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AUGUST, 1944

No. 8

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

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WANTED: Signal Corps Equipment

You may have Radio-Amateur and Photographic equipment that is urgently needed by the Army Signal Corps. The Army will buy the following from private individuals.

Radio: Standard and commercial built short wave transmitters (such as Hallicrafters HT-1, etc.; Temco and Collins Model 32 and 30) and Standard and commercial built short wave receivers (such as Hallicrafter, National, RCA, RME, Hammarlund or Howard); AC and DC Voltmeters, Ammeters, Milliammeters, Radio Frequency Meters and Volt-ohm, milliammeters; Oscilloscopes, 2-3 inch; Audio sig. gen. 30-15,000 cycles; RF sig. gen. 15-215 megacycles; late model Tube Checkers, and other test equipment.

Photographic: 35 MM Motion Picture Cameras (such as Mitchell (all models), Bell & Howell - Standard Professional, Akeley-Professional (all models) and Eyemo (all models) Bell & Howell Mfg.), etc., and 16 MM Motion Picture Cameras (such as Cine-Kodak Special, Magazine Cine-Kodak, Filmo 70.D or Filmo Auto Master); Tripods; Lenses, all types for 35mm and 16mm equipment; Exposure Meters; and Cameras (such as Speed Graphic 4" x 5", and Speed Graphic 2 1/4" x 3 1/4" with or without flash synchronizers) and Leica Model III (F) or 11B (C), or equal; Range Finders; Pack Adaptors and Cut Film Holders.

If you have this type of equipment, you can assist the war effort materially by selling it to the Army. Write to:

**EMERGENCY RELIEF SECTION
PHILADELPHIA SIGNAL CORPS PROCUREMENT DISTRICT
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briefly describing the equipment you have and stating the price at which you can offer each item, FOB Philadelphia. Do not ship any material without specific directions from that office.

Price consideration is based upon your net cost less reasonable depreciation for use, age, and condition of equipment. Inasmuch as all equipment is being purchased FOB Philadelphia, cost of packing and shipping can be shown separately so that an allowance for the costs can be made when material is accepted.



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

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

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

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

WANTED—All kinds of radio test equipment, analyzers, etc. Quote what you have to sell and lowest cost prices. National Sound Equipment Co., 625 Main St., Worcester, Mass.

WANTED—FM receiver or converter, also television receiver and late communications receiver. Will pay cash or trade lot of hard to get tubes and parts. Carl H. Stello, 925 Monroe St., N.E., Washington, D. C.

WANT TO BUY — A Simpson Multimeter Model 201 State condition and price. Lovett's Radio Shop, P.O. Box 143, Newland, N. C.

FOR SALE—One Unitron battery charger. Takes from 1 to 12 batteries at 15 amps. in A-1 condition Price \$50 or will swap for testing equipment such as multimeters or any useful equipment. Lovett's Radio Shop, P.O. Box 143, Newland, N. C.

FOR SALE OR TRADE — Automatic code machine, 3 955 acorn tubes, auto vibrators and transformer, 7" Triplett foundation meter, photo electric cell with relay, chassis, etc. What have you. Joe's Radio Shop, 2224 W. Belden Ave., Chicago 47, Illinois.

FOR SALE — Postcard camera, 1 electric shaver, 3 Brunswick 9 tube chassis, 1 RCA Victor R32 chassis and power pk., 1 fan, 1 Majestic 90B chassis, 1 Majestic 90 pwr. pk., several other chassis, and speakers. All in playing order. Louis A. Goldstone, 1279 Sheridar Ave., Bronx 56, New York.

FOR SALE—Brand new Dumont, 5BPI 5" C R tube Jensen J.H.P. 52.15 In. Co. axial speaker **WANTED**—Hickok, mod. 155 Traceometer, Hickok mod. 510x tube and set tester Write do not call. Sterling Electronic Labs., 521 W. 131st St., New York City.

CASH WAITING — For your pickups or phono motor. Send description and price to Joe's Radio, 2224 W. Belden Ave., Chicago 47, Illinois.

WANT—Rider's 11, 12, 13, power output tube tester, Weston 772 or similar standard make combination. Clough Brengle CRA or similar scope. Have equipment or cash, also short-wave receivers. Glenn Watt, Chanute, Kans.

WANTED—Receiver such as HQ120, Hamerlund or AF77 RCA or equivalent. Robert Rath, 4835 North Kostner, Chicago 30 Ill.

TRADE—Hallcrafters SX24 receiver purchased 2 days before Pearl Harbor for 8mm projector, between 300 and 500 watts L. H. Archambault, 910 N. Washington St., Danville, Ill.

FOR SALE—1941 Philco auto radio almost new, \$35; 1937 Delco auto radio, good condition \$20. Want Oct., Nov. 1937, and Nov., 1938, issues of Radio News. Paul Caputo, 637 W. 21 St., Erie, Pa.

WANTED—Will pay top cash for Supreme 560-560A Vedioyzer and 561 audio oscillator. If you have phone include number and price in your letter. Carl Vorlicek, 3621 E. 63 St., Cleveland, Ohio.

WANTED — Hallicrafters SX-28 or other good all-wave receiver with 2mv. sensitivity or better at reasonable price.

Have list of electronic supplies. Milton Bursma, 105 Avondale, Jackson, Mich.

WANTED—One Meissner 3 gang condenser 280 mmfd., type No. 21-5143B, 15 plate, must be in perfect condition. Wallace M. Kennard, Stone's Throw, R. D. 4, Wilmington, Del.

WANTED — Position as radio serviceman with some reliable shop. Had over 15 years experience as serviceman. Am 42 years old. Pay must be \$1.50 per hour or \$75.00 per week. Graduate of National Radio Institute. Frederick Shutt, Mullens, West Virginia.

SWAP — National NTE-B exciter-speech amp., 4 bands; D104 Astatic mike and stand. Meissner deluxe signal shifter. Instructograph code machine and tapes. Want—Rider Chanalyst complete. Good tube checker; Riders Manuals, VOM. Charles Sutherland, 109 Elliot, Ellensburg, Wash.

TRADE—Model airplane engine "OK Special" and "U" control model airplane. Want Sky Buddy, Sky Champion or similar receiver, will pay difference in cash if needed. Ted Toth, 10005 Kennedy Ave., Cleveland 4, Ohio.

TRADE—Rider's Manuals 1 to 12 inclusive, practically new, for a Johnson outboard motor, 5 or 6 h.p., in very good condition, or will sell for \$100 cash. J. P. Miller, Ashland, Nebraska.

