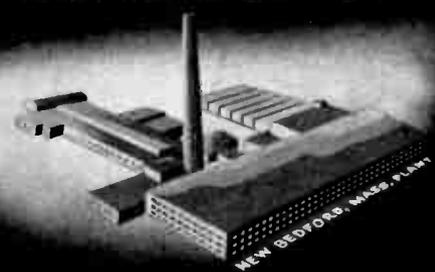


*The* CORNELL-DUBILIER  
**CD**  
 Capacitor



Vol. 8

APRIL, 1943

No. 4

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

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# RADIO SERVICE HINTS

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

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

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 Unpublished items will not be returned.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

### Zenith '41 and '42 Portables

Among several of these sets the writer has serviced, a set was found completely inoperative even though the tubes and speaker checked O.K. The various possible sources of trouble were checked carefully and it was disclosed to be an intershorted condition in the battery.

In order to determine this cause of trouble remove the battery plug while the set is plugged into the a.c. line, and if the set operates it will naturally be from this source. A new battery will therefore be necessary to replace the defective one. — *G. D. Griffin, Ithaca, N. Y.*

### G. E. Models LF-115 F.M.-A.M. Sets

When set becomes inoperative yet phono plays, check for a shorted condenser, C-32, .02 mfd. 400 volts, from plate supply to cathode of 6SG7 converter. This capacitor has been found to fail in several sets serviced by the writer. C-31, a .02 mfd. 400 volts, also breaks down occasionally and should be replaced with new capacitors of higher voltage rating.—*Stanley Luffy, Verona, Pa.*

### Pilot in Plate Lead of 35Z4

In sets using a 35Z5 it may be found difficult to obtain this type tube in the event it may be necessary to be replaced. However while 35Z4 can be substituted, the pilot light may not light.

By connecting the pilot light in series with the plate lead of the rectifier the supply will be ample to light the lamp yet not affect the proper operation of the set.—*E. N. Christner, Middletown, Ohio.*

### Poor Ground at Octal Tube Sockets

Many types of midgets as well as larger sets employing octal tubes are equipped with octal tube sockets which are mounted with a metal rim provided with a solder lug for ground connection to the chassis. When trouble develops in these sets it is always well to check at this source for a poor ground connection as the rings frequently become loose or corroded thus causing poor contact with the chassis. A piece of wire soldered to the ring and chassis will of course correct this trouble.—*N. T. Payne, Bessemer City, N. C.*



# U. S. SIGNAL CORPS NEEDS ENGINEERS

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

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

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

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

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

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

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



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

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

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

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

**WANTED** — Communication receiver, late model. Factory built. Will pay cash. Lowell Ecker, Sedan, Kan.

**SELL OR SWAP** — R.M.E. DB 20 National S.W. 3 complete. Four sets of B.S. coils, Wilcox Gay phone osc. Want Western 772 663 664 or Hickok OSC 12 or equivalent instruments for cash. Wm. Quigley, 102 Avenue S, Brooklyn, N. Y.

**WANTED** — Precision Radio and Audio frequency measurement equipment, Hi Fidelity tuners and auxiliary equipment. M. Chapman, 3410 Ullman Street, San Diego, Calif.

**WANTED** — Books by or about Nikola Tesla. State price, condition, and publisher. O. A. Riddell, 1332 Hood Ave., Chicago, Ill.

**SALE OR SWAP** — National S.W.3 Short Wave Receiver, 4 sets of National coils, Rex Hawaiian guitar, B supply and 2 1/2 and 1 1/2 A supply eliminator, 8 tube Bosch 2 volt table model radio (new). Want mobile 5 or 10 meter receiver for cash or trade. Also need code machine. V. Howerdel, 102 Hancock Ave., Jersey City, N. J.

**WANTED** — Volumes 5 and 7 or later editions of Gernsback's Official Radio Service Manuals. Want all the pages. Also need manuals for 1937-1942. Don't want single make of radio type manuals. Oscars Radio Service, Merrill, Iowa.

**FOR SALE** — Riders Manuals 1 to 11 complete \$50. George Musil, 431 Mansion Ave., Audubon, N. J.

**WANTED** — RCA Voltomist Jr. Must be in good condition. Will pay cash. National Sound Equipment Co., 625 Main St., Worcester, Mass.

**SELL** — 25 books from the NRI Radio course, also public address system book. Best cash offer takes them. Fred Zieber, 565 Douglass St., Reading, Pa.

**WANTED** — Tube checker in good condition, VOM's, condenser checker, etc. Send particulars and prices to B. Paine, 1186 Lexington Ave., New York City.

**EXCHANGE** — Fiction and non-fiction books including books on radio and electricity. Send your list for mine. Fred Wittich, 7202 Juniper Valley Road, Middle Village, N. Y.

**FOR SALE OR TRADE**—Golf clubs, banjo, portable typewriter, and stamp collection. Earl W. Hall, 1427 1/2 Quarrier St., Charleston, W. Va.

