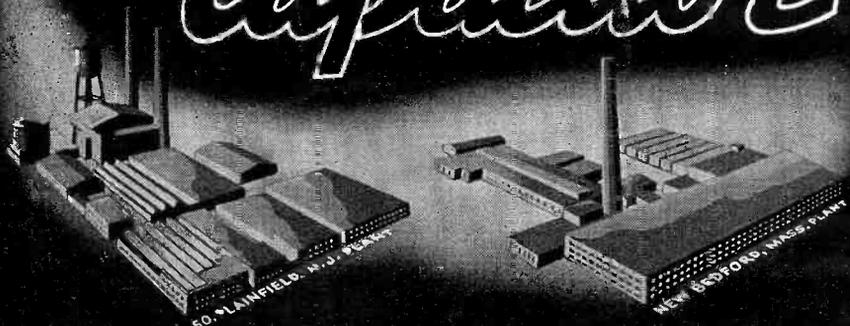


The CORNELL-DUBILIER **CD** *Capacitor*



Vol. 11

JANUARY-FEBRUARY, 1946

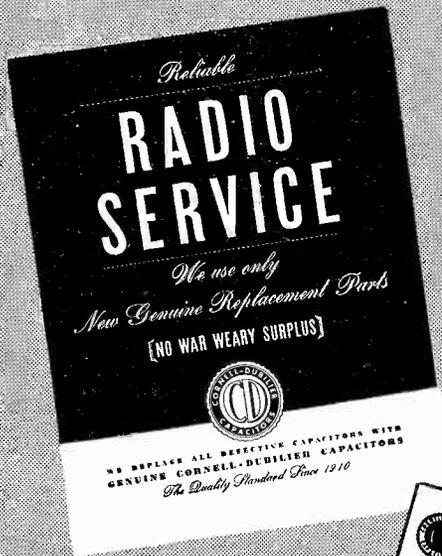
Nos. 1 & 2

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 The Best Mica Color Code
 11 x 14" Color Chart
 1950 Edition
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PRINTED
 IN
 U.S.A.

SPEEDY SERVICING*

How to Use Audio Oscillator and Signal Generator to Simplify Tests of Sets

HOW TO SPEED REPAIRS

Use audio oscillator to produce substitute signal for testing audio stages.

I.F. modulated signal may be injected to test i.f. stages.

Test suspect tubes by substituting new ones.

Use vtvm for testing oscillator stage voltages.

In this article, servicing procedure is outlined. It may prove helpful to radiomen in systematizing and streamlining their own techniques.

Let us assume that the radio serviceman has a set on his bench with the complaint clearly and fully noted on the tag, and a notation telling whether the tubes have checked, and what condition they are in. Let us further assume that the set is dead.

Before plugging the radio in, the repairman looks at the cord plug, watching for shorts or opens. This saves fuse replacement if a short is present. Then the set is plugged in and turned on, and tubes and pilot lamps are observed to see whether they light up.

Removing Parts

While the set is warming up, the chassis bolts are taken out, and the knobs removed, and placed in a tin can on the work bench. If the completion of the job is held up for lack of a part or because a more urgent repair has to be attended to, these parts are put in a small muslin sack, and tied to the line cord near the

chassis. They are always at hand, thus, when the radioman returns to the set, and no time need be wasted hunting for lost screws or knobs.

Defective small parts that are replaced during servicing are similarly placed in a sack and attached to the line cord, so that they may be shown to the customer when the set is delivered.

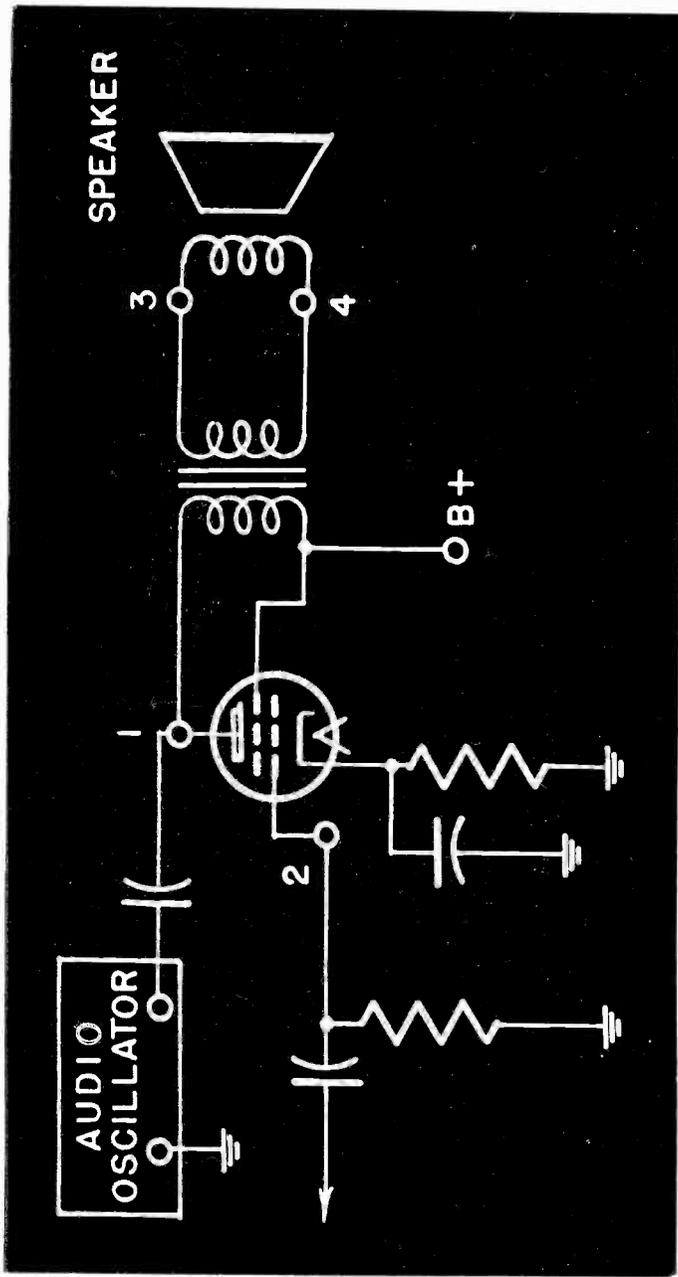
We'll suppose that by now the set has had time to warm up. We listen for hum in the speaker. If no hum appears, the chances are that the output tube or speaker is defective, or else no B voltage is present.

