Vol. 11 JULY, 1946 No. 7

CORNELL-DUBILIER ELECTRIC CORP.
HAMILTON BOULEVARD
SOUTH PLAINFIELD, N. J.

Return Postage Guaranteed

Sec. 562, P. L.&R.
U. S. POSTAGE
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Permit No. 1

Mr. George M. Beale
130 25th Ave.
San Francisco, Calif.

SERVICE TO THE SERVICEMAN

In this issue, and subsequent issues of the C-D Capacitor, we will give you full explanation of the individual C-D sales promotional helps and advise you as to the best way to use the material. Keep these articles for future reference. They will save you time, trouble and money.

Newspaper Ads Win Customers

Your customers read the daily papers for news and shopping information. If your service shop is represented in the columns, even in small space, you will benefit by prestige as an advertiser and your sales opportunities will be greatly increased.

C-D furnishes prepared newspaper mat ads, *free of charge*, to servicemen through their jobbers. The next two pages show you how to use your mats most effectively, and how to convert potential customers into spending customers.

Lucky family, you! Take care of it! Check-ups every 6 months will preserve its brilliant tone and keep it new for a long, long time. We can keep your set in the pink without running up worrisome repair bills. Write or phone us today!

Look for this seal on the service shop window

We use only genuine Cornell-Dubilier Capacitors in our repair work.

1203

SERVICE SHOP IMPRINT

What Is a C-D Ad Mat

The ad mat is a papier-mache impression of the ad with space allowed to imprint your own name and address. It costs you nothing for artwork, typesetting or engraving. You pay only for the low-cost newspaper space. Be sure to include these instructions to your local newspaper: *your name and address, trademark or slogan, date of insertion, position desired in the paper, size of the ad.*

How to Make Copy Changes

In its "New radios need attention" series, C-D supplies three different mat ads—each with sparkling illustrations and snappy sales copy. However, if you wish to feature some special item or change the phrasing, you can do it in this manner: *type or clearly write your copy changes and indicate where you want them to appear in the ad. Insist that your newspaper show you a proof.*

How to Work With Your Newspaper

Every newspaper has its own mechanical requirements, distribution areas, circulation figures, types of readers, and advertising space costs. Your space representative will advise you or send a rate card containing most of the information you need. Here is a simple guide to help you place your ad in the most suitable paper at the lowest cost per prospect.

Morning or Evening—

Morning newspapers generally have a large readership among women. Evening papers are brought home by the breadwinner and the whole family reads them. Hence an evening paper ad would sell your customers in the home.

of a special section, such as sports or radio, usually entails slight extra charges. Sometimes by writing "forward, top position requested," you may be granted this select position without charge. It is our suggestion that you carefully consider the advisability of

Circulation—

"The highest circulation" or "the lowest space cost" does not always signify the best medium for you. Be sure to ask where the paper is distributed, the number and type of readers, how sold, and the reputation of the paper in your community.

Ad Position—

R.O.P., or run of paper, means that your ad can appear on any page in the newspaper. Preferred position, or use requesting position adjacent to radio program schedule.

Ad Size—

Generally newspaper space is measured in 2-inch column widths and line depths. There are 14 lines to the inch. For example, an ad 1 column x 56 lines would be 2" wide by 4" deep. Your space rate is based on that size.

Space Costs—

At the rate of 14c per line for a 50,000 circulation newspaper, your average cost per ad for the three mats in the "new radios need attention" series would be as follows:

What's a party without a radio?

Before you send out a single invitation — check your radio. Make sure she won't be a 'hummin' and a 'whistlin' on the big night. If you want a reliable radio man who uses superior replacement parts, write or phone us! We'll be glad to help.

Look for this seal on the service shop window

Your guarantee that capacitor replacements are made with genuine Cornell-Dubilier parts.

1202

SERVICE SHOP IMPRINT

1 col. x 56 lines =
56 lines x 14¢ or $7.84
1 col. x 60 lines =
60 lines x 14¢ or $8.40
2 cols. x 76 lines =
76 lines x 14¢ x 2 cols, or $21.28

By contracting to use a certain amount of space, you can save on your advertising costs. Typically, your rate for 500 lines used, per line, over a period will be less than the rate per line for 250 lines or less.

Frequency—

The number of insertions per week depends on the amount of business you're shooting for, competition, and your advertising budget. Figure your budget at between 5% and 15% of either last year's sales or anticipated sales. Plan your advertising in advance for each month.

Ad Reprints—

At small cost, you can order printed copies of your ad from the newspaper. These reprints make splendid counter give-aways and envelope stuffers to promote your service in the community.

C-D Mats Help Your Business Grow

It takes many months, even years, of hard plugging to establish your repu-

(*Continued on page* 12)

Capacitor Service Instruments*

Some radio components show deterioration of electrical properties both in active use and when they are not operating. Time and humidity conditions are factors that affect the shelf life of these components, especially those which are not fully hermetically sealed or depend upon electrochemical action to perform their designated functions. These factors are supplemented by voltage stress and extremes of temperatures when the circuit parts are placed in operation.

