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CORNELL-DUBILIER ELECTRIC CORP.
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RADIO SERVICE HINTS

Practical Suggestions on Solution of Radio Servicing Problems Encountered in Actual Experience by Servicemen Everywhere

This section, conducted by our servicemen readers, will be a regular feature of the C-D Capacitor, and is intended to provide other servicemen with helpful notes on testing, locating troubles in specific models of sets, repairing them, or any other suggestions to simplify service work.

Cornell-Dubilier will pay \$2.00 for each hint published in this section. Notes must be limited to 75 words, or less. Any number of hints may be submitted at one time. Unpublished items will not be returned. Be sure to give your name and mailing address. Send hints to: Editor, C-D Capacitor, Cornell-Dubilier Electric Corp., So. Plainfield, N. J.

Checking Noisy I. F. Trans. Primaries

Noisy I.F. primaries are often very difficult to locate. Checking with an ohmmeter may show normal resistance. Testing from plate to ground will not show much fluctuation, because the added drain seems to heal the corroded spot. Pulling out the mixer tube will not prove anything either, since it might be a bad oscillator coil. Try testing across the primary on the 10 volt A.C. range of a high resistance or vacuum tube voltmeter. A good primary will show a very low reading, which will be steady, a bad one will fluctuate constantly, often going as high as six or eight volts.—*Ralph W. Cutts, Bloomington, Ind.*

Continental Radio Model G49x56

This set employs a metal ballast tube in connection with the circuit to the pilot light. If the ballast be-

comes defective in use try connecting the pilot light across prongs 2 and 3 of the 35Z5 tube.

The writer has tried this with good results, and since many types of ballast tubes are scarce these days this improvised method of repair will prove satisfactory for all intents and purposes. — *Edward N. Christner, Middletown, Ohio.*

Minimizing Hum in Phase Inverter Sets

Hum can be minimized in sets using phase inverters if the cathode is by-passed by a reasonably large condenser. While this may have a tendency to unbalance the circuit, its advantage, in these times of shortages, lies in the fact that low voltage, or even reformed capacitors may be used. Naturally, if parts are available, correction should be made in the power supply filter.—*Vincent J. Lewis, Jr., Yonkers, N. Y.*

Servicemen's Essentials on Outside Calls

Servicemen like everyone else must cut down on their calls now due to gas rationing. Many extra trips can be saved by taking along items listed below.

First the serviceman should get the tube line-up of set if possible and take these tubes along. He should also take along tube tester, volt-ohm-milliammeter, tool box with all tools needed. Various sizes of filter and by-pass condensers. Kit of resistors. One length of spaghetti wire covering. Some hook-up wire and tape. Some fine copper wire. Flashlight. Extra a-c receptacle. Dial cable. Powdered rosin. Assorted rubber grommets. Some hardware, nuts, screws, etc. Carbon tetrachloride, and a small brush. The parts will all fit into a small grip and take care of most repair jobs. For major repairs the set must be taken into the shop.—*Robt. J. Oja, Lourium, Mich.*

Making War-Time Tube Substitutions

In many of the a.c.-d.c. type sets 50L6 tubes are required to be replaced quite often. The writer finds that these tubes have been difficult to obtain in his locality and was forced to make substitutions with other types. A satisfactory replacement may be made by substituting a 45Z5 for the 35Z5, and a 35L6 for the 50L6. In many instances a 35L6 will replace a 50L6 without any circuit changes provided the line voltage

does not exceed 108-110 volts.—*Jack Hendrick, Bowling Green, Ky.*

Installing New Dial Cables

With the current shortage of new radios, more and more people are having the old sets repaired. Some of the old sets will need a dial cable installed. As the old timers will remember this is not an easy job at best. I have found that the use of a clamp such as the Mueller 99 "snapper" test probe will be very useful on this job. The prod is so constructed as to have a spring clamp on one end which opens when pressure is applied to the other end. This can be used to thread cable over pulleys that are very difficult to reach without a special tool.—*Lewis Kanoy, Winston-Salem, N. C.*

Crosley Model No. 1117

Bad distortion or fuzzy tone encountered in this set is generally due to a defective 6K5G AF amplifying tube, although this tube may test perfect in a tube tester. Also replace coupling capacitor No. 16 with a new one of the same capacity.

This coupling circuit and 6K5G AF amplifying tube are very critical in this model. The least variation will cause distortion.

The control grid voltage on the 6K5G AF amplifying tube must be kept at -3 volts measured from the control grid to chassis with a VTVM.—*H. Gerald Coggeshall, Waterville, N. Y.*

U. S. SIGNAL CORPS NEEDS ENGINEERS

THE War Department, Aircraft Radio Laboratory at Wright Field, Dayton, Ohio, has a shortage of qualified civilian engineering and inspection personnel. Wright Field is the home of the Materiel Division of the Army Air Corps and there are concentrated all the experimental laboratories which are making such tremendous advances in the development of aircraft and aircraft accessories. The Aircraft Radio Laboratory is responsible for research, development, engineering, and inspection required in the radio field, incident to design, supply, and installation of radio equipment on aircraft.

The basic duties of a radio engineer are to perform or supervise the performance of professional engineering work in design, construction, research, and investigation. Responsibilities and duties are commensurate with the grade.

The Civil Service standards for Junior Radio Engineer, which pays \$2,000 per year, are a degree in electrical engineering from an accredited college. The next higher rating, Assistant Radio Engineer, \$2,600, has requirements of two years of progressive professional experience, plus substituted experiences year for year for college education that is lacking. A college degree, while very desirable, is not essential. A well qualified engineer without a degree is eligible for consideration.

Inspectors of Signal Corps Equipment are required to make inspections and tests of aircraft radio equipment to determine compliance with specifications, etc. This duty is usually performed at the plants of the contracting manufacturers. The salary range is from \$1,620 to \$2,000 per year.

