MAY 28 1932 15c

RADIO WORLD

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The First and Only National Radio Weekly

Eleventh Year—531st Issue

NEW CIRCUIT

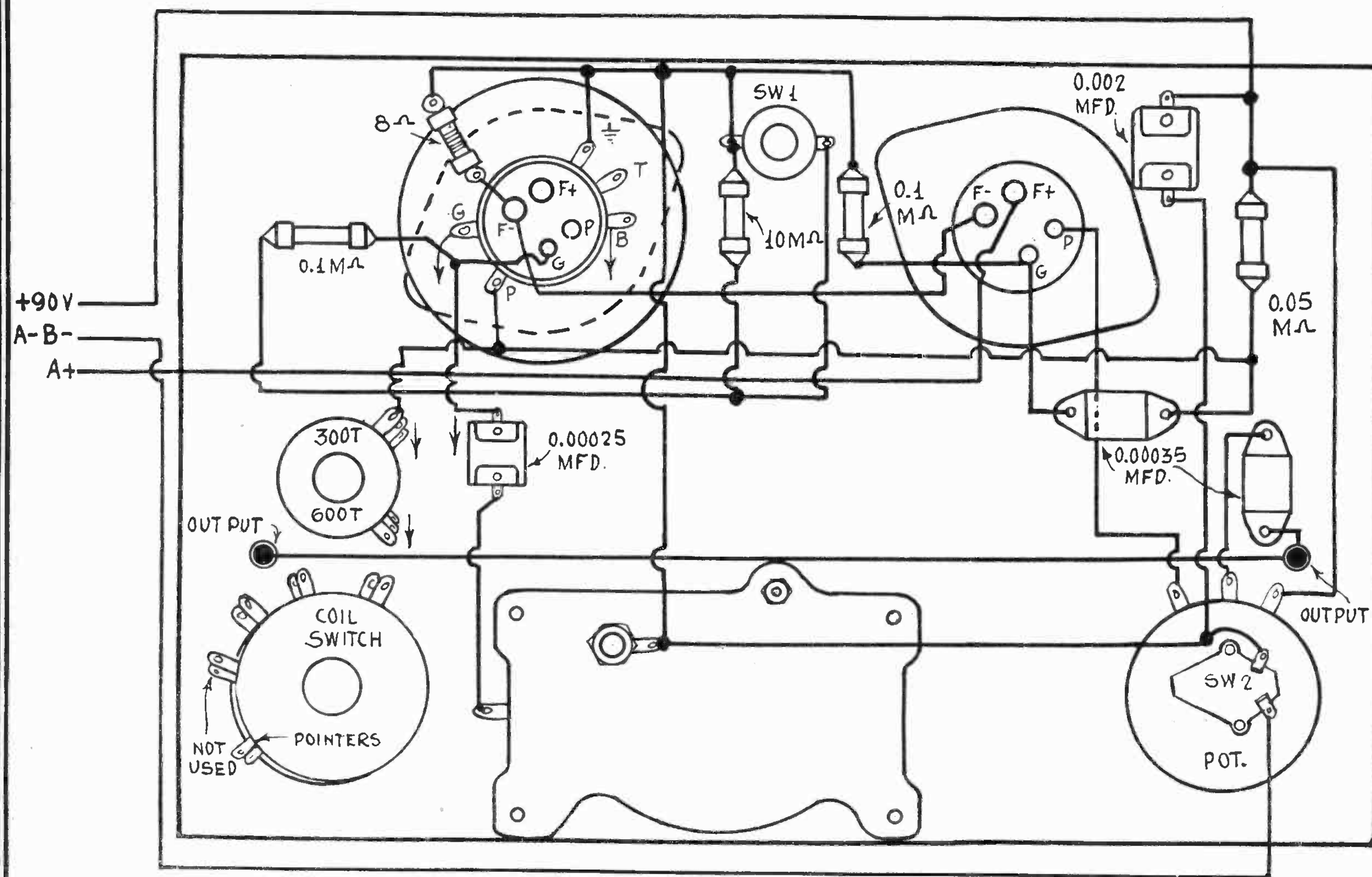
Multi-Stage T-R-F Without Feedback

Plug-in Coil Uses

Super with New Tubes

Spare Parts Short-Wave Set

BATTERY-OPERATED TEST OSCILLATOR



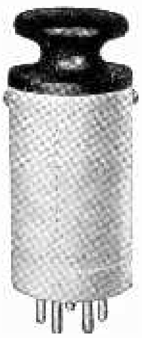
Pictorial diagram (almost full scale) of the test oscillator described on pages 3 and 4.

STROBOSCOPE MEASURES DISC'S SPEED

FIRST BROADCAST TRACED BACK TO 1906

SUPERIORITY ON SHORT WAVES

ISOLANTITE COIL FORMS



The watchword of short waves is "Results." The best results are obtained with plug-in coils. The best plug-in coil results are obtained with non-hygroscopic, low-loss coil forms. Hammarlund's Isolantite coil forms, 1½" diameter, permit of an excellent "shape factor"—a better coil than with smaller diameters. These coil forms are obtainable with UX, UY or 6-pin bases. Removable knob included.

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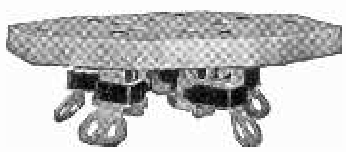
Cat. HCF-5—(UY, five-pin base). Net price......59c

Cat. HCF-6—(six-pin base). Net price...59c

ISOLANTITE SOCKETS



Having a superb coil form, one must have an equally efficient socket for coil form receptacle to produce uniformly superior results. Hammarlund's Isolantite socket may be mounted below or above chassis. Elevating bushings are provided.

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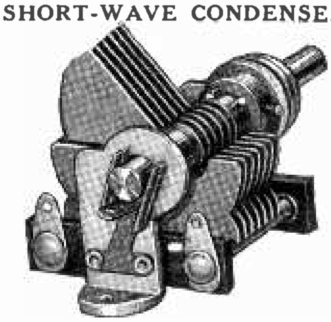
Cat. HS-5—(UY, five-prong socket). Net price......44c

Cat. HS-6—(six-prong socket). Net price.44c

SHORT-WAVE CONDENSERS



Junior midline condensers, single panel hole mount, with Isolantite insulation. Entire condenser encompassed by 2-inch diameter. Front and rear brackets threaded for 6/32 machine screws for optional mounting to chassis. Shaft ¼ inch.

Cat. H-14, capacity 0.00014 mfd., single, net price $1.20

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Cat. H-14D, two gang, 0.00014 mfd. each section $2.40

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Designed by Herman Bernard.