Among those components that are affected by humidity, we have field coils, unpotted transformers, i-f coils, and certain types of capacitors. There is generally a slow penetration of moisture into the active elements of these parts, depending largely on the condition of the atmosphere where they are stored. It is thus important to store these components and allied electronic equipment in dry locations, where temperature variations are at a minimum to avoid this type of deterioration.

Capacitors cause their share of service problems along with the other radio components. Engineering and manufacturing techniques are such that capacitors can be made to outlast any other part of a radio receiver. However, when the cost of such capacitors is considered, such procedure is found to be far from practical.

The day has passed when an a-c continuity tester or an ohmmeter are considered adequate capacitor service instruments. Receivers use capacitors with values ranging from a few mmfd in mica and ceramic types to the multi-tapped electrolytic types running to many mfd. The range of voltage ratings for these capacitors is generally between 10 volts d-c and something above 500 d-c. Leakage failure of capacitors found frequently in the older receivers, requires the use of a more complex measuring instrument.

Class of Capacitor	Short Circuit	Open Circuit	Intermittent Circuit	Off Capacity	High Power Factor	High Leakage
Paper	*	*	*	—	—	*
Mica or Ceramic	*					
Electrolytic	*	*	*	*	*	*

Table 1
Defects most frequently found

Defects Usually Found

Defective capacitors can be classified according to the most frequent troubles found; table 1. Aside from mechanical failure, the defects shown in the table comprise the main causes of practically all fixed-capacitor troubles.

There are many capacitor service meter instruments available. Some are simply radio-frequency continuity testers that indicate impedance or measure a very limited range of capacity. Although such instruments are convenient to use because some of the capacitors tested do not have to be disconnected from the circuit, the tests are far from complete. There are other instruments which depend upon the power line voltage for capacity measurements. These are not too accurate and do not indicate the true quality of capacitors.

Bridge Instruments

The most popular and reliable method of measuring capacity employs an a-c bridge. By this method the capacity readings are entirely independent of line-voltage variations. An adjustment of the bridge circuit to determine capacity is generally supplemented by a similar operation to determine the power factor, the both readings taken simultaneously.

** By William M. Robinson, Assistant Chief Engineer, Cornell-Dubilier, in "Service" Magazine.*

One basic capacity-bridge arrangement is that which provides logarithmic scale readings. The circuit consists of a potentiometer utilized as two arms of the bridge with a standard resistor, and the unknown capacitor composing the other two. Fig. 1 shows this bridge arrangement with the signal voltage, generally 60 cycles, supplied through a step-down transformer, applied across the potentiometer R_1 R_2. The center tap of the potentiometer and the junction of the capacitor standard, C_s, and an unknown capacitor, C_x, are connected to a sensitive null detector. A rheostat, R_s, introduced in series with the capacitor standard, provides the means of balancing the phase differential in the bridge components.

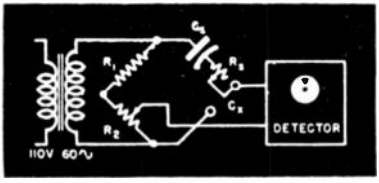

Fig. 1. A bridge arrangement with a 60-cycle signal-voltage input supplied through a stepdown transformer.

The potentiometer is calibrated over its full rotation with scale markings corresponding to values of capacity connected across C_x. Several capacitor standards are generally used to provide a number of ranges for capacity measurements so that readings may be taken quite accurately. Power factor calibrations are made on the rheostat in series with the main capacitor standard.

One advantage of the above bridge arrangement is that four common capacitor defects may be determined in approximately the same number of seconds. The insertion of a capacitor across the test position will result in a balance of the bridge which will indicate the true capacity and power factor, as well as short and open-circuited defects and some intermittent operation types.

A commercial instrument that performs the testing operations described above is illustrated in Fig. 2. The

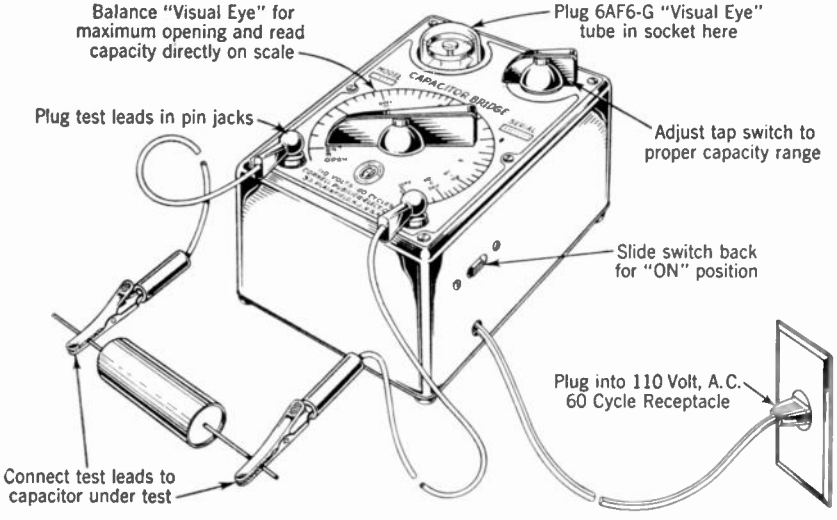

Fig. 2. Commercial bridge-type capacitor tester.