WANTED—Good used 3" oscillograph at reasonable price. Also any good 3 tube, 3 or 4 band preselector (2 stage RF amp.) such as Howard 650, RME DB-20, or Meissner 9-1031, also RME LF-90 low frequency inverter. Michael J. Blackwell, c/o Marine Hospital, Foot California Ave., Memphis 5, Tennessee

FOR SALE—Weston 0-1 dc milliammeter, model 301 like new. Four new RCA 954. Good used transmitting tubes, 2 RCA 865, 2 RCA 828, 5 WE 212D with 2 WE tube sockets and Stancor filament trans. 14v at 12 amps. Need 6 ft. Par-Metal relay rack No. RR195 in A-1 condition. Joseph Mackora, 63 Pratt St., East Hartford, Conn.

FOR SALE—1 each Turner Hi-impedance dynamic mikes, CD, 22D, 33D, U9S Universal; 3 2-sec. floor type mike stands; 3 -sec. floor type mike stands, 3 Utah 12P FM, 12" spkrs., 2 crystal pick-ups. All new, mikes with 25 ft. mike cable. John J. Spankovich, 239 N. 9th Street, Allentown, Pa.

FOR SALE — Zenith deluxe trans-ocean Clipper portable radio, model 7G605, like new, extra battery. Also F 1.9 lens 50mm Gundlach-Manhattan. Best cash offer or swap for communications receiver, or what have you? J. J. Cermak, 1928 Grove, Berwyn, Ill.

FOR SALE—Back numbers of radio and mechanical mags., Radio Craft, Radio News, Short Wave Craft, Popular Mechanics, Popular Science, etc. Aubrey Edgerton, 116 W. 6th Ave., Houston 7, Texas.

FOR SALE — Meters, large transformers, transmitter tubes and parts, 175 watt modulator and speech amplifier complete with tubes. Many other good heavy-duty parts. Send for list. Service Manager, Richmond Appliance Co., 207 Clement St., San Francisco, Calif.

WANTED — Dynamic mutual conductance tube tester. Prefer Precision model 912p or mcp; or Hickok model 530C. Also signal generator and oscilloscope for rack mounting. State price and condition. Northwest Radio, 16830 Stahelin Ave., Detroit 19, Mich.

FOR SALE OR TRADE—Rider's Manuals, 1-6; 7" meter Triplett analyzer, automatic tape sender, 15 watt P.A. system, 955 acorn tubes, 5 band all wave tuners, P.E. cell and relay tubes, many other items. What have you? Joe's Radio, 2224 W. Belden Ave., Chicago 47, Ill.

FOR SALE—Keuffel & Esser log log duplex decitrig slide rule, cat. No. 4081-3S, complete with leather case and manual of instruction, \$14. D. Kurz, 4525 45th St., Long Island City 4, N. Y.

WANTED—Urgently need dial glass for Arvin model 1237D. Would buy custom set for 1941 Packard, also heater for same car. Reynolds Electrical Service, 1362 Washington St., South Braintree, Mass.

MUST SELL NOW—1 Webster 4L35 35 w. amp., 2 30 w. booster amp., Hickock output meter, 2 Cinuodograph HWA units with SW horns, 1 University PAH unit with LH horn, 3 shielded 200 ohm to grid line trans., 2 model 55B Shure Unidyne, 1 RCA 50-A inductor mikes with floor stands, 1 Brush B1 hand mike, 1 250, 1 100, 1 75 and 2 25 ft. lengths 2 wire shielded mike cable, all with Amphenol connectors, 6 Oxford 12" dynamics with horns, all like new. John's Radio Shop, 32 Maple St., Perry, Ohio.

FOR SALE—RCA station allocator, \$10.00, complete with tubes. Can also be used on batteries. Robert E. Lee, Station WALL, Middletown, N. Y.

(Continued on page 11)

INDUCTANCE MEASUREMENTS*

Many practical methods of measuring various inductances with the application of present-day test instruments.

Precision-type inductance bridges and inductance standards will not be found in the small laboratory of the wartime radionic hobbyist. Nor were they frequently in amateur hands before the present shortages. Such apparatus is costly.

Lack of highly specialized instruments need be no hindrance to the serious experimenter who needs to know

and, even when particularly desired, a simple version may be assembled readily from spare parts. In lieu of a circuit employing a milliammeter, a magic-eye tube may be employed, as will be shown later.

The various systems of measurement will be described completely in separate sections. While the experienced technician will recognize standard practice in the methods, less versed workers will find new or refresher information.

Fundamental Relations

Before explaining the simple methods of measuring inductance, it is advisable to review briefly certain fundamental electrical relations upon which our procedures will be based. The first of these is the relation of inductance (L), reactance (X), impedance (Z), and resistance (R), all properties of a coil. In all of the equations which follow, unless specifically stated otherwise, L will be rated in henries; R, X, and Z in ohms; and frequency (f) in cycles-per-second.

$$X = \omega L \quad (1)$$

Where ω is 6.28 f. (Table I lists ω for common frequencies)

$$L = \frac{X}{\omega} \quad (2)$$

Equation (2) would be sufficient, except that a coil has a resistive as well as a reactive component, and these two vector quantities combine to give the joint property of *impedance*. The following equation is therefore more closely true:

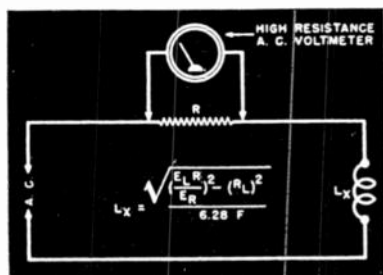


Fig. 1. Voltmeter method.

coil values, since it is possible with simple radio instruments to measure inductance with sufficient accuracy for most experimental purposes. This article will explain the practical methods of making such measurements.

The reader will find in this discussion one or more methods which will tie in with the apparatus he has on hand. In general, no new equipment will be required. The only piece of equipment apt to be missing from a large number of shops is the a-c vacuum-tube voltmeter. But this device is not necessary to all of the methods;

* By Guy Dexter in "Radio News."

$$L = \frac{Z}{\omega} \quad (3)$$

Impedance is a vector term ($Z = R + j\omega L$), therefore:

$$Z = \sqrt{R^2 + X^2} \quad (4)$$

Expanded, Equation (4) becomes:

$$Z = \sqrt{R^2 + (6.28fL)^2} \quad (5)$$

Now, it is seen that if we measure R and Z by means of simple instruments, we may determine L after re-writing Equation (5):

$$L = \frac{\sqrt{Z^2 - R^2}}{6.28 f} \quad (6)$$

The next relationship to be considered is that between impedance (Z), voltage (E), and current (I). In the equations applying to this relationship, unless specifically stated otherwise, E will be rated in volts and I in amperes.