**WANTED** — Closed circuit jacks, prefer midget types, battery chargers, resistors. Also any type of General Radio Co. equipment. Will pay cash. Richmond Radio Club, Robt. N. Eubank, 1227 Windsor Ave., Richmond, Va.

**SALE OR TRADE** — Western Electric 2HP 230 v. D.C. motor, Motorola Golden-Voice Car radio, new car heater, Webster power amplifier, new Watermatic washing machine, and piano accordion. Want analyzers, test equipment, manuals, books. Also short wave receiver. Glenn Watt, Chanute, Kan.

**WANTED** — Ammeter, voltmeter, ohmmeter, and other service equipment. Will pay cash for good instruments. Carl Schradieck, 65 Hazard Ave., Providence, R. I.

**FOR SALE** — Superior channel analyzer. Also would like to buy good output meter or multimeter. G. E. Tripp, Rock Valley, Iowa.

**WANTED** — New or used Hickok tube and set tester Model 510X. Also new or used power transformer. State condition and price. John M. Sulak, 422 1/2 N. Klein St., Springfield, Ill.

**WILL TRADE** — Rider's Manual No. 2, Rider's Manual for 1931 (804 pages) for test equipment. Also have Western Tube Checker, model 682, back issues QST (1920-35), and tubes and parts. Edwin Belcher, 56 Putnam St., Somerville, Mass.

**TRADE** — Triplett vibrator tester No. 1672, (brand new); C-B 79-B audio oscillator, Riders 4, 5, and 6. Need good condenser tester (Solar C E preferred), frequency standard and V.T. V.O.M. Will pay any cash difference. The Radio hospital, Oklahoma City, Okla.

**TRADE** — Moaernized Simpson model 222 tube tester in portable case for good 3" oscilloscope. L. R. Battersby, 206 Branch Ave., Red Bank, N. J.

**WANTED** — Small battery charger for one or more batteries. State make, price, and condition. Wm. Schmidt, Batesville, Ind.

**SALE OR SWAP** — Radio technical books and magazines, 1/2 HP Briggs Stratton gas engine, stripped Dodge G.A. generator intended for 750 watt a.c. generator. Want books on winding and motor repairing; also saw filing machine. William E. Barrett, 2828 South 9th St., Sheboygan, Wis.

**SALE OR TRADE** — Set steel-shaft golf clubs 2, 5, 6, 7, 8 Hagen irons, 3 matched woods and bag, electric soldering iron, exposure meter, enlarging easel, darkroom light, camera and 7 watches. Want enlarging timers, Hornet gas engine, Anniversary speed graphic, and enlarger. Fred J. Gomme, 46 NW 94 St., Miami Shores, Fla.

**SELL OR TRADE** — Send for list of new and used radio parts. Want Chanalyst or similar signal tracer vacuum voltmeter, 0.1 mil meter of good make. Grey's Radio and Sound Systems, Inc., Bridgewater, Conn.

**FOR SALE** — Riders Manuals 1 to 4 incl. almost new. \$15 for the lot. Ira I. Walker, 1612 Central Ave., Great Falls, Mont.

**WANTED**—Until new tubes are available, I will buy or trade, good second-hand radio tubes of the critical types, such as 1A7, 35Z5, 80, etc. Send me your list and price. Roxy Radio Repair, Mitchell, S. Dak.

**BUY and SELL**—Foreign tubes such as: Valvo, Telefunken, Philips, Tungram, etc. Aladdin Camera & Radio, 4 East 32nd St., New York City.

**FOR SALE** — G.E. A205 radio chassis \$60. Also several G.E. \$55 dynamic speakers \$18 each (new). Will consider test equipment in trade. Scott Radio Service, 163 Hanover St., Bridgeport, Conn.

**FOR SALE** — Two Supreme instruments, one model 333 set analyzer and one model 35 tube checker with adapters for all tubes. Both in good condition. \$25 for both. Beale Radio and Elec., 336 North Chelsea, Kansas City, Mo.

**SALE OR TRADE** — Radio parts. Let me know your needs, enclosing stamp. Send list of tubes or parts you have for sale or trade. E. E. Youngkin, 602 E. Grant Ave., Altoona, Pa.

**FOR SALE OR TRADE** — 10 tube Scott F.M. tuner, cost \$119, sell \$80; New Scott 15" speaker, cost \$39, sell \$25; other speakers at \$2 each; Universal input pre-amplifier \$5; Shure crystal mike and cable \$3; radio magazines, etc. Want Clough-Brengle, Hickok, or RCA signalist oscillator. Henry Bal, 20 South 13th St., Newark, N. J.

**WANTED** — Oscilloscope 2 or 3 inch, tubes, cathode-ray tubes, parts, and all kinds of testing equipment for cash. Please give full details. Scott Radio Service, 163 Hanover St., Bridgeport, Conn.

**WANTED** — Junior or Senior voltohmyst, also late model tube checker, preferably Precision, will pay original price for these in first class condition. Southern Radio Service, 342 West Jackson St., Thomasville, Georgia.