Fig. 3. Capacitor analyzer using a capacity bridge and adjustable d-c power supply.

power to the instrument is provided through the regular 110-volt a-c circuits. A 12A7 dual-purpose tube is used as a half-wave rectifier and as a pentode amplifier for the bridge signal. The bridge balance of capacity and power factor, as well as indications of limited types of defective capacitors, is made by the use of a 6AF6G cathode eye tube.

The capacity measurement is made by connecting a capacitor across the test terminals, then adjusting the bridge control knob after the proper range has been selected. When the shadow angle of the eye tube reaches its maximum opening, the capacity is read directly from the scale calibration under the knob. The shadow angle for capacitors with low power factor will be approximately 90°. As the magnitude of the power factor is found to be higher on the various capacitors, the angle will be smaller, reaching 0° at approximately 50% power factor. Electrolytic capacitors that show no shadow angle for any bridge control setting, are generally considered unsatisfactory for use.

Capacitor Analyzer

While this instrument finds great utility in service work, it does not provide a leakage test for paper and electrolytic capacitors. A larger, slightly more complex meter, generally classified as a capacitor analyzer (Fig. 3) is used for measuring all the properties of capacitors. The analyzer consists of a capacity bridge plus an adjustable d-c power supply with a means of measuring values of leakage current from less than a microampere to several milliamperes. The analyzer illus-

trated employs a bridge circuit that has linear scale calibrations for all ranges of capacity. This is accomplished by using a rheostat as one arm of the

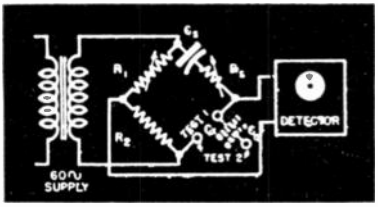

Fig. 4. Circuit of analyzer bridge, showing ratio of R_1 and R_2 as linear over a full rotation of R_1.

bridge with a standard resistor, standard capacitor, and the capacitor under test composing the other arms.

Fig. 4, illustrating this type of bridge circuit, shows the ratio of R_1 and R_2 to be linear over the full rotation of rheostat, R_1. This compares with the logarithmic relationship of R_1 and R_2 in Fig. 1. The uniformly-spaced capacity-scale calibrations of the analyzer simplify the readings considerably and provide greater accuracy of measurements. Standards in the bridge circuit are arranged for continuous capacity readings on six ranges from .00001 mfd to 240 mfd. The upper limit may be extended indefinitely, if the occasion arises, by using any large capacity in position, C_a, and applying a formula: this formula may also be used to extend the range of the previously described capacity bridges:

$$C_x = \frac{C_a\ C_r}{C_a - C_r}$$

where: C_x = microfarads of capacitor being tested
C_a = microfarads of series capacitor
C_r = reading of bridge in microfarads with C_a and C_x in series.

Power factor measurements of electrolytic capacitors are made by adjusting R_x, connected in series with capacitor standard, C_x, as shown in Fig. 4. The rheostat is calibrated to scale calibrations over a power factor range of from 0 to 50%. An adjustment of the rheostat during the bridge balance provides a reading of the exact power factor of the capacitor. This refinement is somewhat superior than that obtained with the use of the capacity bridge previously discussed, where the power factor readings have to be made on a comparative basis.

Leakage tests with the analyzer can be made at voltages close to the rating of electrolytic capacitors, and at a fixed value of 450 volts d-c for paper or mica dielectric types. The power supply has two means of adjustment; steps of approximately 100 volts by a selector switch connected to a bleeder resistor, with the intermediate points obtained by adjusting a rheostat in series with the test capacitor. On tests of electrolytic capacitors, the voltage starts out at a low value building up as the leakage current drops until full rating is reached. This limits the aging current so that the electrolytic capacitor will not be affected adversely. The 450 volts d-c applied to paper or mica capacitors during the leakage test is not considered harmful to good capacitors. Defective units may frequently fail when the voltage is applied even before a leakage measurement can be made.

The leakage current of capacitors is determined by two methods because of the extreme range of values. Current through electrolytic types is returned to the power supply through a resistor which sets up a bias voltage across a 6E5 cathode-eye tube. The movement of the shadow angle of the 6E5 is fairly linear over practically its entire range with respect to the bias voltage applied. Therefore, the leakage current is roughly, directly proportional to the number of degrees of the shadow angle. In the analyzer under discussion it was found most convenient to bias the 6E5 so that a zero-degree shadow angle would correspond with substantially zero leakage current, with the 90 angle calibrated for approximately 5 milliamperes; Fig. 5.

