Vol. 8 MAY, 1943 No. 5

CORNELL-DUBILIER ELECTRIC CORP.
HAMILTON BOULEVARD
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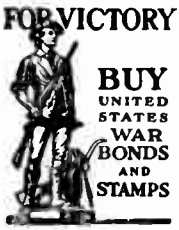

Leon Miley
Nine East Orange St.,
Lititz Pa.

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 Unpublished items will not be returned.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.

Phono Switch Problem

Among the many problems of servicing is the installation of phono pickup switches. The usual fault is the difficulty of cutting out the radio signal completely on phono player operation when switching to audio input.

A simple solution is to use a D.P. D.T. switch and to ground the signal on the phono player position. No trace of the signal will therefore be heard, and in all sets with volume controls in the grid circuit use the control for phono player operation also.—*Herbert S. Waldman, Bronx, New York.*

An Output Meter Improvement

By using an output transformer with the high impedance primary connected to an a.c. output meter, and the low impedance secondary connected to the voice coil terminals, a step-up in voltage is had, which greatly improves alignment operations.

This system has the advantage of eliminating the need of connections to the output tube plate terminal, and greatly expedites the operation. —*Joseph S. Napora, Uniontown, Pa.*

Slipping Dial Cords on Small Sets

Trouble is occasionally encountered in the newer types of table model sets with dial cord slipping when the set warms up. This condition can of course only be corrected by replacing with a new dial cord or applying some sort of preparation to prevent the dial cord from slipping. The most satisfactory repair of this condition the writer finds is to replace the cord, and instead of making two turns around the dial add one additional turn.—*John W. Burger, Westphalia, Kan.*

Detrola Model 389 Portable

In this set the writer encountered trouble with the 30 and 50 ohm ¼ watt wire resistors burning out at the 35Z4 rectifier tube. By replacing this resistor with a 30 ohm ½ watt wire wound resistor the trouble was corrected. However, be sure the 35Z4 is not shorted when tapping it. This is what causes the small wire resistors to burn out. If the new wire wound type units heat up this will be an indication that there is a bad tube in the set.—*C. E. Stranman, Pacific, Mo.*

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Outside Aerials on A. C. - D. C. Sets

Reception and tone quality of small a.c.-d.c receivers with built-in loops can be improved considerably by employing an outside aerial and ground.

To do this the writer uses a 25 ft. coil of insulated wire tacked against the back of the set with the outside aerial and ground connected to either end of the coil.

An outside aerial and ground must never be connected directly to a set with built in loop unless through a proper antenna coil.—*Ezra Schurr, Cisne, Ill.*

Emerson Model FU 424 and 428 Sets

This receiver may be found to operate satisfactorily on battery supply but on a.c. operation distortion will occur when the volume is increased, or will go into oscillation when the volume is turned very low.

The writer found that by replacing the 40 mfd. 25 volt electrolytic capacitor between the filament of the 1N5 first I.F. tube and ground with a new unit of the same capacity and voltage rating the trouble disappeared.—*Tony Leanusa, New York City.*

Checking Oscillation

The method employed by the writer for checking oscillation is first to take reading of the cathode voltage with a voltmeter. This voltage will ordinarily be between 1 and 10 volts. While this is being done short out the oscillator coil. If the voltage remains constant or drops the circuit is not oscillating. If the voltage rises 2 to 3 volts the circuit is oscillating.

This applies to ultra-high frequency oscillators as well as broadcast oscillators. A tube not oscillating draws at normal current, thus, a larger voltage in the cathode circuit.—*Milton V. Ratynski, Keansburg, N. J.*

Distortion in Sets With 50L6 Tubes

If distortion occurs in sets such as Transitones No. E-14375 which employ the 50L6 type tube this trouble is frequently due to the tube becaming defective, yet the tube will check O.K. on the tube tester.

Since this type tube is difficult to obtain in many localities, the writer suggests connecting a 50-100 ohm 20 watt W.W. resistor between the line and the heater prong of the 35Z5 or similar tube. This will lower the heater voltages, thus eliminating the distortion but still give satisfactory volume and also give longer life to the tubes.—*Frank L. Kessler, Jr., Delair, N. J.*

Renewing Life of 35Z5 Tubes

A number of the 35Z5 tubes are often discarded that may still be put to use, especially in experimental circuits. A tube checker may indicate the tube as being burnt out, but this is not always the case. Checking with an ohmmeter will reveal that in most cases the open is between contacts No. 2 and 3. That leaves us with tube of thirty volts heater rating using contacts 3 and 7. In most cases the writer found that the tube can be put back into service in its original circuit by bridging socket contacts 2 and 3 with a forty to fifty ohm one half watt resistor. They can also be used as ballast tubes where a 30 volt drop is needed.—*E. E. Youngkin, Altoona, Pa.*

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 — Queens-Gray Wheatstone bridge, Weston 45-0-1½ ma meter, Keuffel & Esser log-log duplex slide rule. Foth 6 power binoculars, Weston 280, 301, 425 and 546 panel meters, inter-com units. Gus Jacobson, 264 E. 165th, Bronx, New York City.

WANTED—Will pay cash for good used 110 v. a.c. to 32 v. d.c. rectifier pack such as ATR No. 32 A or B, or will trade some good used tubes. DeWitt Radio Service, Cottonwood Falls, Kans.

WANTED—A 3 or 5 inch RF 0-5 Hickok oscilloscope or Dumont, RCA late models, also Precision model 912 P portable 4⅞" meter tube tester, late model. Also a neon or meter type output meter. Paul Capito 637 W. 21 St., Erie, Pa.

WANTED—8 mm motion picture projector, Bell & Howell preferred, or Eastman. 500 watts or more. Describe age, condition and price. Robert N. Pinkerton, 807 West Mercury Street, Butte Montana.

WANTED — Late model portable radio tubes and set tester combination. Must be in A-1 condition. State lowest cash price in first letter. Henry House, 306 So. 2nd St., Guthrie, Okla.

FOR SALE—Gernsback official radio service manuals, vols. 1, 2, 3, 4, 5, 6, 7. Price $17.50. Radio Electric Service, Wilbur, Washington.

