

The CORNELL-DUBILIER
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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 Unpublished items will not be returned.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.

Wiper Contact Noises

Noisy tuning controls in TRF and many super-het models may often be traced to poor contacts made by wiper springs on the rotor plates of tuning condensers.

These springs are usually located between the sections of the plates on the rotor gang and should be removed and cleaned thoroughly with carbon tetrachloride. A small quantity of powdered graphite mixed with vaseline and applied to these contacts will lubricate and prevent corrosion at these points.—*Robert J. Oja, Laurium, Mich.*

Pilot Model T 1351 A. C.-D. C. Portable

When trouble develops in this model as the result of tubes and batteries going bad, or the set becomes inoperative on the batteries, check for defective pin contacts on tube bases.

The original tubes furnished with this model had bakelite bases and No. 1 pin on one of them was found open. Two of these were replaced with GT tubes with a metal band around the base which connects to the No. 1

pin. This metal base is closely located to the IF transformers and apt to touch them and cause a ground.

To remedy this trouble, wind a piece of insulating cambric cloth around each IF transformer and fasten with scotch tape. — *Al. R. Days, Brooklyn, N. Y.*

Replace Choke With Resistor Unit

An improvised method of making repair of open choke coils in many a.c.-d.c. sets is to replace the choke with a resistor, provided, of course, the speaker field is not employed as the choke in the set. The writer has substituted a 1,000 ohm 10 watt resistor in numerous sets with excellent results.

In these times when chokes are difficult to obtain, this suggestion may put many of the inoperative sets back into condition again even if the efficiency of a set is not what it might be were a unit of the exact operating characteristics replaced.—*Lee C. Sprague, Star City, Ark.*

An Easily-Made Pillow Speaker

A practical radio accessory for the sick can be made from an old car phone unit and some sponge rubber salvaged from an old chair pad. If the rubber can not be obtained, some other material such as kapok may be used. The phone piece is covered completely with the sponge rubber so as to make a small pillow about eight inches square. The pillow is then covered with a heavy soft cloth such as poplin. This device has been more desirable than head phones for the sick room as it does not interfere with the patient's position. — *Elmer W. Rhodes, Dayton, Ohio.*

Zenith Model 760

If reception on this model seems to fade-out slowly after the set has been tuned on for five minutes or so, check the 15,000 ohm resistor, part number 63-301. This condition may be caused by resistance drop in this unit as the result of its becoming defective.

The solution of course is to replace this resistor with a new 15,000 ohm 10 watt unit. — *G. D. Griffin, Ithaca, N. Y.*

Repair for Slipping Vernier Dials

In many types of sets employing vernier dials, such as in the Philco 54 and others, this type of dial often develops a slipping control due to wear.

By soldering the shaft to the vernier ferrule, use of the vernier action will not be had, but the dial will function effectively and will no longer slip. — *Ed. Christner, Middletown, Ohio.*

Alter Resistance on Gassy Output Tubes

Distortion in many a.c.-d.c. receivers is often caused by output tubes which have become gassy. The grid resistance values usually employed on these tubes averages $\frac{1}{2}$ to 1 megohm, and frequently run higher. Therefore the higher the resistance values the greater the opposing bias generated by the tube.

Lowering the grid resistance to about .15 megohms, the writer finds has restored normal operation in a majority of such cases without having to replace the tubes. Such sets have sufficient gain to compensate for the partial loss incurred by this gassy tube condition.—*M. Schaeffer, New York, N. Y.*

Radio Program Recording Made Easy

On many home recording radio-phonographs it is quite difficult to obtain good recordings without special equipment and connections. The writer found that the simplest way to get good results is through the use of a good wireless record player, receiving the signal of the record player with the recorder in the "to record radio" position.

Using this method, several different recordings, or parts thereof, can be "spliced" into one practically continuous recording. In doing this, when shutting off, quickly turn down the gain and then turn off the motor switch. To begin the next part of the recording, turn the recorder motor on first and then turn up the gain. Good results can be obtained after a little practice. — *D. J. Foard, Kalamazoo, Mich.*

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.

WANTED—Solor condenser checker Model CB-2-U. Will pay a reasonable price if checker is in good condition. Steve Antosy's Radio Repair Shop, 450 Bingaman St., Reading, Pa.

WANTED — A complete set of Rider's Manuals. Will pay cash. State price and condition. Clinton Radio Sales and Service, 7 Clinton St., Brooklyn, N. Y.

FOR SALE OR TRADE — Large assortment of chemicals and apparatus including experiment books and formulary, original value \$15. Will trade for communications receiver and cash or v.o.m. in fair condition. Julius Zimmelman, 289 South 1st St., Brooklyn, N. Y.

WANTED — Will pay cash for Hickok No. 155 Traceometer; Hickok No. 575 Electronic Bridge; Hickok No. 177X - 188X Signal Generator; Hickok late model Tube Checker and Analyzer; any late Hickok test equipment or General Radio equipment. Sterling Electronic Labs., 521 W. 131 St., New York City.

CASH — For Riders Manuals, tube testers, FCA Voltohmism. Let me know model number and price. National Sound Equipment, 625 Main St., Worcester, Mass.

FOR SALE — Supreme Tube Tester Model 85PL, excellent condition, \$10. Royce Saxton, R. 1, Pontiac, Ill.

WANTED — Riders Manuals Vol. 11, 12. Will pay top price. J. Levine, 625 Main St., Worcester, Mass.