Leakage tests of paper and mica capacitors require a more involved cir-

cuit arrangement, since the magnitude of the current is about one microampere or less. For this purpose a relaxation oscillator is provided to obtain the initial signal voltage. The capacitor under test is charged through a neon bulb shunted by a capacitor. When the test capacitor voltage reaches a certain optimum value, the cut-off point of the neon bulb causes the current to stop flowing. Then the capacitor discharges through its internal shunt resistance until the striking voltage of the neon is reached; $E_s - E_c$, Fig. 6. The circuit functions on the principle that there is a difference between the cut-off and striking voltage of the neon tube. The result of the operation of the circuit is a series of saw-tooth voltage impulses across C_x, the frequency and amplitude depending upon the capacity of C_x, voltage E_s, capacity and shunt resistance of C_x. While the neon tube glows on each successive charge of C_x, the indication is unreliable for measuring purposes.

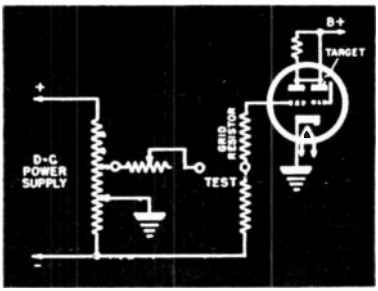

Fig. 5. Biasing of 6E5 so that a zero-degree shadow angle will correspond to substantially zero-leakage coverage.

Therefore, the voltage fluctuations across C_x are connected to the input of the 6E5 cathode-eye tube. While the leakage current of the capacitor is being measured, it is convenient to express the result in terms of the shunt resistance of the capacitor. By counting the frequency or time between flashes of the 6E5, the shunt resistance of the capacitor may be determined by applying the expression:

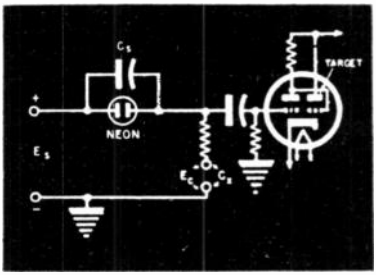

Fig. 6. Relaxation oscillator used for leakage tests of paper and mica capacitors.

$$R = 50N$$

where: R = insulation resistance in megohms
N = number of seconds interval between flashes.

Dry Electrolytic Capacitors

Working Voltages	*D-C Leakage in MA*
25	
50	0.01 MA per mfd. plus 0.5 MA
100	
150	
200	0.02 MA per mfd. plus 0.5 MA
250	
300	
350	
400	0.03 MA per mfd. plus 0.5 MA
450	
500	

Wet Electrolytic Capacitors

25	
50	0.02 MA per mfd. plus 0.9 MA
100	
150	
200	0.03 MA per mfd. plus 0.1 MA
250	
300	
350	
400	0.05 MA per mfd. plus 1.0 MA
450	
500	

Table 2
Leakage currents of wet and dry electrolytics.

This capacitor analyzer shows one flash of the 6E5 per second for a capacitor with a shunt resistance of 50 megohms. The shunt resistance is directly

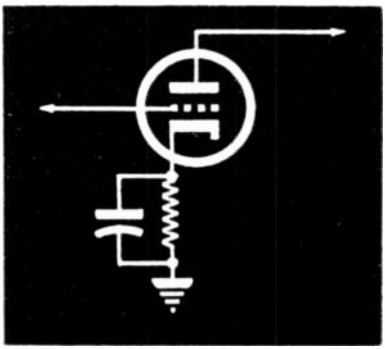

Fig. 7. Paper dielectric bypass in circuit with a cathode-bias resistor across it. Resistor does not affect operation because of capacitance resistance.

proportional to the interval of time between flashes so that one flash every 10 seconds would result for a value of 500 megohms.

It is obvious that open or short-circuited capacitors of all types should be replaced. Other defective units must be considered carefully with respect to their effect on circuit operation and expectant life before being removed from a receiver. Some capacitors far below usual standards of quality may give entirely satisfactory service for a long time. Circuit requirements differ to the extent that some defective capacitors may be removed from critical circuits and located in a different circuit, where they may operate without interfering with the performance of a receiver. Low-internal shunt resistance, off capacity, and high-power-factor units should be considered from this angle.

Low resistance in a paper or mica capacitor is generally an indication that the capacitor will not give top quality performance. If the capacitor is operated at rated voltage, it will not have a long useful life. Values below 100 megohms at room temperature for fractional capacities are generally considered to be unsatisfactory depending, of course, on the circuit requirements. Measurements of shunt resistance made at room temperature are to be divided by a factor of 20 if the capacitor operates at 150° F., or by 60 if at 185° F., as is the case in some receivers, especially auto-radio types. Since the capacitor operates above room temperature, the working shunt resistance at that temperature should be considered when determining the effect on circuit operation.

Paper and mica dielectric capacitors have a shunt resistance of many megohms, often well into the thousands of megohms. Where such units are shunted by a resistor of only a few thousand ohms, it is obvious that the capacitor resistance alone will not affect the operation of the circuit. A capacitor in such a location may not have to be replaced if it has an internal resistance of only a few megohms, providing it is operating on less than half-rated working voltage. Fig. 7 shows a paper dielectric bypass capacitor in such an application connected across a cathode bias resistor. Some discretion must be observed when operating a low-resistance capacitor in this and in other circuits.