FOR SALE OR SWAP — Have Western Electric 2 H.P. 230 v. d.c. motor, Webster 250PP power amplifier, Motorola Golden Voice car radio, hot water heater, other items. Want radio testing equipment of most any kind and manuals, or what? Glenn Watt, Chanute Kans.

WANTED—Following issues of "Proceedings of the Institute of Radio Engineers": 1930 Year Book, Vol. 18, Nos. 1, 3, 10 and 12. 1931 Year Book—Vol. 19, Nos. 1, 6, 8, 11, 12. 1932 Year Book, Vol. 20, Nos. 5, 6. 1933 Year Book, Vol. 21, Nos. 3, 4. 1934 Year Book, Vol. 22, Nos. 2, 9. 1935 Year Book—Vol. 23, Nos. 1, 4, 7, 10, 11, 12. All subsequent issues to date. Waters Conley Company, Rochester, Minnesota.

FOR SALE OR TRADE—1930-1940 bound file QST years inclusive in brand new condition. Want good electric phonograph and communications receiver, used but in working order. Rosradio, 518 Troy N. W., Canton, Ohio.

FOR SALE OR SWAP — Dunco low and high current relays, Clough-Brengle 3" oscillograph, Ferranti transformers, A. & B. series and 3 Sangamo hour counters and other items. Will sell or swap for VTVOM chanalyst or equivalent, A. F. oscillator. J. J. Bressler, 25 Dongan Place, New York City.

WANTED—One National NC 100A or NC 100XA with or without tubes or speaker. Will pay cash or trade some of following: Weston 676R tube tester, Dumont 5 in. scope model 148 new tube, Clough Brengle OMA FM and AM; all wave oscillator, dynamic portable tube tester, Clough-Brengle frequency modulator, motor plus tube type, transmitting equipment. Give full details first letter. Will do same. Bob Eubank, 1227 Windsor Ave., Richmond, Va.

WANTED—Rider's Manuals Nos. 10 to 13 also good output meter and late model tube tester. Fossum's Radio Service, Ashland Wis.

WANTED—Tube checker, signal generator also Rider's Manuals, vols. 10 to 13. Will pay cash. Must be in perfect condition. Eugene Gilbert, 1296 Sheridan Ave., Bronx, N. Y.

WANTED—Weston master exposure meter, model 850 or earlier model. In good condition. Please quote price. Cpl. Sidney Haskoe, Sig. Hq. and Hq. Co., Sub Post No. 1, Mitchel Field, L. I., N. Y.

FOR SALE—Webster-Chicago 30 watt public address system, Master series W-929-A. 6 v. d.c. 110 v. a. c. phono-turntable, two Jensen 12 inch speakers, Atlas steel baffles, crystal mike, chrome floor stand, 150 ft. heavy rubber covered cable. Just like new. Norman Eide, 6747 Stevens Ave. So., Minneapolis, Minnesota.

WILL SWAP a signal generator Triplett model 1232 for a good volt-ohmmeter, and pay the difference. Send full details. P. Covella, 190 Fulton St., Brooklyn, N. Y.

WANTED—Jensen type GHP or EHP 801 or 802 loud speaker in like new condition. Pay good cash price. Charles Weyl, 255 Harvey Street, Philadelphia, Pa.

WANTED—Any or all "Proceedings of the IRE," '30-'38 inclusive, bound volumes or complete sets of monthly issues. Name price. J. S. Jamison, Jr., 313 Letcher Avenue, Lexington, Va.

WILL SELL—Zenith Car Radio in good condition, 5 tubes, $14.00 takes it; 5 in. P.M. speaker new W-D $2.00; 10 in. P.M. speaker, new, $4.00. Want 38 calibre revolver with 6 inch barrel only. Griffin, Box 21, Ithaca, N Y.

BATTERIES WANTED — Eveready 467 or 455 or equivalent for use in RCA BP-10 portable sets. Will pay cash. Ed. Christner, 313 Crawford St., Middletown, Ohio.

WANT — Test equipment, meters, meter parts, precision multipliers, multiple rotary switches, bridges, decade boxes, tools, fire arms, of all types. Describe fully, state price. Roby's Swapmart, 3569 Cottage Grove, Chicago, Illinois.

WANTED—Would like to buy one Rider's Chanalyst by RCA. State condition and price in first letter. Roberts Radio Service, St. Louis, Michigan.

FOR SALE—5 Faradon condensers 5000 volts effective. .005 mfd. 15 amp. at 1000 k.c., 6 amp. at 100 k.c. Cost new about $20, $40 takes all. G. U. Cusack, Box 338, Fowler, Colo

WANTED—Radio City No. 411 or 411P supertester. Quote price, condition, in first letter. Joe's Electric Co., 525 N. State St., Jackson, Mich

FOR SALE—One G. E. 6 volt car radio, model B-40, A1 condition, 3 pc., $10; one Delco 6 v. car radio, model R-663, under dash type, A-1 shape, $10. one NRI study course, $6; One RCP tube tester, $6; steel tool box, new, $1.25; tool box no tray $0.80; one portable Triplett all wave, all purpose tester, 4 in. square meter, A-1 shape, less batteries, $12.00. Clarence W. Hull, Mineral Springs, Pa.

WANTED — Hickok instruments, RFO-5, 510x, 530, 19x and 202 or volt ohmist jr. Will pay cash, can make repairs if needed. State condition and price. Earl D. Kent, Emmett, Idaho.

WANTED—2" flush type a c. voltmeter, 0 to 150 v. scale. Preferred: Weston, Simpson, or Triplett. State condition. Will pay cash. E. J. McCreery, 1617 Sunnyside Ave., Lansing, Michigan.

FOR SALE—Supreme 385 automatic analyzer and tube tester, modernized for later tubes $100. Supreme Model 561 combination af and rf signal generator $140. Solar capacitor analyzer, model CE, serial 70803 $60. Triumph model 830 oscillograph wobbulator, $115. Tobe condenser analyzer with case and tube $20. Hickok diamond point tube tester $15. First certified bank check for one or all gets them. Geo C. Anderson, 2236 Indiana Ave., St. Louis, Mo.

WANTED — Phono radio combination or separate phono player, small amplifier, reasonable. Royce Saxton's Radio Shop, Route 1, Pontiac, Illinois.