The voltage from plate to cathode of the output tube is noted, and also that between screen and cathode. If voltage is present between screen and cathode, and absent between plate and cathode, there is either an open in the output transformer primary or lead, or a shorted plate by-pass capacitor. In this case, we immediately switch from volts to ohms, and check for 300 to 500 ohms from screen to plate of the output tube.

In case the primary of the transformer winding shows normal resistance, the ohms reading from plate to ground should be noted, and if a short reading is obtained, the plate by-pass capacitor is unsoldered at one end and checked. This usually clears up the problem, but there is still the chance of a shorted tube, or a grounded lead being present. These possibilities should be investigated if the capacitor tests ok.

In case the voltages were normal on the output tube, the audio oscillator test probe is put into action. There is a .01 mfd capacitor in the lead to prevent shorting out the power supply, so

* By R. F. Wallace and E. D. Jackson in "Radio and Television Retailing."



Using audio oscillator to test audio stages. The "high" lead is injected at points 1, 2, and preceding points. To test voice coil, oscillator is injected to points 3 and 4.

it can safely be jabbed on the plate pin of the output tube.

Chasing the Signal

If we get the signal through the speaker, we put the probe on the grid of the output tube, from there to the grid of the preceding audio tube, until we get no response, and then we look for the trouble in the area just following the point from which no signal is heard in the speaker. If we don't get signal through the speaker with the probe on the plate of the output tube, the audio oscillator output is put across the voice coil leads. If the signal comes through the speaker here, we look for a plate by-pass capacitor that returns to B plus rather than ground, that is shorted, before searching for trouble in the output transformer secondary.

The winding of the secondary is of such heavy wire that it seldom gives trouble, and it generally comes out to the junction panel, so there is no joint to produce defects. The same holds for a hum-bucking coil. If the signal fails to come through when it is applied to the voice coil leads, it is probable that the voice coil is open. To check this, it is necessary to disconnect one of the leads from the voice coil to the output transformer, when it should show one to twenty ohms dc resistance.

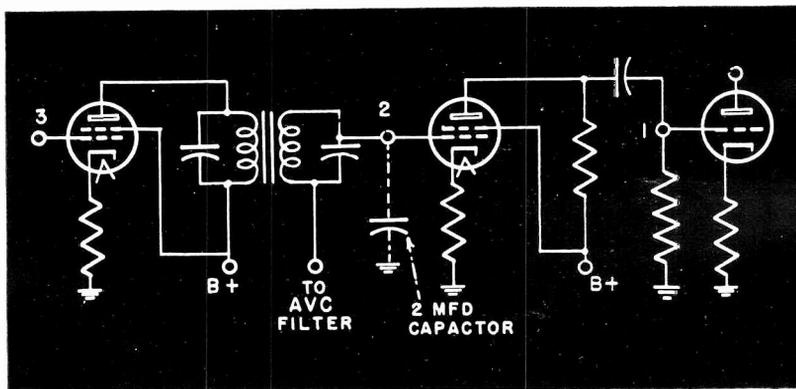
If, instead of a no-hum condition, a loud hum is received, most likely there is low capacitance in filter system. When application of a 16 mfd capacitor between screen and ground on an ac set, or 30 mfd on an ac-dc set, fails to take out the hum, it is time to look up the schematic in Rider's Manuals, and get a picture of how the radio is hooked up.

By checking the diagram we may find that the filter system works with the negative side of the capacitors below ground. By identifying some prominent below-ground point in the circuit, we can try our substitutions from that point.