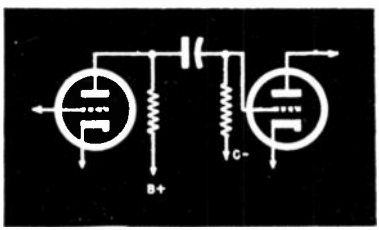

Fig. 8. In this circuit the shunt resistance of a paper or mica capacitor is usually critical. Therefore, capacitor replacement may be necessary.

Fig. 8 shows a circuit where the shunt resistance of a paper or mica capacitor may be critical. In the plate-to-grid coupling application, a low-

capacitor resistance in the order of a few megohms at operating temperature may change the bias on the final tube. Since the grid resistance is in series with the capacitor across the plate voltage of the first tube, it acts as part of a voltage divider with the voltage across it bucking the normal bias. This is a frequent cause for capacitor replacement.

The bypass capacitor in Fig. 9 generally receives a voltage close to its rating, including a large alternating-current ripple in the audio stages of a receiver. The conditions under which the capacitor must work are such that low internal shunt resistance indicates an early failure due to the capacitor becoming short circuited. It is generally advisable to replace such capacitors if the resistance falls below 250 megohms.

The capacity of paper and mica capacitors remains substantially unchanged regardless of how long they are in service. It is safe to say that most receiver design engineers select capacitors with stability consistent with the circuit requirements. Very infrequently a mica capacitor may lose capacity because of some of the internal elements becoming disconnected. Reference to the service manual for a description of the part, and the effect of **off** capacity on the circuit will generally determine if the capacitor should be replaced.

Electrolytic capacitors being electrochemical in nature are somewhat different from the types just described. When such a capacitor remains inoperative for a long time, there is a deformation of its insulating medium causing high initial leakage current when it is placed in service. Under this condition the capacitor should be permitted to remain connected to the analyzer for five minutes or more, before passing judgment on its quality. If the capacitor is satisfactory, the leakage current will slowly drop to an acceptable value. Dry construction electrolytics take less time on this aging operation than do the wet electrolytic types.

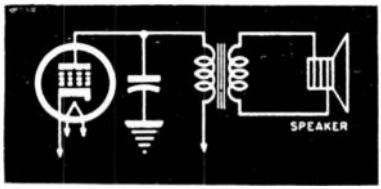

Fig. 9. Bypass capacitor application where the capacitor receives voltage close to its rating, as well as a large a-c ripple in the a-f stages. It is, therefore, necessary to watch the capacitor replacement in this instance very carefully.

Non-polarized electrolytics found in some types of midget receivers should be checked for leakage in both directions of polarity. This is accomplished by testing the capacitor by the usual method. After readings are taken, the connections should be reversed and the process repeated. Alternating-current electrolytic capacitors do not require a d-c leakage test. The electrolytic capacitor may develop high leakage as a result of continued operation, especially at high temperatures. Chemical decomposition of the element may take place. This may cause the capacitor to become defective because of high leakage current, a condition that may cause a change of circuit voltages due to the increased current through the various resistors.

After adequate aging time on the analyzer the leakage current should be less than the values shown in Table 2. Some discretion should be observed when replacing a high-leakage electrolytic capacitor, as the effect on circuit operation must be considered. If the capacitor is operating at a voltage far below its rating, an allowance should be made for this factor, as compared with a unit operating at full voltage. Leaky capacitors in low-resistance circuits do not affect the operation of receivers as much as when working in the higher-resistance circuits. Where a capacitor has been in continuous service for a long time, it is expected that the leakage current should be quite low. High leakage indicates chemical decomposition or a defect in

the preliminary stages. Therefore it is safe to replace the capacitor to be assured that the receiver will remain in operation. The chemical decomposition may also result in the internal connecting leads of the electrolytic capacitor to become open circuited. A further trouble is that high leakage current may develop between elements of a multi-tapped capacitor. It is not infrequent that high leakage conditions lead to the capacitor becoming short circuited.

Other types of defects likely to develop in an electrolytic capacitor are low capacity and high power factor. Exceptionally high capacity in this type of unit is not unusual, generally causing improved performance of the receiver. Low capacity and high-power factor on the other hand reduce the effectiveness of the bypass and filtering action and are frequently cause for replacement of electrolytic capacitors.

Intermittently open or short-circuited capacitors are somewhat difficult to detect. This is equally true of such conditions in other components, and for circuit connections as well. The bridge measurement is an effective means of identifying intermittent operation capacitors. When the bridge circuit is in complete balance, slight jarring or movement of the capacitor will generally cause the shadow angle of the eye to be erratic. The angle may vary only a few degrees or may close entirely. With an intermittent-operation capacitor the power factor setting may have to be adjusted to obtain the bridge balance or in some cases the capacity knob will balance as open or short, depending upon the type of intermittent defect. A great deal of patience is required to locate all intermittent faults.