**WANTED**—All types of Weston meters, any size, new or used in any quantity, d.c. or a.c. meters, will pay cash. Write before sending meters, a description and price. M. Mogavero, 17 Bloomfield Ave., Newark, N. J.

**WILL SELL** RCA communications receiver 7 tubes, for \$40.00. Interested in B.C. tubes, v.o.m., signal generator and 200 microampere meter. Arnold T. Halpen, 119 Tudor Pl., Bronx, New York, N. Y.

**WANTED** — Portable a.c. ammeter 0-50 amperes or more. Must be in good condition. Will pay cash. George H. Woker, 305 N. Washington St., Nashville, Illinois.

**SELL**—Jewel d.c. milliammeters; Jewel a.c. voltmeters; W.E. double button carbon microphone; American double button microphone. W9BRY, M. H. Nelson, 301 Oak Knolls Ave., Rockford, Ill.

**FOR SALE**—Two type 47409 G.E. mercury arc rectifier tubes. One used 150 hours \$7.50, one never removed from case \$15.00. Grant W. Crotto, Box 511, Brandon, Vt.

(Continued on page 12)

# PRACTICAL U. H. F. OSCILLATORS\*

## A Revealing Study of U. H. F. Oscillator Performance When Changes Are Made in LC Ratio

Most experimenters make a practice of accumulating old parts and salvaged items from receivers and other apparatus that they have constructed. Even old broadcast sets are filled with parts that may be used for the construction of high-frequency equipment providing alterations are made, and further, that the insulation is adequate for the frequencies to be employed. This article will show how to construct highly efficient oscillators covering from 70 to 100 megacycles on fundamentals and possessing a stable linear output over the entire range. We will discuss just such an oscillator in this article together with a general review of several other types used in recent years, in order to more fully explain the advantages of the R-K Oscillator.

First, let us review the U.H.F. oscillator field and bring our knowledge up to date. Without exception most attacks on the oscillator field in the last seven years have followed a general fixed pattern of three types, the first being the "Negative Grid Oscillators." The minimum capacities were considered fixed by the tube's construction. The inductance (L) was decreased to increase the frequency. Let us express the critical value at which the tube will resonate as  $(\omega t)$ . One observes that the (t) or transient time is the limiting factor to the apparent conductance of the tube as an oscillator, and the conductance of the tube goes up in proportion to the square of the frequency (F). Then note, that  $F^2 = Gm$  at high frequencies. When practical limits were reached, smaller tubes were designed such as the acorn tubes. U.H.F. oscillators with fair outputs were designed up to

150 megacycles. Note, however, that the engineer or experimenter had to be very careful of mechanical layout and the characteristics of the tubes to get oscillators working smoothly even at 70 megacycles.

The illustration (Fig. 1) shows a typical negative-grid oscillator, which no doubt the engineers and the experimenters are familiar with, since it is a rather old circuit.

The second big step in oscillator work began with the trend towards transmission line networks and "coaxial" tuners. Transmission lines have

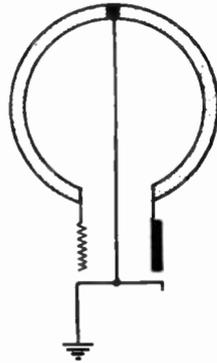


Fig. 1. Typical negative-grid osc.

worked out very well indeed and are very popular, although many newer and more efficient types of oscillators have been designed on which there is little quantitative data. For general reference on the newer fields, this writer recommends the latest book by

\* By Robert Ricketts in "Radio News."

the D. Van Nostrand and Company on U.H.F. Technique. The effective Q of a transmission line circuit is very high, the illustration (Fig. 2) showing how one could analyze such a circuit. Theoretically, it is viewed as a parallel resonant circuit. A condenser is shown as a shorting bar, since it will serve to isolate the d.c. current, but at high frequencies act as a short for the a.c.

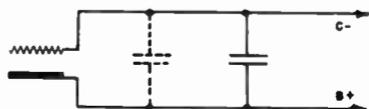


Fig. 2. Typical transmission line type osc.

component of the current. The dotted lines to the condenser near the tube terminals indicate the capacity of the parallel feeders, as well as the internal capacities of the tube.

Coaxial tuners present more of a problem to construct, and operate somewhat like the transmission line circuits described above, with one interesting difference. If we use a coaxial grid-plate tuner and coaxial filament lines, the impedance of the filament lines may load up the oscillator circuit to such an extent that they actually may have more to do with determining the oscillator frequency than the grid plate coaxial tuners.

In summary, let us say that the previously mentioned oscillators are very nice, but for frequencies up to 150 megacycles, such as for receivers, the above mentioned types of oscillators, whichever one we choose, will present difficulties in electrical and particularly in mechanical construction. The large amount of space needed for such an oscillator as the coaxial tuner, also makes this type of oscillator undesirable.