WANTED — Line cord for Hallicrafters S-29 Sky Traveler. Contains 2 450 ohm resistors. J. W. Brown, Ga. Tech Box 2593, Atlanta, Ga.

WANTED — An NRI radio servicing course in fair condition including experimental kits if possible. Also a vom, low priced, in fair condition. State prices on both. Martin Newman, 778 Driggs Ave., Brooklyn, N. Y.

WANTED — Supreme tube tester model 504, Triplett model 1200A. Volt ohm M.A. Riders Manuals Vol. 6 to 12. State condition. Charles I. Amplo, 2228 Newbold Ave., Bronx, N. Y.

FOR SALE — Precision Master Analyzer No. 829. Separate AC and DC meters. Condition like new and looks it — hardly used. Portable model. Want \$35 cash. H. Roth, 1381 Sterling Pl., Brooklyn, N. Y.

FOR SALE OR TRADE — New Philco table radios models 38-A and 623 battery operated all-wave receivers. Want Precision E200 signal generator or cash offer. Chester T. Martowicz, 116 East 7th St., New York City.

WANTED — 0-1 mil meter suitable for construction of vacuum tube voltmeter. Would prefer one calibrated in volts, but will accept plain type. Must be in fairly good condition. Oscar's Radio Service, Merrill, Iowa.

FOR TRADE — Philtone portable and Silvertone radio chassis. Both in playing condition. No cabinet. Want 3" meter voltmeter 1000 ohms per volt. George Hague, 82 Varley St., Fall River, Mass.

WANTED — Will pay 50 cents for a good telegraph or radio key. Melvin Ahrendsen, Merrill, Iowa.

WANTED — Riders Manuals 10, 11, 12, and 13. Will pay \$7 each if in first class condition for any one or all. Also want good late model service oscillator. J. B. Mosley, 1426 North 24th St., Birmingham, Ala.

SALE OR TRADE — Collins commercial built radio transmitter 32 B in A1 condition for movie projector and camera in good condition. Send full details. V. C. Howardel, Jr., 102 Hancock Ave., Jersey City, N. J.

WANTED — Kodak Bantam f4.5 lens or other fast lens candid camera. Will swap radio parts or pay cash. Roger Stevens, 16 Howard Ave., Rutland, Vt.

FOR SALE — Emerson service notes 4 vols. \$1.50; RCA service notes 1931-37 6 vols. \$4.50; Supreme Pub. radio servicing course \$1.75; Precision rack for 954 and E200 \$15; also other equipment. T. Wojciechowski, 2837 Fulton St., Brooklyn, N. Y.

FOR SALE — 3 Brunswick chassis and speakers; 4 Kolsters 20 and 43; 3 Kolsters K5 Power Cones, new; Zeniths, Atwater Kents, Fada, RCA and others. All in fair condition and playing. Goldstone Radio, 1279 Sheridan Ave., Bronx, N. Y.

WANTED — All kinds of radio test equipment. Also Riders Manuals 1 to 12, and other radio publications. Quote best cash price. H. B. Howell, R. 1, Anna, Texas.

FOR SALE — Riders Manuals 1, 2, 3, 4. No. 1 is soiled but entirely serviceable. Make reasonable offer. W. E. Randall, 1122 Green St., Harrisburg, Pa.

FOR SALE — RCP702 test oscillator, not 2 years old, in perfect condition, \$25 prepaid. RCP308 tube checker in perfect condition, except for getting mfr.'s setting for the few tubes out, \$22 prepaid. Write for list. Reis Radio, 333 E. Saratoga, Ferndale, Mich.

WANTED — Service equipment, tube and set tester, signal generator, condenser analyzer, etc. All instruments to be in first class condition and of a reliable make. State model, make and price. George Pitherny, 54 East 100th St., New York, N. Y.

SALE OR TRADE — Used tubes, radio parts, speakers, radio magazines, tube checkers, meters, transformers, typewriter, firearms, etc. Include stamp for list. Jack's, 574 E. 35th St., Chicago, Ill.

TRADE — Good Superior Channel Analyzer for Electronic voltmeter or analyzer late model that reads various voltages at tube sockets. G. R. Roska, 1434 2nd St., N.E., Canton, Ohio.

FOR SALE — Brand new Revere Double 8mm movie camera. Fast 3.5 lens. Takes color or black and white films. Price \$38.50. Shipped C.O.D. Clyde W. Wimer, Ellwood City, R.D. 2, Pa.

FOR SALE — Ghirardi radio servicing \$4; electric phonograph \$10; speakers, vibrators, volume controls, and other radio parts; Popular Science, Popular Mechanics, Radio Craft, and Radio News magazines. T Wojciechowski, 2837 Fulton St., Brooklyn, N. Y.

WANTED — Books on electric motors, wiring and mathematics; also on refrigeration and air conditioning. State price, etc. J. Seidler, 887 Freeman St., New York City.

FOR SALE OR TRADE — 36 issues of radio magazines 1940, 1941, and 1942. Mostly Radio News and a few Short Wave and Television issues. Too good to destroy; make an offer. Frank H. Carlson, New London, Iowa.

WANTED — A good used signal generator, with full instructions for operating. Geo. A. Lewis, 705 Cayuga St., Storm Lake, Iowa.

WANTED — Bench lathe 9 or 10" swing or other machinist's tools. Will swap 504 Supreme Tester with Supreme 593 free point unit for 504 18" Cinadagraph High Fidelity Speaker SU18-12. New 55c Unidyne Mike, 15 assorted UTC Linear Standard audio units and transformers—Cash. Louis Loerzel, 51 Wood Pl., Dumont, N. J.