Current passing through a coil will encounter the opposing action of im-

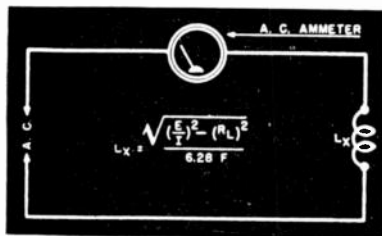


Fig. 2. Ammeter method.

pedance. The current forced by a given voltage will attain the value:

$$I = \frac{E}{Z} \text{ and } Z = \frac{E}{I} \quad (7)$$

Current passing through the coil in a suitable circuit will produce a voltage drop across the coil proportional to the impedance:

$$E = IZ \quad (8)$$

Thus, it is seen that if current or voltage associated with a coil is meas-

ured with suitable a-c meters, the deflection of the latter will be governed by both resistive and reactive properties of the coil and the impedance of the latter may be determined by the proper one of the immediately preceding equations. If this impedance value is then substituted in Equation (6), together with the frequency of the test voltage or current, the coil inductance may be determined.

The final relationship to be considered is that between inductance (L),

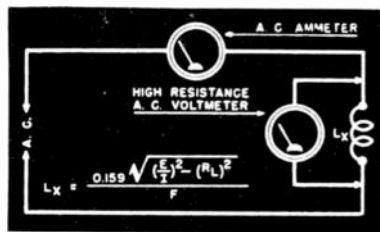


Fig. 3. Voltmeter-ammeter method.

frequency (f), and capacitance (C) in a resonant circuit in which the coil under test is connected either in series or parallel with a capacitor of known value. In the equations applying to this relationship, unless specifically stated otherwise, L will be rated in henries, f in cycles-per-second, and C in farads.

Since in a resonant circuit, either series or parallel:

$$f = \frac{1}{6.28 \sqrt{LC}} \quad (9)$$

Then:

$$L = \frac{1}{39.4 f^2 C} \quad (10)$$

From these relations, it is seen that if a coil of unknown inductance is connected in a resonant circuit with a known capacitance, and the resonant frequency of the circuit determined by means of a suitable oscillator, the inductance may be calculated by means of Equation (10).

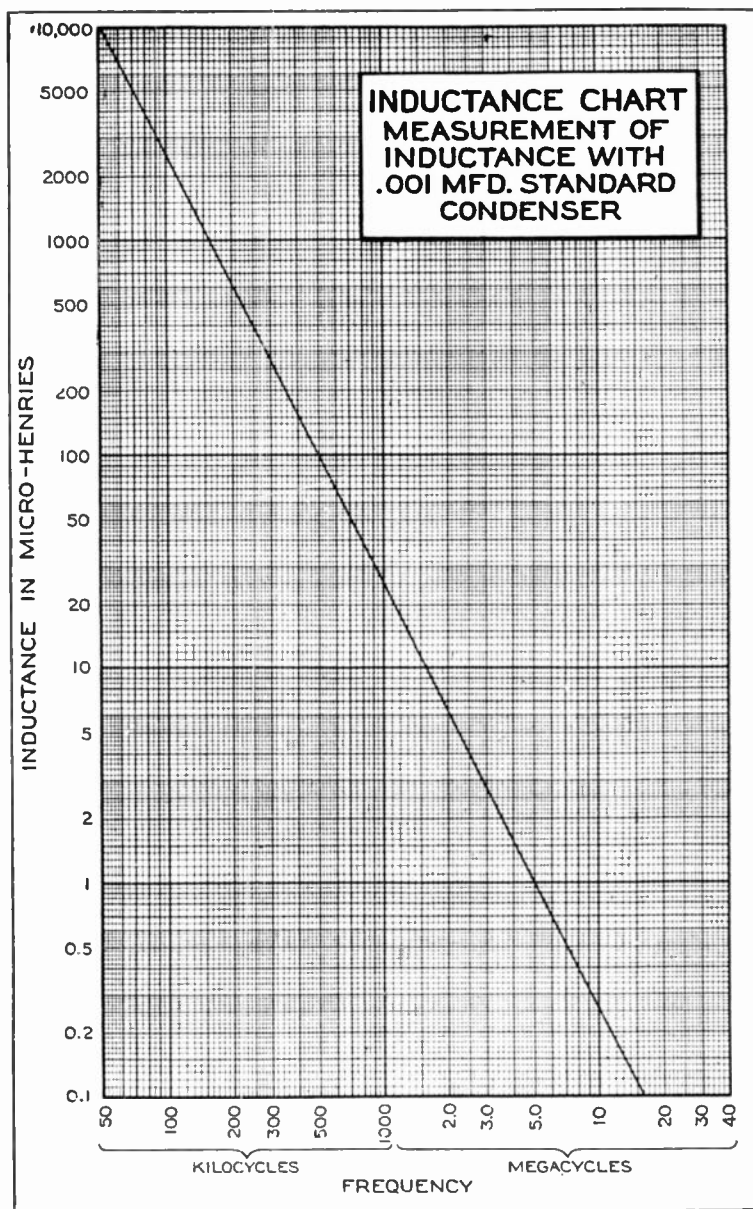


Fig. 4. Inductance chart.

Voltmeter Method

Apparatus required for measurement by this method includes a high-resistance a-c voltmeter (preferably a v.t. voltmeter), a small resistance, preferably non-inductive, and a source of alternating voltage. The circuit is shown in Figure 1. L is the coil of unknown inductance and R is a resistor of any value, provided it is not so large as to reduce the flow of current through the coil to too low a value. The alternating voltage may be supplied by an a-f oscillator or by a filament transformer.

The voltmeter is first connected across the coil and the voltage drop recorded as E_L , then it is connected across the resistor and the corresponding voltage drop recorded as E_r . The voltage drop across the resistor is proportional to the current flowing through the resistor, and therefore through the entire circuit. This current is equal to E_r/R . The voltmeter

of Equation (6), substituting $E_L R/E_r$ for Z , and R_L for R .

Ammeter Method

The second system, illustrated in Figure 2, is similar to the one just described, except that an a-c ammeter is employed and the resistor is not necessary unless high input voltage necessitates reduction of current through the coil.