The above salary rates are of course initial rates and promotions for higher rates of pay are made commensurate with responsibility and experience.

Engineers and service men who are interested in these positions are invited to submit a letter outlining their education and experience directly to:

DIRECTOR, AIRCRAFT RADIO LABORATORY
Wright Field **Dayton, Ohio**



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.

FOR SALE OR SWAP — Two sets steel-shafted golf clubs in good used condition. Earl Hall, 1427½ Quarrier St., Charleston, W. Va.

WANTED — Set analyzer, tube tester, oscillator. Late models. Please give price and description. S. Berenblum, Greenwich, Conn.

WANTED — NC100XA, SX17, or other good communications receiver, with crystal filter and speaker. Advise condition and lowest cash price. Sell or trade 199 Jewell Analyzer \$15; also large file QST. Ray H. Kendrick, 46 Center St., West Haven, Conn.

FOR SALE — Giant Racon Units also have a mobile six volt ac-dc amplifier. Write for price. Jack Levine, 625 Main St., Worcester, Mass.

WANTED — 5BP4/1802 P 4 5" kinescope, 6AC7/1852, 6AB7/1853, and 1851 tubes. Facsimile machine or any television equipment both transmitting and receiving. All letters answered. Jack Schermund, 401 N. Main Street, West Milton, Ohio.

FOR SALE — New tubes, controls, aerials, speakers, transformers, condensers, resistors. Also instruments and many used parts and books. Clarence W. Hull, Mineral Springs, Pa.

WANTED — Master Model Teleplex, good condition, complete with tapes. Julius R. Bartz, 410 N. 32nd St., Milwaukee, Wis.

FOR SALE OR TRADE — Rola G12, 2500 ohm field, 18 watts. Two aluminum horns for 10" speakers. Francis Higgins, 14965 Bringard Drive, Detroit, Mich.

FOR SALE OR SWAP — One drafting set, Weston Model 676 tube tester 6" meter, RCA 861 with socket, 500 watt Thoradson class B transformer, two plate transformers 1100-0-1100 pri. 110 1KW rating, 1-500 mil 30 H choke, T-125's 03Z tubes. Write for list. Nelson K. Stover, 751 Tioga St., York, Pa.

WANTED — Will pay cash for any good vacuum tube voltmeter, Philco 027 preferred; also Tripplett tube checker type 1620. Walter Peary, 1628 Swann St., N.W., Washington, D. C.

FOR SALE — ICS Practical Radio Servicing Course, \$25. \$5 with purchase, balance C.O.D. Will return deposit if sold. Course in good shape and printed, not mimeographed. J. B. Rodgers, 2422 Juliet St., Los Angeles, Calif.

FOR SALE — Practically new Jackson dynamic tube tester model 636. Tested less than 100 tubes. Highest cash offer. Cost me \$70. Robertson Radio Service, 221 W. Main St., Greenwood, Ind.

FOR SALE — 3 15 watt P.A. systems complete; 1 Tripplett V.O.M. with signal generator. Elmer Showers, Jr., 513 Chapel St., Schenectady, N. Y.

WANTED — All-wave signal generator. Will pay cash for reasonably priced instrument. Please give full particulars in first letter. Can also use a good tube checker. Arthur C. Hedburg, 427 North 1st St., Charlottesville, Va.

FOR SALE — Postcard request brings large list parts at clean-out prices. C-B 79C b-f oscillator, perfect, \$45. Magnavox 305 15", new, \$12. Back numbers Electronics, Radio Engineering, QST (1921-29), Proc.I.R.E. E. Watts, Germantown Hospital, Philadelphia, Pa.

FOR SALE — Rider's Manuals 1 to 6 and index. Excellent condition. Complete \$25, or \$7 per vol. separately. Also complete set Supreme Manuals, \$5 for 4 vols. or \$2 per vol. separately. Want gas engine generator or wind charger. P. T. Hering, 5 Pepper Drive, Los Altos, Calif.

FOR SALE — Hundreds of used radio parts, magazines, tubes, books, rifles, transformers, tennis rackets, mimeograph, typewriter, tube checker, meters, short wave receiver, etc., reasonable. Send stamp. Jack's, 574 East 35th St., Chicago, Ill.

SELL OR SWAP — Radio parts; Mossberg Model 25A .22 rifle, with heavy leather military sling and special sights in Al condition, like new. Want test equipment, Riders Manuals, radio books, good slide rule, drafting set, pistol or revolver .22 caliber. Oliver F. Klein, 2235 N. 39th St., Milwaukee, Wis.

WANTED — Gernsback Manuals Vols. 1, 3, and 5. Write stating condition and cash price. The Home Radio Service, Gratton, Ohio.

WANTED — Good television set. State price, condition, age, and make. Also a 3-inch cathode-ray oscillograph and condenser tester. Michael A. Petko, 4322 Wayne Ave., Philadelphia, Pa.

FOR SALE OR TRADE — Many years complete of QST, Radio, Radio News, Radiocraft, S. W. Craft, Radio and Television, Radio Today, F. M., Service, All Wave Radio, etc. What do you want? Major Fred Kline, Kent, Ohio.

WANTED — Supreme 562 audolyzer or similar signal tracer. Must be in good condition and reasonably priced. Also Rider's Manuals 7 and 8. G. E. Tripp, Rock Valley, Iowa.

FOR SALE — A Supreme tube checker, model 506, push button model in quartered oak case with instructions \$20; and a G. E. car radio C-41 with new tubes and volume control \$10. Tom Selles, 4411 34th Ave., S., Seattle, Wash.

WANTED — Automatic record playing unit with or without pick-up, for custom built cabinet; also 9-10 tube a.c. radio chassis, with or without speakers or tubes. L. B. Mundy, 351 Fudge St., Covington, Va.

WANTED — Sound equipment, mobile and portable, new and used. Give full description and lowest cash price. Parts or complete. A. A. Marchand, 637 Massachusetts Ave., Arlington, Mass.