FOR SALE — Phonograph amplifier with 2A3S output tubes, with one or two speakers \$12 and \$15. Reynolds Radio Service, 875 Raymond Ave., St. Paul, Minn.

WANTED — Ham parts such as panels, tubes and meters; also want communication receiver. Will offer fair price trade or buy. Okey Gill, Cincoc, W. Va.

FOR SALE OR TRADE — Used converter 32 volts D.C. to 110 volts A.C., 100 watt capacity. \$2.25 postpaid. Selling out 3rd edition M.Y. Radio Encyclopedias, 264 pages, 35c each, postpaid. Max Shively, 3115 Ingham, Lansing, Mich.

FOR SALE — Brock all-electric record player, with an enclosed five inch speaker, two tube amplifier, and five dollars worth of new modern two face records. The player is in a portable carrying case with tan leather covering and cost \$20. The best cash offer takes it. Wayne C. McClung, 1114 Dawson Road, Albany, Ga.

(Continued on page 12)

THEORY OF THE CATHODE-RAY OSCILLOSCOPE*

PART 2

The Relaxation Oscillator

While there are several types of electronic oscillators that will perform the function of producing a linear sweep, the relaxation oscillator is the simplest and most adaptable to our work. This type oscillator is used in all present-day commercial oscilloscopes.

It is also known as the "saw-tooth" oscillator, linear timing axis, grid-glow or thyratron oscillator, and perhaps another name or two. Its action is quite simple, but because it may be unfamiliar to some, it will be described in detail.

Evolution of Linear Timing Circuit

We have seen from the mechanical arrangement just described that a sweep oscillator must move the beam at a uniform rate in one direction and return to its starting point instantaneously. It is quite apparent, then, that our usual sine-wave oscillators are not suitable for this particular job.

The problem is to develop a suitable voltage for horizontally deflecting the beam and then to provide a means for instantly reducing this voltage to zero.

A simple neon oscillator is shown in Fig. 12. Current from the d.c. input circuit, flowing through resistor R, charges condenser C. The neon bulb N, has no effect until its flashing voltage (50 or 60 volts) is reached. At this point, gas within the bulb ionizes, rendering the bulb a conductor, and instantly discharges condenser C as if it were a short circuit.

When the voltage across condenser C becomes reduced to almost zero, the neon gas de-ionizes, suddenly restoring the bulb to its former status of an insulator. Here another cycle of operation begins as condenser C begins "filling up" with another charge.

The frequency of operation is determined by the time required for charging condenser C. By selection of proper capacity values, and by making R variable, oscillation of any frequency from a few cycles up to many thousands may be obtained.

While extremely simple, this oscillator has three major faults which must be corrected before it can be used in a first-class oscilloscope.

First: its output, which will be slightly less than the neon bulb's flashing potential, is not sufficient to swing the electron beam completely across the screen.

Second: its frequency is not easily synchronized to the signal frequency. And third: as the condenser becomes more and more charged, its charging rate decreases, hence the output voltage does not increase linearly with respect to time.

Now, what to do about it! The first fault, insufficient output, is overcome simply by hooking on a stage of amplification.

Fault number two is remedied by changing to a thyratron tube, this being a more or less glorified version of the neon bulb. It looks just like a 76 but behaves differently.

A simple thyratron oscillator circuit is shown in Fig. 13. Instead of the neon bulb is a type 884 or 885 gas-triode (thyratron), which has a heater, cathode and plate—but has a little inert gas mixed with its vacuum content. Its action is quite similar to the neon bulb, except that its flashing voltage may be set to any predetermined value by application of proper grid bias potential E_c.

Two more resistors, R₁ and R₂, have been added to the circuit. The former simply limits the maximum charging rate, while the latter pre-

* By Jay Boyd in "Radio."

vents C1 from discharging more rapidly than the little tube will stand.

It is a characteristic of type 884 and 885 tubes, that discharge will occur whenever the plate potential reaches about seven times the negative grid bias value. Since we will amplify the output voltage anyway, we can fix the flashing voltage at about 20 volts by biasing the grid to about -3 volts. This gives plentiful output and makes the saw-tooth wave linear in the bargain, the explanation of which will follow.

We have already mentioned that a condenser takes its charge in exponential fashion. The curved and dotted line in Fig. 14 shows this charging characteristic. The condenser starts charging fast but slows down as its potential approaches that of the charging voltage.

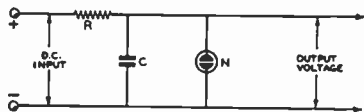


Fig. 12. Simple neon oscillator.

If such tank condenser is "flashed" when about half full its charging curve will be "rounded" like the solid line. Such a curve will make the pretty patterns on our cathode-ray screen rather distorted.

However, if the thyratron is set for a low flashing voltage—that is, only five or ten per cent of the d.c. charging voltage, this charging curve will be essentially linear, as shown in Fig. 15. Here we flash the condenser before its curve starts bending to any appreciable extent.²

² Another method of obtaining a linear output voltage is frequently found in television receiver designs, and in some of the older oscilloscopes. Instead of flashing the thyratron at a low potential, this method flashes at a much higher value; that is, two or three hundred volts, thereby eliminating the amplifier. By substituting a pentode tube for the current limiting

Synchronization

And now, about synchronization. We stated that the flashing voltage was determined by the thyratron's grid

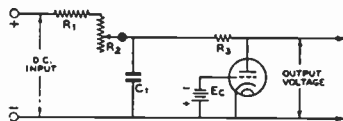


Fig. 13. Simple gas-triode (thyratron) oscillator circuit.

bias. If a small potential—less than a volt being required—is fed back from the signal under inspection to this thyratron grid, the tube will flash, always at the instant a certain signal voltage is reached.