The resistance of the coil is measured with an ohmmeter or bridge, calling this value R_L , and the coil is placed in the circuit. The reading of the ammeter is then noted, recording this value as I . Then I will be proportional to the impedance of the coil, as indicated by the Equation (7) and Z is equal to the input voltage divided by I . The unknown inductance may then be calculated from Equation (6) by substituting this E/I value for Z , and R_L for R .

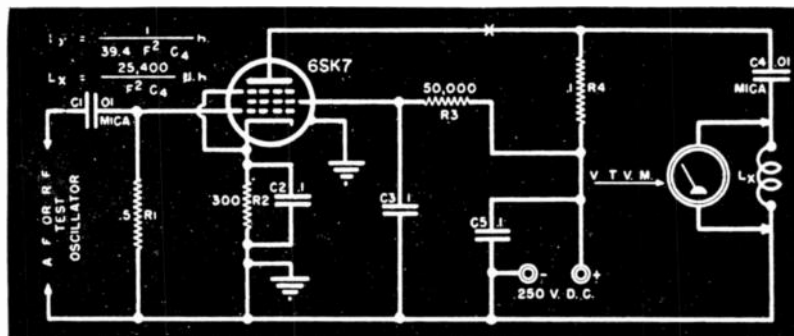


Fig. 5. Amplifier used for the measurement of inductances.

is actually serving as an ammeter in this position. Since impedance is equal to E/I , the impedance of the coil in Figure 1 will be:

$$Z = \frac{E_L R}{E_r} \quad (11)$$

The coil is then disconnected from the circuit and its resistance measured with an ohmmeter or bridge, calling this value R_L . The unknown inductance may then be calculated by means

Voltmeter-Ammeter Method

In some cases, both an ammeter and a voltmeter will be available. The voltmeter must have high input resistance and is preferably a v. t. voltmeter. The circuit for the voltmeter-ammeter method is shown in Figure 3.

The resistance of the coil, R_L , is first measured with an ohmmeter or bridge and the coil is inserted in the circuit. The ammeter deflection is recorded as I ; the voltmeter deflection as E . The

unknown inductance may then be calculated by means of this relationship:

$$L = \frac{.159 \sqrt{(E/I)^2 - (R)^2}}{f} \quad (12)$$

where f is the frequency of the input voltage.

Constant-Impedance Method

The constant-impedance method is illustrated in Figure 8. Here an a-c ammeter is the indicating instrument. The circuit contains, in addition to the

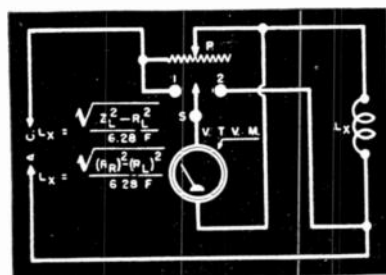


Fig. 6. Z-meter method.

coil of unknown inductance, a switch, S , and a capacitor, C . Since this capacitor must be variable, the C element will actually be a series of capacitors (preferably a decade arrangement).

In this circuit, the line current, indicated by the ammeter, will be the same with the switch open or closed when the proper value of capacitance has been switched-in at C . In manipulation, the capacitance is adjusted, while opening and closing the switch, until this equilibrium is obtained. At that point, the unknown inductance is calculated from:

$$L = \frac{1}{2\omega^2 C} \quad \text{Where } \omega = 6.28f \quad (13)$$

Z-Meter Method

The method illustrated in the circuit of Figure 6 utilizes the well-known impedance meter. A vacuum-tube voltmeter is required here.

The coil of unknown inductance is connected in series with a calibrated variable resistor, R , and the source of a-c voltage. The v. t. voltmeter is arranged with a single-pole, double-throw switch so that the meter may read the drop across the resistor or the drop across the coil.

In operation S is thrown to position 1 and the drop across the resistor, E_r , noted. S is then thrown to position 2 and the drop across the coil, E_l , noted. R is adjusted until the same drop appears across both R and L and no change takes place in the meter deflection as S is thrown from one position to the other. E_l , then being equal to E_r , the resistance of R at that setting is equal to the impedance, Z , of the coil. The resistance of the coil is then measured with an ohmmeter or bridge.

The values of R and Z , thus obtained, may be substituted in Equation (6) to obtain the inductance of the coil.

The impedance meter is very handy for the measurement of impedances as well as inductances over a wide range and may be assembled from stray parts.

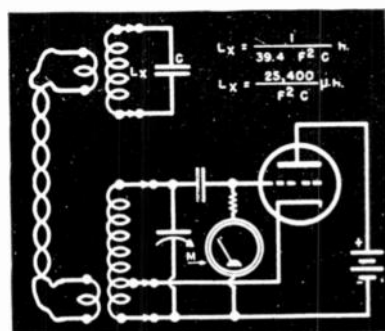


Fig. 7. Grid-dip meter.

The variable resistor, R , may be a radio volume control type of rheostat. The input voltage may be supplied by a filament transformer, operated by the 60-cycle line, for common measurements, or by a 1000- or 400-cycle oscillator for measurement of impedance of transformers, voice coils, and similar audio equipment.

Amplifier Method

The method illustrated in Figure 5 is very useful in that it may be employed with large iron-cored coils as well as the tiny inductors used for radio-frequency work. The other methods described up to this point are most useful only for measurements at low frequencies where the coils almost always will be of the filter choke variety, or in any case will possess rather large inductance. The amplifier method is universal.

TABLE I

f (Cycles per Second)	ω
20 ..	125.6
25 ..	157.0
30 ..	188.4
40 ..	251.2
50 ..	314.0
60 ..	376.8
100	628.0
120	753.6
133	835.24
150	924.0
200	1256.0
400	2512.0
500 ..	3140.0
800 ..	5024.0
1000 ..	6280.0

In this arrangement, the coil of unknown inductance is made part of a series resonant circuit, the capacitor of this circuit being included permanently within the instrument. The resonant circuit is connected in the plate portion of a pentode amplifier, the resonant-circuit capacitor serving as the blocking capacitor of the shunt-fed arrangement.

An a-c vacuum-tube voltmeter is connected across the coil; or if the v. t. instrument is not available, a d-c milliammeter may be inserted in the plate lead at the point marked "X". The grid input terminals are connected to a variable-frequency oscillator. If the inductance values expected are larger than 1 millihenry, an audio oscillator must be used; if smaller, a radio-fre-

quency oscillator (preferably tuning from 50 kc., or lower, to 30 Mc.) will be required.