Eight coils $3.00
One power transformer 3.15
Two 0.00014 mfd... 2.40
One 0.0002 mfd.... 1.35
One 0.00035 mfd... .12
Six 0.002 mfd...... 1.20
Two 0.01 mfd...... .30
Three 0.1 mfd..... .57
One 1 mfd......... .45
Two 8 mfd. dry, washers 1.24
One 800 ohm........ .20
One 0.05 meg...... .15
Two 0.02 meg...... .30
Two 0.25 meg...... .30
Two 0.1 meg....... .30
Two 0.5 meg....... .30
One 5,000 ohm...... 15
One 10-ohm center-tapped .... .45
One fuse, holder... .25
One dynamic speaker with 1,800-ohm field coil tapped at 3,000 ohms.... 4.50
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Two knobs .... .20
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Tubes: one '35, two '24, one '47 and one '80 .... 7.35

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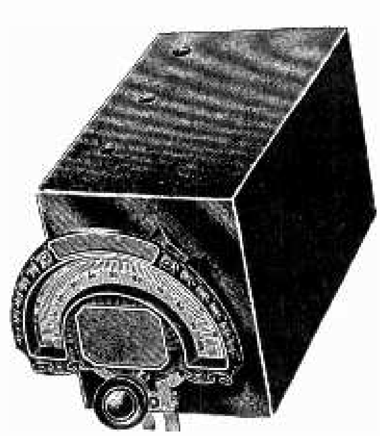
MATCHED TUNING UNITS

DIAL, SHIELDED CONDENSER, SHIELDED COILS



A 5-to-1 vernier dial (ghost type), with travelling light; a three-gang brass-plate shielded condenser, with trimmers built in; and a set of three shielded coils constitute the Matched Tuning Units for tuned radio frequency (two screen grid r-f and any type detector).
The coils are tapped once on each secondary, so that by switching it is possible to tune in from 80 to 200 meters, as well as the full broadcast band.
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For double detection circuits two equal coils are furnished as above, while the third coil is for padding for broadcast band only. The padding condenser is supplied for 175 kc.
Order Cat. TU-O @..$4.83

Coils, 1" diam. tubing, 2" diam. shields. Four lugs at bottom, one at side. Code follows: P and B, primary; G and side lug, secondary. The tap for 80 meters, to which condenser stators may be switched, is the ground symbol lug at bottom. Markings stamped on shield base over which base the shield (not shown) fits tightly. For oscillation connect B to plate and P to B plus.

GUARANTY RADIO GOODS CO., 145 West 45th St., N. Y.

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Managing Editor

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Battery-Run Oscillator

Modulation and Coil Switching Included

By Beman C. Krassop

A TEST oscillator for battery operation, with modulated-unmodulated service by switching, is shown in Fig. 1. Moreover, the wave bands are controlled by a single switch, of the double pole, triple throw variety. The bands covered are about 530 to 1490 kc, 1520 to 4000 kc, and 170 to 475 kc. Thus the broadcast band is fully covered, in fact exceeded, at one throw of the switch, while at another position one may tune higher than the highest broadcast frequency by the amount of any intermediate frequency (up to 2000 kc intermediate), and the popular intermediate frequencies are covered at the third setting.

For battery tubes the simplest modulating process is to use a leak of such high value that the grid blocks. This produces a high-pitched squeal, yet one readily discernible. When modulation is not desired the high value leak is shorted out and a smaller value, always in circuit, alone remains. Values of 0.1 and 10 meg. may be sued.

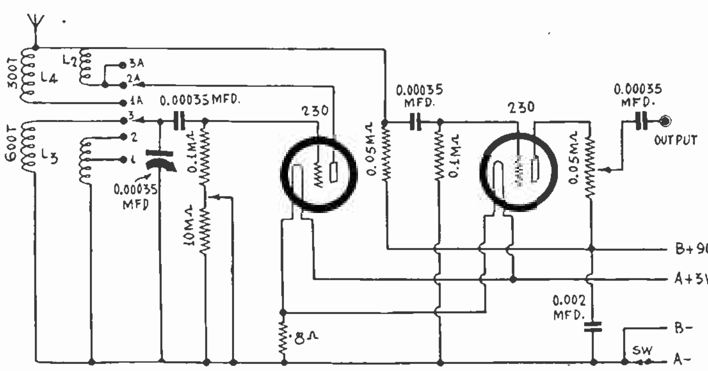

FIG. 1
A modulated-unmodulated-battery-operated test oscillator for 3-volt source of A voltage. If a 6-volt battery is used, replace the 8 ohms with 33-1/3 ohms.

Attenuator Included

Besides the oscillator itself there is a stage of amplification, desirable both for improving the strength and for rendering the oscillator circuit relatively free from frequency changes due to different load conditions (tested circuits). The output has an attenuator, so that if volume is too great it may be cut down.

The tuning condenser is any 0.00035 mfd. or 0.0005 mfd. capacity. The coil data will be given for 0.00035 mfd., but if a larger capacity condenser is used the same data may be followed, as the frequency span will be merely a little larger for each switch setting. There is no advantage in this, nor yet any disadvantage.

L1L2 is a radio frequency transformer wound on 1 inch diameter and having 120 turns of No. 32 enamel-covered wire for L1, while 30 turns of any fine insulated wire are wound over the center of the secondary, for L2, the tickler. The connections to the circuit may be made in any polarity and if no oscillation results reverse the connections of either winding. This advice is usually easier to follow than one of prescribing windings in a particular direction and polarities of a particular type, without saying what to do in case the builder makes a mistake and there is no oscillation.

Honeycombs for Low Frequencies

The secondary L2 has a tap at 30 turns from the ground end, therefore the winding consists in reality of 120 turns total, with 90 turns between grid and tap and 30 turns between tap and ground. Since the tap is picked up by the switch at one position, the tickler outlet is duplicated for the tap position of the grid winding.

The low frequency coil system consists of two 300 turns in series for the grid and another 300 for the tickler. The total diameter of each is about 1 inch. The three coils are held together in parallel position by putting a long machine screw through the cores of their wooden dowels, and tightening down with a nut. The coils should be mounted so that the natural separation arising from the extension of the dowels beyond the winding gives the greater of two possible degrees of separation between tickler and secondary. Again the advice applies as to reversal of either connections to either winding if oscillation fails. The two grid coils must be in series aiding, the way that requires less capacity for any given frequency. The closer mounting option should be used.

The reason for the tap on the broadcast coil is that an extra secondary is rendered unnecessary. Of course the frequency ratio will be about the same for the condenser, that is, 3-to-1, therefore if we start a little lower than 1500 kc we wind up at around 4000 kc. There is no great need for the higher frequencies, but since they are obtainable it is just as well to include them.

Tests Intermediate Frequencies

In fact, rising above the highest broadcast frequency is due only to the desire to be able to test an oscillator in a broadcast set. If the intermediate frequency is f' then the oscillator at its highest frequency setting should tune to 1500 + f', or a trifle higher to be safe. So, for 175 kc, the popular intermediate frequency, the oscillator might

(Continued on next page)

(*Continued from preceding page*)
tune to 1680 kc, or for 450 kc, the other extreme in present use, to 1960 kc. Since some short-wave supers have high intermediate frequencies, these may be checked with the oscillator, as may the input to any short-wave set for the range of about 1500 to 4000 kc.

The low frequency range will be from about 170 kc to above 450 kc, and that encompasses the popular intermediate frequencies of 175 kc, 365 kc, 400 kc, 450 kc and 465 kc.

After you have built such an oscillator, or any other, it is of no value to you unless it is calibrated. However, you can calibrate it yourself.

Calibration

The broadcast band is quite easy. Simply tune for a zero beat with broadcasting stations, using a receiver to bring in the station, and coupling the oscillator to the antenna near the set by wrapping insulated flexible wire around the aerial at that point, no conductive contact, except to oscillator output. Zero beat is that tuning point of both receiver and test oscillator when there is no difference in frequency between the two, and is aurally determined when the growling note near zero beat disappears. Sometimes the growl cannot be entirely eliminated, but then use the lowest frequency growl as your guide. When ten points are registered with good frequency distribution get some graph paper and plot the curve, frequency against dial settings.

For the frequencies higher than those of the broadcast band, make the broadcast set oscillate and then tune the test oscillator to lowest frequency—say, 1520 kc. Then tune the set until a squeal is picked up. If a station is on the air on 760 kc you can identify the squeal fairly well, and your test oscillator is tuned to the second harmonic, or 1520 kc. If the station is too weak, use some higher frequency on the test oscillator, still near the highest capacity end of the condenser, until you are certain you have your result. Then spot half a dozen or more well-distributed points by the same method and plot the curve.

For the low frequency coil system, recall that there are three harmonics of 175 kc represented by stations in the broadcast band, and hunt for them by the beat method. These harmonics are 700, 1050 and 1400 kc. Three other harmonics in the same frequency span are not even tens.