WANTED — Jackson condenser tester and tube tester in the 8 1/2" x 8 1/2" size. Will pay cash. Chas. Crank, 626 Bernard Ave., Hamilton, Ohio.

SALE OR TRADE — Readrite tube tester 430, oak case, perfect condition, sell for \$10 or trade for any one of Riders Manuals 7, 9, 10, 11, or 12. Ernest Olson, Allegan, Mich.

WANTED — Can pay \$5 for model BQC or QCA Solar condenser quick check and bridge if still in good working order. Have Weston model 425 0-125 r.f.m.a. Jewell model 74, 0-15 v. a.c. meters. Vol. 1 and 2 Official Radio Service Manuals. Ray Parker, 112 Ave. C, West, Kingman, Kan.

FOR SALE — Clough-Brengle type UC vacuum tube voltmeter \$45 net, postpaid. Radiart vibrator checker, type 4100, used one week. Regular net \$17.50, sell for \$12 postpaid. Several 6 1/2" magnetic speakers, good as new, \$1.10 each postpaid. Max Shively, 3115 Ingham, Lansing, Mich.

SALE OR TRADE — Superior set tester RMA model, Tobe Condenser Tester, tubes, meters, Zenith 35mm Projector complete with stand, lamphouse, etc., camera with built-in range finder and exposure meter, 2 other cameras. Want radio sets of 10 or more tubes, must be in perfect condition, PA system about 35 watts complete with mike and speakers, Precision Volt-Ohmmeter No. 830 in good working order. David Meyer-son, 3425 Knox Pl., Bronx, N. Y.

FOR SALE — Radio receiving and transmitting equipment, all high quality merchandise. Send stamp for complete list. Edward Kertz, Kenosha Police Dept., Kenosha, Wis.

FOR SALE OR TRADE — F.B.X.A. with 20-40-80 meter coils and peak pre selector. Will swap for phono turntable and pick-up, photo equipment or cash. No reasonable offer refused. F. A. Fillmore, 5758 Itaska, St. Louis, Mo.

SALE OR TRADE — Radio parts, tubes, test equipment, refrigerator tools and tanks. Photographic equipment and supplies. Want wrist watch, typewriter, pocket microscope, or slide rule. Wm. Hansen, R. 3, Niles, Mich.

SALE OR TRADE — 502 Supreme comb. set tester and tube checker, portable, hardwood case. 2000 ohm Trimm, Cannonball head sets, copper, chrome tear-drop keys. Want 16mm camera, splicer, film, etc. Henre G Freeman, 1947 62nd St., Brooklyn, N. Y.

WANTED — Supreme model 599 portable or counter type. Precision model 920P or 920C or 920 PM or model 922 or 922 PM or model 914 or 954 P. Also want Precision model 844L. Kindly give prices and condition in first letter. Tony's Radio Shop, 1729 Lexington Ave., New York City.

(Continued on page 13)

THE CATHODE-RAY OSCILLOSCOPE*

PART 4 - PRACTICAL OSCILLOSCOPE DESIGN

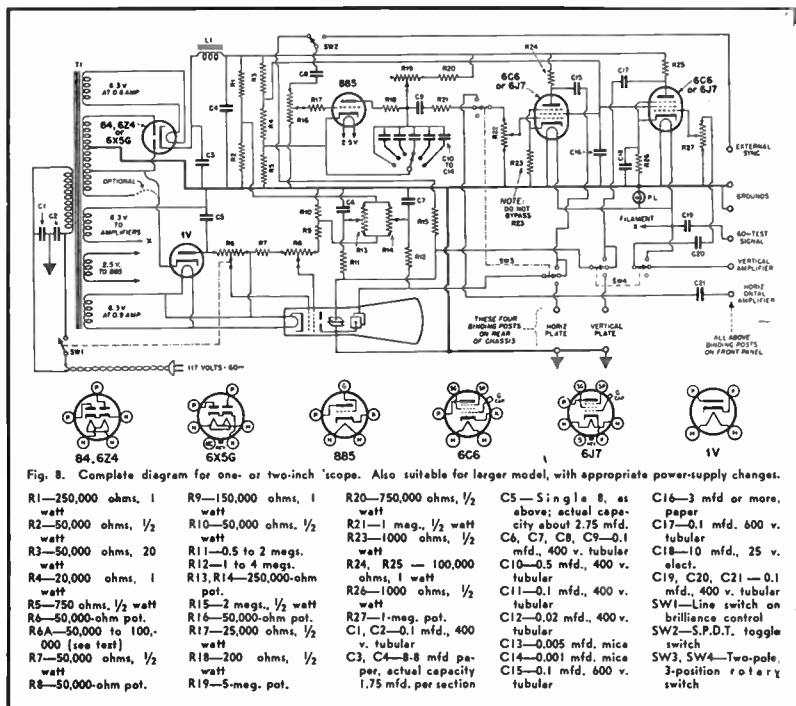
In regard to the design of the saw-tooth oscillator (Figs. 5, 6, and 7 in the November issue) it was pointed out that if fixed bias is used, the output will be essentially flat up to about 10,000 cycles, at which point the output diminishes rapidly.

A semi-fixed bias arrangement is shown in the complete diagram, Fig. 8. As previously mentioned, the bleeder current of about five milliamperes will be drained through R5. The 884 or 885¹ will operate with a charging current up to two milliamperes. However, the charging current in this particular design, which has

worked so well in practice, never exceeds 0.550 milliampere.

At this low charging rate there will be less energy to discharge, for any given frequency, permitting its quicker disposal through the tube, resulting in a quicker sweep return time. Also, by making the bleeder current many times greater than the variation of

¹The 884 and 885 are identical, except for heater voltage. The former tube operates at 6.3 volts, while the latter was designed for 2.5 volts. Choice depends on filament winding available.