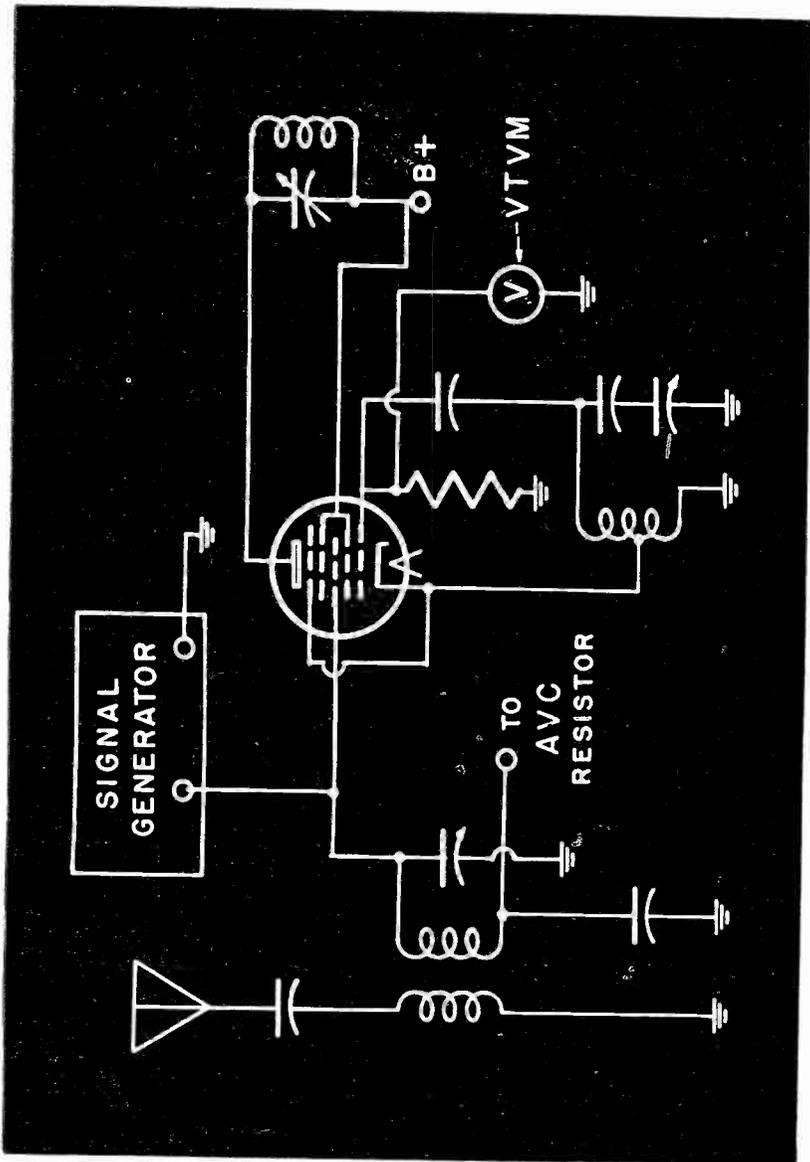
Hum Test

If the hum seems to come from the filter system (by-passing the output tube grid or grids to ground with a 2 mfd paper capacitor will take out all but filter hum), and if there are several filter capacitors, we check them all for decreased capacitance by bridging them with equivalent units.

If the hum proves to be of different origin than the filter system, the stage-by-stage method of elimination is tried. The 2 mfd capacitor is used to by-pass successively earlier grids to ground, until the stage that picks up the hum is located.



Testing for hum source. A 2 mfd. capacitor by-passes successively earlier grids to ground.



Testing i.f. stages. Signal generator output is applied between mixer grid and ground.

(Continued on page 13)



A Free Market-Place for Buyers, Sellers, and Swappers.

These advertisements are listed FREE of charge to C-D readers so if there is anything you would like to buy or sell; if you wish to obtain a position or if you have a position to offer to C-D readers, just send in your ad.

These columns are open only to those who have a legitimate, WANTED, SELL or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transactions involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

SWAP—A complete microscope set and a phonograph pick-up arm for a spring wound instructograph and accessories in very good condition. Roger E. Many, 1029 Minor Ave., Hamilton, Ohio.

WANTED — VOM or cheap Multitester. Will trade a 35mm strip film projector for the above or a good 35 mm or 127 size candid camera. Projector cost \$33.39. Picture of it if wanted. John Arnold, P.O. Box 84, Bluffs, Ill.

SALE OR TRADE — Fishing tackle; photo equipment; 35 mm motion picture projector and camera; Class 2 or 3 boat lights, radio and elec. parts. **WANT**—Chem. Tech. books, apparatus, microscope, lab. elec. furnace, scales, etc. Hansen Rad. Ser., 165 Silverbrook, Niles, Michigan.

FOR SALE—Lightning Bug Vibroplex. A1 condition \$15; Mossberg 46M .22 cal. with water proof carrying case, little used, \$35. Herbert Browne, 1709 W. 10th St., Brooklyn 23, New York.

FOR SALE—Philco radio chassis and spks. models 111, 96, 78, 76. Fada chassis and spkr., Brunswick chassis and spkr. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

FOR SALE—One Philco auto radio mod. NRI. Used but undamaged. Needs spkr. cone. Make offer. Andrea Radio, 107 Franklin Ave., Rochelle Park, N. J.

WANTED—Schematic for Radio City Oscilloscope, model 553, Serial 183. Will pay \$2.00 for same. Sam L. Oliva, 1808 Blandina St., Utica 3, N. Y.

FOR SALE—Tubes in sealed cartons, at list prices. Send for list or your needs. Herbert Levinson, 2422 N. Natrona St., Philadelphia 32, Pa.

FOR SALE—A number of record changers, complete with motors, 1 oz. pickups and turntables. Also rim driven motors with 9" turntables. All reasonably priced. William Blaha, 2233 South 59th Ave., Cicero 50, Illinois.

WANTED — Sig. generator. Give make, model, description, condition, price. Harold W. Reid, 411 So. Phillips, Salina, Kansas

FOR SALE—Telephone hand set, transmitter and earphone combined. Used with any type transmitters or pa system. \$10. All letters answered. J. R. Sidelko, 30 Main St., Luzerne, Pa.

WANTED — Model E-200 Precision signal generator also model 030 Philco dynamic tester. State condition and price. Louis Fialkoff, 143-48 41 Ave., Flushing, L. I., N. Y.

FOR SALE—Motorola car radio and head, for any car, almost new, \$40. Emerson portable, ac or dc, almost new, needs power tube 117-P7, \$25. Ben Mueller, 736 Rittenhouse St., N.W., Washington 11, D. C.

FOR SALE—4 Kolsters K 20s, with PM or magnetic spkrs. Mod. 48 Kolster, brand new mod. K5 Kolster. 11" dynamic spkr., Majestic 90B and 90 spkr., Colonial 38. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

FOR SALE—RCA modulated oscillator \$5; Weston 3 meter mod. 547 Multitester \$20; IRC resistance analyzer and indicator \$4; Superior instruments: Channel analyzer \$15; mod. 1280 comb. tube and set tester \$22; mod. T-37 sig. gen. \$1; Cash and carry. Write for inspection appt. H. Newton, 46 Downing St., Brooklyn 15, New York.

FOR SALE—Experimental short-wave receiver, 5 bands from 140 kc to 40 mc, 10 tubes and spkr., \$28. V. Kozma, 3104 Wilkinson Ave., New York 61, N. Y.