A potentiometer, R4 in Fig. 16, provides control of the synchronizing po-

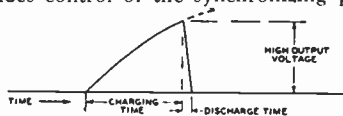


Fig. 14. Effect of operating at a high flashing voltage.

tential. This voltage is usually taken from the signal voltage on the free vertical deflection plate, but in some cases from the signal, itself and occasionally from the 60-cycle a.c. power source.

Something should be said of the polarity of output, both from the tank condenser C, and the complete sweep circuit, with amplifier. Referring to the first portion of Fig. 17 will be found the "saw-tooth" waveform across the tank condenser. This voltage varies from a few volts above ground to the flashing potential of the thyra-

resistor R, current flow to the tank condenser is limited to a constant rate. This method, however, is just as complicated as the low-flash-and-amplify method and is not nearly so flexible. Also, with the low-flashing circuit, the amplifier is also available for amplification of external signals, if desired, making it much more suitable for oscilloscopic use.

tron. Note that this voltage is always positive. The waveform is a sawtooth pulse, rather than an alternating current wave, at this point. However, the oscillator is coupled to the horizontal amplifier grid through a coupling condenser C6, Fig. 16. Here on the amplifier grid we will find the same sawtooth characteristic. But the amplitude is now divided half above and half below our ground line of zero potential.

Now after amplifying this wave, we find that the amplifier has shifted its phase 180 degrees, as will be seen in the last portion of Fig. 17. This phase reversal is of no real importance, though. If the cathode-ray tube is mounted so the free horizontal plate is at one's left, the sweep cycle will begin at that side, travel to the right, and then snap back to start the cycle all over again. Our cathode-ray screen graphs will be correctly plotted from left to right, in relation to time.

About Amplifiers

In small commercial oscilloscopes one usually finds one vertical and one horizontal amplifier. The larger models, using five-inch tubes or larger, are usually equipped with two vertical amplifiers.

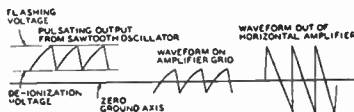
The vertical amplifier simply builds up the signal under test to sufficient

amplitude and have as flat a frequency characteristic as can be obtained.

Fig. 15. Obtaining sweep-circuit linearity by means of a low flashing voltage.



Fig. 17. Pulsating oscillator output becomes a.c. on output side of coupling condenser.



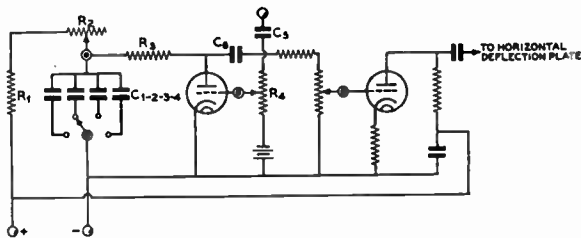
A flexible switching arrangement is always provided to make the oscilloscope as versatile as possible.

Practical Oscilloscope Design

The following will be devoted to practical design, so the reader may build a one-, two-, or three-inch oscilloscope that will compare favorably with commercial instruments of comparable size.

This will not be an academic text on the subject but will be written around certain specifications which

Fig. 16. Complete sweep circuit, consisting of sawtooth oscillator and horizontal amplifier.



amplitude to deflect the electron beam to the desired degree.

The chief purpose of the horizontal amplifier is to amplify the sawtooth timing wave, as previously described, largely in the interest of linearity.

There is nothing unusual about either of these amplifiers, except that they should operate with as little dis-

experience has shown to be practical, even if not always ideal. The reason for selection of certain values will be given in many cases, and the effects of changing these values explained.

We already mentioned that the general purpose oscilloscope was made up of five units; that is, the cathode-ray tube circuit, the vertical amplifier, saw-

tooth oscillator, horizontal amplifier and a dual power supply for all units.

There is practically no difference in circuit design, whether one builds his 'scope around a one- or two-inch tube. A three-inch job will require more voltage for the cathode-ray tube but the saw-tooth oscillator, amplifier and switching arrangement will be identical for all models. Circuit design will be considered first, with suggested physical layouts being given in another installment.

Selecting the Tube

Whether to use a small cathode-ray tube or a larger one is a problem each builder must decide for himself. The larger tubes produce bigger patterns, of course, but a little 913 will show up faults of the apparatus under test just about as well as a three-inch tube. The larger screen is much better, though, where accurate measurements of the pattern are made by a ruler or dividers on the screen.

On the other hand, the smaller jobs may be much more compact. We know of one geophysics laboratory that uses a five-inch 'scope "at home" but takes little one-inch 'scopes out in the field. They are more portable and less liable to accidental breakage.

Although the writer has built several oscilloscopes using both one- and two-inch tubes, he has used one of the smaller ones for three years. Building that two-inch job for himself is an event still hanging on the calendar, parts having been on hand for months. Experience with three-inch jobs has been that of using and repairing a few commercial jobs that went on the rampage.