* By Jay Boyd in "Radio."

charging rate, the variation of output is kept low. The whole results in simple design and excellent performance.

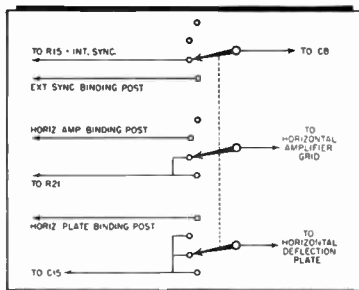


Fig. 9. Optional switching arrangement, combining synchronism selection with horizontal selector switch.

If You Have to Substitute

Unfortunately, though, the five-megohm potentiometer specified for R19 in Fig. 8 may be hard to obtain. A two- or three-megohm control may be used along with 300,000 or 450,000 ohms for R20. This will increase the charging rate, so the discharge resistor, R18, should be increased to 400 or 500 ohms to protect the tube. The increased charging rate also increases the oscillation frequency, so the values of all tank condensers, C10 to C14, should be doubled to maintain the same approximate oscillation frequencies.

At the higher charging rate, operation may be erratic, or the tube may fail to oscillate. If this occurs, increase R5 to 1000 ohms, or until satisfactory performance is obtained.

Calculating the Sweep Frequency

The values of R19 and R20, and condensers C10 to C14 will give any frequency from 12 or 14 cycles up to the maximum oscillation frequency of the gas-triode, when operated at the bias voltage given.

For the benefit of those who like to juggle their own figures, we will say that the frequency in cycles per

second will equal $1/VC$, the current being given in amperes, potential in volts, and capacity in farads. The voltage (V) will be the potential at which the tube flashes, minus its de-ionization voltage.

But since the writer has no definite figure on this latter voltage, the above formula doesn't mean too much. This de-ionization voltage, however, seems to be somewhere around 10 volts.

Note that C11 is one-fourth the capacity of C10. Therefore its frequencies will be five times those of the former condenser. Also note that the ratio of R20 to R19 + R20 is 7.66. A ratio of 5 to 1 is all that is required but the excess takes care of frequency variation from synchronization and prevents any lack of overlap between frequency ranges.

Making the Sweep Wave Linear

We have mentioned that the saw-tooth oscillator would give a linear output if adjusted for a low flashing voltage. The manufacturer's tube data tells us the output will be linear if the tank condensers are flashed at five per cent of the charging voltage, but their later circuits specify a grid bias of 6.5 volts, which would cause flashing at over twice the former figure.

Experience has shown a bias voltage as low as 3.75 volts to be reliable and practical if the tank condenser charging rate does not exceed one milliampere. The flashing voltage is 28 or 30 volts and the useful peak-to-peak output around 18 or 20 volts. Under such conditions linearity is excellent and the sweep return time very fast.

Keeping It Linear

But generating a linear saw-tooth wave is but half the battle; it must be amplified and applied to the free horizontal plate without loss of this highly desirable linearity. If the horizontal amplifier is not linear, or if its grid circuit impedance loads the oscillator, a bend will occur in the saw-

tooth waveform. If the total resistance of R21 and R22 equals four megohms the loading will be negligible. A higher resistance causes a phase shift in the grid circuit, while a lower impedance than two megohms will cause some departure from linearity.

The same statement holds true for the horizontal deflector plate return resistor, R12. Here five or ten megohms would be desirable for linearity. But since these plates pick up a few stray electrons, which must find their way to ground through this resistor, too many megohms will produce a bias on the plate. The beam will drift to one side, and change position with a variation in beam intensity. The most practical value, then, will be from one to four megohms, depending on the particular tube. But try the higher value first.

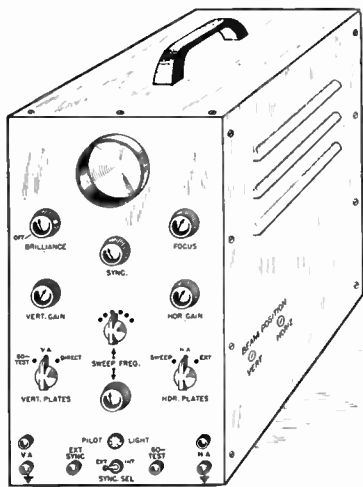


Fig. 10. Panel layout for one- or two-inch scope.

Amplifiers for Oscilloscopes

It is essential that the oscilloscope's amplifiers be capable of high voltage gain without distortion. While not ideal in every respect, simple pentode

amplifiers of the 6C6 or 6J7 type are quite practical, being found in most commercial oscilloscopes.

These are operated at higher plate voltages than usual, but being resistance coupled, only about half that voltage is actually applied to their plates. Plate load resistors are somewhat lower than usual. Cathode resistors must be those specified and screen voltage not less than 100 nor more than 125 volts.

The vertical amplifier cathode resistor may be by-passed by a high value of capacity to prevent degeneration. But don't by-pass the horizontal amplifier cathode resistor, as this will cause objectionable tails on the sweep wave.

The plate coupling condensers, C15 and C17, should be of fresh stock. Old ones frequently pass a slight leakage current, placing some d.c. potential on the deflector plates, and preventing centering of the beam. The screen by-pass condenser, C16, must be not less than three microfarads, and preferably of the paper type.

Flexible Switching Arrangement

Two rotary switches are provided for deflector plate switching. The vertical plate may be switched either to the output of its amplifier or to a separate binding post for signals requiring no amplification. As r.f. is frequently applied to this plate, this binding post should be located on the rear of the chassis. No attenuation is provided in this case, potentiometers being rather allergic to r.f.

Smaller signals are applied to the vertical amplifier, which has its gain control and binding post on the front panel. A third position is provided so a 60-cycle test signal may be picked up from a filament winding. This is useful for focusing and comparison, and is too handy a feature to omit.