FOR SALE—Superior de luxe set analyzer with adapters and instructions. Supreme de luxe tube tester and set analyzer, also checks condenser, all in Al condition. Carr Electric Products Co., 17 Kelley Square, Worcester 4, Mass.

FOR SALE—Hard to get tubes in sealed cartons. 2 Racon units, gene motor, turn tables, pick-ups. Write for prices. Carr Electric Products Co., 17 Kelley Square, Worcester 4, Mass.

SALE OR TRADE—6 tube ac-dc demonstrator for radio course or books. J. Bazewick, 3000 No. Christian, Chicago 18, Illinois.

WANTED—Set of Riders Manuals or individual numbers. Have for sale or trade 22 L.R. Savage N.R.A. type with sling. Silverstone portable with aluminum front, ac-dc. Other radio sets. Carl L. Negley, Electric Service, Crivitz, Wis.

FOR SALE—U. S. Signal Corps BC-412B oscilloscope (5") also 1" oscilloscope, in perfect condition, \$40 takes both. Chester T. Martowicz, 116 East 7th St., New York 3, N. Y.

WANTED—Nat. FB-7 with 20, 40 and 80 meter coils. Reasonable price. For sale 2½ meter recvr., built-in spkr., tubes 7A4, 6J5, 6F6, no power supply, \$20. Express prepaid. Bou Radio Service, 3131 N. Percy St., Philadelphia, Pa. W3ESX.

SALE OR TRADE—0-1 millimeter, 57S Marion, new, over 6" scale, 8½"×6¾" rectangular case, 100 ohms, sell for \$10, or trade for thermogalvanometer or other meters. M. E. Lawson, 1362 Park Ave., Plainfield, N. J.

FOR SALE—About 15 radio and electrical books, mostly theory, very slightly used. Send for list. Clarke, Box 18, Inwood Station, New York 34, N. Y.

FOR SALE—Brand new RME LF-90 freq. inverter \$23; new ATR model A power supply 6 vdc at 6.5 a. output, 110 v. ac input \$18; new Colt .38 spl. 4" bbl. revolver and 50 cartridges \$50. E. L. Smith, 116—10th St., Norfolk 10, Va.

FOR SALE—National AC-SW-3 receiver and power supply complete with tubes and 2 pairs coils, \$25. F.O.B. Milton Kalashian, 2 Congress St., Newburyport, Mass.

FOR SALE—Mod. 531 professional service combination, composed of mods. 444 set analyzer, 562 test oscillator and power supply for tube testing, including tubes, balts., leads, test accessories and carrying case, complete, \$38. A. Peart, 23 Ivy St., Newark 6, N. J.

FOR SALE—Simpson giant set tester \$30, giant tube tester \$25; Precision 700 modernized tube and set tester \$35; Precision E-200 sig. gen. \$35; RCP 663A vtvm, new, \$50; RCP 417 appliance tester, new, \$16; Brewster FM converter \$25. Paul Wunsch, Jr., 387 Clifton Ave., Clifton, New Jersey.

BOOKS—\$18 for all. Hi-Freq. Measurements, Radio and Communication Engineering, Theory Thermionic V. T., Radio Operating, Q. and A., Radio Traffic Manual and Op. Reg., others. Nathan H. Glenner, 1695 Gladstone Ave., Detroit, Mich.

TUBES—Some new, some used, meter test OK, 40% off, varied quantities. Write for list. Nathan H. Glenner, 1695 Gladstone Ave., Detroit, Mich.

FOR SALE OR SWAP—Transmitting, receiving equipment and parts; Pyrex chemistry glass ware and reagents, etc. Send for list. Raymond H. Ives, 822 Windsor Ave., Norfolk 4, Va.

WANTED—Ac-dc converter 100 w. new or used, in good condition. Riders Manuals, 7 to 12, quote price, condition. Automatic record changer, chassis, new or used. Julius C. Auccello, Pleasantville, N. Y.

FOR SALE OR TRADE—Complete National Schools radio and television course, cost \$250.00. 2 code osc., keys and phones, use O1A or 30 tubes included; audio trans. 3 and 5 to 1 ratio. H. Freeman, Box 5, Sta. Y, Brooklyn, New York.

FOR SALE—Remington triple head close shaver, like new in original box, complete with instructions, \$12. S. S. Schlisel, 3957 Gouverneur Ave., New York 63, N. Y.

WANTED—All kinds of test equipment and radio parts, trade or cash. 2 to 6 tubes radio kits with speakers, not assembled. State wants. Lominacks Radio Shop, 420 N. Cedar St., Greensboro, N. C.

FOR SALE—Dumont No. 208 5" oscilloscope, slightly used, electrically perfect, \$110. A. Sylvane, 612 Empire Blvd., Brooklyn, N. Y.

(Continued on page 14)

NEW REQUIREMENTS OF FM AND TELEVISION SERVICING*

Selection and Use of Test Equipment for Servicing Sets Operating in the New High-Frequency Channels

Television and frequency modulation receivers use new principles, higher voltages, and higher frequencies. These factors make it necessary to have accurate, safe, and reliable test equipment, capable of handling a much wider range of tests and measurements. The higher cost of television and FM home receivers must also be considered since their owners will hesitate to turn such sets over to the radio technician unless he can show that his equipment and experience are equal to the job. On the other hand, a service shop that neglects this field of television and FM maintenance, and limits its work to broadcast and all-wave receivers is likely to suffer a loss of prestige in its territory and lose much service work to better equipped competitors. Though standard tube testers, multimeters, etc., will be widely used, a brief listing of the new factors involved in television and FM servicing will show the need for new methods and equipment.