WANTED—Three inch oscilloscope. Must be in perfect condition and complete with tubes. Please state make, model number, age of instrument and lowest cash price. Dexter Kurs, 4525 45 St., Long Island City, N. Y.

WANTED — Hallicrafter Model SX24 or Howard Model 460 communication receiver. Please state age of set and cash price. Dexter Kurs, 4525 45 St., Long Island City, N. Y.

WANTED—Beam compass with micrometer adjustment Set must contain both pen and pencil attachment. Please state make, and lowest cash price. Dexter Kurs 4525 45 St., Long Island City, N. Y.

FOR SALE—Utah radio transmitter, modulator antenna tuning unit and microphone. All complete for $100. This outfit is all Utah kits put together by experienced men. Mike is Shure mike. Write, Bush Mumpower, Jr., Box 26, Fairfield, Ala.

WANTED — Adding machine, six bank, small for cash or trade for Colmont high power stero prism binoculars in case Davis Sales, Lansing, Mich.

(*Continued on page* 14)

REPLACING SCREEN-GRID TUBES WITH VARIABLE-MU TYPES *

As a rule, even the trained and skilled Service Man considers a job well done when he locates the trouble and applies the exact remedies called for in the specification. This done, he sits back and whirls the dials with the feeling of satisfaction that the set is just as good as it was when it was new. The question may be asked . . . how good was the set when it was new in comparison with sets of later models, or those of today? Generally we can find room for improvement and often these improvements can be made simply with little additional cost, and in some cases there may be a saving involved. As an example, practically all receivers built prior to the use of variable-mu tubes can be improved to a great extent by changing the circuit to accommodate tubes of the remote cutoff type in place of conventional screen-grid tubes. A number of advantages result from this change. The local distance switch can be eliminated. The exact duplicate type of double volume control generally hard to get is replaced with a single standard C-bias control. The set will have a smoother range of volume control action: cross-talk interference will disappear, and there will be no distortion when strong stations are tuned in at a low volume level.

Doing a little more than just ordinary "repair" requires some engineering which, in most cases, need not be beyond the Service Man's capabilities, provided he knows his fundamentals and can apply common sense. Today more than ever, the old set becomes worth while not only to fix but also to improve. Changes will have to be made at times because replacement parts or tubes are not obtainable. As a rule, even the more complicated remodeling or modernizing of a set requires no elaborate calculations. Once we have decided what we intend to do, there are many practical ways to solve the problem. However, it is a good policy to do a little paper work. There is a great amount of satisfaction when the paper and pencil work turns out in practice just as we have calculated. Preparation of this kind also saves time and the practical final check will show up our mistake. After all, one learns by his own mistakes and as long as we learn we shall benefit. It will be seen that we need not be too critical in figuring out the circuit constants for the intended changeover. Variations within plus or minus five or even ten per cent will not affect the general performance in most cases.

Changing Screen Grid R-F Amplifiers

Among the screen-grid tubes, the type 24A will be most commonly encountered. When the 6.3 volt tubes were first introduced, pentodes had replaced the tetrodes and sets generally employed pentodes in the r-f stages with remote cutoff characteristics. The 24A's can be replaced quite easily with type 35 tubes. In certain cases, 6.3 volt tubes can also be used in place of the 24A's provided there are facilities to obtain additional filament voltage. A small filament transformer is inexpensive. The five-prong sockets need not be changed if we choose type 39/44's in which the suppressor grid is tied to the cathode within the tube.

The first item which we must consider in changing over to variable-mu tubes is the need for higher negative grid bias for control purposes. While

* *By Frederick E. Bartholy in "Service" Magazine.*

the 24A will cut-off at approximately 15 volts bias, the 35 requires over 40 volts. There are two alternate ways to provide grid bias, namely by applying a voltage to the grid which is negative with respect to the cathode, or by raising the voltage of the cathode positive with respect to a reference point to which the grid electrode returns. The first-mentioned way is preferable in that it will not change the plate and screen grid potentials with respect to the cathode. However, it requires a source of bias in addition to the voltage source used for the anode and screen grid electrodes. The source can be any voltage drop in the power supply circuit which is negative with respect to the cathodes of the controlled r-f tubes: for example, the voltage drop across a speaker field in the negative side of the supply, or the voltage drop across a voltage divider used for the power tubes when operating at a fixed bias. A number of receivers have such supply circuits where a negative bias of 40 to 50 volts can easily be obtained. In these cases, as will be pointed out by practical examples, it is necessary to remove the grid return from ground or isolate the r-f input circuit from the direct-current bias circuit of the grids.

The majority of receivers employ self bias for the power tubes and the additional negative bias of 40 volts cannot be obtained without lowering to the same extent, the plate and screen potentials of the controlled tubes. Sets of this type have the negative side of the plate supply grounded, at which point the r-f grids also terminate. The work involved in these sets, to obtain bias voltage for the grids means almost a rebuilding of the entire supply circuit. With such sets the second alternative is the simplest way and the cathode voltage is raised positive with respect to ground. The bias so obtained is taken from the effective anode and screen grid potentials which means that when the cathode is raised from the minimum bias position, generally + 3 volts to + 40 volts, the screen grid as well as the plate potentials will be 37 volts less than they were when the cathode was 3 volts positive. The change in screen voltage reacts on the transconductance of the tube and it will be found that cut-off is obtained at a cathode voltage less than 40 volts when the screen voltage is lowered simultaneously with the increase in cathode voltage. While this condition limits the usefulness of a super-control tube as far as volume control action, it is of no serious consequence. Moreover, in many cases, excessive variation of screen voltage can be overcome by a suitable resistor in series with the screen-grid lead, in which the variation of screen current will compensate for the voltage drop.

Circuit Changes

Let us see what changes must be effected to accommodate variable-mu tubes in typical sets originally designed for sharp cut-off screen-grid tubes. We may group the sets as follows: (1) receivers having grid bias control; (2) receivers having cathode bias control where the bias is derived from the main voltage divider; (3) receivers having cathode bias control where the bias is derived purely from the plate current; and (4) receivers having screen-grid control.