In manipulation, the oscillator is tuned until a sharp upward deflection of the v. t. voltmeter, or downward deflection of the d-c milliammeter, indicates resonance. Knowing the exact value of the capacitor, C, and the oscillator frequency at resonance, the inductance of the coil may then be calculated by substituting these values in Equation (10).

A very reliable method for use at radio frequencies makes use of a variable-frequency r.f. oscillator (See Figure 7) in which a d-c milliammeter is connected at M in the grid circuit. In lieu of the meter, a magic eye tube might be used. The coil of unknown inductance is connected in parallel with a capacitor, C, the capacitance of which is known very precisely, and is coupled to the oscillator tank coil.

At the resonant frequency of the L-C combination, the oscillator will be thrown out of oscillation, or will have its oscillation strength reduced, sharp-

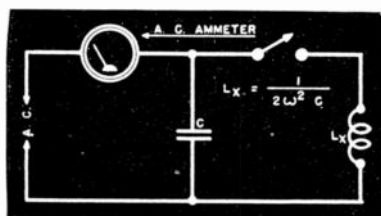


Fig. 8. Constant-impedance method.

ly by wave-trap action of the combination. The grid milliammeter will indicate this condition.

In manipulation, the frequency of the oscillator is varied until a sharp deflection of the meter indicates resonance. The oscillator frequency is noted. The inductance of the coil may then be calculated in terms of the capacitance, C, and the resonant frequency by substitution of these values in Equation (10).

Since Equation (10) is set up with henries, farads, and cycles, and these values are all rather out of size for radio-frequency calculations, it will be found somewhat more convenient to employ the formula:

$$L = \frac{25,400}{fC} \quad (14)$$

Where: L , is in microhenries,
 C , in micromicrofarads, and
 f , in megacycles

For rapid determination of inductance between .1 and 10,000 microhenries, a chart is given in Figure 4 for use with a C capacitance of .001 μ fd.

Larger capacitances might be employed, whereupon the inductance values from the chart must be multiplied by C_1/C_2 , where C_1 is .001, the capacitance upon which the chart is based, and C_2 is the capacitance of the capacitor employed.

THE RADIO TRADING POST

(Continued from page 4)

FOR SALE—15 Triplett model 327A $3\frac{1}{2}$ " square bakelite case d.c. microammeters, special low resistance of 95 ohms, 0-200, subject to prior sale Brand new meters at \$18.00 each. Radio Parts & Equipment Co., 244 Clinton Ave., N. Rochester 5, N. Y.

FOR SALE—3 885 and 1 2051 tubes in perfect condition, \$5.00, or swap for other tubes, new or in good shape, or radio parts. Mac Green, 5047 Washington Blvd., Chicago 44, Illinois.

FOR SALE—A number of radio chassis, with and without power packs, well-known makes, write for 1st. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

WANTED—5" television receiver, must be perfect, will pay cash or will trade 771 Weston tube and set tester, perfect can be modernized, also have Readrite 710 Tester, like new. Henry Bollmann, Springfield and Plainfield Ave., Berkeley Heights, N. J.

FOR SALE OR TRADE—Underwood standard typewriter, I.R.C. resistance analyzer, Crosley push button car radio. A. Mayfield, 3330 Lawrence, Denver 5, Colo.

WANTED—Rider's Manuals 6 to 13 in good condition, all wave sig. generator, Solar condenser checker, model CB-1-60. State price and condition in first letter. A. Mayfield 3330 Lawrence, Denver 5, Colo.

WANTED—2 Hypex speakers and driver units for 35 watt P.A., also gas driven power unit for 110 v.a.c. output. Patrick's Radio & Sound Service, 1818 West Cermak Rd., Chicago 8, Ill.

FOR SALE—K. and E. Mannheim slide rule No. 4041 perfect condition, \$7.50. L. J. Schnedorf, 610 Monroe Ave., River Forest, Ill.

FOR SALE OR TRADE—3" oscilloscope, Clough-Bregle, model CRA, serial 2386, excellent condition. Will trade for anything useful, or highest price offered. Joe's Radio, 2224 West Belden Ave., Chicago 47, Ill.

WANTED—One late model tube tester, also a late model signal generator. Cpl. Bob Bosch, 13115693, 302nd Base Unit, Squadron "A," Flight "F," Hunter Field, Ga.

WILL BUY—Complete kit of parts or assembled unit with or without tubes and speaker of Radio News revised edition of 1940 full range amplifier. Have radio and electrical supplies if anyone interested. E. Laurence Luke, Baltic, Ohio.

FOR SALE—One complete late N.R.I. communications course in two binders, answers, experimental kits including meters, etc. in A-1 condition, less analyzer; cost \$129.50, make offer. Also new and used tubes, capacitors, resistors. Raymond H. Ives, R.T. 1c; Radio Lab., Bldg. 813, U.S.C.G. Base, Berkley, Norfolk 6, Va.

SWAP—Pet rabbits, New Zealand whites, for radios, par's, meters, testing equipment, or what have you. Lester Moleenaar, Lake Lillian, Minn.

WANTED—Radio tubes, new or used. 12SA7, 12SQ7, 50L6, 35L6, 80, 523, 1A7, 6Q7, 12A8, etc. Send list and best price. Will pay full wholesale price for new tubes. Can use "good" used tubes. Radion 87-10 Lelferts Blvd., Richmond Hill 18, N. Y.

FOR SALE — New tubes in sealed cartons. Write for list. Box 21, Whiteland, Ind.

WANTED — Small radios, any condition, also Riders X to XIII. Will pay cash or trade camera and photo accessories, other items. W. J. Closson, 295 8th St., Troy, N. Y.

WANTED — Wireless phonograph oscillator complete with tubes. Must be in good operating condition. Will pay cash. Dexter Kurs, 4525 45th St., Long Island City 4, N. Y.

CASH for Hickok 510X or 530C dynamic M. Conductance tube tester. Also No. 913 1" cathode ray tube. Roland Chang, 1217 Calhoun, Fort Wayne 2, Ind.

WANTED — One power transformer RCA No. 12463 for RCA Record Player R-99. George M. Gum, Major, T. C., Fort Slocum, N. Y.

FOR SALE — One 0-15 M.A. Weston 3" meter, round type, \$5.50. Also one General Electric 0-2 amp. D.C. meter 3" round type, switchboard type mtg. \$4. Jack Goldstein, 151-09 34th Ave, Flushing, Long Island.