Higher Frequencies

The rf range of the new test equipment must extend to at least 106 megacycles, the present limit of commercial television and FM allocations. To properly align very-high-frequency (vhf) receivers, the signal generator frequency should be accurately calibrated up to 106 mc, and its output should be adjustable and calibrated. For rapid alignment of the many wide-band amplifiers used in television and FM receivers a frequency-modulating circuit, or "wobulator," will prove very desirable. Point-by-point alignment of a 6-mc-wide i.f. stage, by hand adjustment of the signal generator frequency, is altogether too time-consuming, and the usual "peaking" method of alignment will definitely ruin the performance of any television or FM

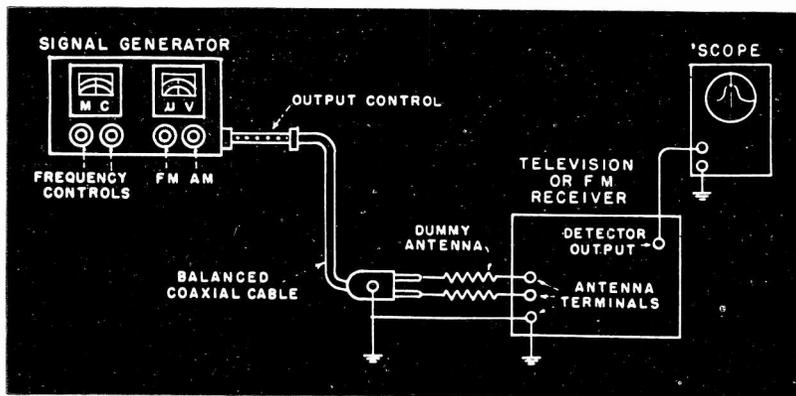
receiver. The only practical solution is the method used by manufacturers, known as "visual alignment." The accompanying block diagram shows the equipment required for visual alignment of a receiver.

The signal generator shown in this set-up should have a frequency range of about 4 to 110 mc and would be used only for alignment and testing of television and FM receivers. The rf output should be adjustable from at least 10 microvolts to 1/10th volt. In the sketch this output adjustment consists of a hollow cylindrical tube which slides in and out of the signal generator to provide variable coupling between the signal generator and the output cable. This type of output control is known as a "mutual inductance attenuator." It is more accurate than the resistance attenuators used at lower frequencies, and its construction and use is quite simple.

Signal Generator Output

The output cable shown in the sketch connects the signal generator to the antenna terminals of the television or FM receiver being tested. A matched, "twin-coaxial" cable is necessary at vhf to prevent reflection of the vhf signals back and forth between the receiver and signal generator. This reflection would cause errors in alignment, since the signal strength would vary, depending on the amount of reflection at each particular frequency used. The output cable must have two conductors, each centered within its own shield and terminating in two binding posts for connection to a dummy antenna. Most television and FM receivers operate from a "dipole" antenna, connected to the receiver terminals through a two-conductor cable having a characteristic impedance of about 72 ohms at 40 to 100

* Courtesy of "Radio and Television Retailing."



Typical Layout of Test Equipment

mc. If the signal generator output cable has similar characteristics no dummy antenna will usually be necessary, since the function of the dummy antenna resistors is mainly to match the cable to the receiver antenna.

For visual alignment of television and FM receivers the signal generator should incorporate a frequency sweep circuit. This circuit automatically tunes the signal generator frequency up and down over a range corresponding to the band width of the circuit being aligned. The amount of frequency sweep may be adjusted by the control labeled "FM" in the figure, and for television alignment, should extend to at least 3 mc either side of the alignment frequency.

The three graphs in the illustration show the types of patterns that would appear on the screen of the "scope" (cathode-ray oscilloscope) connected as in the circuit just discussed. The top curve shows the flat response (between points B and D) attainable on good double or triple tuned television—FM intermediate frequency amplifiers. If the older point-by-point alignment were attempted on such an amplifier, it would be necessary to tune the signal generator to frequencies corresponding to A, B, C, D, and E, the critical alignment points, while at the

same time watching an output indicator and adjusting trimmers on the receiver. Since FM receivers may have ten to twenty trimmer adjustments (and television receivers have many more), it is obviously impossible to check five points on each tuned circuit by point-to-point methods. The middle and bottom curves show what might happen if a band-pass stage is improperly aligned. These double and triple humps would distort FM and television signals to such an extent that the receiver would be practically useless, yet their presence would not show up with point-to-point alignment unless at least five frequency points were checked.

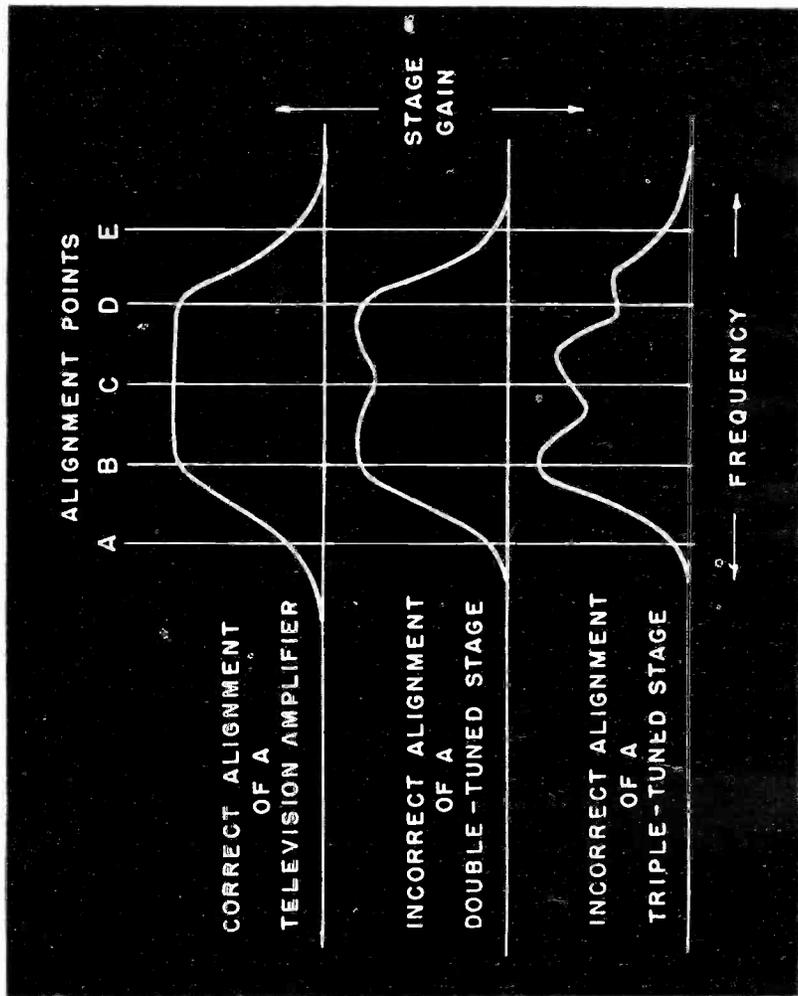
By presenting a continuous picture of tuned amplifier response, the visual alignment method overcomes the difficulties of wide-band alignment and makes servicing of television-FM receivers practical for a properly equipped electronic service shop.