Receivers with Grid Bias Control

In this group, the changeover is comparatively simple. The grids of the controlled tubes generally return to the volume control and are already supplied with a negative bias potential. The problem is to make the available bias potential larger for the super-control tubes to be used. As an example, let us take the Stromberg-Carlson Model 10 or 11 receiver (Rider's Manual, Book I, page 14). This set has three r-f stages employing 24A tubes, a 24A biased detector stage and two 45 tubes in push-pull. To begin with our design consideration, it is a time-saving policy to make a simplified sketch of the voltage distribution circuit as shown in Fig. 1. It is seen that the operating voltages for the tubes are derived from a voltage divider resistor placed across the output of the rectifier power supply. The voltage divider in

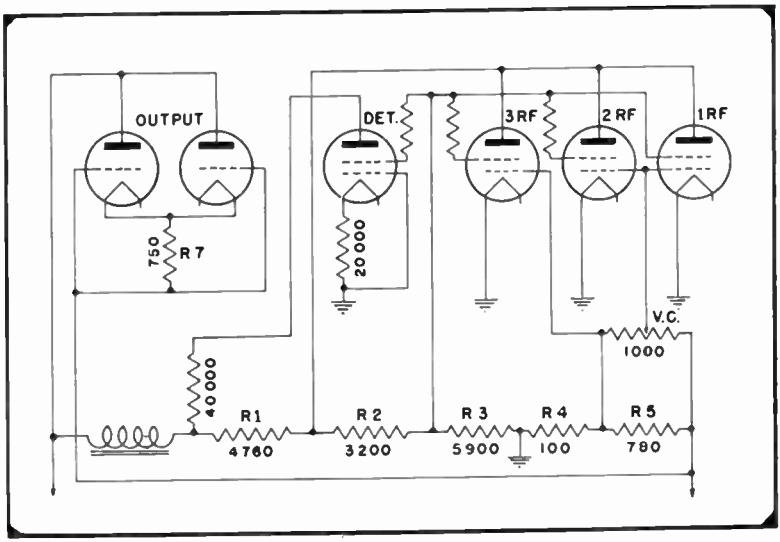

Fig. 1. The voltage distribution circuit of the Stromberg-Carlson 10 and 11 receivers.

the set comprises two large wire-wound ceramic covered resistors with a number of taps which are indicated in the circuit diagram. We should first determine what the voltage drop is across each section. This can easily be accomplished when the set is in operative condition by measuring the voltage across each portion of the divider. However, the Service Man usually has a defective set on hand to start with, which in most cases would have to be restored to its original condition before voltages could be measured accurately. If it is a simple repair job it should be done before making the changeover. On the other hand, the data supplied in the service manual is generally sufficient to do the design work and tackle the repair at the same time when the changeover is made.

Referring to the table in the Service Manual giving voltage data, we read that in the radio frequency stages the tubes operate at a plate voltage of 135 and with the volume control at maximum, the grid bias is 2½ volts. This gives us a clue immediately, for the current in a portion of the voltage divider. The minimum bias is taken off from the 100 ohm resistor indicated R_4 in Fig. 1, and since this voltage drop is 2½ volts, the current will be .025 ampere. The negative portion of the voltage divider, taking the cathode of the r-f tubes as a reference point, carries the total current of the radio frequency tubes and the initial bleeder current. Since the grids take no load, the voltage utilized for control purposes will be the voltage drop across the 780-ohm resistor R_5. The latter is bridged by a 1000-ohm volume control. The current in this branch will be the same as in the 100-ohm minimum bias resistor. Therefore, if we calculate the joint resistance of the parallel branch, we can determine the maximum bias voltage available. By the simple formula the joint resistance $R_J = \frac{R_1 \times R_2}{R_1 + R_2}$.

Substituting, we have $R_J = 780{,}000$ divided by 1780. This gives us 438 ohms approximately. Multiplying this with the current we have a voltage of 11 volts. This added to the minimum bias voltage of 2½, gives a total of

13½ volts. In order to obtain at least 40 volts for controlling the new tubes, we need 26½ volts more. For good measure, we can round out this to 30 volts. The 30 volts which we need in addition must be taken from the total voltage applied to the tubes. It becomes apparent when we follow the plate returns, that we have extra available voltage which is not used for the radio frequency tubes. Referring again to the table, we note that the screen voltage is 80 volts and that the plate voltage is 135 volts. These two voltages appear across resistors R_2 and R_3 in the voltage divider. The drop across R_3 will be 80 volts and that across R_2 will be 55 volts. Now if we add all the known voltages together, we can find out what the voltage drop is across the resistor R_1, which is our available source for getting more control potential. In accordance with the table, the power tubes operate at a plate potential of 235 volts and a bias potential of 45 volts. The above plate voltage is to be taken between the filament and the plate of the output tubes. Therefore, the voltage drop across the cathode-bias resistor R_7 of the output tubes must be added to the plate voltage to give us the total voltage supplied from the power supply. That is, 235 and 45 = 280 volts. This is the terminal voltage applied to the voltage divider including, in series, the second filter choke since the output tubes obtain their plate voltage from this point. The voltage drop across the choke which does not carry the current of the output tubes is generally not over 10 volts. Assuming then that the voltage across the whole divider is 280 volts, less 10 volts drop in the choke, we proceed in adding the voltage drops that we know now, as follows:

voltage across R_2 — 55
voltage across R_3 — 80
voltage across R_4 — 2.5
voltage across R_5 — 11

148.5 volts

Subtracting this from the total voltage of 270 volts gives 121½ volts. To sim-

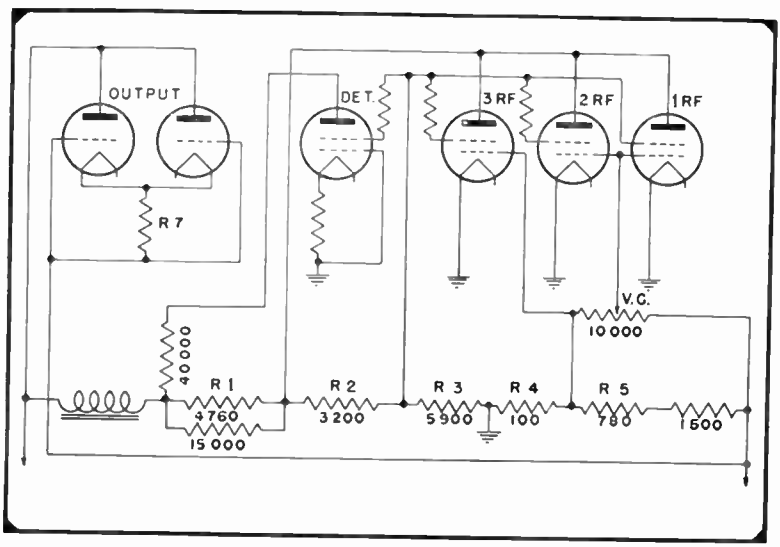

Fig. 2. Illustrating the method of obtaining the required resistance values with the modified voltage divider.

plify the calculations, the 1½ volts may be dropped, giving 120 volts total across R_1. Of this, we need 30 volts for bias purposes. Therefore, we need only a drop of 90 volts across this portion of the divider.