Capacitors to be tested by the capacitor bridge or capacitor analyzer do not have to be removed from a receiver. It is only necessary to disconnect one lead of the capacitor from a circuit, preferably the high-potential lead. Before making connections between the instrument and the capacitor, it is advisable to disconnect the receiver from the power line, antenna, and ground, to obtain maximum accuracy of measurements, as well as to eliminate the possibility of damage to the equipment or shock to the operator.

After a defective capacitor has been identified, it is essential that the replacement be of satisfactory quality. If the new unit has borderline characteristics because of extended storage, the receiver may not give top performance or may become inoperative at an early date. All replacement capacitors should be measured for electrical properties before being used.

SERVICE TO THE SERVICEMAN

(*Continued from page 4*)

tation as a reliable serviceman. But why wait? You can do it overnight with this compelling "new radios need attention" mat series. They tell your customers why their new radios should have a 6-month check-up. They impress your customers with the all-important fact that you employ *only genuine parts —such as C-D replacement Capacitors in your repair work.*

C-D mats are free, and you can get them now from your local jobber. Place the ads as directed and watch your business grow.

Free Promotion Book—

42 items designed to make your shop the leader in your community. Newspaper mats, Displays, Postcards, Book Matches, Decals, Stationery, Shipping Labels, Catalogs—a fully integrated program to take your mind off sales and give you more time for repair work. Ask your local jobber, for these Free mats, or if he can't fill your requirements for C-D Sales Aids, write direct to us and we will advise you where they can be had. (To be continued in August issue of the C-D Capacitor.)

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 transaction 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—22 cal. Iver Johnson sealed eight revolver. Misc. radio engineering books, very good condition, half price. Back issues of QST, Radio News, Radio Craft, Popular Science, and Popular Mechanics magazines. Wilbur A. Hart, 40 Quincy St., Medford, Mass.

FOR SALE—Tubes, 1H6G, 1E7G, 6X5G, 6AC5G, 6Z7G, 50c each. Guaranteed new tubes but not in individual cartons. Also a Radio City model 410 multi-tester for $20. Howard Warner, 406 West Joppa Rd., Towson 4, Md.

FOR SALE OR TRADE—Hickock multimeter, model 210X, with zero current meter, decibel and capacity meter, $50, or will trade for signal generator or tube tester in good condition. Robert L. Turpin, 795 St. Anthony Ave., St. Paul 4, Minnesota.

FOR SALE—Philco tube checker in A1 condition, $25. UHF receiver for 144-148 mc. with built in speaker, tubes 7A4, 6C5 and 6F6, $10. MC 100 M. Var. Hammarlund condensers, 2 for $2. Two 10 tubes, $1.50 for both. Bou Radio Service, 3131 N. Percy St., Philadelphia 33, Pa.

WANTED—Schematic drawing of 1933 or 1934, Simplex ac-dc all wave radio with 5 plug in coils (one for each band) using the following tubes. 1-77, 1-6F7, 1-43, and 25Z5. D. F. Ingersoll, 1741 Lysander, Detroit 8, Mich.

FOR SALE—Weston meters, RCA transmitting tubes, transmitting condensers and transformers. Also have radio parts for sale. Send for list. Leo F. Kersey, White Sulphur Springs, W. Va.

FOR SALE—Clough-Brengle frequency modulator and signal generator. RCA Rider chanalyst, Thordarson oscilloscope completely built. Rider manuals I to XIV, RCA station allocator and complete stock of tubes. Mrs. J. V. Shepard, N. Diamond St., Greenville, Pa.

FOR SALE—Brand new "Shure" crystal pickup, metal curved arm type, $3, postpaid. J. Goldstein, 151-09 34th Ave., Flushing, L. I.

WANTED—1 Kenyon transformer, S-14021 also S-14020. Can also use T-254 and T-259. Will pay cash. W3BBV, 1357 Hill St., York, Pa.

WANTED—One Hickok Traceometer, model 155. Must be in good condition and reasonable. Also a 3" oscillograph. A. DeRossi, 536 Lower East Main St., Amsterdam, N. Y.

WANTED—Information on changes to be made on Army Scope, model BC-412-B. Serial number 2163, to be used as industrial oscilloscope. Victory Plastics Co., Apsley St., Hudson, Mass.

WANTED—Veteran needs hard-to-get radio tubes at 40% off list, any amount. Have ready cash. Send lists. Beck Radio and Sound Lab, Straw Pump, Irwin, Pa.

SWAP—Hickok OS-7 Signal generator and Hallicrafters S-29 all-wave portable, both perfect. Want 8mm camera and projector (Revere, B & H, Eastman); 7X50 coated binoculars, Robot lenses, Kine Exakta. D. J. McLaughlin, 1720 W St., S. E., Washington 20, D. C.

FOR SALE—Meters, transformers, chokes, condensers, BC312 receiver, and other surplus material. 1KW transmitter complete with spare tubes, $500. Price FOB York, Pa. Write Nelson Stover, PO Box 722, York, Pa.

FOR SALE-Scarce tubes at list; other types at 20% off. Also hearing aid tubes (501-509), acorns (954-959), diode tubes (v.r. 78, v.r.92), 717A, 6AK5, 1T4, 3S4. Write for price list. Commercial Radio, 36 Brattle St., Boston, Mass.