For the visual alignment set-up shown in the diagram, any type of cathode-ray oscilloscope would be satisfactory. The vertical input of the scope will be connected to the receiver 2nd detector or discriminator, where the signal voltage is relatively high (about one volt). Any scope will be capable of producing a one-inch vertical trace with an input of less

than one volt, and the frequency response of the 'scope need not be good, since for visual alignment, the detector signal consists mainly of the 60 to 120-cycle sweep frequency. Before purchasing an inexpensive 'scope, however, it would be well to consider the various applications of the "wide-range" type of 'scope for television and

FM servicing, since these more versatile instruments may be better investments in the long run.

During World War II the superiority of the cathode-ray tube, as compared to meters, was definitely proved for most applications involving signal measurements. Since television signals are even more complex than radar sig-



Wide-Band Visual Alignment Patterns

nals, it is difficult to see how a complete television service department can function without a suitable cathode-ray oscilloscope. Television experts can diagnose many troubles by observing the picture pattern on the receiver's cathode-ray tube. Unfortunately this tube cannot be connected to various circuits in the set for localizing the trouble, and even the expert must use a 'scope of the best available type for trouble location in the "video" stages of television receivers.

The "best available" types of oscilloscopes, at present, are hardly within the financial reach of many radio service shops. Unfortunately, lower priced 'scopes are strictly limited, in their applications, to alignment work and audio frequency measurements. As a standard by which to judge oscilloscopes in general, the following specifications can be laid down for an instrument capable of handling all "video" signal tracing on television receivers.

Video-Range Oscilloscope

Frequency Range—15 cps to 5 mc, $\pm 10\%$, on vertical amplifier. There is some advantage in having identical vertical and horizontal amplifiers.

Deflection Sensitivity — 0.05 rms volts input should produce at least one inch of vertical deflection. Similar horizontal sensitivity is desirable, but not so necessary. The amplifiers should be capable of spreading the trace to twice the screen diameter without distortion, especially on the horizontal axis. The horizontal amplifier should not cause obvious horizontal distortion, or non-linearity, when viewing the same signal on different portions of the horizontal sweep. This type of defect is common in the lower priced oscilloscopes, and can be detected by applying a sine-wave signal to the vertical input and measuring the horizontal wave length of the trace at various parts of the screen, using a sweep rate of one-quarter to one-eighth the signal frequency.

Range of Input Voltages—0.05 to 500 rms volts for one inch deflection. This requires a range of input attenuation of 10,000 to 1, usually obtained by means of a "step" attenuator switch, used in conjunction with a gain control potentiometer.

Input Impedance—equivalent to at least one megohm resistance, in parallel with less than 70 micro-microfarads input capacity.

Signal Probe, with about four feet of shielded connecting cable, is desirable. The probe should have an isolating network at the input end, the impedance of which should be on the order of one megohm, shunted by not more than 40 micro-microfarads, to reduce loading of the circuit being tested.

Horizontal Sweep Frequency—15 to 30,000 sweeps per second from an internal "saw-tooth" oscillator of good linearity.

Sweep Synchronization—(1) "Internal," from the applied signal; (2) from an external signal, or (3) from the power line. The latter is required for measuring hum voltages which may be too small to synchronize the sweep in any other way.

Intensity Control—either by hand, or from a signal connected to an "Intensity Modulation" terminal.

Fine Points of Tele

Other television service problems include:

a. Cathode-ray tube testing, preferably by applying test patterns from a video pattern generator.

b. VHF antenna installation and maintenance. A portable field strength meter would be very useful for this work.

c. RF voltage measurements up to frequencies of 110 mc. AC vacuum-tube voltmeters equipped with high-frequency probes are capable of measuring stage-gain, etc., at frequencies far above the range of the best oscilloscopes. Their use, however, should be limited to unmodulated or "continuous wave" signals.

Much of the test equipment mentioned above will not be placed on the market until widespread sales of television and FM sets create the necessary demand. Nevertheless, service

technicians who wish to remain at the head of their profession are advised to prepare for the new service requirements by keeping in touch with the latest developments in this field.

SPEEDY SERVICING

(Continued from page 6)

Tube Test

At that stage, the associated tube is checked, with a special lookout made for cathode leakage. Resistance is checked in different parts of the circuit, bypass and coupling capacitors are tested for leakage, and roughly for capacity by bridging with a good capacitor of the right value.

Our tube testing consists of substituting a new tube, or one known to be good in that particular service. For instance, it wouldn't do to substitute a 6J7, that has been removed from an amplifier in which it was serving as a triode, in an autodyne mixer-oscillator circuit, because it could have a short between the grids which might not show up in triode service, but would render the autodyne circuit inoperative.