Previous to the war, much progress had been made by several private laboratories, and television companies in U.H.F. design, but it also followed stereotyped lines. One method used

by hams and some manufacturers was to use the medium frequency crystal oscillator and double or triple up to the desired frequency in a superhet receiver. It was a very good engineer indeed who could get a stable superhet receiver to work with doublers or triplers with a minimum of image reception and maximum sensitivity. This type of receiver also covered only a very narrow band without using band switching. The other oscillators used were chiefly acorn tube oscillators of various kinds. Using an acorn tube had its disadvantages, since as previously mentioned in paragraph two, the mechanical spacing of the elements (Gm) more or less determines the range of frequencies the tube would oscillate over.

This meant that much experimentation went into the manufacture of each television or high frequency receiver. On some commercial receivers, it was noted that the 75 megacycle calibration drifted 5 megacycles or more overnight, indeed it was very rare that any commercial receiver was calibrated correctly above its 30 mega-

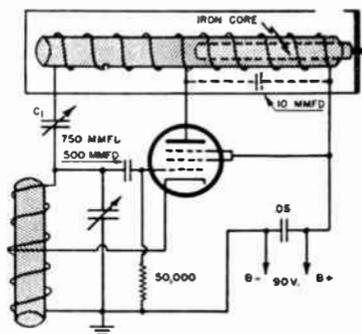


Fig. 3. Diagram of 4-16 m. oscillator.

cycle range. Doubling or tripling means extra tubes and circuits, while the acorn type of tubes meant extra space and careful mechanical construction in addition to the disadvantages previously mentioned.

The writer maintains that a fundamental premise has been either overlooked or disregarded in designing oscillators, for frequencies up to 150 megacycles anyway. Let us refer back to paragraph two of this article . . . "assuming that (t) of  $\omega t$  (t) being transient time, is the limiting factor of the apparent conductance of the tube, then the apparent conductance of the tube goes up in proportion to the square of the frequency (F), and  $F^2=Gm$ ." What happens then when you use a tube as an oscillator with a high Gm, and how high can one get such a tube to oscillate?

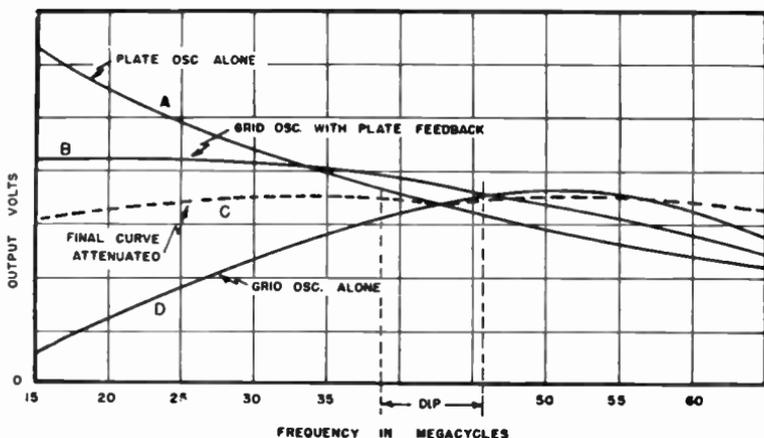
There are a half dozen commercial tubes that work very well as U.H.F. oscillators, among them were tried, 6SJ7, 6L7, 6K7, and others. In recent experiments with the circuit as shown in Fig. 3, curves were plotted up to 70 megacycles on fundamentals with a 4:1 tuning ratio under several conditions. The graph will be referred to later in this article. The tubes worked well, and the outputs were about the same. The ease in working with them would place their usefulness in the order that they are listed above. The 6SJ7 was the tube chosen to make the final tests.

### Construction of the R-K Oscillator

The oscillator can be constructed with the following components, plus one of the tubes mentioned, some No. 18 enameled wire, a tuning condenser from a broadcast receiver, a 50,000 ohm grid leak, .0005 fixed condenser, midget condenser for the feedback condenser (can use a broadcast condenser here by trimming the plates) and if desired, a 10 $\mu$ fd. padder condenser, .05 by-pass condenser and a power supply. Fig. No. 3 illustrates the wiring diagram. The small padder is used to tune up the low end of the band.

(a) The grid coil is wound with three turns of wire about  $\frac{1}{4}$ " in diameter. It is center-tapped. The tap on this coil is critical and experimenting must be done to show what portion of the center turn is tapped, particularly on the first of these oscillators you build. Keep the leads to the tube very short, if possible solder directly to the tube socket.

(b) The plate tank coil is surprisingly found to have from 30 to 50 turns (40 turns used on last oscillator of No. 18 enameled wire) depending on the frequencies you wish to cover. This coil



Operational data for the performance of the U.H.F. Oscillator.

is center tapped also, but the tap is not so critical as on the grid coil. If a padder is used (10 $\mu$ mf) for the low end of the band, you can pick out the approximate center. Iron cores can be used to tune the bottom half of the tank coil providing a large amount of a.c. is not desired from the oscillator. Note also that the iron core will act as an attenuator as it is moved into the coil.

