jumper on R-286 B and adding a 220 mmf 1500v capacitor C-287 across the secondary of the horizontal output transformer T-204 (Pins 4 & 5). When replacing the 10-inch mask with the 12-inch mask longer screws will be needed.

Stromberg Carlson
Service Dept.

RCA 19" Models 9T57-77-79-89
Corona Interference

An interference pattern consisting of narrow vertical bars at the left-hand side of the raster may be the result of internal corona, or arcing, within the 4.7 mmf capacitor (C198) located in the plate circuit of the horizontal sweep output tube.

This interference may be mistaken for barkausen oscillation, but none of the normal Barkausen preventative methods will be effective in eliminating the interference.

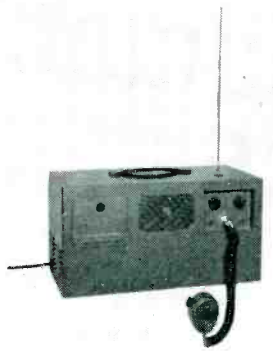
If such a condition is encountered the capacitor should be replaced.

RCA Service Co.

NEW PRODUCTS

MOBILE-TRANSCEIVER

This adjacent-channel transceiver, designated by RCA as the Carfone Station Unit 15, will meet all needs of either a fixed or portable



station for mobile communication systems in the 152-175 megacycle bands. The 44-pound station unit is a companion equipment to RCA's Carfone mobile units, announced last year.

INDOOR TV ANTENNA

The JFD Manufacturing Company of Brooklyn announces the manufacture of its new "Tip-Proof" Indoor Television Antenna, unconditionally guaranteed against tipping.

A uniquely designed base, perfectly balanced and weighted prevents the JFD Indoor Antenna from tipping or rocking despite full extension of dipoles—an exclusive JFD feature. Made of beautifully engraved satin finish

mahogany plastic, it harmonizes perfectly with any room in the home. Three-section, triple-chrome plated telescopic dipoles can be adjusted from 15 to 41 inches for quick and easy orientation. Unique tension design holds dipoles at any position—collapsed or extended. A felt pad cushions the base of the antenna and protects the finest furniture surfaces.

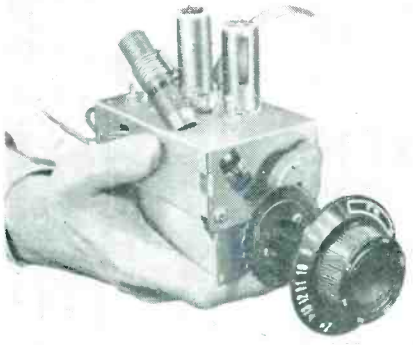
The JFD "Tip-Proof" Indoor TV Antenna, complete with 30 ohm twin lead, lists at $6.95 complete. Literature describing this new antenna is available from the manufacturer.

NEW DUMONT INPUTUNER

One-knob quick-click tuning of TV channels yet retaining the continuous tuning feature for critical on-the-button reception of TV plus FM programs, distinguishes the new Series T3C Du Mont Inputuner. Announced by the Electronic Parts Division of Allen B. Du Mont Laboratories, Inc., East Paterson, N. J., the new unit is a ready replacement, both mechanically and electrically, for the majority of switch-type tuners.

The simplified dial covers all TV and FM channels in only four turns, and occupies the same panel area as indicating devices used on most switch-type tuners. The one-knob operation simply clicks into any TV channel and then fine-tunes for superlative results.

The Du Mont Series T3C (jobber model with dial) or Series T3B (manufacturer's model) utilizes the Mallory-Ware 3-gang spiral Inductuner plus antenna tuning which provides 4-circuit performance without extending the physical length of the chassis.



The 6BC5 pentode RF stage with tuned input provides maximum sensitivity. The RF stage is over-coupled to the 6J6 mixer-oscillator for wide band-pass. A mixer plate network is available to match the IF system of most TV chassis. The Inputuner is ready to install—just tune mixer plate coil and sound trap (if provided) for IF system of associated TV set.

Dimensions: 4-51/64" L., 3-3/32" W., 5-5/64" H. Shipping weight, 4 lbs. Available in four models, viz., aligned for sound center IF of 21.25 or 21.75 mcs., with or without sound trap.

DUAL CONCENTRIC CONTROL

A new dual concentric 15/16" variable resistor has been added to the Mallory Midgetrol line marketed by the Wholesale Division of P. R. Mallory & Co., Inc., Indianapolis.

In order to attain maximum coverage of a great variety of television and auto radio receivers, the dual controls are being sold through Mallory distributors in sub-assembly

form. The serviceman can complete the assembly in less than five minutes, combining control sections of specified ratings for his particular application. The control sections are supplied in factory-assembled form, making possible complete factory inspection and testing. A new AC switch makes attachment simple and sure by positive indexing and design that permits secure locking in position without removng the control housing.

It has also been announced that the single section Mallory Midgetrol is now supplied with a permanently fixed, tubular brass shaft that can be adapted in a few sections for split-knurl or flatted type knobs by inserting one of two steel shaft ends contained in every package. The purpose of the new design is to make installation by the serviceman as fast and simple as possible, without sacrificing the stability of a permanently secured shaft.

Additional details can be secured by addressing P. R. Mallory & Co., Inc., P.O. Box 1558, Indianapolis, Indiana.