This adding and subtracting may appear a little confusing. However, if we visualize that the entire voltage divider may be regarded as a potenitometer and we simply want to shift the cathode, screen and plate returns of the radio frequency tubes in a direction to the left in Fig. 1 to the extent that to the right or negative portion we shall have 30 volts more than before, the problem becomes more simple. There are fixed taps on the voltage divider. Consequently, we cannot do actual shifting of the returns but must take away some resistance from the left-hand side to obtain 30 volts less and add some resistance to the right-hand side to obtain 30 volts more.

The general procedure outlined above applies to most sets and was given mainly to illustrate how voltages should be added and subtracted. There is, of course, a simpler way to find the drop when the current is known. In this example, the current in R_1 can readily be found since it must be the same that flows through R_4 that is, .025 ampere. The resistance value of R_1 is known, hence the voltage drop there across will be the $I \times R$ drop that is $4760 \times .025$, which is 119 volts. This checks with our former estimate of 120 volts.

The next step is to determine what should be the resistance of R_1 to give a 90 volt drop. The current is known. Therefore, $R_1 = 90$ divided by .025 = 3600 ohms. Therefore, instead of 4760 ohms, R_1 of the voltage divider will have to be 3600 ohms. This value is not usually handy to obtain in the Service Department and instead a 3500 ohm resistor may be used. This will only mean a loss of 2½ volts in plate voltage, which is negligible. The terminal wire to the voltage divider can be disconnected and a 3500 ohm resistor placed between the disconnected wires and the first tap of the divider.

Another way to obtain the required resistance value is to bridge the 4760-ohm resistor with another in parallel to give 3600 ohms. The latter method may save a few cents since the parallel resistor need not have the wattage rating of the 3500 ohm resistor. The latter will have to be at least $W = I^2R = .025^2 \times 3500 = 2\frac{1}{2}$ and for all practical purposes a 5 or 10 watt resistor. The parallel resistor to give 3600 ohms is calculated as follows:

$$R = \frac{4760 \times 3600}{4760 - 3600} = 14{,}770$$

Of course, a 15,000 ohm resistor will do perfectly well. This can be a standard one-watt resistor since the dissipation

$$W = \frac{E^2}{R} = \frac{90^2}{15{,}000} = .54 \text{ watt.}$$

Now then, using the second method, a one-watt 15,000 ohm resistor is placed across R_1 to obtain the required resistance value of 3600 ohms. On the negative side of the divider the work is simple. The minimum bias resistor of 100 ohms will be satisfactory. The original control is of insufficient value in that with a current of .025 ampere, a 1000-ohm resistor would give only 25 volts. We need 40 volts at .025 ampere, which means a resistance of 1600 ohms. A control of such odd value is not readily available. Therefore, we choose a standard control, let us say, 10,000 ohms, and make up the needed value by a parallel combination. The resistance in parallel with 10,000 ohms to give 1600 ohms is calculated as before.

$$R = \frac{10{,}000 \times 1{,}600}{10{,}000 - 1{,}600} = 1{,}900.$$

Of this we have 780 ohms in the divider (former R_5) so that we need to add in series with it 1120 ohms. This also is an odd value but the tolerance is not critical and anything between 1000 to 1500 ohms will be satisfactory. It is better to take the larger size to get more control voltage than less, so that even the strongest signal

shall not come through when the volume control is in the off position.

This completes the job. Only two one-watt resistors and a new volume control are needed for the changeover. If we want to be more conservative, five or ten-watt resistors can be used at a somewhat higher cost. In Fig. 2 is shown the changed voltage divider with the values of the added elements indicated. The first two r-f tubes are now replaced by type 35 tubes. The short and long antenna jumper can be placed in the position which will give the best overall performance for the particular locality or antenna used. The improvement will be very noticeable, especially if comparison can be made with the set as it was originally.

(To be continued)

THE RADIO TRADING POST

(Continued from page 6)

FOR SALE OR TRADE—One set of ten small photographic textbooks in case and covering a wide phase of photography. Value $10. Will trade for good radio equipment, preferably meters, servicing, or experimental equipment. Bob Armstrong, c/o Radio Station KGNC, Amarillo, Texas.

WANTED—Precision E-200 or any electrically operated all-wave signal generator. Will pay cash. C. T. Martowicz, 116 East 7th St, New York City.

FOR SALE—200 radio magazines, 1930 to date, Radio Engineering, Radio-Craft, Radio News, etc. $6 takes all. Horowitz, 4934 No. Kedzie, Chicago, Ill.

CASH—For late condenser tester and tube tester of the Jackson make in the 8½"x 8½" gray metal cases. Also tubes and parts, 16 mm sound and silent films. Chas. Crank, 626 Bernard Ave., Hamilton, Ohio.

WANTED—1 Precision 954P, will pay good price for same if meter is decent, or 1920P 1940 model preferred in this type or 1941. Meter must be in fair to excellent condition. Leas Radio Service, 715-19 Hopkinson Avenue, Brooklyn, N. Y.

WANTED—RCA Chanalyst and Junior Volt-ohmyst. Will pay cash. Both must be of RCA type. Gelman's Radio & Electric Service, 2438 S. Fairhill, Philadelphia, Pa.