Get the points for these coils and again plot a curve. Those desiring a more detailed discussion of calibrating an oscillator will find the subject fully discussed by Brunsten Brunn in the May 7th issue.

The pictorial diagram is printed on the front cover. This shows all the connections, except for the coil switch and the coils themselves where connected to switch. The detail would have been too confusing, so was omitted. On the type of switch used, however, it will be found that the two pointer connections for the "high" sides of the grid and plate windings go to a pair of lugs not in regular formation about the assembly. If the switch has four other pairs of lugs, use only three, as there are only three coils to be switched.

Line Switch Built In

These three coils are (1), tickler and secondary for broadcast use; (2), same tickler and part of same secondary for higher than 1500 kc; (3) separate tickler and separate secondary for the intermediate frequency band.

For tuning the intermediate frequencies the two series-connected 300-turn coils are regarded as one, for they become one in fact, while the tickler is another 300-turn coil. These are honeycombs, as previously explained.

It will be seen that the "low" sides of the ticklers are connected permanently to the plate resistor, and the two different ticklers are picked up automatically. Since one tickler serves two purposes in connection with the solenoid, the "high" side of the tickler is brought to two lugs of the switch, instead of to only one lug. Either deck of the switch may be used for secondaries or tickler, but having chosen one, be sure to retain consistency.

The line switch is built into the attenuator (potentiometer), which is practical, for there is never any need for the attenuator when the oscillator is not turned on.

The output posts are shown on the pictorial diagram, as this is a handy provision, obviating crossing the top panel with a wire lead in case the tested circuit is on what would be the "wrong" side of the test oscillator. Since the dial is on this panel, the lead from test oscillator to tested circuit therefore never need cross the dial, and moreover there is no danger then of body capacity due to the hand being too close to the output lead.

Resistor for 6 Volts

If the test oscillator is to be used consistently with a 6-volt source of A voltage, then the filament resistor should be 33 1/3 ohms theoretically. A 4-ohm resistor in series with a 30-ohm rheostat, with the full resistance of the rheostat in circuit, will do nicely, or the 30-ohm element may be a fixed resistor. The 4 ohms may be any resistor previously intended to drop 6 volts to the 5 volts required for a 201A tube.

The condenser illustrated on the front cover actually was 0.0005 mfd., but, as previously intimated, satisfactory frequency coverage will result even when using coils intended primarily for 0.00035 mfd., because the frequency span for any one tuned inductance will be merely a little greater.

Minimum Capacity

The only precaution necessary when using the larger capacity is to be sure that the minimum capacity of the condenser is not too high. In modern condensers it will not be, as values around 10 or 12 mmfd. are the rule, rather than the exception.

WELLS TO SAIL FOR ICELAND

Carveth Wells, NBC explorer, who sails in June for Iceland and Lapland, has worked for the British government in the jungles of the Malay Peninsula, has scaled the Mountains of the Moon in equatorial Africa and watched the last lemming migration in Lapland for the American Museum of Natural History.

Short Wave Club

The following is a list of new members of the Short-Wave Club:

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James M. Mascotti, 1067½ Elm Ave., Glendale, Calif.
Allan McCombs, 620 Race St., Statesville, N. C.
Edwin H. Baxter, care Pan-American Pet. Co., Aruba, D.W.I.
Hans Frehrking, 5 Union St., Montclair, N. J.
Arthur B. Myers (SWL), R.F.D. No. 2, Hamburg, N. Y.
Frank Groves, 823 N. 18th St., St. Louis, Mo.
Zell U. Thomas, Biglerville, Penna.
A. T. Perry, 1718 Newton St., N.W., Washington, D.C.
José Alvarez, 171 Hostos St., Mayaguez, P. R.
Elmer Mills Harris, Jr., 473 Monroe St., Monterey, Calif.
Arthur Janes, 704 Pennington St., Elizabeth, N. J.
Hugh Barker, Box 81, Jenkintown, Penna.
Charles A. Hoellein, 118 Dengler St., Pittsburgh, Penna.
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Gerald Green, 3616 Pinegrove Ave., Chicago, Ill.
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Winfield Jenne, 714 Lake Ave., Elyria, Ohio.
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T. E. Metzger, Stewart, Cuba.

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Short Wave Editor, Radio World, 145 *West* 45*th St., New York.*
Please enroll me as a member of Radio World's Short Wave Club. This does not commit me to any obligation whatever.

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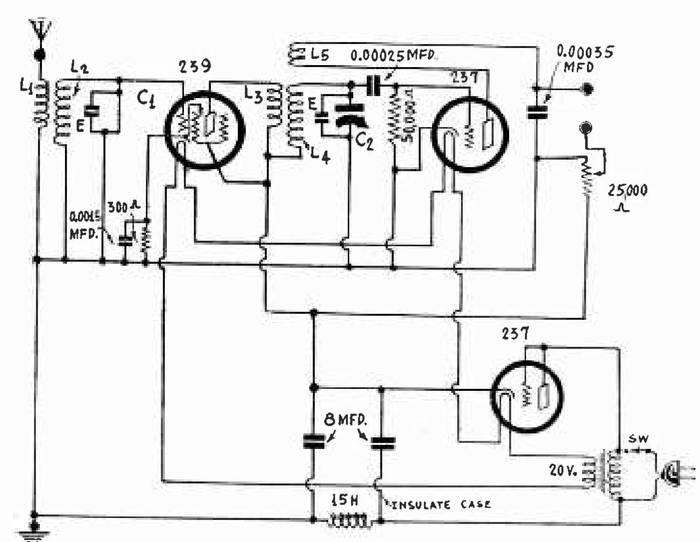
UY INTERSTAGE PLUG-IN



The circuit of a simple three-tube regenerative receiver, utilizing one 239 r-f amplifier, one 237 detector, and one 237 as B supply rectifier. Regeneration is controlled by a variable resistance of 25,000 ohms in the plate circuit of the detector. The heaters are in series across a 20-volt secondary. Note how a UY plug-in form is used for interstage, despite three windings.

Battery Earphone Set

Useful for Broadcasts and Short Waves

By Asa Barclay

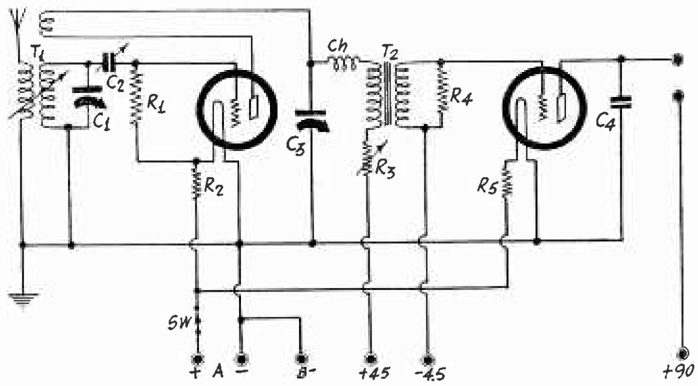


FIG. 1

This two-tube battery operated receiver is suitable both for short and broadcast wave reception. To adapt it to either type it is only necessary to select the proper coils and tuning condenser.

NOW and then there is call for a simple regenerative receiver of the type that was in vogue during the early days of tube receivers, but brought up to date in respect to coils and tubes. Headphone reception is the rule with these small sets, for they are usually employed by persons who desire to listen in where they are not permitted to operate a loudspeaker. Sets of this type are asked for both for short and broadcast waves.

For a set of this type the most suitable tubes are the 230's. A couple of them can be operated a long time on two No. 6 dry cells for the normal filament current of two 230's is only 0.120 ampere, and the rated current of a cell of the size specified is 0.25 ampere. The voltage of two of these cells in series is 3 volts, whereas the tubes require only 2 volts, and will work on even a little less. Therefore we have to put in a ballast resistance to take up the difference.