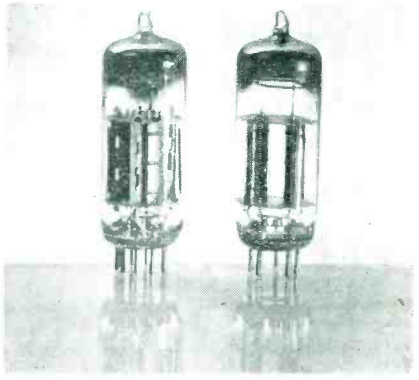
HYTRON PROBING TWEEZERS

Pestered by elusive intermittents, shorts, opens, noise, feedback? Want to probe for

them with set operating? Without danger? Without detuning effects? Try new Hytron Probing Tweezers. The precise . . . safe . . . natural extension of your own fingers long sought for this job. Of rich, tough polystyrene with ideal electrical and mechanical characteristics. This Contest prize winner saves time, money . . . mayhe your life. 35c from Hytron jobbers.

TV TUBE-12BH7

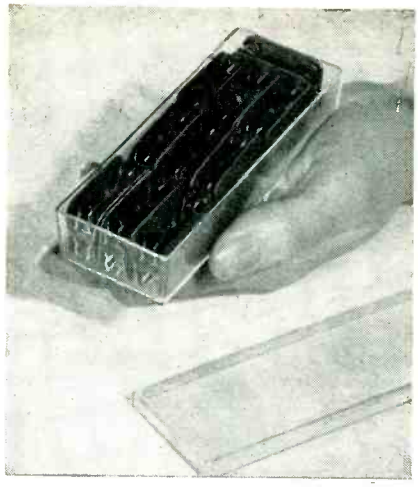
A new television receiving tube, designed primarily for vertical oscillator and amplifier service with large wide-angle picture tubes, has been announced by General Electric's Tube Divisions.



The tube (Type 12BH7) is a 9-pin miniature double triode having semi-high perveance units. In addition to its application in TV receivers, the 12BH7 may also be used in applications where two similar triodes in a single envelope are desirable from a viewpoint of space conservation and cost reduction.

PIGTAIL HOLDER BOX OF 100 USES

In order to provide TV service men with their demand for a larger, more compact unit of TV Snap On Fuse Holders, Littlefuse Inc. of Chicago has produced a package of 10 of



the Holders in a hard, long-wearing, plastic box.

The box, which is transparent, has approximately 100 uses to the service man after his supply of fuse holders has been used. Its dimensions are 5⅛ x 2 x 1⅛ inches—a good size for keepng extra nuts, bolts, fuses, or any loose items which should be easily visible for quick repair and which should always be in a service mans' kit when he needs them.

This holder is the attachment which has made possible the replacement of blown Pigtail fuses without time-wasting soldering. It snaps directly onto the blown fuse within the set and the new fuse slips into the opposite side. All future replacements are made with this same attachment which is used again and again, or for the life of the set.

JENSEN ACOUSTIC TAPE

With newly acquired interests in the magnetic tape manufacturing field. Jensen Industries, Inc., leading Chicago phonograph needle manufacturer, announces a complete

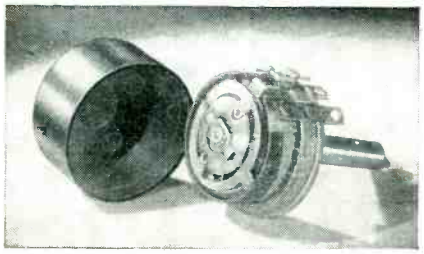
line of magnetic recording tape. The new "Jensen Acoustic Tape," according to this announcement, is said to provide higher fidelity with less distortion and noise and is already being used by many of the country's leading broadcasting stations.

"Jensen Acoustic Tape" is available in either plastic or paper base, on 600 and 1200-foot plastic reels. Additional information and literature may be obtained by writing direct to Jensen Industries, Inc., 329 South Wood Street, Chicago 12, Illinois.

PRECISION-BUILT POTENTIOMETER

Indicative of the growing demand for precision-built components used in today's critical electronic assemblies, is this special potentiometer developed by Clarostat Mfg., Co., Inc., Dover, N. H.

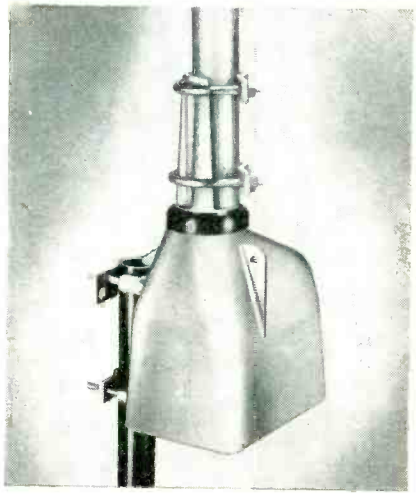
To meet the exceptionally rigid mechanical and electrical specifications, this control was designed, tooled and produced in limited quantities, as a special number. The tapered winding is held to a tolerance of plus/minus 1½% linearity as measured at ten test points. Mechanical tolerances are held as close as plus/minus 0.00025 inch. The unit must operate dependably over extreme ranges of temperature, humidity and altitude or barometric pressure, and under severe vibration. It is treated to meet fungus and corrosive conditions.



The body of this special Clarostat control is molded in yellow or low-los- Bakelite. Positive low-loss conductivity is assured by the silver contact carried by the ring-shaped slider which rides the winding as well as the contact rail. A slip-on black plastic cap protects the control mechanism.