FOR SALE—Tubes NU813, RCA 1624, and RCA 89Y. Condensers C-D .0001 at 5000 volts and C-D 1. at 2000 volts dc Make an offer. C. M. Allman, 922 23rd St., Newport News, Va.

FOR SALE—Tripplett No. 1125 tester in new case. Price $20. Shipped Railway Express COD. Send for description. Charles W. Dreese, 4905 Main, Kansas City 2, Mo.

TRADE — Shure Stratoliner new crystal microphone model 508C, less stand, and 25 lesson modern television course for late model tube tester, small oscilloscope, receiver meters, or what have you? Karl H. Stello, 3619 W. 102nd St., Inglewood, Calif.

WILL SELL—Have new Weston model 772, instruction book, tube chart and Weston model Socket Select, or model 666 for sale. Please make an offer. Excellent condition. Frank A. Lazar, 8919 St. Catherine Ave., Cleveland 4, Ohio.

WANTED—One late RCA Chanalyst. Will sell Weston meter, luminous, $7; Supreme, 5" fan type, $6.50; Perfect Triumph oscillator, $76. Roberts Radio Service, Wheeler, Mich.

SALE OR TRADE—Radio and photographic equipment. 35mm camera and projector and other articles. Want chemical equipment, scales, glassware, electric furnace, etc., and books. Also want surveyors transit or level. Hansen Radio Service, 165 Silverbrook, Ave., Niles, Mich.

FOR SALE—Macy, Majestic, Sparton, Philco, Fada and Kolster radios for sale. For Prices and description write to Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, N. Y.

FOR SALE—Old issues "Radio News," "Radio Broadcast," other magazines, 1924-25-26-etc., 50c a copy. Also T-55, 809 tube and 807's. J. C. Nelson, 75 Minaville St., Amsterdam, N. Y.

TUBES at list prices. Send in needs and for list. Types 1LH4 and 1LN5 at 15% off list; 32L7 and 70L7 replacements in stock. Herbert Levinson, 2422 Natrona St., Philadelphia 32, Pa.

FOR SALE—Slide Rule Short Cuts. 2,500 words of real information for Radio Engineers and Technicians. Copyright, 1945. Price, $1, postpaid. W. P. Miller, 536 F St., San Diego 1, Calif.

FOR SALE — General Electric all-wave superheterodyne radio receiver, model E-76, with 7 tubes and 12" electro-dynamic speaker. Perfect working order. Best offer takes it. Milton Maultasch, 535 Grand St., Brooklyn 11, N. Y.

WANTED—Riders' 11, 12 and 13. Also a short-wave set, age, model or condition not important. Have Superior 1130S tube and set tester, Riders' 1, 2 and 3, Underwood typewriter No. 5, French Colemont 8 power prism binoculars, National short-wave receiver. Will exchange lists. Glenn Watt, Chanute, Kans.

FOR SALE—110 volt ac generator, 1800 RPM, separately excited 6/12 volt field, 600 watt. Excellent condition. Gerald Evans, RFD 1, Ola, Arkansas.

WANTED—Riders' Manuals. State price and condition. Roy Aberle, 161 Bush St., Brooklyn 31, N. Y.

FOR SALE—One Alliance phono motor, new; also Shure crystal pickup, both for $10. L. E. Smith, Route 1, Trion, Ga.

FOR SALE—New RCA Rider Chanalyst, bought 3 months ago. Price, $100. This includes chanalyst, all test leads and instruction book. Jesse E. Urquizo, 400 S. Halstead, Chicago 7, Ill.

WILL SWAP—1 Simpson model 215 and 1 Triplett pocket model 666 multi-testers, for S-W-3 or other S-W set with coils. Charles Kleinz, 1411 S. 4th St., Philadelphia 47, Pa.

FOR SALE—1941 or 1942 Dodge or Plymouth custom built auto radio, 6 tube push-button, new condition, $40. One 1/4 HP ac motor, new condition, $12. One 6 tube Motorola universal built auto radio, $35. Paul Capito, 637 W. 21 St., Erie, Pa.

FOR SALE—100 KC Xtals, ac and dc Selsyns, Ham Xformers, etc. Lectronic Research, 5832 Hegerman St., Philadelphia 24, Pa.

FOR SALE—15 modern metal and 13 glass tubes. Many new, others slightly used. All in excellent operating condition. Ceiling price of all, $34. Cash price, $10. Herman Fischer, 626 Carlton Ave., Brooklyn 17, N. Y.

TUBES FOR SALE—One 1LA6, one 1LH4, two 1LN5's, $4. per set. Also have others at 60% off list. Send for list. Ed's Radio Service, 2868 Woodhill Rd., Cleveland 4, Ohio.

FOR SALE—Stancor 20P transmitter, complete except for xtal and meters, perfect condition, worked both coasts with 1 set of coils. First $50 takes it. Also RK60 tube, 10 meter xtal and Briggs Stratton engine. Write for prices. Frank's Radio Lab., New London, Iowa.