To familiarize the reader with several of the more suitable cathode-ray tubes, the accompanying Comparison Table has been prepared so their size, operating voltage, and deflection sensitivities may be compared.

In addition to the manufacturer's specifications, some of the sensitivity ratings have been recalculated for the actual voltages obtained from a Thoradson 92R33 transformer, operating from a 117-volt line, both with and

without the high-voltage tap in use.

To furnish more useful figures, sensitivity has been calculated in d.c. volts per inch, d.c. volts for half-screen deflection, and a.c. potentials necessary for full-screen deflection. The d.c. voltages given are those required to shift the beam from the center of the tube to its outer edge. The a.c. voltages shift the beam in both directions, of course, so the figures given are those necessary to touch both edges of the screen.

From the Comparison Table we find, that for a given voltage, the deflection sensitivity in millimeters per volt is approximately proportional to the diameter of the screen. However, the voltage necessary for full-screen deflection is roughly the same, regardless of tube size. That is, a little more or less than a hundred volts will be required for the pattern to touch all edges of the screen.

It can be seen, then, that any saw-tooth oscillator and amplifier arrangement designed for one type of tube will be suitable for any other tube listed. The only difference in circuit design and component selection will be in the power supply.

(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 — First edition of Radio Engineering Handbook by Henny. C. A. Brethen, 150 Saranac St., Rochester, N. Y.

FOR SALE OR SWAP — 6 midget 456 K.C. iron core I.F. transformers, trimmers and can, complete 45c each postpaid. Inputs or outputs. P.A. system 40 watt complete with dual 12" P.M. speakers in case. Floor stand mike, all factory built \$75 cash F.O.B. Max Shively, 3115 Ingham, Lansing, Mich.

WANTED — Two or four cylinder gasoline engine driven A.C. generator 110 volts 60 cycles, one to seven kilowatt. Good condition complete on skids. Will pay cash. Paul H. Thomsen, 903 Phila. Ave., Silver Spring, Md.

FOR SALE — Philco home recording kit No. 45-2820 new \$17.50. Univex camera model A8 f5.6 lens used, single 8 film in case \$14.75. Anchor Radio, 203 Elm, Ithaca, N. Y.

SWAP — Hallicrafters Super-Skyrider. Covers from 1.3 to 32 MC. Five bands, S.W. only, no broadcast. Eight tubes. Also two Lansing 15" self-powered speakers Models 15XAC, field 1800, voice coils 2" dia. Original list price \$65 each. Want Riders vols. 8, 10, 11, 12, clean and not mutilated. Day and Night Electric Shop, 6209 Santa Monica Blvd., Hollywood, Calif.

SELL OR TRADE — Precision tube checker, 9" meter, up to the minute. 2 Rola G12 speakers in 4' trumpets; 1-20W mobile amplifier; 2-12" speakers P.M. in parabolic baffles; 1-0 to 200 Micro-ampere Weston 301 meters. Want oscilloscope, V.T. voltmeter, audio oscillator, Riders Manuals 6 to 13. Jacobson, 1117 Gerard Ave., Bronx, N. Y.

FOR SALE — Howard 435A. Condition like new. \$30. E. B. Lowell, 4032 Oregon Ave., St. Louis, Mo.

FOR SALE — 2 Western Electric 3 A 200 ohm Oil Damp Pick-ups with arms and scratch filters. A-1 condition, sold for \$75 each. Will sell for \$20 each. Clough Bregle model OCA Radio Frequency Signal Generator. A-1 condition, \$22.50. Amperite Velocity SR 80 microphone, 200 ohm, like new, \$35. John J. Spankowitch, 239 N 9th St., Allentown, Pa.

WANTED — 38 cal. Colt Automatic. Must be in good condition. Have radio parts and Univex 8MM movie camera to trade. Griffin Film Co., Box 21, Ithaca, N. Y.

WANTED — Power transformer from a Montgomery Ward Airline model 62-68. Do you have one of these radios? Harry Banister, LaFontaine, Ind.

FOR SALE OR TRADE — 10 tube new Scott F.M. Tuner, cost \$119, sell \$95; new Scott 15" dynamic Philharmonic speaker, cost \$39, sell \$30; Jensen 10" dynamic speaker \$3; 8" P.M. speaker \$2; Pre-amplifier dry cell battery operated \$5. Want C.B., Hickok or RCA Test equipment, all Riders Manuals, Code Oscillator and Key. Will pay cash. Henry Bal, 20 South 13th St., Newark, N. J.

TRADE OR SALE — New Dumont latest model 183X television receiver; Delco, Buick and Chevrolet custom built auto radios in original General Motors cartons; Harrison Auto Heaters. Will take electrical appliances, standard brand radios, or cash at our cost. Frankenstein, 439 Penna Ave., Brooklyn, N. Y.

WANTED — Rider's Manuals, Vols. 3, 4, or 5, to Vol 13 inclusive. Kindly state lowest price. Will pay cash for books in good condition. All correspondence answered. H. L. Mills, 8006 Truxton Ave., Los Angeles, Calif.

WANTED — Riders Manuals 1 to 13 inclusive, must be in good condition with index and supplements. Cash. B. W. Wojciechowski, 1286 Broadway, Buffalo, N. Y.

WANTED — RCA volt-ohm-ist; RCA sound movie 16mm newsreel camera or 16mm Filmo movie camera silent with f2.5 universal focus lens. State price and condition. Frank Miller, Wyalusing, Pa.