ANTENNA ROTATORS

Crown Controls Co., Inc., New Bremen, Ohio, announces a new Antenna Rotator Drive motor which will feature ⅝" steel drive shafts, 3" final shaft steel gears for greater strength and more turning power. The new Rotator is in production now, at Crown's completely conveyorized plant located in New Bremen.



The Rotator is available with two styles of beauti-mahogany finished control boxes. One is the "Electric Eye" model which flashes the position of the antenna while the other is the fomous Crown "Compass' model which gives accurate readings showing the actual position of the antenna at all times.

FLUORESCENT LAMP STARTERS

Designed for use in every fluorescent installation where some instant light is desirable, the new Sheldon MULTI-PURPOSE Fluorescent lamp starter prolongs the life of any lamp by providing adequate pre-heating according to a recent announcement by the Sheldon Electric Company, a Division of Allied Electric Products Inc. of Irvington, N. J.

These special fluorescent lamp starters are POSITIVE D-C starters. Their normally closed starting circuit means that the lamp's ends light up immediately, furnishing instant illumination. They operate at low temperature on either A-C or D-C. They provide certain starting where ballast output is low or high. They

prolong a lamp's life by insuring adequate pre-heating. These Multi Purpose Starters, made according to Sheldon's rigid production standards, is recommended whenever some instant light in the lamp is required.

Sheldon Multi-Purpose Lamps are made in 3 types: for 14, 15 and 20-Watt lamps; for 22-Watt Circline and 18-Watt Circlarc lamps, and for 13, 30 and 40-Watt lamps. Like all Sheldon fluorescent starters, these Multi-Purpose starters are pretested and guaranteed against electrical and mechanical defects. They are approved by U/L and CSA of Ontario, Canada.

OPEN LINE T.V. TRANSMISSION LINE

Originally developed especially for "problem" installations in remote and fringe areas, and where atmospheric conditions are destructive to conventional leadin, T.V. Wire Products Open Line of San Francisco, because of its

exceptionally low signal loss and permanent resistance to weather, is rapidly growing in popularity.

Actual laboratory tests prove open lines insures 1/6 the loss from good quality conventional twin leadin. Released figures show 0.5 DB loss per 100-feet at 200 mc., making possible longer line installations in remote and

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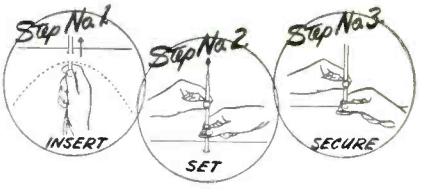
NATIONAL CARBON COMPANY
Division of
UNION CARBIDE AND CARBON CORPORATION
30 East 42nd Street, New York 17, N. Y.

District Sales Offices:
Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

fringe areas. As for resistance to atmospheric conditions, laboratory tests also show that T.V. Products Open Line resists atmospheric conditions indefinitely. Extensive 300-hour salt spray corrosion tests has proven its ability to withstand the elements in any climate in any area. Another feature which distinguishes Open Line from conventional leadin is "air insulation," made possible through the use of electronically harmonized Polystyrene Spacers strategically placed every 6-inches throughout the entire length of the run.

AUTO ANTENNA

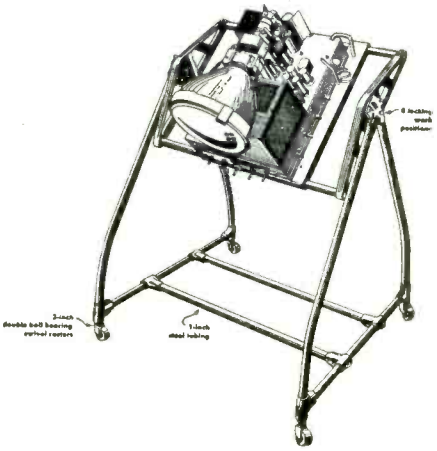
A new auto radio antenna designed especially for fast and easy installation by one man is announced by the National Electronic Mfg. Corp., Long Island City, N. Y. Called the NEMCO "Triple-Kwik", it is made of



heavily chrome-plated brass, fits the fender or cowl of any late model car, is rustproof and rattle-free, has three telescoping sections extending to 60 inches, and has a permanently attached three-foot shielded lead-in cable with Delco and Motorola fittings. The list price is $5.50.

CHASSIS CRADLE

Louis Bros., Los Angeles, Calif. announces their new "Chassis Cradle". Its features are: Adjustable chassis supports; Bolt chassis down at time of delivery, then remove only



when job is completed; Supports constructed of 1" steel tubing and cradle of light but rugged aluminum casting; 4 swivel casters enables maneuvering in smallest shop; Eliminates workbench space.

HIGH QUALITY 'SCOPE

A new 5" oscillograph is announced as a high quality, versatile instrument designed for general purpose industrial and electronic laboratory use. Called the Model 640, this new 'scope features outstanding stability, range and sensitivity generally available only in higher priced equipment.

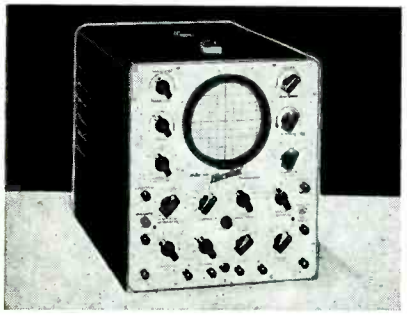
Technical characteristics are as follows: Wide Band Amplifier—Frequency response DC, 0 to 4.5 mc, (down 3 db).