FOR SALE — Brand new FM adapter, General Electric Model JFM 90, tubes included. In original carton, never used. \$35. Harry Puccetti, c-o National Broadcasting Co., 420 Taylor St., San Francisco, Calif.

FOR SALE — Many radio and electronic instruments and supplies. Send for list. Need service instruments. J. Trowbridge, 7936 Parnell, Chicago 20, Ill.

WANTED — Two small a.c.-d.c. volt-ohm-mill. meters. Tubes one 1A7, two 35L6, and two 50L6. Also small phono tables with pickup. Stephen W. Bieda, 680 Alma St., Mountain View, Calif.

WANTED — Public address equipment, amplifiers, phonograph motors, mike stands. Also two Sylvania Stock Boy cabinets in good condition. State price. Fox Sound Equipment Co., 435 S. Fifth St., Richmond, Ind.

WANTED—Supreme model 561 and Supreme model 560A. in excellent condition. will pay \$225. cash F.O.B your place. R. L. Bradford, 712 6th Ave., W., Decatur, Ala.

FOR SALE—Starrett O 1 in. Vernier micrometer No. 238—best cash offer. Walter Kryger, 912 W. 151 St., East Chicago, Ind.

WANTED—Amphenol connectors type 93C, 93M, and co-axial cable No. 72-12. Frank J. Polinski, Warren, N. Y.

TRADE — 3 asst. power transformers, 3 chokes, 2 output transformers, 3 asst. speakers, 2 radio chassis, 25 asst. 2F R.F. Ant., 2 osc. coils., 25 asst. bypass condns., 25 asst. resistors, 1 lb. radio hardware—for just ONE Rider Manual, 8 to 13. Troch, 413 Hummel Ave., Lemoyne, Pa.

FOR SALE—Complete stock of Radio tubes. NEED Mobile PA systems, Xtal mikes with rubber-covered shielded cable—best price for burnt out Cathode ray tubes—also 83 tubes, V. Kozma, 3104 Wilkinson Ave., N. Y. 61.

FOR SALE—Meissner Analyst Model 10-1154 in perfect electrical condition. Price \$75. C.O.D. Mathews Radio Service, P.O. Box 387, Bloomingdale, N. J.

FOR SALE—Radio tubes (many hard to get) or will trade for late test equipment. Send for list. Roxy Radio Repair, Mitchell, S. D.

FOR SALE—Inverter from 32v d.c. to 110v a.c. 110v port. light plant like new, suitable for operating mobile PA system. WANTED—Voltomyst Jr., perfect cond. Also test equip. and P M speakers. W. S. Frank, R. Rt. 3, Chippewa Falls, Wis.

FOR SALE OR TRADE—6 tube Western Electric mod. 4D receiver; also one tube WE regenerative receiver, both in working order with all tubes (215A types) WANT test equip. or ham receiver. George S. Maxey, 174 Taurus Ave., Oakland 11, Calif.

WANTED — Automatic record changing, record player unit. Prefer Garrard or Capehart. State full details and price. Dexter Kurs, 4525 45th St., Long Island City 4, N. Y.

WANTED—Colt .22 cal. Woodsman automatic pistol. Also Rider's Manuals 5 to 13 incl. State condition and price. G. T. Iler, P. O. Box 71, Fanwood, N. J.

WANTED—Late model portable tube tester of good standard make and condition and have neon short test. State price and description. Big Sandy Maytag Co., Pikeville, Ky.

WANTED—Rider's Manuals, vol VI and all later issues. Cash or radio merchandise in exchange. E. D. Cook, Radio Dept., 1071 Union Ave., Memphis, Tenn.

FOR SALE—Portable Diathermy mach., "Eleo" & Violet ray; Port. Health mach. for Sinusoidal and Faradic and Violet ray treatments; 2 Brunswick 9 tube Supers with or without sprrs; 4 Kolster radios, mod. K20; 1 Temple chassis and power pk. good job. Louis A Goldstone, 1279 Sheridan Ave, Bronx, New York 56.

FOR SALE—Ultra-High Frequency Techniques, by Brainerd, Kohler, Reich and Woodruff, \$4. Frequency Modulation by John Rider, \$1. General Radio Service, 1203 Eckart St., Fort Wayne 5, Ind.

FOR SALE—Complete N.R.I. Course incl. advanced course. \$15. Arthur Kruger, 1316 Morgan Ave., North, Minneapolis, 11, Minn.

WANTED—For Cash—Good used televison receiver. Also 8mm. movie camera and projector. Give details. Michael A. Petko, 4322 Wayne Ave., Philadelphia 40, Pa.

SELL OR SWAP—Model Craftsman, Radio, Popular Photography, Minicam magazines, radio parts, miscellaneous photographic accessories, lenses. **WANTED**—Model Engineer and Electrician magazines, Hornet Engine, Kodaslide projector. Write your wants; all letters answered. Fred J. Gomm, 46 N. W. 94 St., Miami, 38, Florida.

FOR SALE—G M Delco auto radio and speaker, \$15. Remington p.a. rifle \$20. vice and parts data factory manuals. Also Arvin factory parts and service manuals. Paul Capito, 637 W. 21 St., Erie, Pa.

FOR SALE—Supreme No. 85 tube checker with adapters, \$20. — **WANTED**—Rider's Manuals from 6 to 13, and radio tubes. Castle Hill Radio, 2228 Newbold Ave., Bronx New York, 61.

WANTED—Large scale set analyzer. Give full particulars. Will pay cash or trade for meters. Also want Riders Manuals. Sam Berenblum, Greenwich, Conn.

WANTED—Good signal generator. Give full particulars. Will pay cash or trade for meters. Sam Berenblum, Greenwich, Conn.

TRADE—35mm Univex "Mercury" 3.5 lens 1-1000 Sec. for reflex type with similar lens, test equipment, Rider Manuals or make offer. W. J. Closson, 295 8th St., Troy, N. Y.

SELL OR TRADE—Burton Rogers model 21 tube tester; Vacuum tube volt meter with Q-I MA meter; Dayrad all wave signal generator. WANT 100-1000 kc Crystal for frequency standard or complete unit. W. S. Crooks, Box 94, Kent, Ohio.

FOR SALE OR EXCHANGE—Test Instruments, tubes, supplies. John Trowbridge, 7936 Parnell, Chicago, 20, Ill.

WANTED—Maytags or other makes washing machines; state price and condition. Have Stewart Warner receiver and cash. J. W. Akers, Box 96, Stone, Ky.

FOR SALE OR TRADE—Supreme 5 in. fan meter from tube tester. Ol ma. **WANTED** .303 Savage rifle in good cond., Roberts Radio Service, Wheeler, Mich.