### Operation

Note that due to the peculiar characteristics of this oscillator, very little capacity is added to the grid circuit by the coupling condenser (C1) or the distributed capacity and padder in the tank circuit. Tests made showed that this added capacity even at the higher frequencies can be neglected since it is so very small. Refer to the graph accompanying this article and you will note results of several conditions recorded approximately. The plate feedback can be entirely disconnected and you will find that the tube is still oscillating. This is possible, due to the shielding effect of the screen on the plate, and explains how we get, in effect, the sum of two conditions in which we can assume that the plate circuit and the grid circuit are oscillating separately but adding up to give us our high a.c. output. The output is so high in fact that we can use attenuating devices to level off our output and give us a flat power output curve over the entire tuning range.

Referring again to the graph, we have several conditions illustrated as to the operation of this oscillator. Curve A shows the output over the band with just the plate oscillation condition. Curve B shows the effect of the combined grid oscillation, and the plate feedback. Curve D shows grid oscillation alone, without plate feedback, while Curve C shows the effect of some attenuation, nearly approaching the linear power output we desire over the band. Note the dip still showing in the center; with a little more attenuation, we would eliminate this condition and get a perfectly flat curve. Limiting circuits were

tried to aid in getting the proper attenuation, but at these frequencies the limiting circuits with conventional tubes seem to have very little effect.

The screen grid acts as an effective shield, as mentioned previously, and must be hooked up as illustrated in Fig. 3. No R.F. chokes are to be used under any conditions in the filament or power leads, since at these frequencies the distributed capacity together with the inductance of such a choke would combine to give a parallel tuned circuit which would change the characteristics of the oscillator and possibly stop it from oscillating. Note remarks of this effect under discussion of coaxial tuner in "Ultra-High-Frequency Techniques" by the D. Van Nostrand Co.

### Oscillator Calibration

Experimentally, this oscillator was first constructed on a breadboard, so that the component parts were readily available to change and experiment with. To check the frequencies at which this oscillator works, an F.M. tuner was first used, then with the F.M. tuner and harmonics from a strong local station, a wavemeter was constructed and calibrated. Some difficulties were encountered in the first breadboard construction which should be pointed out since they probably will appear regardless of the mechanical construction used. The first of these was the appearance of harmonics above and below the fundamentals that were very strong. The second was the appearance of spurious frequencies that were not multiples of the fundamental frequencies. This latter condition was quickly traced to poor dressing of power and filament leads. These should be dressed away from the grid circuit and the filament leads should be twisted neatly to get the proper "bucking" action.

The harmonics and spurious oscillation conditions can be checked very easily. Disconnect the bias condenser from the tube and the plate feedback lead. Tune over the band with your wavemeter and look for apparent

strong peaks. If any are noted, this indicates that you still have strong oscillation nodes or points that do not belong there. Check your mechanical construction and observe the previously mentioned conditions for power and filament leads. A common ground point should be used . . . a piece of copper makes an excellent ground medium.

After you are generally satisfied with the output of the oscillator, check the output and you may find several miniature peaks with the dip in the

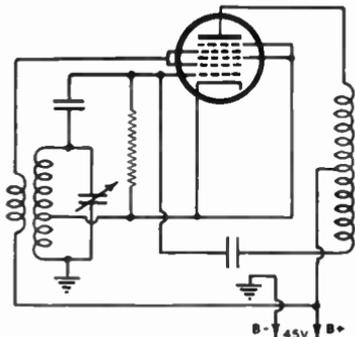


Fig. 4.

middle of the band. The question of attenuation to get a flat power output curve has been discussed previously. You will find that by using a heavy duty carbon resistor you can attenuate the output to get this flat curve. After finding the proper value of resistor, the carbon can be replaced with a good non-inductive resistor or if resistance wire is available you can wind your own.

### History of the Circuit

This circuit was first used experimentally by Bernard Berger of New York City, a young radio engineer in 1936. He had excellent success with the first version of it on an all wave receiver design and is now working with this writer on a laboratory test oscillator for experimental use after the war.

The latest work done with this oscillator has shown it to work well up into the 100 megacycle range. Since it is difficult to get equipment to accurately check the output above 60 megacycles at the present time, our test has been with a wavemeter with which we are approximately checking the higher frequencies. We do not yet have the quantitative or qualitative data available up to 150 megacycles but the ease with which it oscillates above 70 megacycles and its constant output at these frequencies leads us to believe that it will work well into the 150 megacycle band. We hope to have more information at a later date. Remember that we are using a very large value of C in the grid circuit and large values of L in the plate circuit.

### Receivers with the R-K Oscillator

The last five years have found airport traffic control receivers swinging towards U.H.F. ranges. Several types of receivers for different channels usually are used covering fixed bands. Obviously a stable trouble free receiver could be designed for such operation. Investigation would reveal that trick oscillator circuits or crystal oscillators with doubling or tripling stages have both been used.