FOR SALE—Few tubes; parts; 2 telephones; Gernsback manuals (radio vols. I to VI inc.) (refrig. vol. 1) (air cond.), radio and electrical books and corres. course; 8x10 camera. Make offer or will send list. H. W. Schendel, 518 W. Main St., Sparta, Wis.

SELL OR TRADE—1 channel analyzer, Superior, slightly used; 1 Superior signal generator 1230, not used; 1 Superior 1220, 5,000 ohms per volt, dc and ac volt-ohmmeter and milliammeter with decibel range., instruction sheets complete, all bought in 1942. 1 set of Rider's blue book manuals 1 to 6 with separate index, used but in good condition. Will accept any good offer. A. W. Sullivan, 222 John St., Fall River, Mass.

FOR SALE OR TRADE — Green Flier 2 speed motor with crystal pick-up $12. Wood lathe $12. Hickok AC49 tube tester with adapters for some octal tubes $13.50. 14 in. Peerless speaker copper oxide rectifier and output transformer for PP45s, etc., $2. A. Dayes, 1418 81st St., Brooklyn, N. Y.

TUBES WANTED—Will pay list less 40% FOB your town. 1 to 200, 35L6; 1 to 300, 35Z5; 1 to 200, 50L6, 1 to 200, 12SA7; 1 to 100, 12SK7; 1 to 300, 35Z4; 1 to 100, 1A7; 1 to 100, 70L7; 1 to 100, 117Z6. Ship by Railway Express, COD to Success Radio Service, 122 Motor Ave., Salt Lake City, Utah.

WILL SWAP—Have ac-dc 4 tube TCA radio. WANT—Rider's Manuals, tube tester, or radio tester, will pay cash for Weston or some other good make dc milliammeter 0-75 or 0-100. Also typewriter. Louis A. Goldstone, 1279 Sheridan Ave., Bronx, New York, N. Y.

WILL SELL or SWAP—Have 3 Majestic 90 chassis and power packs, in playing condition. Want Rider's Manuals, tube and set testers. Give details in first letter. L. A Goldstone, 1279 Sheridan Ave., Bronx, New York, N. Y.

FOR SALE—Have large assortment tubes in original cartons, as well as all types used tubes and parts of all makes of radios. Converters, motors, turntables. Want 12SA7, 12SK7, 50L6, 35Z5, Rider's Manuals, oscilloscope. Stephenson's Radio Service, 1307 H St., N. W., Washington, D. C.

TRADE—A c. Clough Brengle model OMA amplitude and sweep frequency modulated oscillator. 5 band hand calibrated ½ of 1%. 100 k.c. to 30 m.c. fundamentals, higher on harmonics. No. 81 modulator built in. Also 400 cycle audio, has every control needed. Wanted Precision E-200 and some cash, etc., as net price is double that of E-200. Guaranteed new condition. Bob Eubank, 1227 Windsor Ave., Richmond, Va.

SELL OR SWAP—Aerovox model 95 L C checker. 6 band built in r.f. oscillator 60 k c. to 26 m.c. Tests inductances and capacitors under operating conditions, parallel capacitors may be checked in circuits, also capacitors with circuits across them, an all around unit, excellent condition, net about $35.00. Trade for Aerovox capacity-resistance bridge, with meter. Full details first letter, guaranteed. Bob Eubank, 1227 Windsor Ave., Richmond, Va.

WANTED—Grunow console radio, 10D or similar. C M. Brennan, General Delivery, Columbus, Georgia.

FOR SALE—ICS practical radio servicing course. Up to date, complete in every detail. Best home study course obtainable, cost $130, will sell for $25 cash. Send $5 with order, balance C.O.D. Rush money order at once or be too late. Write Clyde W. Wimer, Ellwood City, Pa., R. D. No. 2.

WANTED — Supreme Model 333 deluxe analyzer or the meter therefrom if in good condition. Write stating lowest price to Ridgley A. Tyrrell, Box 33, Packer, Conn.

WANTED — Superior Dynarometer with giant 6½ inch double jewelled meter, made by Superior Instruments Co. Write me the description, working condition and price. I'll pay transportation charges. J. E. McManus, Thornton, Ark.

WANTED—HA 100X and HA 113X transformers. Also HA 108X. Please state lowest cash price. A. F. Toth, 3608 29th St., Astoria, L. I., N. Y.

FOR SALE—WE high impedance headphones, complete with headband and cords. Nearly new. A. F. Toth, 3608 29th St., Astoria, L. I., N. Y.

FOR SALE—1 Triplette VOM, 25 m. per volt, $40, Red dot meters (twin); 1 Triplett tube tester model 1210A $15; 1 Weston model 506 milliammeter (new) $7, 0-100 m.a., case 2⅜ in.; 1 Weston model 301 milliammeter, $8, scale 30-0-30 zero center, 3 in. Cash or P.O.M.O. acceptable only. Shipment via P.P. insured. Reference: Union National Bank, Lewisburg, Pa. Frank L. Dodd, 300 Rural Ave., Lewisburg, Pa.

WANTED — Rider's Manuals volumes 11 through 13, good condition, cash. Advise what you have. Karl Wagner, C. C. Bk. Bldg., Des Moines, Iowa.

WANTED—Capitol Radio Engineering Institute course. Must be 1940 or later. Will trade camera using 616 film, f 4.5, almost new condition which cost $41 for such a course or will pay cash. C. A. Brethen, 150 Saranac St., Rochester, N. Y.

WANTED — Tube checker, oscilloscope, vacuum tube voltmeter, multitester, signal chaser, audio oscillator, condenser tester, also Rider's Manuals, vols. 8 to 13, and good camera. Will pay cash or trade radio equipment. Norman Jacobson, 1117 Gerard Ave., Bronx, New York.

WANTED—Will pay cash for Solar model BQC, quick check and bridge. Have Weston model 425, RFO 125 ma, Jewell 74 0-15 v.a.c, several a.f. transformers, and large Amrad power trans. Ray Parker, 112 Ave C West, Kingman, Kans.

FOR SALE—Jackson model 640 test oscillator; Weston model 773 tube checker; West model 665 Analyzer type 1; W. E. 200 ohm oil damp 4A pick-up; Triplett ac amp. meter. John J. Spankowitch, 239 N. 9th Street, Allentown, Pa.