FOR SALE—New Astatic JT-30 TT Xtal mike for $15.95 with cover. Also American RC mike for $10. Astatic 07S Pickup for $5.95. 12SA7GT, 12SK7GT, 6H6, 6K6GT, 7A7, 12AH7, 12J5, 01A tubes at list. Also 25Z6 at list. Can supply battery types in lots of 100 at list. No loctals. No C.O.D. orders accepted. Edward Howell, Rte. 2, Dillon, S. C.

SWAP OR SELL—Will swap brand new Raytheon 6V6GGT tubes for new 35Z5's, 50L6's, or any other tubes or parts, or will sell for $1 each. Will answer all letters or cards. John R. Naples, 836 Ford Ave., Youngstown, Ohio.

FOR SALE—Precision No. EV-10 vacuum tube voltmeter, new condition, used very little; Jackson No. 643 Universal multimeter, new, never used; radio books and magazines. T. Wojciechowski, 2837 Fulton St., Brooklyn 7, N. Y.

FOR SALE—Immediate delivery. Signal Corps double button throat microphones, complete with shielded cable, $1.95. All types radio tubes, OPA list, less 10%. 2 tube portable radio kits, cover shortwave and broadcast bands. Complete with 2 tubes and 5 coils, $6.95. A. Valentino Radio Service, 57-13 69th St., Maspeth, New York.

FOR SALE—Dual speaker carrying cases; studio boom and salt shaker microphones; Jensen speaker and cabinet (with roll off frequency control); Juke box amplifier. Hal Karlsen, 184 Ridge St., Newark 4, N. J.

FOR SALE OR TRADE—Riders' Manuals, 1 to 8, good condition and index. Also other manuals. Make offer. Also have test equipment, etc. Send for list. Parks Electric Service, Edna, Texas.

FOR SALE—Ferris Microvolter, model 18B. Slightly used, cost $455. Want $300. Luke McSherry, 1211 Hoe Ave., New York 59, N. Y.

WANTED — Television receivers, General Electric HM185, HM187; RCA television sets models TT5, TRK9 and TRK12. Also either RCA or Dumont oscilloscopes. Please state price and condition. Leonard Chioma, 24 Central Ave., Tarrytown, N. Y.

WANTED—Superior Channel-Analyzer, also Superior pocket laboratory, model 1220. Will trade 35mm strip film projector, 16mm Keystone projector, one 30 watt OP amplifier with one speaker and crystal mike and all cables in new portable case. Have Cash also. Will not sell, trade only John Arnold, PO Box 84, Bluffs, Ill

FOR SALE — Ghirardi's Radio Physics Course. Modern Radio Servicing, Troubleshooter's Handbook and other radio books for sale. Write for list. Aubrey Edgerton, 116 W. 6th Ave., Houston 7, Texas.

WANTED—Superior channel-analyzer and audio oscillator. Lyons Radio Service, 5706 S. Marshfield Ave., Chicago 36, Ill.

WANTED—110 volt 60 cycle ac 300 watt light plant or generator, or Genemotor 110 volt dc to 110 volt ac 60 cycle 300 watt. Must be in good condition and small for portable use. Parks Electric Service, Edna, Texas.

FOR SALE—Crosley 1914 radio, less batteries and tubes. Will ship for $15. Also have most anything in radio line. Battery tubes in lots of 50 at retail list. Guaranteed new. What have you and what do you need? Write "Electronic" Howell, Rte. 2, Dillon, S. C.

WILL SELL—Radio repair shop, reasonable, finest equipment, good stock, growing Northeastern Ohio community, 15,000 population. Will accept car as part payment. B. F. Reimold, 1549 E. 86 St., Cleveland Ohio.

EVEN SWAP—One R & M 16" oscillating ac electric fan in good operating condition, for a Royal Signet portable typewriter in good condition, with or without case. Local swap preferred. Fan too large for home use. Wesley W. Brogan, RFD 1 Ambler Pa.

NEXT MONTH — "RELIABLE RADIO SERVICE" AD MATS

Be sure to see the next issue of "The C-D Capacitor" for full details on another series of Cornell-Dubilier ad mats for radio service sales promotion.

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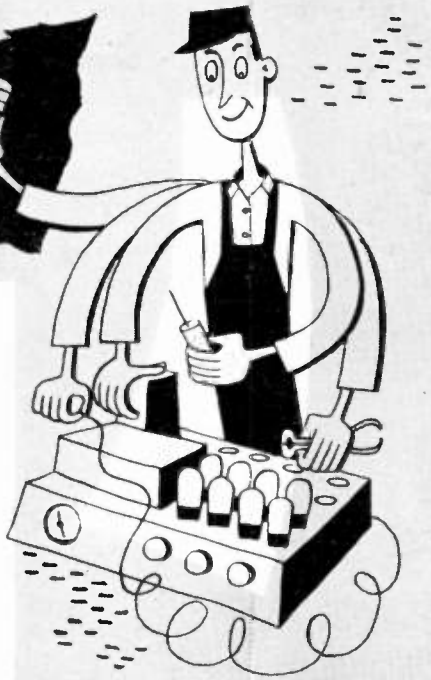

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