FOR SALE — Model YSA 16mm sound motion picture projector; model 85 Supreme tube tester; Jewell 540; Philco 040 radio tester and oscillator \$10. Frank Miller, Wyalusing, Pa.

FOR SALE — Small amplifier, \$1.50; 4" P.M. speakers \$1.35; Output transformers for speakers \$1.65; Weston 3 range milliammeter model No. 269, ranges 0 to 15 ma., 0 to 75 ma. \$5; 2 Faradon type UC 1842 Mica Condensers, 5,000 volts, .004 mfd. \$5 each; large store type fluorescent fixture \$30. Paul H. Prokes, 9216 S. Menard Ave., Oak Lawn, Ill.

FOR SALE — Large assortment of transformers for Kolster, Fada, Sparton, Majestic and other radios. Write for list. Goldstone Radio, 1279 Sheridan Ave., Bronx, N. Y.

FOR SALE OR TRADE — Hundreds of used radio parts, tubes, magazines, meters, tube checkers, firearms, golf clubs, typewriter mimeograph, tennis racket, tools, etc. Want test equipment, list for stamp. Roby's 6-3569 Cottage Grove, Chicago, Ill.

WANTED — Defense School interested in purchasing outright complete shop equipment sufficient to carry on radio maintenance classes. Write us, giving list of items, condition and price. A. W. Hinds, Pueblo Junior College, Pueblo, Colo.

FOR SALE — All kinds of radio service equipment such as meters, tube tester, service manuals, etc. Write for complete list. Reese Sales Co., Box 484, Shawnee, Okla.

WANTED — Any good condenser tester. Standard make preferred. Give full details in first letter. W. G. Muir, Harper, Kan.

SELL OR SWAP — Weston, Jewel and Westinghouse ammeters, voltmeters, R.F. meter, milliammeters, etc. Also 6 ampere Tungar bulbs, T-20 Taylor tubes and 2 Cooper-Hewitt mercury vapor lights, complete. Want gasoline motor-scooter over 1 HP. or 110 volt gasoline light plant. M. J. Nesterostek, 2001 Green St., Allentown, Pa.

FOR SALE — 2 sets ICA short wave 4-prong plug-in coils No. 1421 tuning from 9½ to 217 meters 85c per set; both sets for \$1.50. Write for list of other short-wave set parts.—Paul H. Prokes, 1955 W. Schiller St., Chicago, Ill.

FOR SALE OR TRADE — Because I am in the Navy I must close my radio shop for the duration. Will sell all equipment for \$225 cash, or will swap for high grade 8mm cine equipment. If interested write for list. C. Earle Short, P.O. Box 565, Annapolis, Md.

WANTED — Riders Manuals 1, 2, 3, 4, 5. Must be in good condition. Will pay cash. State price. Radicia's Radio Service, 101 Martin St., Bergenfield, N. J.

SALE OR TRADE — Weston 0-15 DC volt-meter, GE 0-80 DC voltmeter, Edison phonograph, quarter horse AC motor, 4 watt amplifier, Federal condenser tester, Tork clock time switch, 6 volt converter to 7500 AC at 10 MA., car radio revamped for AC. Send offers. Stanley, 2748 Meade, Detroit, Mich.

SALE OR TRADE — Neon Sign "Radio," Jensen D9, Sp. horns, Dependable tube checker, ORS Manuals '33, '34, Supreme No. 333, Maj. F-50 chassis, Shure D.B. mike ring and springs. Want 16mm. proj., light meter, port. transmitter equip., oscilloscope, R.F. meter. L. J. A., 721 Bradford Ave. N., Minneapolis, Minn.

WANTED — U.H. freq. transmitters, parts and receivers. Need not have power supply. U.H.F. tubes 1 to 10 watts. Rider books other than manuals. Stencil post card duplicator. Give best cash price. What do you need in trade? Bob Eubank, 1227 Windsor Ave., Richmond, Va.

FOR SALE — Mobile transmitter or receiver vibrator type power transformer. 6 volt full-wave input, 310 v. at 70 ma. each side C.T. secondary. Brand new, \$1.85. 4" PM speakers with output transformer to match 25L6, 50L6 and similar tubes. New. \$1.95. Prices are F.O.B., Chicago, Ill. Paul H. Prokes, 1955 W. Schiller St., Chicago, Ill.

FOR SALE — Radio tubes. Most all types on hand. Write for prices on the type you need. Type 7G7/1232 \$3.60 ea., 2 for \$1.00. Type 6L6 \$1 ea., 2 for \$1.80. All tubes have never been used. Prices F.O.B. Chicago, Ill. Paul H. Prokes, 1955 W. Schiller St., Chicago, Ill.

WANTED — Good used amplifier must be in A-1 condition between 15 and 20 watts output, for crystal mike input. George Bartlett, 261 Whitman St., New Bedford, Mass.

WANTED — Good used 3" cathode-ray oscillograph. Must be in A-1 condition, any make. George Bartlett, 261 Whitman St., New Bedford, Mass.

FOR SALE — New and used transmitting and receiving parts. What do you need? Send for list. Will swap or pay cash for good photo enlarger. Herman Yellin, 351 New Lots Ave., Brooklyn, N. Y.

WANTED — National SW-3 receiver, 6 volt model. Want receiver only, without coils or power supply. Write giving model, condition and price. Gordon W. Marino, 22 Muller St., Vallejo, Calif.