Suppose that a set does not pass a broadcast signal at all, but does respond to an audio signal from the oscillator at any point back to the high side of the volume control (in a duo-diode triode detector circuit). Our next test is to see if an audio modulated i.f. signal of the proper frequency will come on through and operate the loudspeaker.

Testing I.F. Stages

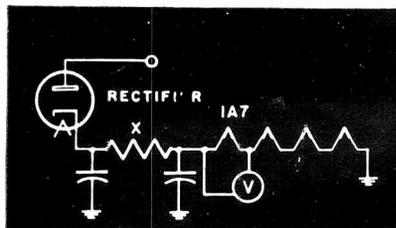
We apply the signal, with the signal generator wide open, to the grid of the mixer-oscillator, and if no signal is forthcoming, the frequency of the signal generator is varied over a wide band to see if reception at any frequency may occur. If none comes through, we return the frequency to that called for in the Manuals, and feed it to the grid of the i.f. tube, changing frequency if necessary to bring in a signal.

Of course, we would notice at once if the stage were completely dead, and would check the tube and the voltages on the pins immediately.

If no reception can be picked up with the test oscillator feeding into the grid of the i.f. tube, signal is fed directly to the diodes of the detector tube. If this fails to bring in a signal, the diodes are tested, resistance of the i.f. transformer windings is checked, resistance of the diode load, and so on down the line, until the trouble is located.

Once a signal is brought through the i.f. system, it is aligned. It is often necessary to start aligning at a frequency other than the one prescribed by the book, and slip it up or down, a little at a time, until the signal comes through at the proper frequency.

When we have correct functioning of the i.f. system and following stages, we still may not be able to get a signal of broadcast frequency through the set. This is usually due to failure



Testing for inoperative 1A7. Filament voltage of less than 1.4 v may cause tube to stop oscillating. Shunting "X" with resistor of about 10,000 ohms or less will often bring voltage and tube operation back to normal.

of the local oscillator. 1A7 tubes are frequent offenders, and we substitute a new tube on general principles when trouble of this sort is present, and a 1A7 is used in the set.

When the oscillator is working correctly, there is a negative potential from oscillator grid to ground. This can be measured with a voltmeter with a 1,000 ohm-volt resistance, but for accuracy, a vacuum tube voltmeter should be used. Where the set is inoperative over part of the band, and the rotor plates of the variable tuning capacitor are not rubbing, this voltage

is noted while the dial is run over from one end of the band to the other.

Absence of voltage at any point often indicates that the oscillator tube is not working well. If this is the case, several new tubes may have to be substituted, before one is encountered that will function perfectly in the circuit under test.

Service technique is, it seems to us, an important part of efficient operation of a radio repair department. We hope our method may prove interesting and helpful to other radiomen.

THE RADIO TRADING POST

(Continued from page 8)

FOR SALE—Good used custom fit and universal fit auto radios. '40, '41, '42 Plymouth and Dodge custom fit, Ford '41 and '37 custom fit. Write for prices. Paul Capito, 637 W. 21 St., Erie, Pa.

FOR SALE—1945 course in novelty manufacturing. Never used. \$8 takes same. Sherman Goldman, 26881 Minock Circle, Detroit 23, Mich.

WANTED — Design, development, and drafting work in the electrical, electronic, mechanical or modern furniture fields. Strictly confidential. J. W. Bourke, 148 Winthrop St., Brooklyn 25, New York.

WANTED—Plate transformer with 3500-0-3500 secondary, primary 110 volts or 220. Secondary should be at least 500 mils. Nelson K. Stover, 1357 Hill St., York, Pa.

FOR SALE—Cine-Master movie camera, 8mm or double 8mm F-3.5 lens. Built-in range finder. Uses color or black and white film. Used 12 times, \$75. I. W. Rykert, 6 Fairmont Ave., Batavia, N. Y.

SALE OR TRADE—Army tank model 10 tube FM recvr. Best offer over \$100 or trade for panoramic adaptor, oscilloscope, or with Meissner 14 tube Communications Master recvr. for SX-28. C. E. Nichols, 12 Prescott St., Wellesley Hills, Mass.

WANTED—U. S. or foreign stamp collection, recent Scott catalog, and opera glasses. Will trade trans. and recvg. parts, tubes, meters, mikes, 2" oscilloscope, rotary converter, etc. Send for list. B. Bernbaum, 5746 North Park Ave., Philadelphia 41, Pa.

FOR SALE—Philco 2v. batt. set, mod. 34; Majestic, Colonial, RCA console sets at \$10 each. Supreme mod. 85 tube tester, like new \$25, will only test old type tubes. Large stock tubes at 25% off list. Millhurst Radio Service, Freehold, N. J.

FOR SALE—Weston switchboard meters, recording pyrometers, Edison bats, power packs, RCA 18, no spk., \$10; Motorola 41D sup-het, batt-port, no tubes or bats, \$10; Air-King 3906 sup-het, batt-port, perfect, no bats, \$15. Philco dynamometer. Alfred Livingstone, 12-01 Ellis Ave., Fair Lawn, N. J.

TRADE—100 455 kc i.f. transfs., 100 201As, 100 26s, 50 27s, 25 112s, 25 171s, French phone with stand, 3 Jewell 74 0-15 ac voltmeters. Want test equipment, meters, .32 cal. shorts, small 110 vac drill. Roby's Swapmart, 820 E. 61 St., Chicago 37, Ill.

FOR SALE—Tungar battery charger with bulb. Westinghouse trickle charger, 3 vari. condns., single about 365 mmf., and 10 back issues Radio-Craft or Radio and Television, buyer pay freight, all for \$5. Joseph Marsh, 115 Stout Ave., Bound Brook, N. J.