The drawing, Fig. 1, shows two ballasts, R2 and R5, or one for each tube. Each should therefore be 16.7 ohms, obtained by dividing the excess voltage by the current in each tube, or 0.06 ampere. Of course, there is no fixed resistance of this value but it can easily be obtained by cutting down a 20-ohm resistor. It is also permissible to join the filaments so that only one resistor would suffice, in which case the resistance should be one-half the value given above, or 8.3 ohms. This can be obtained by removing a little wire from a 10-ohm resistor. The resistance should be adjusted until a voltmeter reads 2 volts when connected across the filaments on the tube sockets.

Three Circuit Tuner Used

A three-winding coil is used between the antenna and the first tube. The coupling between the antenna, or primary, and the secondary is shown to be variable. Coils of this type are available. The tickler is fixed, but coils are also available with a movable tickler. The type of coil used is optional, and in either case the variable coil is used for volume control. There is no difference in the results obtained.

For a fixed tickler there are two means for varying the regeneration. We have first the variable condenser C3, which should be a 350 mmfd. unit. Then we have the variable resistor R3 in the plate circuit of the tube. This should have a maximum value of 25,000 ohms. This resistor controls the effective voltage on the plate and so controls the regeneration

The grid leak R1 should have a value of 2 megohms, or even a higher value. The grid condenser C2 is shown to be variable, but if the set is to be used for broadcast waves only it may be fixed and have a value of 0.00025 mfd. If the set is used for short waves, and it is quite suitable for that, C2 should not be larger than 0.0001 mfd. Note that the grid leak is connected between the grid and the positive end of the filament.

The choke Ch is used to prevent radio frequency current from escaping to ground through the capacity of the primary of the audio transformer. Without the choke it would not be possible to control the regeneration effectively with C3. The coils should have a value of 10 millihenries or more, but not exceeding 85 millihenries. One of the 800 turn duolateral chokes used in intermediate transformers would be just right. This will work not only on broadcast frequencies but also on higher frequencies.

The Audio Amplifier

A 3.5-to-1 audio frequency transformer T2 is used to couple the detector to the audio amplifier. The resistance R4 across the secondary of this transformer should have a value of 500,000 ohms. This is used to take out some of the noise that develops on high signal frequencies. C4, a condenser of 0.001 mfd. is used for the same purpose.

The applied plate voltage on the detector is 45 volts and that on the amplifier 90 volts. The applied bias on the second tube is 4.5 volts. If only headphone reception is expected the applied voltage on the second tube need only be 45 volts, and in that case the bias is not needed. The grid return can be made directly to the ground.

If the circuit is to be used for broadcast reception it is recommended that a regular three circuit tuner be used for the coil T1, one wound for a 350 mmfd. condenser. If, however, it is to be used for short wave reception plug-in coils should be used. All the winding may then be fixed. These coils should have UY bases since there are five independent terminals. The two ground terminals can be combined and connected to one pin.

0.00014 Mfd. Tuning Condenser

For short wave the tuning condenser C1 should have a capacity of 140 mmfd. because most short wave coils are wound for this capacity. The following set of plug-in coils may be used, provided that the tuning condenser has a capacity of 140 mmfd. and the lowest frequency to be received is 1,500 kc. A stray capacity of 10 mmfd. has been allowed for in addition to the 140 mmfd. A minimum capacity of 30 mmfd. has been assumed and a diameter of 1.25 inches:

Coil	Inductance in Micro-henries	N1	N2	N3	Wire for N1
A	75	55	5	36	No. 26 en.
B	15	19.5	2	13	No. 24 en.
C	3	7	1	5	No. 20 en.
D	0.6	3	1	2	No. 18 en.

In this table N1 is the tuned winding, N2 the primary, and N3 the tickler. N2 may be wound with the same wire as N1, but N3 should be wound with much finer wire, say No. 30 double silk for all the coils. The first two windings may be wound as one with a tap at the appropriate point. N3 should be wound at the top of the form, on the grid side of N1. The follow-in terminal arrangement is suitable. G to G, K to ground, and Hk to the antenna; P to P and Hp to the radio frequency choke and C3. The socket should be wired consistently with this arrangement, or with any other terminal arrangement selected.

LIST OF PARTS

Coils

T1—One set of plug-in coils as described for short waves or one three circuit tuner for a 350 mmfd. tuning condenser for broadcast waves
T2—One 3.5-to-1 audio frequency transformer
Ch—One 800 turn duolateral coil, about 10 millihenries

Condensers

C1—One 140 mmfd. tuning condenser for short waves, or one 350 mmfd. for broadcast waves
C2—One 0.0001 or 0.00025 mfd. grid condenser
C3—One 350 mmfd. variable condenser
C4—One 0.001 mfd. bypass condenser

Resistors

R1—One 2 megohm, or higher, grid leak
R2, R5—Two 16.7 ohm ballast resistors
R3—One 25,000 ohm variable resistor
R4—One 500,000 ohm grid leak

Other requirements

Sw—One filament switch
Ten binding posts
Two UX sockets

CKWO About to Join the Columbia System

Malcolm G. Campbell, president of Essex Broadcasters, Ltd., which will operate CKWO, now under construction in South Sandwich, Canada, has appointed Joseph H. Neebe to be in charge of the Detroit office of the company, headquarters of which are in Windsor. CKWO will become a member of the Columbia network on May 31st.

Mr. Neebe was formerly vice president of the World Broadcasting System, in which he was associated with Gustave Haenschen, conductor.

Broadcasting's Birth

Dr. Kintner Tells of 1906 Transmission

THE controversy regarding the time and place of the first transmission of voice and music by radio came up anew when Dr. S. M. Kintner, vice-president of the Westinghouse Electric & Manufacturing Company, in an address made before members of the Institute of Radio Engineers in Pittsburgh, placed the first transmission of voice and music on Christmas Eve, 1906. Professor Fessenden, at Brant Rock, Mass., did it, said the speaker. Lonely ship operators were astonished to hear music and speech suddenly substituted for the dots and dashes to which they had been listening, Dr. Kintner told the members of the Institute. Dr. Kintner, who was associated with Prof. Fessenden just after leaving college, paid him high tribute for his foresight in connection with the radio development.

Song, Verse, Violin and Speech

In describing this historical transmission Dr. Kintner said:

"The general call 'CQ' was sent out from Brant Rock, Mass. Then followed a song, the reading of a verse, a violin solo, a speech and an invitation to report the results of the reception by all who heard. This was the first radio telephone broadcasting program.

"One can well imagine the feelings of surprise of the lonely ship operators—accustomed to the cold colorless dash and dot of the Morse code—when music suddenly burst upon their ears—to be followed by understandable speech. It was quite a shock and I don't doubt that some superstitious operators gave rather serious thought to their mode of living."

Shortly after the unscheduled program was sent out Fessenden received a large number of letters from ship operators all over the North Atlantic asking all about how it was done.

Dr. Kintner spoke from his own personal experiences.

"It has been my good fortune to be intimately associated with several individuals whose part in the development of this art has been of major importance," he told the institute members in explaining his close association with those pioneers with whom he cooperated in promoting a science that has grown to world-wide importance.

Election Returns in 1920

These experiments continued and the development progressed step by step until eventually KDKA on November 2, 1920, sent out the first broadcast for public reception. This broadcast was the first of those transmitted on a regular schedule. Since the first program KDKA has not missed one single day of broadcasting.