SALE OR TRADE—Radio parts, tubes, test equip.; meters, refrigerator tools and tanks; books and guns. Want slide rule, portable typewriter, navigation course, books, barometer OR? Wm. Hansen, R. 3, Niles, Mich.

WANTED — 1942 Hickok dynamic mutual conductance tube tester, model 530 portable or model 510X combination. Must be in A-1 condition. Give full particulars, lowest cash price in first letter. L. M. Burtis, 2333 S. E. 53rd Ave., Portland, Oregon.

SELL OR SWAP—Bausch Lomb microscope new, cost $85, also small one in wood case, .22 Colt revolver; new Argus Cintar candid camera f. 3.5, 35 mm. film. Numerous other articles. Want water pump, record changer, typewriter, or what have you? A. R. Kreuzer, Leroy, Mich.

WILL SWAP—A brand new Revere 88 movie camera, 3.5 lens, never used. Want Rider's Manuals 7 to 12. Will pay some difference. List radio equipment in trade on this camera. Clyde W. Wimer, Ellwood City, Pa., R. No. 2.

WANTED—Hickok RF 0-4 or RF 0-5 oscilloscope. Will pay cash. The Radio Man, 1724 Central Ave., Middletown, O.

STOLEN—On April 1st our shop was broken into and the following equipment was stolen: Last nine vols. of Rider's Manuals; 1 RCA test oscillator, type TMB 973 serial No. 1895; 1 RCA oscillator, model No. 167; 1 Solar condenser checker, No. 30551; 1 Motorola power supply, No. 160C45T, serial 3069; 1 Precision tube checker, model No. 912, serial 7926; 1 Jackson tube checker; condenser .1, .05, .0001 mfd.; resistors; 2 power transformers; 1 set of spin-tight wrenches. A reward of $100 has been offered for return of above material. 42nd St. Electric, 4114 University Ave., Des Moines, Iowa.

WANTED—Public address systems, large amplifier, 16mm projector with sound; will buy or swap for model 460 Jackson mf signal generator, recorder, etc. Write Tom Trinka, 610 Douglas St., Middletown, Ohio.

WANTED—Test equipment, meters, copper-oxide rectifiers, precision resistors, short wave receivers, plug in coils, all kinds switches, tools, firearms, Describe fully. Quote lowest prices. Roby's Swapmart, 3569 Cottage Grove, Chicago, Ill.

CRYSTAL-RADIO experimenters, we have a complete stock of hard-to-get, supplies. Molybdenite, oscillating zincite crystals, rubyite, carborundum, silicon, galena goldite. Couplers, potentiometers, coils, condensers. Loudspeaker crystal set. All diagrams. Free particulars write, Hewlett's Radio, 29 East 39th St., New York City.

WANTED—3" and larger meters, power trans. for 902 C.R. tube, No. 884 tube, socket hole punches, crystal for Hickok No. 188X, also Biley 100-1000 k.c. crystal. Have parts, sets, etc., cash. Huntress Radio, 418½ W. Spring, Freeport, Ill.

FOR SALE—Tire Reliners, 6.00-6.25 x 16, 5.50-600 x 17 new material 2 ply and composition, self vulcanizing $2.95 or will trade for radio tubes. Auto-Appliance Supply, Granby, Mo.

WANTED—A 3" oscilloscope in good condition. Will pay cash. Give full particulars. Must be late model. Fred Hartman, 32-26—54 St., Woodside, L. I., N. Y.

WANTED—Will pay cash for r.f. meter 0 to 1 amp., also 0 to .5 amp., any make; also want capacitor analyzer and oscilloscope, any make. A. Y. Cottrell, Supt. Radio City of Lenoir, Lenoir, N. C.

FOR SALE OR TRADE—A Majestic Super-B current supply, rating 60 mils. at 180 v. Needs line cord and Majestic super power tube. Also have a Meissner coil and tuning kit containing: (a) 4 band ant., r.f. and osc. coil assembly with band switch completely wired and prealigned on sub-chassis. (b) 8" two speed oval airplane dial with second hand. (c) Ferrocast 456 k.c. input i.f. transformer. (d) Ferrocast 456 k.c. output i.f. transformer. (e) Beat frequency osc. transformer. (f) 3 gang .000410 mfd. variable condenser. Want: .25 caliber automatic, automatic tape machine or what have you. George Gould, 1540 E. 24th St., Brooklyn, N. Y.

WANTED—Supreme tube and set analyzer 585; Rider's Manuals from 1-6 volumes; D.C. milliammeters 0-50 or 0 to 75. Must be in good condition and state lowest price. Have all makes of old radio sets in playing condition, what am I offered. Goldstone Radio, 1279 Sheridan Ave., Bronx, New York.

FOR TRADE—Several of each: 954, 955, 956 Acorn tubes, RCA, for cameras, photographing equipment, transmitting equipment, such as power transformers and filter condensers, radio tubes, test equipment, and Weston meters. Household Repair Service, 6 Market St., Pittston, Pa.

WANTED—Any standard make condenser tester. Will pay cash. State lowest price. Will also pay cash for brand new radio tubes in original cartons; state your best discount from list prices. C. A. Goditus, 313 East Market St., Wilkes-Barre, Pa.

WANTED—Emergency -- Multi-range volt-ohm-m.a. meter. Scale 3000 to 5000 v., resistance not less than one million ohms, complete with batteries and leads. If not available 2000 v. range, with corresponding ohm and m.a. range. Wanted by soldier in the islands, unable to get station equipment. Needs this equipment badly. Will pay cash for same. Paul Bauman, 242 Cambridge Ave., Jersey City, N. J.

FOR SALE OR TRADE for test equipment, or a Model WM Briggs and Stratton wash machine engine, many new and used radio parts and tubes. Write for list. Frank H. Carlson, New London, Iowa.

HAVE CASH—Want late radio tube, set testers, Channel analyzers, scopes, radio books, P.A. amplifier using 866s, 6 ft. trumpets, oscillators, vibrator testers, radio tubes in sealed cartons, neon radio sign. Glen Smith, 323 Factory St., Watertown, N. Y.

FOR SALE—Volumes 1, 2, 3, 4, 5, 6 and 13 Riders Manuals in absolutely perfect shape, complete with index. Reasonable. Moch Radio and Sound Service, 5925 S. Albany Ave., Chicago, Ill.