Vertical DC and AC Amplifier: 10 MV per inch with sensitivity switch in high position. 25 MV per inch in low positon. Frequency Response: 0 to 1,000,000 cycles, (3 db point), in high position. 0 to 4,500,000 cycles, (3

db point), in low. Maximum Input Potential; 1000 volts peak. Input Impedance; 2 megohms, 50 mmf.

Horizontal Amplifier: Deflection Factor—Direct: 20 volts RMS per inch. Full Gain Setting: 50 millivolts RMS per inch. Frequency Response: 0 to 200,000 cycles, (3 db down).

Test Signals: Line Frequency, 3 volts RMS per inch. Sawtooth available from front panel. Direct connection to both horizontal and vertical deflection plates.



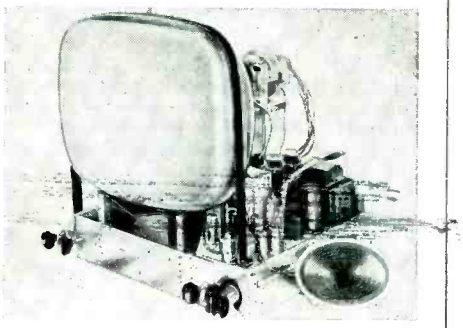
Linear Time Base: Recurrent and Driven Sweep; 2 cycles to 30,000 cycles. Provision for external capacities for slower frequency sweeps of 10 seconds and slower. Sweep Speeds; Faster than 0.75 inch per microsecond. Television Fixed Frequencies; 30 and 7,875 for observing circuits of TV receivers. Synchronization at line or 2-times line frequency.

"Z" Axis Modulation: Capacitively coupled to the grid of the cathode ray tube 15 volts blank trace fully at normal intensity.

Shielded, Shock Mounted, Built-in Calibrating Voltages, Excellent Stability and Expandable Sweep (6 times expansion) are several additional features of this highest quality instrument. Priced today at $355.00, and available with good delivery to priority users. For full information, write the Hickok Electrical Instrument Co., 10533 Dupont Avenue, Cleveland 8, Ohio.

ADVANCED 630 TYPE TV KIT

The basic 630 type circuit has been further developed to the point where Tech-Master Products Company of New York City believe it represents the last word in television engineering. Of its many features, the major ones are quick action keyed AGC circuit, "hi-sweep" voltage multiplier system, advanced 12—channel turret tuner, full 4 Mc band width, and excellent sensitivity.



Carefully planned schematic and pictorial diagrams, as well as simple-to-follow instructions, will help the purchaser completely assemble this kit over a week-end. Top quality, circuit aligned components minimize the amount of final adjustments necessary. This kit comes in two models, the De Luxe kit, Model 630D19, has the principal components mounted in place, while the Standard kit, Model 630S19, comes unassembled. Both kits are supplied with all components, picture tube mounting brackets, speaker, and all tubes (less kine, wire, and

solder). The chassis measures 21¾" wide by 15¾" deep.

3-SPEED PORTABLE PHONO

Model 621, a portable three-speed automatic phonograph produced by Webster-Chicago Corporation, includes a "feeler" mechanism that regulates the swing of the tone arm to

the width of all three sizes of records. It has a five-inch speaker and a three-tube amplifier. The changer is housed in a burgundy leatherette carrying case and the complete unit weighs 30 pounds.

TEST OSCILLATOR

A wide-range Test Oscillator Model 3432 with uniformly illuminated dial is announced by Triplett. Seven long (330°) scales with widely separated divisions easily read. Lighting also provides an ON-OFF indicator. Five fundamental ranges—165 KC to 40 MC, and two harmonic ranges directly calibrated 36 MC to 120 MC. Range selector is a five-position follow-up coil switch with complete shielding. R.F. Selector provides high and low

R.F. Output. Output Attenuator provides fine control R.F. Output to Co-Axial output cable connector. Circuit selector provides for internally modulated signal (Variable 0 to 100% at 400 cycle). Variable amplitude of external modulation 40 to 15,000 cycles. All R.F. and Audio circuits are double shielded with copper plated steel shields.

Metal case, 15 11/32" x 11 1/32" x 6¼", with black enamel finish. Leather strap handle for ease in carrying.

Power: 115 volt, 50-60 cycle A.C. (electrostatic shielded transformer), Wt. 14½" lbs. net. For further details write The Triplett Electrical Instrument Co., Bluffton, Ohio.

TRADE FLASHES

[from page 12]

come a wholly-owned subsidiary of The Gabriel Company.

In their announcement, Briggs and Greene noted that the arrangement offered new opportunities for both companies. Plans are already under way to expand Workshop engineering and Gabriel's production facilities, and the two will cooperate on many new development programs. Current plans are to keep both organizations intact, they stated, an no change was indicated in existing operating policies ad procedures of either.

DuMont Service Ciinics

The Teleset Service Control Department of Allen B. Du Mont Laboratories, Inc., has scheduled 450 television service clinics to be held all over the country in coming months, it was announced yesterday by E. W. Merriam, manager of the Du Mont Teleset Service Control Department.

The service clinics, to be conducted for the benefit of authorized Du Mont service organizations and servicing dealers, will be run by Du Mont regional service managers and field representatives in conjunction with the Receiver Sales Division's distributors. The clinics will start immediately.

Copies of the lectures will be distributed to service representatives who can keep them as text book references.