Experiments with the pioneering of radio were expensive, Dr. Kintner declared. T. Hart Given and Hay Walker contributed more than $2,000,000 to promote the experimental and development work of Fessenden. In discussing this vast outlay of funds the Westinghouse executive told the audience:

"The courage of these two men, who put more than $2,000,000 of their own money into this radio company, is one of the most striking recollections I hold of genuine confidence in the future of radio. Unfortunately, neither reaped the benefits of his sacrifice, as Mr. Given, who bought Mr. Walker's interest during the war, died about one year before broadcasting raised radio to its full stature. It has always been a great regret to me that he could not have lived to see his dreams come true.

Experimental Stations Built

"The company organized by Given, Walker and Fessenden was operated solely for the purpose of developing the latter's inventions. It was called the National Electric Signaling Co. and not one dollar's worth of stock was offered for sale to the public. Particular emphasis is laid upon this fact because those were the days when selling stock in a new wireless company was the racket of the time.

"This particular company devoted its energies to developing a system to engage in the communication business. A number of stations were constructed for development uses. First there were three, one at Old Point Comfort, a second at Ocean View and the third one at Cape Charles.

"Those were small stations with gasoline engine driven dynamos and plain spark gap oscillation generators. Next a pair of stations, one at Jersey City, N. J., and the other at Collingwood, N. J., were built. There was then erected a third station at Washington, D. C. These stations exchanged code messages at times but were not sufficiently free from interference and fading to give a reliable service.

Trans-Ocean Hopes

"Then, with the experience gained in the operating of these several stations, an ambitious program was undertaken of erecting two stations for experimental trans-Atlantic operation. One station was located at Brant Rock, Mass., and the other at Machrinhanish, Scotland. These stations were constructed in 1905 and were powered by 35 kw., 125 cycle alternators with rotary spark frequency of 250 sparks per second. The antenna systems consisted of a single straight tubing 36 inches outside diameter and 420 feet long. This tubing was built in eight-foot sections, bolted together. It rested on a steel sphere at the bottom and was guyed at four points along its length. Both the guys and the tower were insulated from earth.

"At first the tubing alone constituted all of the antenna. Later, a form of umbrella structure carrying an additional spread of wires at the top of the tubing was added.

"On New Year's night, 1906, the first exchange of messages took place between these two stations. The power was not sufficient to insure reliable communication and for weeks at a time it was not possible to get messages across. In July, 1907, the tower at Machrihanish was blown down in a wind storm. The station was so badly damaged that it was never rebuilt."

Gloom Before the Bright Dawn

Dr. Kintner then told of continued efforts made to foster trans-Atlantic radio development. In company with others he made a tour of England, France, Germany, Sweden and Denmark in order to stimulate interest in trans-oceanic communication by radio. "Several doubted our ability to build a satisfactory station, but said that if we were able to do so then they would be willing to talk to us." He continued:

"We returned with rather dampened spirits but determined to go ahead with the building of a big station in the hope that something would show up. It was apparent that the money earned in the operation of the several shore stations along the North Atlantic coast would not support the company and that other operations must be found.

"The manufacture and sale of apparatus to amateurs was considered. when what proved to be a very happy thought of the late Dr. H. P. Davis, vice-president of the Westinghouse Electric and Manufacturing Company, produced the solution to the problem."

One of the most important steps was then revealed by Dr. Kintner, who told of what led up to the first broadcast for public reception. The first broadcast was sent out by KDKA November 2nd, 1920, and consisted of returns of the Harding-Cox presidential contest.

Davis's Contribution

Describing preliminary work for this broadcast Dr. Kintner told the members of the convention:

"All during the war one of the busiest of the Westinghouse engineers was Dr. Frank Conrad. He was devising all kinds of equipment from hand grenades to radio sets. This interest in radio and development of it for the Government gave him special privileges and he was permitted to operate various sending sets in the perfection of apparatus under development all during the period of the government seizure of the radio stations.

"At the close of the war when the government necessity for radio development was no longer present he continued as a result of his own interest. He was a Morse operator, but not particularly speedy and so concluded that the substitution of a microphone for the key would speed up his communications. This was done and he continued his experiments from his station, then located on the second floor of his garage at his home at East End and Penn Ave., Pittsburgh.

Amateurs Listened at First

"His listeners were amateurs, but they gradually increased in numbers when they were no longer required to read the code to understand what was going on."

"From the vast majority of amateur messages that I've read in log books and others, I never could see that anyone missed very much real information by such lack of code reading ability. Finally these amateurs called up Conrad on the 'phone so frequently and at such inconvenient times that he established regular times when he would operate his station. This generally was Wednesday and Saturday nights. The information regarding these concerts of Conrad's was gradually passed by word of mouth until quite a number knew of it. Then, after about a year, some enterprising maker of radio receiving sets persuaded the Joseph Horne Co. to place them on sale."

The department store placed an advertisement in a Pittsburgh newspaper. This caught the eye of Davis. What happened then is told by Dr. Kintner:

"The next day Dr. Davis called together his little 'Radio Cabinet,' consisting of Dr. Frank Conrad, L. W. Chubb, O. S. Schairer and your speaker.

Davis Scented Possibilities

"He told of reading the Horne Advertisement and made the suggestion that the Westinghouse Electric & Manufacturing Co. erect a station at East Pittsburgh and operate it every night on an advertised program, so that people would acquire the habit of listening to it just as they do of reading a newspaper. He said: 'If there is sufficient interest to justify a department store in advertising radio sets for sale on an uncertain plan of permanence, I believe there would be sufficient interest to justify the expense of rendering a regular service—looking to the sale of sets and the advertising of the Westinghouse Company for our returns.'

"Dr. Davis asked us whether we could get a station in operation by November 2nd, in time to report the election returns. We, of course said yes and Dr. Conrad, assisted by D. G. Little, did the most of the work in completing the installation.

"It was tested out on the evening of the first and while not as strong as we had hoped, it was passably good. However, the

(Continued on next page)

A Neon Oscillator

Audio Frequency Due to Voltage Sensitivity

By Arthur J. W. Hargy

THIS is a radio frequency oscillator modulated by a neon tube audio oscillator. The radio oscillator is of the tuned grid type and the frequency is determined by L2 and C3. The audio frequency generated by the neon tube is determined by the values of C and R, as well as by the voltage B applied in the plate circuit.

The theory of the neon tube oscillator depends on the fact that there is one voltage at which the tube begins to glow and another voltage, lower than the first, at which the glow disappears. The voltage of the battery B must be considerably higher than the glow voltage of the tube because of the steady drop of voltage in R. Let us assume that the tube is glowing.

When the Glow Stops

Immediately there is a considerable current through the neon tube. The voltage across the tube drops because of the increased drop in R. But the drop to the extinguishing voltage is not instantaneous because the condenser C has accumulated a charge, which is discharged through the neon tube as well as through the vacuum tube. When the charge on C is exhausted the glow stops because the voltage has fallen below the extinguishing voltage.

As soon as the glow stops the voltage again rises because the current through the neon tube has stopped. The condenser C begins to charge again and ultimately the voltage across the condenser and the neon tube is up again to the glow voltage. This process continues as long as the power is on.

What Determines Frequency

The rate of audio frequency oscillation depends on the value of R and the capacity of C. The larger C is the longer the time required for it to charge and to discharge. Also, the larger R is the longer it takes for the condenser to charge. Hence the audio frequency can be adjusted by adjusting either C or R.

The neon tube oscillator requires rather critical adjustment before it will oscillate. The maximum voltage across the tube has to be very nearly equal to the voltage at which the glow appears. If it is much higher the voltage will not drop to the extinguishing point. And if it is lower the glow will not appear at all. After the frequency has been selected by selecting C and R, the oscillation adjustment should be made on the voltage. The radio frequency oscillation will be modulated because the effective voltage on the plate circuit will fluctuate with the voltage across the neon tube, or across the condenser C.