In most applications a linear sweep signal is used so the horizontal plate is connected to its amplifier, which, in turn, is switched to the saw-tooth os-

cillator. Sometimes the horizontal sweep voltage is taken from the apparatus under test, as in the case of transmitter testing, for instance, so a direct connection is also provided at the rear for the horizontal plate.

For certain types of work it may be desirable to feed the signal being tested into the horizontal amplifier, so switching should be provided in its grid circuit, too.

Synchronization

Synchronization of the saw-tooth oscillator is usually obtained by feeding back a small signal voltage from the vertical deflector plate. Receiver alignment work requires synchronizing the saw-tooth oscillator with the wobulated oscillator, so an "external sync." binding post is provided, as well as a toggle selector switch.

This latter switch may be eliminated from the panel, though, by providing another gang and point on the horizontal switch. An optional circuit for this arrangement is shown in Fig. 9.

One of the front panel binding posts is marked "60-cycle test," but serves several purposes. Sixty-cycle synchronization may be had by running a jumper over to the "external sync." binding post.

Sometimes a 60-cycle sinusoidal sweep is desirable. A jumper from that binding post to the "H.A." post provides it when needed.

This useful post can also be used as a 60-cycle signal for running into amplifiers, either for testing or frequency comparison. It's worth its weight in rubber!

Constructional Pointers

With the various design problems disposed of, let's consider some constructional details. Anyone who has built a receiver, transmitter or amplifier should have no difficulty building a first-class oscilloscope if a few important points are adhered to.

To begin, we know the 'scope should be enclosed in a metal cabinet for shielding and protection of the c.r. tube and other parts. A typical cabinet and panel layout is sketched in Fig. 10, being quite similar to some commercial products. Unfortunately, there are no suitable blank cabinets available, but building one yourself or having it made by a good sheet metal shop offers no particular problem.

But don't try to stuff your 'scope into a regular receiver cabinet! If you do it will be necessary to place the power transformer under the c.r. tube or to one side of it—and such an

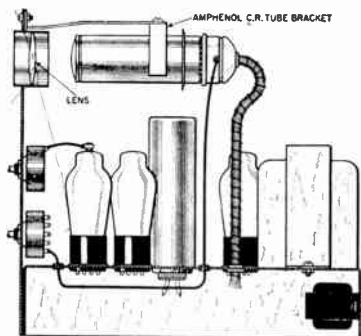


Fig. 11. Sectional view of one-inch oscilloscope. A satisfactory lens can be purchased at a Woolworth store.

arrangement just won't work. Magnetic fields from the transformer will spoil the job.

The cabinet size will depend on the tube used, the following being recommended: For a one-inch 'scope, panel, 7 x 10 inches, with parts mounted on a 7 x 10 x 2-inch chassis. A bottom plate should also be provided. Such a stock chassis starts you off right. Add a panel and make up a cover and there you have it.

A two-inch oscilloscope requires a little more care. If laid out like Fig. 12, the chassis must be made to order. It should be 7 x 12½ x 4½ inches

and the panel must be $11\frac{1}{2}$ inches tall. If one wishes to use a stock chassis, placing the transformer on top, as shown in Fig. 11, the chassis must be at least 13 inches in length and $1\frac{1}{2}$ or 2 inches high, with a panel one foot tall; no less. Spacing between the c.r. tube and transformer is a point that must be respected.

All the above specifications are based on using one of the special

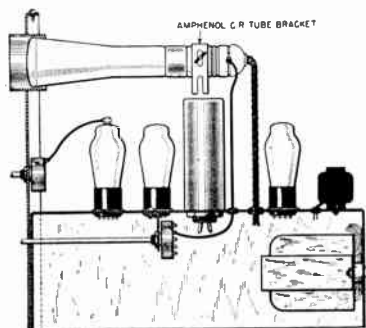


Fig. 12. Sectional drawing of two-inch oscilloscope.

c.r. power transformers mentioned. If two receiver transformers are used, the chassis must be an inch longer in every case. A single transformer should be located in the center of the chassis so as to be in line with the tube. If two transformers are used place them side by side and make the lead wire holes large enough to allow reversing their position 180° . Turning one of them around may cause a bucking or balancing of fields so as to affect the beam as little as possible.

Panel Layout

It may not be apparent at first glance but the location of all panel controls follows a logical order. The two c.r. tube controls, brilliance and focus, are located nearest the screen. Running down the left we find the vertical gain control, vertical plate switch and vertical amplifier binding

posts. The right side is similar except everything has a horizontal function. Using round knobs on potentiometers and bar type for switches makes the panel look simpler.

In the center row we find all controls for the saw-tooth oscillator. The "sync. selector" switch may be omitted if the optional circuit, Fig. 9, is used. But keep the pilot light. A c.r.o. is noiseless in operation and it's too easy to leave it running all night long!

Construction will be made easier if an Amphenol cathode-ray mounting assembly is used, or you can make your own if you like. Cable all wires going to the tube, except those two going to the deflector plates, which must be kept in the clear.

Fig. 13 shows a chassis layout for two-inch 'scopes but is equally suitable for one- or three-inch jobs by altering the spacing to suit. Note that the oscillator tank condensers are mounted on top of the chassis, in front of the oscillator tube and behind their selector switch.

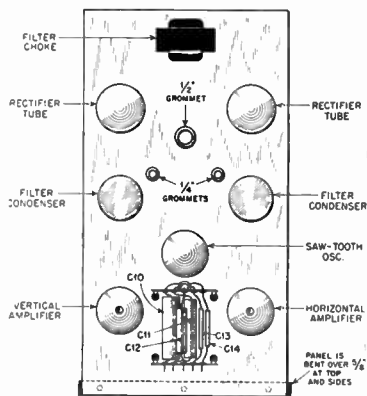


Fig. 13. Chassis layout for two-inch 'scope. Also adaptable for larger or smaller job by appropriate dimension changes.

Hoods and Lenses

Although any tube affords sufficient brilliance for daylight observation, a

hood should be used to prevent overworking the fluorescent screen. This is simply a metal tube of proper size, and can be made by rolling a piece of sheet metal.