Topics to be covered during the service clinics include: Production changes and current field problems; adjustment procedure for current production models; alignment and trouble shooting on Du Mont electronic tuners; trouble shooting procedure on synchronizing circuits; trouble shooting procedure on deflection circuits; trouble shooting procedure for video and IF circuits; amplifiers and cathode-ray tube circuits; trouble shooting procedure on sound circuits and low voltage power supplies and general alignment principles and procedures.

New Award of Merit for Burgess Battery Company

The Certificate of Merit for 1950 has been awarded to Burgess Battery Company, Freeport, Illinois, by the New York Hall of Science. The announcement of the award was made by Robert P. Shaw director of the New York Hall of Science.

In making the award, Mr. Shaw

said that two of the research and development projects conducted by the Burgess Battery Company served as the basis for the 1950 award. One of the outstanding achievements was the pioneering of artificial electrolytic manganese dioxides; and the second, the founding of the industry of reserve type cells.

Sams To Distribute Coyne Publication

Coyne Electrical and Television-Radio School, of Chicago and Howard W. Sams & Co., Inc., Indianapolis technical publishers recently announced that the Sams organization will distribute the Coyne electronic and electrical publications under exclusive franchise in the electronic parts suppliers industry.

A joint announcement by Howard W. Sams and by Ray A. Snyder, general manager of the Coyne technical book division said that the entire Coyne list of field reference and home study electronic-electrical technical, handbooks and practical instruction material of the 52-year old Chicago institution will be handled through the Howard W. Sams organization's distributors and representatives in the electronics after-market.

Technical Lectures Made Available

The Television Technicians Lecture Bureau will make available to all registered Service Associations a series of six interesting lectures on important technical and business subjects to start in September 1951—and at no cost to the cooperating associations.

The lectures, which will all be slide-film-recorded presentations, will each be furnished complete with projector and sound reproducer so that a minimum of equipment will have to be obtained by the program committee. The lecture will be one unit of a complete one and one-half hour program that will be furnished for each of these six meetings.

In order to participate in this unusual plan it is vitally necessary that complete information about the Association be forwarded to Paul H. Wendell, Television Technicians Lecture Bureau, P.O. Box 1321, Indianapolis 6, Indiana.

W. G. Many Now Sales Consultant

W. G. (Bill) Many, who for the past twelve years has been advertising & Sales Promotion Manager of the Cornell-Dubilier Corporation, South Plainfield, New Jersey, and Editor of the "C-D Capacitor," recently announced his resignation. He will conduct a personalized public relations service handling sales and

engineering catalogs, literature, house organs, publicity, advertising and other related sales promotion activities for electronic and photographic equipment manufacturers.

He attended Columbia University School of Journalism, has been managing editor and editor of various well-known technical and popular radio trade journals, and is author of innumerable books, articles and literature of all varieties on radio, photographic and other technical subjects.

Temporarily, Bill is making his headquarters at his home in Metuchen, New Jersey until better facilities can be located elsewhere.

Zetka Acquires Interest in New Color Tube Process

Meyer Bonuck, President of Zetka Television Tubes, Inc., of Clifton, New Jersey, announces that his company has acquired the right to purchase an interest in Sightmaster Corporation's patent position for the sum of $250,000. He states that Zetka has already made a substantial payment on account. Information was also forthcoming from Michael L. Kaplan, President of Sightmaster Corporation, that these patents and patent applications affect the improved construction of color cathode ray tubes.

By the use of these patents, the brightness of a cathode ray tube is increased and the intensity of the primary shades of the spectrum, red, blue and green, is also increased evenly. This improvement in cathode ray tube construction for color applies to either the CBS system or the RCA system.

NEMCO Resumes Electronic Parts Manufacture

The National Electronic Mfg. Corp. of Long Island City, N. Y., which made large quantities of quartz crystals, crystal holders, and other electronic parts during World War II, has resumed production of these items to meet current military demand, according to Bernard L. Cahn, sales manager. Most of the company's new factory at 4202 Vernon Boulevard is being devoted to this work. Other NEMCO products are auto and television antennas, boosters, ignition suppressors and insulators.

I.R.E. Show Attracts Thousands

Thousands of servicemen and engineers attended the I.R.E. show which ran four days, Mar. 19-22, at the Grand Central Palace in New York City.

High on the list of 210 topics discussed as far as security permits during 43 sessions held by the group, which met for the 40th year and has a 29,000 world-wide membership, were vital military items such as atomic piles, radar, guided-missile controls, and gun-aiming computors. Communications and warning apparatus using electron tubes and needed for civilian defense will also receive top attention.

Along civilian lines, new circuits and component parts that permit critical materials such as aluminum, copper and cobalt to be conserved while at the same time retaining or improving the performance of television sets, radio receivers, sound apparatus and industrial electronic controls was disclosed. Freer interchange of design ideas among engineers and their organizations for the common good is predicted during the emergency period.

The meeting covered a number of topics of popular interest. One technical paper delivered, for example, described a new electronic device that automatically turns off radios after one or two syllables of speech, turns it back on again the instant music begins to play. Another describes a manufacturing technique by which a 12-tube radio receiver may be built within the space occupied by a quart of milk.

Scene at the Vanderbilt Hotel where Reps and NEDA members held a dinner and dance on February 17.

SLOGANS

[*from page 28*]

"If We Accept Your Radio To Be Repaired We Will Repair It"—Ross, Dallas.

"We Furnish A Radio While Repairing Yours"—Burns, Memphis, Tenn.

"One Way—Is The Right Way"—One-Way, Memphis.