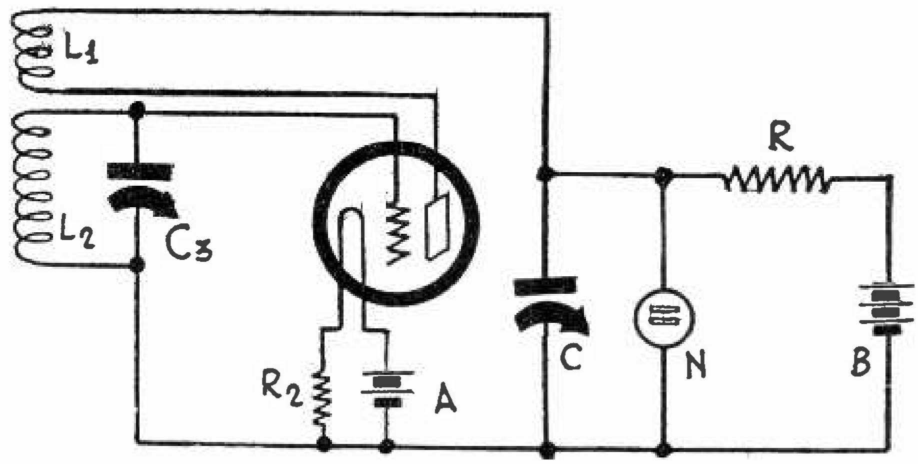


FIG. 1

A tuned grid radio frequency oscillator modulated by a neon tube oscillator connected in the plate circuit.

RADIO COURSE IN FLORIDA

Radio service men from all over Florida and adjoining states will assemble at the University of Florida, Gainesville, Fla., on June 6th to begin a study of the latest developments in their chosen field. This is the third annual Short Course for Radio Service Men held under the auspices of the General Extension Division and the College of Engineering of the University of Florida, at which dealers, distributors, service men, and factory representatives meet for one week to discuss their mutual problems in the radio game.

Pointed Opinion

By E. T. CUNNINGHAM, President, *RCA Radiotron:*

"Up to the present sets in the lower price range have performed about as well as sets in the higher price range, practically speaking. The average person, listening to a good midget, would say it sounded about as well as a high-priced console. The principal incentive to buy the console was the appearance of the cabinet,—strictly a furniture appeal. The average person can be more readily traded up by increasing radio values rather than just furniture values alone. The sensational new tubes—types 56, 57, 58, 46 and 82—featuring dual grid power, mercury vapor rectification, triple grid amplification, super control, etc.—have been designed with the single aim of enabling set designers to create new and outstanding radio performance values."

Radio's Rapid Growth Recalled

(*Continued from preceding page*)

next day, by more careful adjustment it was considerably improved and pronounced ready for use.

Rapid Growth of Interest

"Dr. Conrad stayed at his home, prepared to shift over to his station in the event of a failure of the East Pittsburgh Station, then known as 8ZZ. No such trouble was encountered and the little transmitter, with its two 50-watt oscillators and its four 50-watt modulators, completed its first schedule without trouble.

"The few available receiving sets were distributed around to the best advantage. Some were placed in clubs, where crowds got the benefit of them, others were in the homes of the Westinghouse Electric & Manufacturing Company's officers. Surprising interest was aroused. We were sorely tried in efforts to provide suitable programs and the phonograph was our best available talent. The interest grew so rapidly that supply stores were unable to keep up with the demands for telephone receivers and 'B' batteries. Everything that looked like a telephone receiver was pressed into service and there was scarcely even a watch-case receiver in the down-stairs hallway of any apartment house in the city—they had all been conscripted by radio broadcasts enthusiasts."

Traces Wide Growth

Discussing the talent available for the early broadcasts with that offered the public today, Dr. Kintner said:

"When the reproduction was reasonably good, the demand for better and better talent increased and is still with us. In fact, today no talent is too good for the radio and there is little, if there is any, of it that has not yielded to the temptation of using this means of displaying talents to millions instead of hundreds."

In concluding his talk Dr. Kintner summed up the manner in which broadcasting increased in power and importance until today no section is out of reach of the powerful waves that carry knowledge and entertainment into the most remote sections of the earth.

Recent Station Changes

1140 kc. WAPI. Change owner to WAPI Broadcast Co.

1200 kc, Insert KGVO, Missoula, Mont., Mosby's, Inc., 100W (See 1420 kc below).

1420 kc. Delete KGVO (See 1200 kc above).

1420 kc. WPAD, Change owner to Paducah Broadcasting Co., Inc.

HOW TO UTILIZE A STROBO 60 CY

By Edward

A STROBOSCOPE is an optical heterodyne device by which two periodic motions are compared, usually by the zero beat method. The regular heterodyne between two electrical currents of different frequencies is well known to all who have done much work in radio. When the frequencies of the two currents are slightly different there is an audible frequency beat produced, equal to the difference between the frequencies of the two currents. When the two have exactly the same frequency we have the phenomenon of zero beat.

Those who have done work in music are also familiar with beats, for musical instruments are tuned by the beat method. Harmony means a condition of zero beat, even though the fundamental tones of the two sounds involved do not have the same frequency or pitch. Discord means a certain deviation from zero beat. There can be no discord when only one sound is present even though a note may be recognized as off pitch. The object of tuning is to bring two tones into unison so as to remove heterodynes or beats.

The Stroboscope

The stroboscope is an optical device working on the same principle. Suppose we have some form of period motion or any regular sequence of similar events that may be seen. For example, a wheel having a certain number of spokes is revolving at constant angular velocity and the eye looks at the wheel. At any point on the retina there is a certain succession of impressions of the spokes, and since the spokes are spaced regularly the succession of spokes is regular. The rotation of a gear is another example, the moving of a piston is still another.

If the motion is very rapid it is not possible to see the individual events but only a blur. We may also say that if a sound is high enough in pitch the ear cannot hear it because it becomes an acoustical blur. But suppose we have some means for looking at only one impression out of every fifth, or one out of every hundred, all the others being completely blotted out so that they cannot affect the retina. We then apparently slow the motion down to one-fifth of its real value, or to one hundredth of its value. This apparent speed is the heterodyne. And there is also a zero heterodyne in this case, when the motion appears to have been stopped. It is possible to stop the motion entirely so that we can view the moving mechanism just as if it were actually still. But this is only possible if the motion, or the succession of events, is regularly recurrent.

As an illustration of this we might take the case of a sprocket chain moving at a high rate of speed over a sprocket. Both the sprocket and the chain are regular and therefore we can stop the motion optically without actually stopping the motion. We can do the same with a wheel having spokes.

We might consider an extreme case of stopping the motion optically. Suppose we glance at a clock exactly every 12 hours, forgetting that any time has passed between glances. The clock indicates the same time at every glance, and the observer cannot tell whether that clock is running or keeping correct time. The motion has been stopped optically.

Picket Fence

It often happens that an automobile wheel is viewed through a picket fence. Sometimes the wheel appears to stand still, sometimes to turn slowly either in the forward or backward direction. The picket fence then becomes a stroboscope. The same effect is often noted in the movies. Automobile wheels appear to turn forward, or backward, or stand still, regardless of the fact that the car is always moving in one direction. Here the intermittent exposure produces the effect. The stroboscope in this case is complex for it begins with the camera and ends with the intermittent illumination of the screen by the projector.

The intermittency of the illumination or of the viewing is the essential feature of the stroboscope. If we could blink at a regular and rapid rate while viewing a spinning spoke wheel or some other periodic motion we could stop it optically. But this fails because the blinking cannot be done regularly nor rapidly enough. However, we can interrupt the view regularly by spinning an opaque disc with a hole in it before the eye, or we can do the same by spinning it in front of the source of light.