If a 913 is used a magnifying lens will make observation a lot easier, when using the little 'scope for long periods of time. The dime stores can supply a suitable glass for a few cents. But don't try to get too much magnification as it will cause more eye strain than it saves. The actual screen size of the one-inch tube is about 15/16 inch. Enlarging this to an apparent size of 1 1/4 inches seems most satisfactory. Keep the lens well within the hood to minimize glare from external reflection.

Wiring

Wire the oscilloscope with the same care you would a good amplifier. All filament and d.c. leads may be cabled **but don't cable anything else.** You will get bad interlocking of controls if you do.

You will see from the parts caption that an oscilloscope uses a goodly number of condensers and resistors. Don't let them hang around loose but anchor them down with plenty of tie points.

Beam-centering controls may be omitted for one-inch 'scopes. Place them on the right side of chassis, up near the front, on a two-inch job, with holes in the cabinet for screw-driver adjustment.

Suggestions for a Three-inch 'Scope

A three-inch job should follow all those rules given for the two-inch 'scope. The writer has not had a chance to learn how much magnetic fields affect three-inch tubes so would suggest using the same cabinet dimensions found in commercial jobs; that is, about 14 inches high, 7 1/2 or 8 inches wide, and about 14 inches in depth. Inspecting the "innards" of commercial 'scopes you will find quite a bit of unoccupied chassis space—

and you can be sure it was not left there without reason. With the larger panel, the beam-centering controls might well be placed below the "brilliance" and "focusing" controls.

When the power supply and c.r. tube circuit wiring is completed, insert the tube and see if the beam will focus and center properly. Place some voltage on the deflector plates and see if the beam deflects. Then finish the wiring. If the parts and circuit have been followed correctly the 'scope should work "right off the bat." If not, recheck wiring and parts. If either amplifier distorts, measure the cathode and screen voltages, which must be correct. You may have a defective resistor somewhere.

If the beam centers with amplifiers off and then changes position when they are switched on, replace the leaky plate coupling condenser. When checking voltages on the c.r. tube, remember to put the red probe on ground and the negative probe on the power supply.

(To be continued in next issue)

When You Move or Change Your Address

Be sure to notify the Mailing Dept. of "The C-D Capacitor," Cornell-Dubilier Electric Corp., South Plainfield, New Jersey, giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your co-operation.

THE RADIO TRADING POST

(Continued from page 6)

WANTED — General Radio Variac and a G. R. Vacuum tube voltmeter. Have need also for radio meters and circuit analyzers for use in defense courses in radio. What have you? G. H. Sechrist, Univ. of Wyoming, Laramie, Wyo.

WANTED — Filament transformer. Voltage 6.3 volts 6.0 amperes center-tapped for 110v.-115v. A.C. primary supply. Must be of a well known make, not home made. Will swap amateur parts or pay cash. G. K. Crowell, 15 Academy St., Concord, N. H.

WILL SWAP — Radio Technical Institute complete authorized radio servicing course in perfect condition for model airplane gasoline engine. Stephen J. Hart, Jr., 87 Sherman Ave., Jersey City, N. J.

TRADE — Have a Hickok all wave oscillator model OS 3 to trade for a multi-meter (no Readrite or cheap meter considered). This oscillator is in perfect condition. Argyle L. Daniels, 1420 N. 11th St., Fort Smith, Ark.

WANTED — Will pay cash for good service equipment such as Supreme 560A vedolyzer, 561 signal generator, 562 audolyzer, 571 oscillator, 504, 592, or Precision 920, 954, 844, 854P, E200. K. W. Martin, P. O. Box 32, Ivanhoe, Va.

WANTED — Electronic volt-ohmmeter, Hickok model 202 or RCP model 662-V-7 or volt-ohmmist Junior also Solar QCA condenser tester. Will pay top price for Al equipment. R. B. Gough, 835 Blue Hills Ave., Bloomfield, Conn.

SWAP — Revamped National FBXA with crystal filter, AVC, noise silencer, and 80, 20, and 10 meg general coverage coils; for 0-1 milliammeter (with any type scale) National dial, VOM, LC checker, or what have you. Robert Sederholm, Box B, St. Cloud, Minn.

WANTED — Can use your Radio Physics Course by Ghirardi, and a signal generator, preferably a Superior Model 1230. State your price, or trade, and describe condition. T. Lyons, 5706 S. Marshfield Ave., Chicago, Ill.

SALE OR TRADE — Burton-Webber No. 10 battery, portable oscillator and Dayrad Output Meter \$18; Rex visible desk typewriter \$10; Flexograph portable mimeograph \$8; Erla short wave adapter \$3; Radio Technical Labs. tube checker with modernizing transformer \$9. List for stamp. Roby's Swapmart, 3569 Cottage Grove, Chicago, Ill.

WANTED — 2 Weston 301 0-100 M.A. meters; 1 301 0-200 microamps meter. Will buy radio tubes from persons or companies that are discontinuing their business due to present conditions. Leo F. Kersey, White Sulphur Springs, W. Va.

FOR SALE — Some meters, W. E. tubes 300A, 300B, 262A, 275A, 274A, 259A. Also other radio supplies for sale or trade. Send for list. Leo F. Kersey, White Sulphur Springs, W. Va.

FOR SALE — One Superior tube tester model 1140S in Al condition, \$5 cash or will trade for Rider's or Gernsback Manuals. Johnson Radio Service, 332 Oakwood St., Austin, Minn.

FOR SALE — Home constructed condenser tester. Tests also for shorts, etc. Price \$4. Geo. Sikmon, Carolina, W. Va.