WANTED—Analyzer, volt ohm milliammeter oscillator, tube tester. New and standard models. Send particulars. R. H. Paul, Electrician, Southern University, Scotlandville, La.

WANTED — Hallicrafters S27 FM-AM receiver or S31 tuner. Also two each high fidelity magnetic phono pickups RCA 70A or WE 9A. A. C. Brooks, 70 Gibbs Ave., Newport, R. I.

FOR SALE—Superior 1240 tube tester, Superior 1230 generator, Green Flyer phono motor and turn table, 1500v sign. transformer, tubes etc. Send for list or make offer. R. E. Rice, Fairchild, Wis.

WANTED—Superior tester model 1280 or a Triplett tester model 1604. Will pay cash. State condition and price. Louis Mackay, R.F.D. 1, Box 19, Perth Amboy, N. J.

WANTED—Mallory or other make vibrator tester. Combination tester and tube checker. Also C-D or Solar condenser tester. Will pay your price. The Radio Shop, Galt, Calif.

WANTED—Tripod, good exposure meter and small radios. Will trade for tubes, filters or cash. Gerald Samkolsky, 527 Bedford Ave., Brooklyn, N. Y.

FOR SALE OR TRADE—3" Oscillograph, type 164, made by Dumont, and test oscillator No. 153 made by RCA. WANT signal tracer, Rider's Chanalyst, Hickok or Jackson. Olympic Radio & Refrigeration Service, 108 W Marcy Ave., Montecano, Wash.

FOR SALE—Code practice osc., 8" AC fan, 6v genemotor, AC-DC phono amplifier with tubes and speaker, 2 amp charger, 200 pieces mica conds. Philmore crystal set, elect. clock, tubes 2B7, 224, 238, 57, 56, \$40. takes all Stanley J. Zuchora, 2748 Meade St., Detroit 12, Mich.

WANTED—Signal generator, V-O-M small battery charger. **FOR SALE** — Correspondence Radio Course, 1941 Diag Manual by Radcraft, all A-1. Royce Saxton's Radio Shop, R 1, Pontiac, Ill.

WANTED — Recorder and play back unit with two speed motor; also Ol ma. or O200 mma. meter. I Dowbin, 3211 N. 17 St., Philadelphia, 40, Pa.

WANTED—For cash, sm. VOM, 1" oscilloscope, sm. radios. State price and condition. H. Samkolsky, 527 Bedford Ave., Brooklyn, N. Y.

WANTED—Any quantity—must be perfect and boxed—1A7GT, 7A8, 7B7, 5Y3, 5Y4, 5U4, 12SA7, 12SK7, 12SQ7, 12A8, 12K7, 35A5, 35Z3, 35Z4, 35Z5, 25L6, 35L6, 50L6, 43, 47, 50Y6, 50Z7, 45Z5, all 117v series. Give full particulars first letter. Leading Radio, 114 East 3 St., Mt. Vernon, N. Y.

FOR SALE—Hallcrafters Skyriders Commercial 11 tubes, 5 bands, 110Kc to 11,500 Kc. in metal cabinet for table or rack mounting. 6" speaker with metal cabinet to match. Complete and perfect with tubes, \$105., Harry M. Boone, Radio WFBR, 10 E. North Ave., Baltimore, Md.

FOR SALE—2 metal cabinets for transceivers. H15 1/2" W8" D6" back plates but no panels—1 metal stand for meter (3" hole) D4 3/4" W4 1/2" back height 4 1/2" front height 2 1/2"—3 Ceramic ribbed coil forms, 2 Jewell and 2 Weston meters. John Archibald, 1722 Melville St., Bronx, N. Y.

WANTED—Garrard RC30 record changer or GI C125L. Also other makes. State age, condition and price. Leonard C. Pochap, 2930 Upton St., N. W., Washington 8, D. C.

WILL BUY—Used crystals, 20c ea., any quantity—must be intact and not opened. Cash by return mail, Leading Radio Service, 114 East 3 St., Mt. Vernon, N. Y.

FOR SALE — Used harmonicas; Hohner Chromonica and tenor School Band, both "C"; Minevitch Chromatic, "G"; Vega Little Wonder tenor banjo with case. C. L. Goebel, 221 W 233 St., N.Y. 63, N. Y.

FOR SALE—New Radio Tubes at 30% off list. 2A6; 4S; 6A4/LA; 6A6; 6B7; 6SH7GT; 7V7; 12A; 37; 59; 2A3H. Ralph Hunter, 12 North St., Catskill, N. Y.

WILL TRADE—Philco model 088 battery operated signal generator and a Superior signal generator AC model GNT, for any three Rider Manuals except 1 and 2. Roy H. Bender, 260 S. 5th St., Columbia, Pa.

WANTED—Superior tube tester mod. 1240 or late Supreme tube tester & ohmmeter comb. SELL OR TRADE N.R.I. Radio Snd & Tvsns Course. Also small mica capacitors, odd coils for R.F. exps., coupling transformers—Desire tubes—what have you? Pesarchic's Electronic Serv., 123 McCormoughy St., Johnstown, Pa.

FOR SALE OR TRADE—Weston mod. 772, supersensitive analyzer and Triplett mod. 1200A, volt ohm milliammeter for good med. sized camera or lenses or R.F. oscillator. E. O. Mueller, 3445 Narragansett Ave., Chicago 34, Ill.

WANTED — For cash—Hallcrafters S-20R Sky Champion or S19R Sky Buddy communications receiver. Must be in A1 condition. A. R. Green, 3921 Hampshire Blvd., Fort Worth, Texas.

WANTED—Rider's Manuals 6 to 13. Will accept single copy or set. Also other service material. State price and condition. George Pidherny, 3415 31 Ave., Astoria 3, New York.

FOR SALE—Vol. 1 to 7 incl. Riders Manuals, good condition, complete with index; Burton signal generator model 11, battery operated, range 100 kc to 70 mc. Make offer. C. F. McCracken, Hughes Park, Bridgeport, Pa.

WANTED—Late model signal generator. State lowest price and full particulars. Columbia Radio & Electrical Service, 71 East 183rd St., Bronx 53, N. Y. C., N. Y.

FOR SALE—Power transformers; UTC S40; Kenyon K59 with 220v pri; Scott, in chromium shielded case. New amperite Kontak mike, SKH-H. Imp. with shielded lead. Also tubes, audio transformers, chokes and misc. parts. C. L. Goebel, 221 W 233 St., N. Y. 63, N. Y.