"If It Can't Be Repaired That's Where We Begin"—Reeds, Memphis.

"Service With the Magic Touch"—Aladdins, San Antonio, Texas.

"We Satisfy Our Customers"—Carters, San Antonio.

"Bring Your Radio Troubles To Me"— Hodges, San Antonio.

"Hear 'Em Play Before You Pay"—Reeh, San Antonio.

"Accuracy Is Our Policy"—Accurate, Omaha, Nebr.

"Where Good Service Is a Habit"—All Makes, Omaha.

"If We Can't Fix It Throw It Away"—Weese, Wichita Falls, Tex.

"Have It Done Right"—Kojaks, Beaumont, Tex.

"An Old Timer In the Business"—Franks, Beaumont.

"Repairing That's Better"—Sullivan's, Milwaukee, Wisc.

"Service With A Smile"— Radio Co., Milwaukee, Wisc.

"Simple Service Saves Serious Trouble"–Huddleston, Oklahoma City.

"Where Your Set Is Fixed the Way It Was Built"— Duggers, Oklahoma City.

"There's No Substitute For Experience"—McCurleys, Phenix City, Ga.

"The House That Service Built"—Ed's Hartford, Conn.

"Our Maximum Knowledge of Radio Affords You Minimum Cost"—Melvin's New Orleans, La.

"Workmanship is a Good Investment"—Boydston, Seattle, Wash.

"Radio Trouble Found In a Jiffy—Clarksdale, Louisville, Ky.

All of these selling sentences sell radio services . . . implant a given idea or a given shop definitely in the minds of all who read them wherever they are used.

Such slogans build business because people remember them . . . and remember the essential message they carry in their phrasing.

TUBE TOPICS

[from page 29]

which may be more readily available will replace type 41 when used on a 250-volt B supply with a slight reduction in output capability. See *Fig. 2.* A change to a 5-pin socket is required to effect this substitution along with

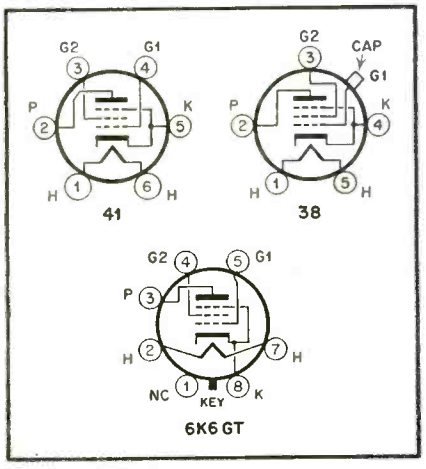


Fig. 2. Socket connections of 41, 38 and 6K6GT tubes.

an increase in the cathode bias resistor to approximately 1000 ohms. Characteristics are tabulated below for comparison.

47

Type 47, the original power output pentode (filamentary), may be replaced by the type 2A5, a similar output pentode which has a cathode. Only change required is the socket. When making the change, the cathode of

	41 6K6GT	38	
Heater potential	6.3	6.3	volts
Heater current	0.4	0.3	amps.
Plate potential	250	250	volts
Screen potential	250	250	volts
Grid bias	-18	-25	volts
Plate current	22	32	ma.
Screen current	5.5	3.8	ma.
Load resistance	7600	10,000	ohms
Power output	3.4	2.5	watts

Types 41 and 38 comparison chart.

the 2A5 should be connected to the center of the filament winding or center-tapped resistor. See *Fig. 3.* Type 2A5 is rated at 3 ma higher plate current and 0.5 watts higher output with a 250-volt B supply.

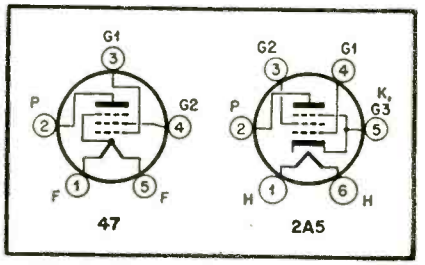


Fig. 3. Types 47 and 2A5 socket connections.

16KP4 vs. 16RP4

These are the popular 16-inch rectangular picture tubes having a gray filter type of face plate. They are identical electrically and mechanically. Difference?—Like the 14BP4 and 14CP4, merely in the external conductive coating. On the 16RP4, the first of the two types, the outer coating is ¾" from the yoke reference line. On the 16KP4 the coating was moved away to 2" from the reference line. The increase in the distance of 2" was to take care of arcing from the yoke to the grounded coating which occurred in a few set designs where the peak voltages across the yoke were unusually high. In order to reduce inventory requirements the stocking of a single type is recommended. Actually industry sales of 16KP4 and 16RP4 were about equal in 1950. At least one manufacturer is currently supplying a double-branded tube bearing the designation 16KP4/16RP4 which has the 16KP4 coating to eliminate the possibility of arcing from the yoke to the outer conductive coating in all set designs. Incidentally, if the grounding wires won't reach the coating, one of the specialty manufacturers is now marketing an outer

coating that merely needs to be painted on the tube. This coating, too is handy in repairing scratched or flaking outer coating.

QUIZ

[*from page 26*]

ful for locating an inoperative stage but if disturbance tests are inconclusive, signal injection and ear tests are not likely to contribute any additional useful information. Since disturbance tests are quicker and simpler, they are preferable. Signal tracing for FM i-f stages is not a common practice.