SELL OR SWAP — Bausch and Lomb table microscope. Folds into wooden box 5 x 6 x 2 1/2. Lamb 4 tube factory built noise silencer; new RCA 808; Bug automatic key; new 807; Hawkins electrical dictionary and guides 7 and 8; Electric Wave Telegraphy by J. A. Fleming; Thermionic Vacuum Tubes by Chaffee; Morecroft's Radio Communication; R.F. Measurements by Brown. What do you offer? R. N. Eubank, 1227 Windsor Ave., Richmond, Va.

WANTED — A d.c. voltmeter that reads 400 volts; a late model tube checker that will test all types of tubes; and a signal generator. Must be in good condition and prices be right. James C. Haygood, R. 3, McEwen, Tenn.

FOR SALE OR TRADE — 5 tube T.R.F. short wave receiver, 4 bands, plug-in coils \$15.50; .22 cal. Stevens single shot rifle \$5; Slocum and Starret 1" micrometers \$5 and \$8 each. List for stamp. G. F. Roby, 3569 Cottage Grove Ave., Chicago, Ill.

SELL OR SWAP — National NC100XA Receiver, Precision Series 500 combination tube and condenser tester, Supreme 89 series tube tester. Both have recently been factory modernized. Oliver F. Klein, 2235 N. 39th St., Milwaukee, Wis.

WANTED — RCA volt-ohmmist Jr. Must be in good condition. Will pay cash or trade sky Buddy (Hallicrafter). S. W. Kimbro, 543 Ohio St., Lexington, Ky.

FOR SALE — Superior utility tester in original carton, never used. A.C.-D.C. amps 0-100, 0-5,000 watts. First \$10.50 takes it. H. Ursillo, 85 State St., East Providence, R. I.

SALE OR TRADE — Radio parts, test equipment, back issues of Radio News, Radio, QST, radio text books, RCA service manuals. Send list of what you want and what you have for trade. F. U. Dillon, 1200 N. Olive Drive, Hollywood, Calif.

WANTED — Meters, parts, test equipment, regardless of condition. Also binoculars, firearms, S.W. receivers, machinist, shop, or draftsman's tools, or anything of value. Describe fully. List for stamp. Roby's Swapmart, 3569 Cottage Grove, Chicago, Ill.

SALE OR TRADE — Weston signal generator No. 694, Weston tube tester No. 682 and Rider's Manuals 1 through 6. Will trade all for standard manufactured oscilloscope 1, 2, or 3" size and sweep frequency generator. Instruments and books are in very good condition. Tube checker will operate on 25 or 60 cycle A.C. Ben Silver 49 216th St., Bayside, L. I., N. Y.

WANTED — Simpson giant model 320. Write stating price. J. Leo Phelan, R.F.D. 3, Waterbury, Conn.

SWAP — \$250 worth of radio equipment and parts, tubes, condensers, resistors, controls, speakers, and many other articles. I want power operated wood working tools in exchange; also hand tools in good condition. Clarence W. Hull, Mineral Springs, Pa.

WANTED — RCA Rider chanalyst in good condition. Will pay cash. State lowest price. C. A. Goditus, 313 East Market St., Wilkes-Barre, Pa.

SWAP OR SALE — Have radio parts, etc. Send stamp for list. John P. Olevian, 5 Williams St., Edwardsville, Pa., Kingston P. O.

WANTED — Will pay cash for a good used RCA model TRK-12 television receiver. Also want Jensen 15" type J coaxial speaker. Give complete details. E. P. Schaeneck, R. 2, Box 16, Wahpeton, N. D.

WANTED — RCA chanalyst, Hickok RFO-5 oscillograph, Hickok 177 signal generator, RCA volt ohmyst, Jr., or other test equipment. Metairie Radio Shop, 341 Metairie Rd., New Orleans, La.

WANTED — A.C. gasoline motor driven generator about 500 to 1,000 watts, portable gasoline motor. Mallory vibrapack and meters; also transmitter parts and communication receiver if reasonable. Karl H. Stello, Beltsville, Md.

FOR SALE — Battery radio tubes, mostly 2 volt types, 1C7G, 1D5G, 1F7G, 7H4G, 1J6G, etc., at 20 cents each, any quantity. All tubes perfect condition. Radietric Labs., Hudson, Wis.

WANTED — Rider's Manuals 2, 12, 13. State price, postpaid, condition, etc. Will sell complete radio service equipment, Rider's Manuals 3-11, etc., if all sold at once. W. Kay, 319 Main St., Niagara Falls, N. Y.

FOR SALE OR SWAP — Majestic 245 hermetically sealed refrigerator, not in working order but can be repaired \$15. Quiet May oil burner and 3 controls \$40. R.K. 20 tubes \$6 each. Al R. Dayes, 1418 81st St., Brooklyn, N. Y.

WANTED — Triplett, model 1672 vibrator tester. Also Electronic Multitester model 661 or 662. Please give all particulars as to condition, price, etc. Ed Christner, 313 Crawford St., Middletown, Ohio.

SELL OR SWAP — Western Electric Model 600-A double button microphone and Jewel 0 to 150 3" a.c. voltmeter. For d.c. voltmeter, d.c. milliammeter or ohmeter, Xtal. Microphone or what have you. Jack H. Goldfarb, 3521 Cedarbrook Rd., University Hgts., Cleveland, Ohio.

WANTED — Will pay top price for modern tube checker. Give full particulars as to condition, etc. Jack Levine, 625 Main St., Worcester, Mass.

WANTED — Supreme Vedolyzer in good condition. Kron Radio Service, 60 Main Ave., Passaic, N. J.

FOR TRADE — I have a 30.06 Springfield as issue No. 885910 (good). Mossberg model 42B .22 cal. and a varipower scope 10X-30X. I would like to get a Win. 70 30.06 or model 81 Remington Auto. 35 cal. Would be interested in other Hi-power rifles. Have cash to make up difference. Wm. Briza, 405 N. Bradford St., Baltimore, Md.

WANTED — Will pay cash for a good oscillograph or a signal tracer such as Rider's chanalyst, Hickok, etc. Frank A. Hoffman, 21 Cleveland Ave., Westfield, Mass.