WANTED — Small gasoline engine, two cylinder preferred, but will consider one cylinder if proper size. Will pay cash or trade radio or photo equipment. Please include stroke and bore when answering. Leonard Freud, 1212 Gilbert Pl., Bronx, N. Y.

WANTED — New or used Hickok model 10X tube and set tester or Weston models 665 or 666 set testers. State condition and price wanted. John M. Sulak, 422½ N. Klein St., Springfield, Ill.

WANTED — 0-1 milliammeter, any type and small portable volt-ohm meter. Send full particulars and price. Willing to pay cash. Oscar's Radio Service, Merrill, Iowa.

WANTED — Service oscillator, late model, good condition. Describe fully with price. If it suits will send money order at once. Also want Rider's 10, 11, 12, or 13 or any one. Will pay cash. J. B. Mosley, 1426 North 24th St., Birmingham, Ala.

SWAP — A 1500 ohms per volt Universal Meter, knife edge pointer, 100 division D.C. scale, alternating current scale, ohms scale, 50 millivolt scale. Rebuilt and fully guaranteed. Want a 1/4" key chuck Black and Decker electric drill in good working order. Edmund McD. Bendheim, 22-33 31st St., Astoria, L. I., N. Y.

WANTED — 3" Oscillograph or 560 Supreme Vedolyzer and 561 Supreme Oscillator. Also a Supreme 549 Electronic voltmeter or Meissner analyst. State condition and price. Hrynicky Radio Service, Thorp, Wis.

WANTED — Grandfather's clock or any other electric chime clock, a recording outfit, a good 16mm movie projector, a vacuum tube voltmeter, Rider's Manuals from 8 on up, a sewing machine, an electric drill, and good work bench. Edward Connor, 907 Brown St., Wilmington, Del.

FOR SALE — Jackson 640 test oscillator new; Jackson 636 portable tube tester like new; Teco T15 multimeter 4 1/2" square meter; Capacitor bridge model BN; 3" 1 mil. meter square. Harold Sohnlein, Woodrow Ave., R.D. 6, North Canton, Ohio.

WANTED — Television receiver, frequency modulation receiver, all types of meters and communications receiver; also 110 volt A.C. gasoline generator for urgent defense work. Must be in good shape and reasonable for cash. Karl H. Stello, Beltsville, Md.

FOR SALE OR TRADE — One Bud radio test set in carrying case, \$15; 100 late Popular Mechanics and radio magazines \$10; and one new General manual slicing machine \$25. K. H. Stello, Beltsville, Md.

FOR SALE — Hallicrafter Sky Champion nearly new \$35. Also Thordarson Oscillograph, brand new completely wired \$30. Charles Horne, 707 W. Park St., Sandusky, Ohio.

FOR SALE — Rider's Manuals, vol. 1 to 6 inclusive. All condition and with index and supplements. As good as new. \$24 F.O.B. Clarence Cheadle, Salem, S. Dak.

FOR SALE — Radio laboratory apparatus such as General Radio, panel type and portable meters of all types. Send stamp for list. L. Tulaukas, 104 N. Eaton Ave., Indianapolis, Ind.

SWAP — New Abbott MRT-3-2 1/2 meter transceiver, no power supply or tubes for Meissner late De Luxe Signal Shifter. Also want crystal microphones, amplifier, good communications, FM or television receiver. Karl H. Stello, Beltsville, Md.

WANTED — A complete set of Rider's Manuals. Will pay cash for books in good condition with indexes and supplements. Please state condition and lowest price asked for the set. Max Person, 4316 Corliss Ave., Seattle, Wash.

WANTED — Radio sets, home and car types, any quantity, late models preferred. Must be reasonably priced for cash. Also want good metal working lathe. Murray E. Main, 250 W. William St. Delaware, Ohio.

FOR SALE — Portable "Presto" Recorder, Type E, Ser. No. 1324. Also one Bogen Playback. Will sell one or both. Earl W. Hall, 1427 1/2 Quarrier St., Charleston, W. Va.

TRADE — Have a Weston Oscillator model 692 battery operated in perfect condition. Want condenser analyzer. L. D. Blow, Wyndmere, N. Dak.

WANTED — Automatic Record Changing Player Unit, Garrard or Webster, with record cutting head. Please state type and model. Will pay cash. Aladdin Camera & Radio Exchange, 4 East 32nd St., New York.

FOR SALE — 1 Jackson tube tester model 535A for \$20. Robert J. Kuntz 3548 Brighton Rd., N.S., Pittsburgh, Pa.

TRADE OR SALE — K&E polyphase duplex Trig slide rule, like new, perfect condition. Also have a Bell 16mm. movie camera. Want 12-inch P.M. speakers of 15 watt continuous rating. What have you. Melvin Cohen, 1025 East 2nd St., Duluth, Minn.

WANTED — Good VOM or high resistance scale 10 megs or more, Triplett, Supreme or Weston or other good brand, reasonable. Royce Saxton, R. 1, Pontiac, Ill.

WANTED — Small 2 or 3 tube AC-DC radio (headphones or speaker). Give full description. L. LeClere, 312 W. Wabash, Carthage, Ill.

WANTED — Weston Model, 547, 565, 566 or Jewell Pattern 444 analyzer. State condition and lowest cash price. IRE Proc. 1931 to 1936 inc., 1939, A. R. Satullo, 3407 East 102 St., Cleveland, Ohio.