A common method of illuminating the subject viewed intermittenly is to use a neon lamp, one that is either driven by an alternating current or one that is itself oscillating. Still another, and one that is also used frequently, is to use an ordinary light that is operated on alternating current.

Using A-C Light

If the light is operated on 60-cycle current there will be 120 light maxima every second, corresponding to the 120 peaks of current every second. This source of light is not the best for stroboscope work because the light does not have time to die down between current peaks. But the effect is sufficient for many applications.

In Fig. 1 we have a stroboscope device for 60-cycle current and an ordinary electric lamp for determining various motions. The disc contains five different rings of equi-spaced black sectors. The inside ring contains five sectors, and that ring is labeled 1,440 r.p.m. and 24 frames. The purpose of this ring is to adjust the speed of a television scanning disc rotated at 1,440 r.p.m., or at 24 frames a second. If a disc is placed on the scanner, concentrically with it, and then viewed in the light of a lamp on 60-cycle current, the disc appears to stand still, in respect to the central ring only, when the speed of the disc is exactly 1,440 r.p.mm., or there are 24 repetitions per second.

Explanation of Sectors

Just why does the inside ring appear to stand still if the speed is 1,440 r.p.m.? If the disc rotates 1,440 r.p.m. then it rotates 24 revolutions per second. Every second there are 120 light maxima. Then between two successive maxima the time is 1/120 second, and in this time the disc rotates 24/120 of a revolution, or 1/5. Since the ring contains 5 sectors the disc rotates the angle between any two sectors beween one light maximum and the next so that at every light maximum the sectors are always in the same relative position. If all the sectors are the same there is no change in the appearance of disc and it appears to stand still. All the other rings are blurred when the inner ring appears to stand still.

The same applies to the second ring, but this one contains six sectors. The required speed to make this one appear to stand still is 1,200 r.p.m., or 20 per second. We obtain the number of equal sectors by dividing the number of light maxima per second by the number of revolutions per second of the disc required. In this case we have 120/20, or 6.

Fifteen Frames

The third ring is for 900 revolutions per minute or 15 frames per second. To get the correct number of equal sectors in this case we divide 120 by 15 and get 8. Hence there are eight sectors in the third ring.

The disc can also be used for adjusting the speed of phonograph turn tables two different speeds, 78 r.p.m. and 33⅓ r.p.m. A disc is placed on the turn table concentrically with it and then viewed in the light from the lamp operated on 60-cycle current. To get the required number of sectors in either ring we divide the number of light maxima per second by the number of revolutions desired per second. Since we want a speed of 78 revolutions per minute in one case, we want 1.3 per second. Therefore there should be 120/1.3, or 92.26 sectors. But we cannot use a fractional number. The nearest whole number is 92 and therefore the second ring from the outside contains this number. This, of course, will make the speed slightly different from 78 but it will be close enough for the adjustment of the speed of the phonograph. The actual speed is 78.26 r.p.m.

The outside ring is for adjustment of the speed of a phonograph turn table to 33⅓ r.p.m. In this case we need 216 sectors in the ring, which gives exactly 33⅓ r.p.m.

Using Harmonics

Any one of the rings may also be used for adjusting to harmonics of the speed intended by allowing the disc to move two, three, four, and so on, sectors between two successive light maxima. Thus

SCOPE; CLE MODEL PROVES HANDY

P. Stokes

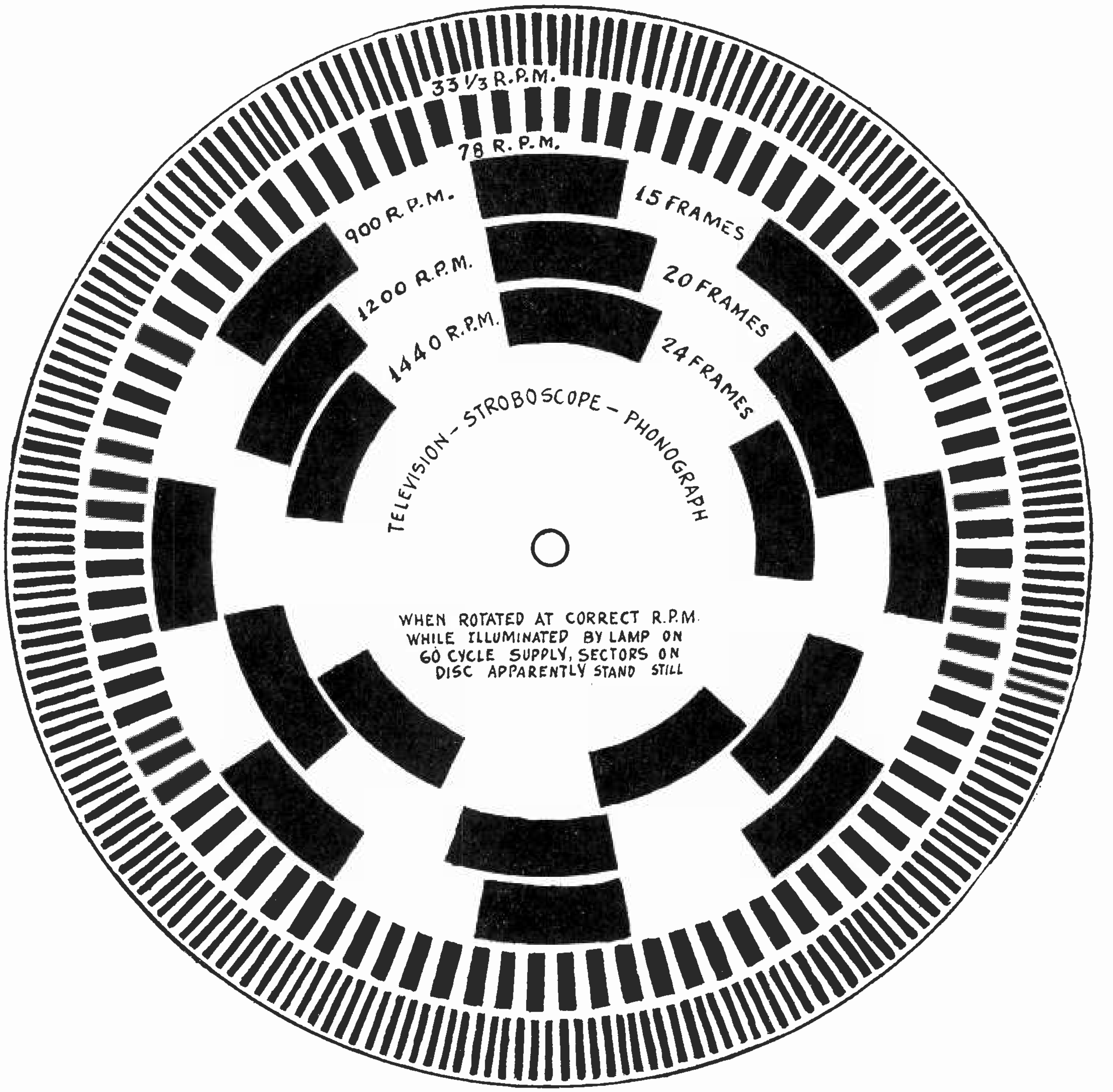


FIG. 1

A stroboscope disc which in connection with a light operated on 60-cycle current can be used for adjusting for different speeds of rotation, such as 24, 20, and 15 times per second and 78 and 33 1/3 per minute.

we can use the third ring for adjusting to a speed of 30 frames per second by doubling the speed of the disc. In the case of the outside ring we can obtain a speed of 66⅔ r.p.m. by allowing two sectors to pass between current maxima, or 100 r.p.m. by allowing three to pass.