ANSWER 3-c

Use of the signal generator and ear will not give precise information concerning the gain of the stage, and since ear checks were inconclusive in the disturbance tests, there is not much point in repeating such tests with a generator. The output meter in the plate of the P.A. gives a wider, more readable and accurate range of voltages than using a meter across the voice coil, where the voltages are stepped down. It is necessary to put a condenser in series with the a-c meter when hooking it to the plate of the P.A. to keep out the a-c voltage on the plate and allow only the a-c signal to go through. An a-c meter, of course, would respond to d-c voltage also and so confuse the gain check if the condenser were not there.

ANSWER 5-c

Since voltage and resistance readings were normal within the usual tolerances, it was logical to suspect a fault that would not affect these readings, such as an open condenser. Substituting a new condenser for *C-33* corrected the trouble. While an open trimmer might also cause low output this possibility was eliminated when both trimmers were found to peak. If *C--32A* were open, turning it would have had no effect on the voltage reading at full load.

A leaky cathode by-pass condenser of leaky *C-35* are ruled out since they would certainly have changed the voltage reading and possibly the resistance readings also.

CONVERTING SPLIT-SOUND

[*from page 27*]

nator leads very close to the chassis so as to use old leads for connection to new discriminator can.

[*Continued on next page*]

2. File old hole of 1st SIF transformer so as to make the new 4.5 mc coil fit properly. Remove clip supports from old 1st SIF transformer and secure new 4.5 mc can with either rivets or small machine screws and nuts.

3. File and drill hole to mount new 4.5 mc discriminator can properly.

4. Insert new 4.5 mc discriminator and 1st SIF cans. (3 terminal side of discriminator can closest to 2nd SIF tube).

5. Connect 470 $\mu\mu$f condenser from top of peaking coil, *L54* in video detector output, to grid of 1st SIF, pin 1. Dress lead from 470 $\mu\mu$f condenser close to chassis and as far away from video and sound output circuits as possible.

6. Connect 22 $\mu\mu$f condenser from plate of 1st SIF to grid of 2nd SIF.

7. Connect 330,000 ohm resistor from grid to 2nd SIF to ground. Disconnect *R15* and C36 and remove.

8. Connect new 1st SIF coil (4.5 mc) to plate of 1st SIF and reconnect leads to new 4.5 mc discriminator.

9. Connect balancing condenser (45 to 370 $\mu\mu$f.) from tertiary winding (center terminal of 3 lug discriminator side), to ground.

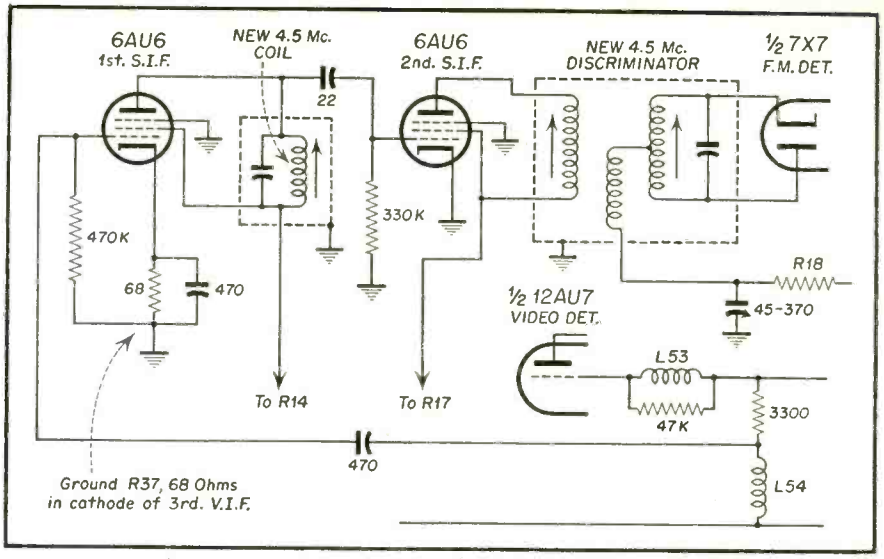


Fig. 2. Revised sound i-f circuit (4.5 mc) showing connections to new 4.5 mc coil in plate circuit of 1st sound i.f. and new 4.5 mc discriminator transformer. New transformers are mounted by proper filing and drilling.

10. Change 1st SIF tube to 6AU6.

NOTE: *Figure 2* shows the sound i-f system after the preceding changes were made.

11. At Align Test Jack pin 3, video detector output feed in accurate 4.5 mc signal from generator. Insert meter in FM Test Jack, pin 2 and peak 1st SIF coil and discriminator primary for maximum indication. Tune discriminator secondary and balancing condenser fo minimum indication.

NOTE: It may be necessary to re-

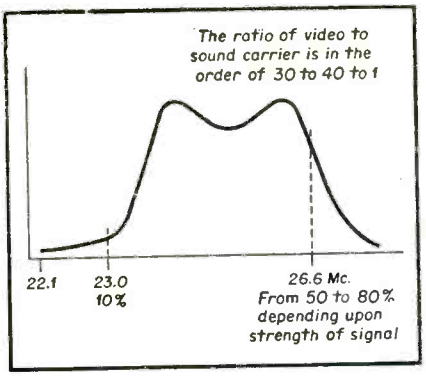


Fig. 3. Video i-f response after alignment

touch Sound i-f adjustments for best sound on station signal.

12. Connect sweep generator output to mixer grid through appropriate jig. Turn channel selector so that the selector is in between channels (not indexing). Connect scope to video detector output through appropriate jig.