WANTED — Precision E-200 Signal Generator; must be in A1 condition. Will pay cash. Describe condition, date of purchase, and price requested in letter. J. Lipiner, 1032 Rutland Road, Brooklyn, N. Y.

WANTED — Rider's Manuals combination book 1 to 3 or 1 to 5. Also will accept National Union, RCA or other manuals. Also want small battery operated VOM meter. Willing to pay fair price. Oscar's Radio Service, Merrill, Iowa.

FOR SALE — New RCA station allocator \$20, or will exchange for a Solor Model CC or CB condenser tester in new condition. Capitol Radio Service, 637 W. 21st St., Erie, Pa.

TRADE — Want test equipment or what have you. We have guitar, Collins Built commercial 32 B transmitter, 6 tube 1½ volt supply G.T.C., 8 tube Farm Radio Bosch, relays, tubes, meters, etc. V. C. Hawerdel, 102 Hancock Ave., Jersey City, N. J.

FOR SALE — 1 RME 99 communication receiver 6 bands, 1 RME DB 20 Preselector, 1 RME DM 30 X Expander. Would like to buy Thordarson tone control choke T-14C70 or T-1C69 preferred. John E. Loraine, 211 Summer Ave., Newark, N. J.

WANTED — Will pay cash for 2 Weston No. 778 Servisets. Must be A1 shape. Sporna Radio Service, Escatawpa, Ala.

WANTED — 0-10 D.C. Ma. Model 326 2" Triplett square meter, new or slightly used. Also Thordarson 1000 v. 300 ma. D.C. plate transformer. Advise as to model number of transformer. Will pay good price for any of above equipment in good condition. Gordon H. Freick, 837 Neptune Ave., Wilmington, Calif.

WANTED — Precision E200 signal generator in good condition. Also Rider's Manuals 12 and 13. George H. Eddy, 35 Madison Ave., Madison, N. J.

FOR SALE — Richerson 10" slide rule with 9 scales, Riders Manuals 1 to 8 inclusive, cathode-ray tubes at work, HY615, 203A, HK24, 872A, 800, B&W coils, meters, Radio books and magazines. D. Buck, 43 Hagen Ave., N. Tonawanda, N. Y.

TRADE — Model 31 Readrite tube tester and a Dayrad signal generator that I will trade for a condenser analyzer or what have you. Also have two or three separate meters. All inquiries answered. Harold Dillman, Roosevelt, Utah.

CASH SALE — Superior 1280 combination tube tester-voltmeter and Superior Channal Analyzer practically new, total cost \$44.70. Highest offer takes both. Newton Francis Radio, 141 West 10th St., New York City.

FOR SALE — Weston tube tester uses 5½" Weston meter and small Weston line meter, in A1 condition. Cost \$100 new. Model 676R. Oliver F. Klein, 2235 N. 39th St., Milwaukee, Wis.

WANTED — RCA Sweep Oscillator No. 150 to match No. 151 oscillograph painted grey. Frank Gause, Eustis, Fla.

FOR SALE — Scott A.C. 23 tube receiver 5 years old in perfect condition, three speakers, tubes brand new, no console, will sell for \$50. John Bennett, 184 Midland Ave., Garfield, N. J.

SALE OR SWAP — Hallicrafter SX16 and speaker; 1 American Flyer streamlined train set complete with track, five signals, whistle, tender, like new; used for one season. Two pairs of skis; Underwood typewriter with metal stand; microphone stand, etc. Send for complete list. Nelson K. Stover, 751 Tioga St., York, Pa.

SALE OR TRADE — One Jewell meter Pat. No. 54, 0-200 d.c. milliamper, flush mounting; One Jewell Pat. 54, 0-6 d.c. volts flush mounting; One Jewell Pat. 74, 0-10 a.c. volts flush mounting; Four National Velvet Vernier Dials 0-100; Two G. E. luminous tube transformers, 115 volt to 15,000 volts 450 volt amp. The meters are practically new and the transformers slightly used. R. Earl Dawes, Box 663, Bozeman, Mont.

WANTED — Slide rule, drafting or mechanical drawing set, gun, Rider's Manuals, radio books. Will pay cash for them or consider them on a trade. Oliver F. Klein, 2235 N. 39th St., Milwaukee, Wis.

FOR SALE — RCA (136) communication receiver, 7 tubes, price \$40. Want a signal generator and a Filtron adapter for Weston tube checker. Arnold Halpen, 119 Tudor Pl., Bronx, N. Y.

WANTED — A good new or second hand condenser tester. Please state price and condition. Wm. Vander Laan, Hudsonville, Box 22, Mich.

WANTED — A chart or copy of chart for Triplett model 1210 tube tester. Will pay any reasonable price. R. H. Bedell, 60 Lindgren St., Merrick, N. Y.

WANTED — A 0-50 microammeter for which I will trade an 0-200 microammeter Triplett 321, 3" and an 0-1 milliammeter 3" Triplett. Also have a Weston 0-500 milliammeter. James Lawless, Providence, R. I.

WANTED — Triplett 666-s VOM; or 301 0-1 ma. milliammeter. Large communication receiver (short wave) and Hallicrafter SX-29 Sky Traveler. Amateur radio equipment of all kinds; transmitting, receiving, parts, tubes, etc. What have you? How much? Will trade! David Frederic Causey, P. O. Box 44a, University Station, Urbana, Ill.

WANTED — All wave signal generator, standard make, also Rider's Manuals. Theodore Lohr, 140-28 247th St., Rosedale, L. I.

FOR SALE — Triplett model 1175 VOM and oscillator \$15. 9" 4.1 mil meter \$9. 0-7½ volts Weston meter \$1.50. 0-2 mil meter Jewel zero center \$2.50. Super Radio Service Co., 138 Vine St., Pymouth, Pa.

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