WANTED 2 RCA wireless players. Must be in good condition. Have Riders Manual No. 10 to swap or will pay cash. State price. Spada Enterprises, 227 Front St., Hartford, Conn.

FOR SALE—Microscope with following optical equipment: oculars—Huyghenian 5x and 7x. Objectives—5x, 15x, 45x, and 2 mm. 1.30 N.A. oil immersion lens. Abbe condenser in substage and double faced mirror. Complete with carrying case, dark field stop, cedar immersion oil, and slides. $65. D. Kurs, 4525 — 45th St., Long Island City, N. Y.

SELL OR SWAP—1 $50.00 Truetone car radio; 1 $50.00 Chevrolet car radio both have cables and control head 1938 and 1937 respectively. Trade either one for good standard keyboard typewriter. Must be in good condition, or sell either one on receipt of money order for $25.00. North Side Radio Service, 652 East 19th St., Indianapolis, Ind.

FOR SALE—National Communications receiver 101X complete with speaker, absolutely in perfect condition $75.00. Radio W6WY, 1901 Park Drive, Los Angeles, Calif.

WANTED—Fishing equipment, reels, rods, lines, etc. Have many sizes of PM and dynamic speakers and many modern tubes to trade or will buy equipment. Joe Svant, 5438 So. Wolcott, Chicago, Ill.

FOR SALE—Twenty Dubilier Mica Condensers, Type 1494; .0006 mfd, working voltage 25,000. Price $50.00 each, fob, N. Y. C. N. R. Keidan, 515 W. 110th St., New York City.

WANTED — National NC 100X receiver. Will pay spot cash or trade following of your choice. Weston 676-R tube tester, Aerovox LC checker, C B oma oscillator, also frequency wobbulator from oma oscillator, portable dynamic tube tester, General Radio freq. meter condenser, G. R. variometer, full details on request. All in new or good used condition. No junk. What items do you need. Also RCA capacity operated electronic control, new, model 41903. R. N. Eubank, 1227 Windsor Ave., Richmond, Va.

FOR SALE OR SWAP—2 G.E. generators, 1 600 v. .21 a. for plate; 1 12.5 v. 27 a. for fil., can be coupled together, also 1 AP772 RCA power amp. unit uses 1-50-2-81, terminals for input, osc. pl., vc., output, de cath. bias, amp. pl., amp. cath., pilot, amp. fil., det. fil., vc fil. Want—Meissner public address tuner or test equipment. What have you? John Holton, 2 Wallingford St., Dover, N. H.

WANTED—Repeating rifles and shotguns, not in working condition, ac signal generator, VT voltmeter, grandfather's clock any condition. Cash or trade. Have coaster brake, bike parts, saxophones, radio and phono parts, other articles. W. J. Closson, 295 8th St., Troy, N. Y.

FOR SALE or SWAP—Radio Sound and Television course, for a good tube tester, also have various parts in good condition which can be used by radio beginner at trade and lab practice, also have lab. course. Pesarchic's Radio Service, 420 Power St., Johnstown, Pa.

FOR SALE—Howard 435 communications receiver, perfect condition, little used. Best offer takes it. Louis Mackay, RFD No. 1, Box 19, Perth Amboy, N. J.

WANTED—All kinds of late model testing equipment. Have some meters which I would like to trade. Sam Berenblum, Greenwich, Conn.

WANTED TO BUY—a dual speed 16" turntable, overhead cutter, about 100 lines per inch. Heavy duty professional recorder, Presto preferred. Vallel Radio-Electric Service, 711 Broad Street, Central Falls, R. I.

WANTED—Radio service work, coils repaired, speakers, etc. Also plenty of 12SA7, 35L6, 50L6, 35Z5, 12SK7, 12SJ7, 12SQ7, 80, 48, 5y3, 6A8, 6K7, 6X5, 5z3, 35Z4, 35Z3, 12Q7, 6H6, 25L6, 12K7, 6F6, 25Z6, 12A8, 6A7, 32, 34. Sell, trade or what have you? Drop me a line. Elmer Hoeppner, 1613 W. 4th Street, Davenport, Iowa

WANTED—Have you a circuit, chassis, or allied part, etc., that you want a finished ink drawing of? All R.M.A. standards used. Prices very reasonable. All drawings kept confidential. Send complete sketch to L. F. Smith, Jr., 19 Palmer St., Passaic, N. J.

WANTED—Instructograph, a.c. model with tapes; 3 inch oscilloscope; 1 ma meter, Weston or Triplett. Condition and date of manufacture more important than price. Describe fully for reply by air mail. B. Evans, 13 Williams Lane, Chevy Chase, Maryland.

SELL—Tork time switch, 1 r p m motors, 2 ampere charger, 6 volt genemotor 200 v. at 40 ma., 2 watt phono amplifier and code oscillator, blow torch, air gauges, 15 amp. synchronous charger, B power supply, electric clocks, etc. Stanley, 2748 Meade St., Detroit, Mich.

WANTED — Bench lathe, prefer South Bend, give full specifications, condition and price. Also accessories. Raymond Conover, Stone Ridge, New York.

WANTED—A Supreme model 563, RCA model 154 or Jackson model 652 audio oscillator. Also Weston, Hickok or Clough Brengle vacuum tube voltmeter. Units needed to service defense sound equipment. Fox Sound Equipment Co., 435 South 5th St., Richmond, Indiana.

FOR SALE—Rider Chanalyst in excellent condition except for defective watt-meter control $45. Solar Bridge model CC-1-60 $25. Clough Brengle Unimater, model 120 $37.50. Fox Radio Service, 435 South 5th St., Richmond, Ind.

FOR SALE—Limited supply of new amplifiers, microphones, pickups, and intercommunication units for sale without priority. Fox Sound Equipment Co., 435 South 5th St., Richmond, Ind.

WANTED TO BUY FOR CASH—Set analyzer, Solar capacity and resistance analyzer, Rider's Manuals, midget sets, with or without cabinets, tubes of all types, must be new in sealed cartons, for cash. Roda Radio-Electric Service, 2130 Westchester Ave., Bronx, N. Y.


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