WANTED—RCA television signal generator, RCA or Dumont 3 or 5" oscilloscope, Hickok or Rider signal chaser, RCA, GE or Dumont television receiver, Riders Vol. X. State condition and price. Will trade Philco 45-2926 Dipole antenna kits and 45-2928 reflector kits. Richard G. Devaney, 216 South 60th St., Philadelphia 39, Pa.

WANTED—15 to 100W amplifiers, turn tables, microphone stands, pickups and intercommunication units. Fox Radio Service, 435 So. 5th St., Richmond, Ind.

TRADE—0-1 milliammeter, Rider Manuals, test equip., tubes, radio equip., etc. WANT K&E Engineer's slide rule or equal, LC checker, Jr. v-ohmmeter, old watches and jewelry. Robert G. Browning, 552 Eleventh Ave., Prospect Park, Pa.

WANTED—Wireless phono oscillator, 1, 2 or 3 tube, in working order. Also 35 mm. candid camera or 127 size for cash. Have sound picture supplies; projectors, lamp houses, generators, rectifiers, sound heads. John Arnold, P. O. Box 84 Bluffs, Ill.

FOR SALE—Readrite tube tester model 430 and Ranger Examiner Signal generator model 557 with new batteries. Any reasonable offer accepted. The Modern Home appliances, 4A Mechanic St., Webster, Mass.

WANTED—6v genemotor 275 or 300v at 80 or .30 ma or 6v vibrator power supply 300v at 100 ma. Single button carbon microphone; small portable volt-ohm meter. L. S. Coleman, 428 Delaware St., Syracuse 4, N. Y.

FOR SALE—Complete tube stock; Input, output & power transformers; crystal cartridges; wire wound and carbon resistors; also condensers. Send stamped, self-addressed envelope for complete lists. Electronic Co., Hudson, Wis.

WANTED—Home recording set with playback in good condition. Reasonable. Lt. Leonard L. Stone, Army Office, Republic Aviation Corp, Farmingdale, L. I., New York.

BURNED OUT TUBES REPAIRED—From 2½ to 70v. Work guaranteed. Price 40c each. Returned C.O.D. W. H. Norman, 112 Douglas Ave., Rockwood, Tenn.

FOR SALE—64 Utah Z612 transformers at \$2.49 net; 55 Utah E6P speakers at \$3.15 net F.O.B. Springfield, Mass. Ralph D. Jones, Inc., 721 Worthington St., Springfield, (5) Mass.

WANTED — Following Victor Records: "Three Shades of Blue"; "Doll Dance"; "Blue Heaven"; "Nola"; "Smoke Gets In Your Eyes"; "Broadway Melody"; also 16 mid 450, 475v Electro-lytic condensers. Frank W. Jones, Gabbs, Nev.

FOR SALE—Used radio parts for building sets. Send stamp for list and price. Richard Wolf, Box 49, Route 2, Wishek, North Dakota

WANTED — Complete instructions for Weston tube checker model 674, either original or photostat. Will pay \$2.00 James O. Trauger, 18 Penna. Ave., Brookline, Upper Darby, Pa.

SELL OR TRADE — Bicycle brakes and brake parts. Can use radio tech. books, manuals, parts or test sets. W. J. Closson, 295 8th St., Troy, N. Y.

FOR SALE—Zenith Pocket radio with tubes \$10. Dictograph earphones 3000 ohm \$1.75. JFD. radio battery adapter harness for Philco BO Paks, \$1. RCA Electronic Control model 41903, \$6.75. A.K. 12" 32v speaker, \$1.50. A.K. "B" Eliminator with 607 rectifier tube, \$2. Purmak 6v fencer, accessories, display rack, \$15. Edwin T. Larason, Box 46, Martinsburg, O.

FOR SALE—Service magazine—Feb. 1932 to Mar. 1942, incl.—122 copies. \$5. takes lot. Ira I. Walker, 1612 Cent Ave., Great Falls, Mont.

SELL OR SWAP—Control units for most cars and sets: Univex 8mm. movie camera, orig. pkg.—WANT—phono motors, crystal pickup, tubes or cash—what have you? Leo Stein, 7 Monroe St., Mt. Vernon, N. Y.

FOR SALE — Clough Brengle OC signal generator, re-aligned with chart—factory pack. and bill. \$50. cash. Supreme Mod. 89. excel. work. cond., with chart and extra tube testing charts. \$30. Precision Radio Service, 40-13 Union St., Flushing, N. Y.

WANTED—Meissner FM chassis, Solar CB analyzer, Carron AF oscillator, RCP signal generator, Superior channel-analyzer. Equivalents considered. State price. Soundways, 560 Walnut St., Fall River, Mass.

FOR SALE—One 5AP4 5 in. White C.R. Television tube, unused, orig. carton; 1 Philco signal generator, good condition. **WANTED**—All types high-grade laboratory equipment in any condition. Charles C. Littell, Jr., 308 W. High St., Piqua, Ohio.

WANTED—Capacitor Analyzer, also 776 Weston A C Oscillator, 504 Supreme tube and St. tester. Must be in first class condition and lowest cash price. Rudolph's Electric Service, 33-35 E. Jackson St., Wilkesbarre, Pa.

FOR SALE OR TRADE—1/10 hp Emerson synchronous motor, 110v single phase, 900 rpm, non-self-starting, reversible, with 1" dia. hollow outside threaded shaft. Dexter Kurs, 4525 45th St., Long Island City 4, N. Y.

FOR SALE—4 filter condensers 2,000 working voltage 2 mmfd. new, condition guaranteed, price \$1.25 each or will swap for pair of 75Ts or pair of neutralizing condensers NC-75 National or N-15 Hammarlund; will pay cash difference. Geo. E. Christophers, 194 Lemuel St., Fall River, Mass.

FOR SALE—Meters—Weston DC 7v; Splitdorf DC 20v; Jewell MA 100v; Jewell OHMS in series with 4.5v, 5000OHMS 15000 OHMS; Weston DC 5v others. Arlington Radio Service, 158 Jamaica Ave., Brooklyn, N. Y.

URGENTLY NEEDED — Complete set or part set Rider's Manuals; new, used or in any condition as long as no pages missing. Buford Brown, Box 190, Trion, Ga.

WANTED—Precision EV-10 V.T.V.M.; 3" oscilloscope; Precision 920 tube & set tester. Must be new or in new condition. State price. Vita' Radio Service, 209 Linden St., Camden, N. J.

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