FOR SALE—Many radio and transmitting items. Have Hallicrafter SX-17, transmitter parts, radio tubes, Weston meters, send for list. Leo F. Kersey, White Sulphur Springs, W. Va.

TRADE — Numerous technical works on radio and electricity, radio mags., etc. Want Jewell 54 or 199 dc meter cases with zero adj., test equipment parts. Send for list. Roby's Swapmart, 820 E. 61st St., Chicago 37, Ill.

WANTED — Electronic Engineering Handbook by Batcher and Moulie and similar technical books. Ralph LeBrun, 257 Kissingbury St., Rochester 13, N. Y.

FOR SALE—Jackson dynamic sig. analyzer, mod. 660, perfect condition, with tubes, ready to plug-in, \$65. Harold Sedgwick, 162 Weir St., Taunton, Mass.

FOR SALE—10 12 SC7 tubes, can be used for 35Z5 or 12SQ7, 1 T 13R04 pwr. transf. What are your needs. Want 1 25B8 tube. Herbert P. Schumann, Box 22, Sugar Land, Texas.

WANTED — Precision signal generator, other test equipment and Rider's Manuals. Carl J. Verona, 12 West 14 St., Bayonne, N. J.

WANTED—Riders Manuals, 3, 9 10, 11, 12, 13, will pay cash. Quote best price, have meters and other radio parts to trade. What do you want? E. L. Somers, 17 Chesapeake Ave., Crisfield, Md.

FOR SALE—Atwater-Kent 60, spkr. and tubes, Colonial 38, chassis and spkr., Fada chassis and spkr. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

FOR SALE—Brand new Supreme mod. 599 tube and set tester comb., in original carton, never used, \$45 cash. William T. Kline, 115 N. Franklin St., Lancaster, Pa.

FOR SALE—700 new radio tubes, some scarce. Send for list. Candler code and mill course. Edward Lindberg, 41 E. Ferry St., Buffalo 8, N. Y.

SWAP—Disc type turntable, good condition. Want Meisner P.A. tuner with slide rule dial, will pay difference. Details first letter. John Holtan, 2 Wallingford St., Dover, N. H.

FOR SALE—American Beauty soldering iron, 200 watts, new, \$8.00. H. Buckley, 1337 Marlowe, Indianapolis 2, Ind.

WANTED—E-200 Precision sig. gen. and Cornell-Dubilier Mod. BF-5C capacitor analyzer. State price and condition. Lee Sweet, Rt. 1, Box 465, Camino, Calif.

WANTED—Set of 4-prong plug-in coils to tune with .0001 var. cond. up to 550 m. and as low as 100 meters. John Poirier, Harlowton, Montana.

WANTED — Tube tester, short wave receiver, prefer SX 24 Sky Champion or Sky Buddy, also like to buy P-40 transmitter, either built or in kit. J. P. Hyde, Box 242, Manassas, Va.

FOR SALE—Westinghouse type FL, 6 mfd., 1000 v.d.c. condensers, for \$1.00 each, plus postage. Don Morris, 303 Home St., Fairmont, W. Va.

WANTED—Utah 5-10-20 transmitter and/or Variac 100-K bargain in first class or new condition. Myron E. Lawson, 1382 Park Ave., Plainfield, N. J.

FOR SALE—Marlin .32 cal., lever action rifle, magazine holds 15 shorts, 14 longs. \$30.00. Parsett N. Snyder, P. O. Box 109, R.D.E., Pitman, Pa.

FOR SALE—Westinghouse 2" round bakelite case panel mount meters. 0-5 amp. R.F. meter \$3.50, 0-1 ma movement has 0-2 KV scale. 2 meg resistor not included, \$3.15. Jack Krinsky, 4603 Church Ave., Brooklyn 3, N. Y.

WANTED—A complete set of Rider's Manuals, new or used will do. Send COD. Cash waiting. Cobb's Radio Sales and Service, 9236 Cardoni Street, Detroit 11, Michigan.

WANTED—16 mm sound film, any subject 100 ft. to 500 ft., also photo cell. Have 35 mm still strip projector, cost \$33.75. Want an electric organ or solovox. Have amplifiers and cash. John Arnold, P.O. Box 84, Bluffs, Ill.

FOR SALE—Hammarlund Super Pro and Hallicrafter. For further details write to Charles Kotval, 2430 So. 58th Court, Cicero 50, Illinois.

FOR SALE—1 mfd. 2000 v. working oil filled condensers, nationally known make, new with mtg. bracket, \$1.50 each. Jack Krinsky, 4603 Church Ave., Brooklyn 3, N. Y.

FOR SALE—Rider's Manuals, 1, 2, 3, 4, \$25; Philco Service notes, \$2; Emerson Service Notes, \$1 per vol.; RCA-Victor Service Notes, 1923 to 1935, 5 vols., \$2 per vol. James W. Iler, Box 71, Fanwood, N. J.

WANTED—Book on Thermionic Vacuum Tubes by Vander Bijl, H. J., published 1920 by McGraw-Hill. All letters answered. L. J. Schnedorf, 610 Monroe Avenue, River Forest, Illinois.

FOR SALE—Power transformer pack including choke and filters for Atwater-Kent 40. Best offer. Audios for same, 1 new 27, 1 used 27, 1 used 71, 1 new 6S7, new at list, used 50% off. Delbert Shaffner, Deepwater, Mo.

FOR SALE—Homelight 1500 w., 115 v., 60 cycle generators, 1 cyl. 2 cycle motor, WE control box with 0-150 vac meter. Brand new in original case. Built to govt. specs. \$260. Fob N.Y. Harold Marder, 374 E. 49 St., Brooklyn, N. Y.

WANTED—Model 030 Philco dynamic tester in good condition. Also E-200 Precision signal generator. Price and condition in first letter. Louis Fialkoff, 143-48 41st Ave., Flushing, L. I., N. Y.

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