13. Observe VIF Response curve, and repad i-f poles so that the response curve shown in *Fig. 3* is obtained.

SWEEP GEN.

[*from page 21*]

pattern may overreach the tube face as the set is brought nearer true alignment. The immediate tendency will be to reduce 'scope gain in order to bring the pattern down to proper level. (In radio receiver alignment the temptation was to use a higher scale of VTVM when the needle swung beyond the end of the scale). In such a case *decrease sweep generator output* until the proper level is secured on the 'scope. Overloaded i-f stages means that the tubes are running at saturation and the output level will be constant. While this gives a flat appearing pattern on the 'scope, it is not a true indication, and the sweep generator output *must* be reduced to a minimum for proper results.

14. A general rule to follow is to use the sweep generator, marker and scope in the following sequence for tracking and alignment procedures:

(a) Set all traps at proper frequency.
(b) Align video i-f stages.
(c) Align sound i-f stages.
(d) Track r-f and mixer stages.
(e) Track oscillator and set trimmers to get best picture and sound at approximate center of fine tuning control setting.

MEN OF RADIO

[*from page 24*]

ing and receiving wireless waves over a distance of 100 yards or more and thus became the first man knowingly to use the Branly "coherer" (the name was coined by Lodge) in receiving wireless waves.

Branly was awarded the Nobel prize for his work almost thirty years after he invented the coherer. By that time, the coherer had achieved fame with Marconi and had long since been supplanted by a long series of improved detectors: the electrolytic detector, the magnetic detector, the crystal detector and the Aladdin's lamp of radio, the vacuum tube. The inventor of the coherer lived until 1940, when he saw his native land invaded by Nazi armies. As he witnessed the attempts of the enemy to divide the sympathies and allegiance of the French people by the use of radio propaganda, he wondered whether the development of the science had not been a mistake. In fact, he was so disappointed and disillusioned that he was led to express regret, publicly, that his invention had helped to make radio possible.

(To Be Continued)

TVI

[*from page 18*]

usually eliminate this source of trouble. Other paths have been found on occasion: direct pick-up by kinescope leads, chassis wiring, and unshelded if transformers, traps, and tubes, but the majority of the interference problems are "front-end" difficulties.

Twin-Lead Measurements

It is obvious that the amount of signal that has to be rejected at the television receiver is a function of the distance between the receiver and the amateur transmtter, but it is sometimes forgotten that the length of the receiving-antenna transmission line is also an important factor.

Fgure 8 is a curve of the r-m-s voltage available with different lengths of feeder on a regular television antenna. The signal source was 29-megocycle radiation from a low-frequency discone antenna. The transmitter power input was 300 watts. When the data was taken, the 300-ohm television feeder, which happened to be about 45 feet long, was progressively length-

ened. At each change in length, the voltage was measured across the line and plotted against the change in wavelength at 29 megacycles. 4.5 volts of r.f. was available at one particular length, but with the feeder ¼ of a wavelength shorter, the measuring equipment was not sensitive enough to record the voltage. The dashed line is the curve produced when a 300-ohm non-inductive resistor was used to terminate various lengths of the line.

This experiment was conducted with the receiving antenna 70 feet from the transmitting antenna. The results have been described here to illustrate the magnitude of the voltages that must be rejected by a television receiver, but I have also presented a description of this experiment to illustrate, in concluding the discussion, one more interference phenomenon.

Secondary Sources of TVI

This last item is an interference condition that I have encountered on numerous occasions, but never so embarrassingly as during the evening the data was taken for *Fig. 8*.

The voltage readings were being taken with a germanium-rectifier high-frequency probe, an innocent device, but the cause for a telephone call from a neighbor I hadn't interfered with for several years. He wondered if some control on my transmitter had been slipping; interference had been getting progressively worse all evening, and now Channel *2* had disappeared and there was bad cross-hatching on Channel 7. This discouraging bit of information coincided nicely with my progress up the curve from point *A* to point *B*, so caught in the act of taking a measurement at *B*, I immediately removed the high-frequency probe, left the transmitter on the air, and asked for a recheck on the interference. The neighbor's ensuing report indicated that there was no interference on any channel, but he was still curious to know "what had happened this time!"

I tried to explain that a little piece of germanium metal about a sixteenth of an inch square was the secondary cause of our predicament, and that non-linear systems did not necessarily have to be connected directly to a transmitter or receiver to cause the generation of harmonics from a sinusoidal signal source. This explanation didn't make much of an impression, but when assurance was given that this particular test wouldn't be run any more, our telephone conversation ended happily and another episode in a long series of similar interruptions was concluded.

AD INDEX

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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-TELEVISION SERVICE DEALER, 67 W. 44 St., New York 18, N. Y. Unused manuscripts cannot be returned unless accompanied by stamped and addressed return envelope.

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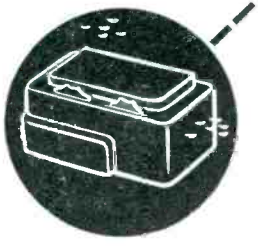
Model B-51

Manufactured by the leading designer and producer of TV tuners "The Standard Tuner"



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- ★ Large two knob control
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  - **Off:** Signal by-passed to set
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  - **On:** Plate voltage applied, booster in operation
  - **Tune:** Fine tuning for sharper picture or sound reception
- ★ Detent Tuning—positive channel selection
- ★ Continuous one knob tuning—no switch from high to low
- ★ Simple installation
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