We suggest the use of the R-K type of oscillator to avoid extra tubes and circuits. We could change the L & C combinations somewhat and make a compact oscillator section about 2" square using coaxial tuning condensers. We could impregnate the whole oscillator section in wax or pitch to make it moisture proof and keep the circuits' constants from changing, leaving the tube socket and tube free from the wax so that the tube can be replaced. The adjusting screws from the coaxial condensers would protrude from the front or rear making them available for readjustment. Note that this unit would be using commercial tubes which would always be available and cheap to replace. Remember also that all the additional circuit elements we eliminate, the less are our maintenance problems.

If portable equipment is desired, the circuit, Fig. 4, works very well on very low plate potentials such as 45 volts, but is more difficult to construct.

### Transmitters

The circuit, Fig. 3, or the modified version of it in Fig. 4 will work very well with low power transmitters. If

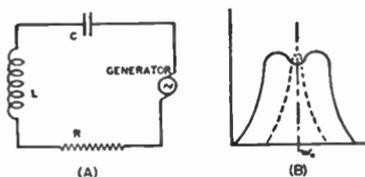


Fig. 5.

tubes with a high enough Gm can be had medium power transmitters should also work well.

Circuit, Fig. 3, is ideal for use with variable frequency receivers and low power transmitters. The two main advantages besides its simplicity and ease of operation are rather obvious:

a. It uses a broadcast tuning condenser: many precision condensers about the same capacity have been manufactured and are still available.

b. The tuning ratio can be as high as 4:1 without excessive attenuation over the whole range.

Fig. 4 shows an oscillator that works very well on low plate potentials. This is a modified version of the first oscillator, but it presents many more difficulties than does the original design previously discussed.

The K (coupling co-efficient) between the screen grid coil and the grid coil serves to make LC designs and ratios very difficult to analyze.

In this circuit if we analyze the grid and screen circuits, the transformer (R.F.) we use would break down somewhat as Fig. 5A indicates, and assuming that  $R_p$  is large,

$$\alpha = \frac{\alpha_0}{1 + j\frac{x}{a} - x^2}$$

we then get the illustration, Fig. 5B, where the  $\omega_0$  is the resonant frequency, which would be the product of two curves tuned to the same frequency. For the experimenter, therefore, this type of oscillator will offer too many difficulties but may be of some interest to the engineer.

## THE RADIO TRADING POST

(Continued from page 6)

**WANTED**—Will pay reasonable price for all wave signal generator and small C-R oscilloscope. Will swap or sell 50 feet Amphenol Co. axial cable (No. 12 gauge solid wire). Harold Armitstead, 1021 Winthrop Avenue, Revere, Mass.

**SALE OR TRADE** — Thordarson 120 watt amplifier with tubes; Supreme 585 diagnetometer; Philco all-wave battery operated signal generator. Want photographic equipment: cameras, projectors or what have you? Make best offer. A. McGull, 305 Adams Ave., W. Hempstead, N. Y.

**FOR SALE**—RCA tube tester, push button type cost \$37.50, sell for \$15.00. In good condition. E. L. Shafer, U.S.C.G. (RM2c), Cleveland RDO. Sta., Cleveland, Ohio.

**FOR SALE OR TRADE**—1 Marvel enlarger with F 4.5 lens, brand new. Cost around \$54, will take \$45 cash. Guaranteed to be in good condition. James C. Haygood, Box 338, Waverly, Tenn.

**FOR SALE**—Set Gernsback Manuals, vols. 1 to 6 inc., with supplements and index; set ICS radio texts; L. L. Cooke E.E. corres. course; key and buzzer practice set. H. W. Schendel, 518 W. Main St., Sparta, Wis.

**FOR SALE** — Model DF "Million" tube tester. Tests all late tubes. Very good condition \$29.95 postpaid. RCA Rider Chanalist in new condition except for audio cable and plug \$112.50 f.o.b. Philco 070 all wave signal generator, new \$39.00 postpaid. Max Shively, 3115 Ingham, Lansing, Mich.

**FOR SALE**—Coyno's Electrical Reference set, \$5; Official Radio Service manuals, first 4, \$1.25 each. Philco 1941 R.M.S. Year Book. Baldwin 10,000 ohm, Acme 25 ohm and single Frost 16,000 ohms headphones. One Brush single band crystal headphone. One Astatic hearing aid ear piece, magnetic, 2000 ohm, one crystal earpiece, both with cords. One Shure lapel mike. Edwin Larason, Martinsburg, Ohio.

**FOR SALE**—NRI Practical Radio Servicing course complete with home experimental outfits, and equipment, never used \$25; also 1942 Ford automobile radio complete, never been used, including aerial, and floor button \$28.00. Lincoln Day, 365 Lafayette Ave., Grantwood, N. J.

**WANTED** — Weston microammeters with scales of 0-50, 0-100 and 50-0-50 or 100-0-100 as well as 0-200. Give model numbers, condition and price. Also want RCA Voltohm, Jr., or other standard electronic volt-ohmmeter. Have Weston Model 24 0-4 and 0-40 voltmeter and a Model 57 0-40 voltmeter and Weston Model 24 ammeters for sale or swap. C.D. Hewitt, 60 Harmon St., Hamden, Conn.