WANTED — Dynamic Mutual Conductance Tube Tester. Full details in first letter. Will pay cash. Leo Kolehmainen, 1426 1/2 Midvale Ave., West Los Angeles, Calif.

WANTED — Scott Receiver 30 tube. Have 10 H.P. outboard motor, power lawn mower, Oxweld welding equipment with 8 tips, cutting torch, hoses and regulators, etc. S. P. Osborn, R.R. 3, Box 90, Bristow, Okla.

WILL SWAP — A-1, 22 cal. bolt action, 7 shot clip, Western Field rifle for short wave receiver, transmitter, test equipment, books, or what have you. Also have a 210 lb. set of Bar-bells with 3 courses on weight lifting. Trade for any of above items. Fred C. Schiebler, 909 Adams St., Neenah, Wis.

WANTED — Any one or all Rider's Manuals, Vols. 8 to 11 inclusive, or will swap xmitting tubes: 6 WL 455's, 1 WL 460, as part payment. Bill Wiborg, 1019 E. Jefferson, Fort Worth, Tex.

FOR SALE — Jackson Dynamic Signal Analyzer in A1 condition; price is low. J. Levine, 625 Main St., Worcester, Mass.

FOR SALE — Breting 12 Recr. \$50. Set Rider's Manuals new includes 1 to 5 abridged, 6 through 13, \$85. Used Manual set 1 through 12, \$85, C.O.D., F.O.B., Los Angeles. Fine condition guaranteed. Send check for prepaid shipment. Your check returned if mds. previously sold. Also Precision E 200 OSC \$40, Triplett 1601, \$35. Earl K. Moore, 11537 Pope Ave., Lynwood, Calif.

TRADE — The following for radio books and tools of equal value: Books on airplane sheet metal shop practice, also How to do aircraft sheet metal work, also steel tool box with layout tools. Clarence W. Hull, Mineral Springs, Pa.

WANTED — A handicapped person is looking for a big hearted radio service man who has no more use for the extra signal generator, parts and radio diagrams which are lying around the shop. Peter J. Jarvis, 4817 S. Elizabeth St., Chicago, Ill.

WANTED — Will buy Rider's Manuals, Vol. 11, 12 and 13; also Hickok model 202 electronic volt-ohm-milliammeter or Triplett model 1200-F automatic volt-ohm-milliammeter. R. L. Thomas, Box 583, Homer, La.

WANTED — Rider's Manuals volumes 4 through 13, good condition, cash. Advise what you have. Karl Wagner, C. C. Bk. Bldg., Des Moines, Iowa.

WANTED — Meissner signal shifter. State model, sets of coils available, condition and price. Nelson K. Stover, 751 Tioga St., York, Pa.

FOR SALE OR TRADE — Transformer 110 v. primary; secondary 6,000 v, 20 ma. Was used for luminous gas sign. Best offer takes it. J. W. Shortell, 2333 Washington Ave., Bronx, New York.

WANTED — All Rider's Manuals complete in good condition; dynamic condenser checker like Solor, Quick Check, etc.; new radio tubes, parts, tools, etc.; V.O.M. of recent manufacture. Radio Clinic, 115 W. 13th St., Sioux Falls, S. Dak.

BUY, SELL and EXCHANGE — All makes of foreign radio tubes. Want foreign radio tube tester. Aladdin Camera & Radio Exchange, 4 East 32nd St., New York.

WANTED — Cheap all wave signal generator, Superior, Readrite, C-B or the like. Will pay cash \$5 to \$10. Would prefer Superior 1230-1130 if possible but will buy any make. Oscar's Radio Service, Merrill, Iowa.

WANTED — Rider's Manuals 1 through 12 in good condition complete with supplements and indexes. Quick cash sale if price is right. If you haven't all 12, what have you. Carl E. Mead, 833 Chicopee St., Williamansett, Mass.

SELL OR SWAP — Rider's Perpetual Manuals No. 1 to and including No. 5. Will trade for short wave communication receiver or pay cash plus manuals for better or larger set. Also have Supreme and Precision tube testers. Oliver F. Klein, 2235 N. 39th St., Milwaukee, Wis.

WANTED — Cheap all wave signal generator for \$5 or \$6. Superior 1130-S or the like. Also want data, diagram, and directions, etc., on Superior Allmeter AMR. Will pay cash for signal generator. Oscar's Radio Service, Merrill, Ia.

FOR SALE — 3-inch oscilloscope built by service engineer to RCA circuit. Neat appearance, tube not burned, no hum. \$65. Model 150 RCA Oscillator excellent condition, \$60. One new 913 Cathode Ray tube \$3. Paul Wilson, 323 S. Phillips Ave., Sioux Falls, S. D.

FOR SALE OR TRADE — Hundreds of used radio parts, tubes, speakers, magazines, electrical books, tube checkers, meters, tools, etc. Describe your goods, list for stamp. Roby's Swapmart, 3569 Cottage Grove, Chicago, Ill.

WANTED — Position as a radio serviceman for young man. Ineligible for draft. Recent graduate of the Y.M.C.A. School, but with no experience. Willing to learn. Will accept nominal salary. Charles J. Neff, 67 Highview Ter., Yonkers, N. Y.

WANTED — Will pay cash for any good service equipment such as Supreme 560A Vedolyzer, 561 audolyzer, 562 signal generator, 571 oscillator, 504, 592 or Precision 920, 954, 844, 854P E-200, Ev10, 856 or Averox 75 condenser checker. Kennedy's Radio, 3407 14th St., N.W., Washington, D. C.

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