**FOR SALE OR TRADE** — Victor radio phonograph, Model 57, complete chassis with speaker, mike and record unit; Philco signal generator 048, Elkon trickle charger, 4 and 6 volt, Valley electrical battery charger, 2 to 24 volts. Exchange for modern tube tester, set analyzer, output meter, voltohm meter, Riders Manuals, Theodore Lohr, 140-28-247th St., Rosedale, L. I., N. Y.

**WANTED**—A Precision Model 912P portable tube tester 4 1/8" meter, a 1941 or 1942 model; also a 3 or 5 inch Dumont, Hickok or RCA oscilloscope. Will sell or trade a new RCA station allocator, or sell for \$20. Paul Capito, 637 W. 21 St., Erie, Pa.

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**WANT:** Royal typewriter, tube and set tester, Rider's manuals. Goldstone Radio, 1279 Sheridan Ave., Bronx, New York.

**WANTED**—New or used 0-1 mill. meter. Will pay cash. State your price and condition of meter. Cpl. Otto Michael, Ft. Monmouth, N. J., Co. B, 15th Sig. Tr. Regt.

**WANTED** — Rider's abridged manuals, vol. 1 to 5, all in one volume. Also Triplett portable laboratory, Model 1181 C, also Triplett point to point tester, Model 1166 C. G. E. E., Lock Box 18, Geneva, Minn.

**SWAP**—1 Hallicrafters Sky-buddy, S-19-R as new; 1 Weston volt-ohmmeter, Model 564; 2 auto radios, all in very good condition.

**WANT**—C-D capacitor analyzer, or the like or what have you? Charles H. Wallace, 532 Foster Rd., Princess Bay, Staten Island, N. Y.

**FOR SALE OR TRADE**—Meissner F-M Converter, 8 tubes, less than a year old, original cost \$44.95, in perfect condition. Will trade for small communications receiver, or sell for best cash offer. Howard Eldridge, 49 Greene St., Burlington, Vt.

**WANTED**—New radio parts and tubes from servicemen who went out of business. Send list and price to Bielamowicz Variety Store, Bremond, Texas.

**WANTED** — Good used sound projector 16 mm. I have radio parts to trade, or will pay cash. Anchor Radio Dist. Serv. Co., Box 21, Ithaca, N. Y.

**WANTED**—Precision E-200 signal generator; must be in A-1 condition. Will pay cash. Describe condition, date of purchase, and price desired in letter. J. Lipner, 1032 Rutland Road, Brooklyn, New York.

**WANTED**—1942 Hickok dynamic mutual conductance tube tester or a 1941 model which has been brought up to date. Must be A-1 condition. Give full particulars, lowest cash price in first letter. L. M. Burtis, 2333 S. E. 53rd Ave., Portland, Oregon.

**WANTED** — Piano accordion, 12 bass in good condition, state make and price, also want a Stancor P 6130 oscilloscope transformer for a 2" scope. Standard gauge locomotive type train and equipment. Jerome J. Anselmo, 895 Pine St., Brooklyn, N. Y.

**WILL SWAP**—Keuffel & Esser polyphase duplex slide rule, 13 scales; pair of RCA 203A tubes; pair of Taylor T 55 tubes; model airplane gas engine, also Gardiner-Levering automatic code sender. Need good communications receiver or oscilloscope. Stephen J. Hart, Jr., 87 Sherman Avenue, Jersey City, N. J.

**FOR SALE**—Quantity 500-1500 kva 2-12 volt heavy duty filament transformers and Allen Bradley No. 410 rheostats. Two 35 mm Viso-matics, complete with turntable and amplifier. Hundreds water sockets and jacks. Three nearly new Cinaudagraph SUA units. Jaymac Co., Jackson, Michigan.

**WANTED**—Will pay top price for modern American and foreign tube checker. Give full particulars as to condition or send in for highest appraisal. Will pay shipping charges, if unsatisfactory. Aladdin Camera & Radio, 4 East 32nd Street, New York City.

**WANTED**—A set of Rider's Service Manuals. Pocket size ohm-multimeter tester. Ac and dc multimeter tester. A good condenser tester. L. W. Bakewell, 434 West Locust St., Springfield, Mo.

**FOR SALE**—One Triplett 1502 tube checker in good condition, with chart. Best offer buys it. Central Repair Shop, 716 Stella St., Ft. Worth, Texas.

**WANTED** — Two or 3 inch oscilloscope, new or used if good condition. Will pay cash. Otis K. Wolfe, P. O. Box 724, Harlan, Kentucky.

**FOR SALE**—Transmitter parts; homemade wireless record player; tubes. Send for prices and details. Al Smith, 320 McCabe St., Mitchell, S. D.

**SWAP** — 10-20 d.c. milliamp, 10-100 d.c. milliamp, 10-300 d.c. ampere, 1 Ranger tube tester, model 440, all for amplifier using 6 volt tubes. Also have parts for old makes of radio, will swap. Charlie's Radio Service, 8123 Stow Rd., Delair, N. J.

**WANTED**—160 meter crystals or 3105 kilocycle crystals, transmitting equipment, outboard motor. Have new and used auto radios, record changers, recorders, crystal and dynamic microphones, speakers and parts. Send list. E. L. Brandmeier, 821 Monocacy St., Bethlehem, Pa.

**WANTED**—Rider's Manuals, vols. I and II, will pay \$4.50 each for either, if in good condition. Wood's Radio Service, Box 362, Ironton, Minn.

**WANTED**—Good model BN, C-D capacitor bridge. State condition and price in first letter. F. H. Myers, 105A, Reed St., Red Oak, Iowa.

**WANTED**—Rider's Manuals, any of series 5 to 12. Indicating wattmeter 110-230 volt, 60 cycle ac, 0-2500 watts. Please state condition and lowest cash price. D. J. Hemingway, 25 Oak Knoll Road, Natick, Mass.

**WANTED** — A Guthman U36 or Stancor DC-3 transmitter and a.c. signal generator. M. R. Neary, Hayes Center, Neb.

**WANTED** — Radio parts, tubes, testing equipment, Manuals. State condition and lowest prices. I will pay cash or possibly trade for equal value. O'Brien's Radio Service, 609 West First St., Fulton New York.

**FOR SALE**—Radio City 702 signal generator \$15; Radio City 801 tube tester and analyzer with 505A; analyzer socket selector unit \$25; new Weston 773 tube tester \$45; Radio Physics Course by Ghrardi \$2.50; Radio Manual by G. E. Sterling \$3 and many others. Walter F. Golczewski, 4427 E. Thompson St., Philadelphia, Pa.

**FOR SALE**—One Shure microphone, Model 708S crystal, with desk stand. It is new and I will take \$12.50 for it, or what do you have to swap. Also have a pair of Brush crystal headphones that are new that I will take \$5.00 for. I would like to buy a plastic cabinet about 9 in. long, 8 in. high, 6 in. deep, and the opening for the dial about 3½ in. square, with two or three holes in it, the outside holes at least 4 in. apart. All letters answered. Dyer Matlock, Jr., Box 423, Mt. Pleasant, Tenn.

**WILL SWAP**—a 14 ft. x 20 ft. slightly used striped canvas, or will pay cash for an intercommunicator master unit with control of one unit. With or without any outlying stations. State tubes in unit. Ernest Herzog, 813 Monocacy, Bethlehem, Pa.

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**FOR SALE** — Rex desk typewriter \$10; Western .22 cal. rifle \$15; Burton-Webber No. 10 portable battery oscillator and Dayrad output meter \$18; meters \$3.25 each. All-Am. tennis racket \$3; radio magazines, parts, tubes, motors, etc. Include stamp. Roby's Swapmart, 3569 Cottage Grove, Chicago, Ill.

**WANTED**—Galvanometer for RCA 16 mm. newsreel camera. New or in repairable condition. Sell or trade all kinds radio equipment. State your needs. R. Stoll, 130 Kenneth Terrace, S. Orange, N. J.

**WANTED**—Several good slide rules are urgently needed for use by signal corps pre-radar students. Please communicate with me as soon as possible fully stating make, type, condition, and price. Paul Lorentzen, 611 North Johnson St., Iowa City, Iowa.

**WANTED**—Tube tester, 1938 make, or later model. A. T. Marr Radio Service, E. Ayer St., Ironwood, Mich.

**FOR SALE OR TRADE**—Rider's Manuals 1 to 5, Service by Signal Tracing, Cathode Ray Tubes at Work, Ghrardi's Troubleshooters Handbook, C. E. Drew's How to Pass License Exam., Henney's Radio Eng. Handbook, 2nd edition, excellent condition. M. P. Vincent, Box 4192, South Richmond, Va.

**WANTED** — RCP dependable multitester, model 408 ac-dc. Write to Roy H. Bender, P. O. Box No. 53, Manheim, Pa.

**WANTED**—All kinds of test equipment, Oscilloscope, signal generator, Rider's Manuals vols. 10, 11, 12, and 13. Ernie's Radio Service, 516 Hayward St., Peoria, Ill.

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**FOR SALE**—1 Weston model 676 tube tester \$20, 2 sets drafting instruments \$7.50 each, 1 microphone and stand \$13, transmitting tubes and parts. Write for list. Nelson K. Stover, 751 Tioga St., York, Pa.

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**WANTED**—Superior tube checker model 1240. State condition and price in first letter. Will pay cash. Arthur Comer, 19 Laurel St., Paterson, N. J.

**WANTED**—A portable radio tube and set tester combination; preferably with an associated plug-in set analyzer unit. Must be in good operating condition. State price and make. Alex Levenson, 250 Ocean Parkway, Brooklyn, N. Y.

**FOR SALE**—One late 1941 complete N. R. I. radio servicing course in first class condition, bound looseleaf in beautiful binders and indexed for quick reference complete with questions and answers also experimental parts of the course. State your highest bid in your first letter. Quality Radio Service, 1615 Brown Ave., Norfolk, Va.

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