There are many special applications of stroboscopes which yield a great deal of information. For example, we might study the motion of a loudspeaker diaphragm simply by illuminating it by an intermittent light and varying the rate of the illumination to differ slightly from the cyclic speed of the diaphragm. The motion may be stopped at the peak or it may be slowed down almost to a standstill. For example, the diaphragm may be driven at the rate of 100 times a second and the motion slowed down to one cycle a second, or one in ten seconds. This may be done at any other frequency as well provided only that we have complete control of the rate of illumination.

THE THREE PLUG-IN COIL NEW

By Herman

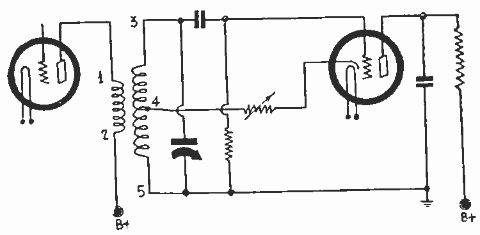


FIG. 1

A special type of Hartley circuit for a regenerative detector, with regeneration controlled by a variable resistance in the cathode leg, no bypass condenser across this resistance. A UY form is needed.

PLUG-IN coil forms are in general use for short-wave reception, because of the better electrical results over the wide frequency span, as compared to the more convenient switching devices. The switching method is more expensive, in general, so that plug-in coils might be assumed to be selected for economical reasons, but this is not so, for the two outstanding and most expensive short-wave receivers use plug-in coils.

The only reason for preferring plug-in coils is that results are better. It is only incidental that the cost is less. The better results may be ascribed to the absence of stray coupling between used and unused coils, the absence of any high minimum capacity such as arises from many types of switches, the lower losses generally and, particularly, the better contacts. Switch contacts are not infallible.

More Latitude

The type of plug-in coil most commonly used is of a moulded material, of good insulating quality but not wholly free from moisture effects nor from metallic content. Thus, with an hygroscopic form there will be more moisture present if the moulding is done on a wet or damp day, as compared to a dry day, and the inductance will differ between coil models wound on the two different specimens, despite equal number of turns of the same kind of wire and equal axial length of winding. The metallic content, moreover, introduces eddy current losses and might decrease the inductance additionally.

So it is well to use the better grade of coil forms, represented by non-metallic and non-hygroscopic moulding material, examples of which are found in the products of several manufacturers of parts, including Hammarlund Manufacturing Co., Inc., and National Company.

Six-Pin Type Available

Until recently all plug-in coils, with an occasional exception, were of the UX or UY base type, that is, had four or five pins. One manufacturer had a six-prong socket and form, but for his exclusive use. Therefore circuits had to be designed that could use the coils existing at the time. Now, with two tubes on the market that require six-prong sockets, the sockets of this type are available and the form manufacturers have provided six-pin forms as well, giving greater circuit latitude.

Makeshifts Introduced

It was always possible to get around the absence of an otherwise needed pin on the form by putting an r-f choke coil in the plate circuit of a tube, connecting a fixed condenser to a small winding, or to the secondary, tuning the secondary, and having it or the other winding returned to a point common to some other winding. But there were objections to this method, principally the one that the efficiency was not so good, due to the r-f choke damping the circuit for some frequencies, certainly not being equally effective at all frequencies where a wide frequency range was to be covered. Then, too, extra parts were needed, and they would cost more than a proper coil, or form, if such were obtainable.

Five diagrams herewith show the methods that may be used. First, in Fig. 1, there is a special type of Hartley oscillator, extremely simple and equally effective as an oscillator, having the fine advantage of keeping right on oscillating at the high frequencies, say to something above 60 mgc (below 5 meters).

The diagrams, however, are principally intended to show regenerative detectors, which means that the tube is hooked up for detection, and that it is primarily oscillating, with the oscillation under control. In such an instance bypassing or other equivalent of negative feedback is introduced to make the circuit workable for the purposes intended. In any other instance positive feedback is introduced by the control.

What the Numbers Mean

Fig. 1, though excellent as an oscillator, may prove rather critical of adjustment for regenerative purposes, unless just the right value of resistance is introduced in the cathode leg. The tendency of this type of oscillator is to oscillate or not oscillate, that is, generate radio waves strongly, or afford no feedback, so that this abruptness requires special care in the resistor selection to make the system completely acceptable for regenerative detector purposes. As an oscillator in a superheterodyne, or for test oscillator construction, it is a good one indeed, but the tested circuit should not be tightly coupled to it.

Fig 1. represents the use of a single winding to obtain oscillation, there being a tap, which may be at center, so three connections are required. If the return of the primary is to some other potential than one used for any part of the secondary, then a UY form must be used, but if a common connection is applicable to the two terminals of two windings, then a UX form could be used.

The numbers at coil terminals are put on to designate the number of coil terminals, and therefore where the highest number is 4 the form is UX, where 5 it is UY and where six it is of the six-pin type, which has not yet been given a designation by initials.

Reason for Bypass Condenser

In Fig. 2 is shown a precautionary method of using the UX form. The precaution consists of introducing comparatively large capacity mica dielectric condensers in series with the tuning and feedback condensers, so that if the plates of these adjustable condensers touch there will be no short circuit of the B supply. These series condensers are C1 and C5 and may be ten times as great as the maximum capacities of the adjustable condensers.

The plate circuit is tuned, therefore a bypass condenser has to be put between the B plus connection for the tuned coil and the grounded rotor of the tuning condenser. This bypass capacity naturally would be in the circuit anyway, but it is well to have it physically as close as possible to the points as shown in the diagram.

Feedback is controlled by varying the bypassing, for obviously the feedback condenser is a detector plate bypass condenser, assuming the cathode resistance high enough in value for detection.

The tubes in all the figures are shown without screens, but in reality they are in general intended to be screen grid tubes, as intimated by the resistance plate loads. But for transformer coupling out of the detector these tubes may be of the general purpose type. Of the five systems, the first is for a-c operation only, or, at least, only for heater type tubes, while the four others may be for battery-type tubes if the bias is provided accordingly, or grid return made to minus or plus (usually plus) filament for detection. The grid leak-condenser combination permits of actual grid return to a different potential than that of the tuned winding's return.

Option of Condenser Types

The object of the grid leak and condenser is to afford frequency stability, by maintaining fairly good d-c voltage constancy. A high resistance grid circuit load is required for enabling grid current flow to establish a negative bias on the grid, and this the leak does in all instances illustrated.

However, as stated, for grid leak-condenser detection simply make the correct grid return, and avoid the negative bias otherwise required.

It is assumed that there is a stage of tuned radio frequency ahead of the regenerative detectors illustrated, and therefore Fig. 2 has to be carefully constructed, otherwise there will be considerable feedback to the first tube, which indeed may be almost uncontrollably oscillatory. One solution would be to raise the value of the biasing resistor, or negative bias, on the r-f tube, another to leave the biasing resistor as it is for a-c type r-f tubes, and omit the bypass condenser from the cathode leg of that tube, another to put a high resistance in the grid return lead and bypass it with a condenser of large capacity, and do the same in the screen lead, if the tube has a screen.

Grounded rotors of condensers, meaning grounded to r-f and d-c potentials, were shown in Figs. 1 and 2, but if a condenser is used that is mounted on an insulated front panel, and not connected in any way to a metal chassis, the rotor may go to B plus, which is an r-f ground potential due to bypassing, and thus a UY form may be used with a three-winding coil. The reason is that two of the terminals of two coils are common.

C1 is the bypass condenser completing the tuned circuit. The capacity feedback method is used, or, rather, it is really inductance feedback with variable detecting efficiency, the higher efficiency resulting when more of the capacity of the regeneration control condenser is used. It is a makeshift method of coil connections.

The same may be said of Fig. 4, for the

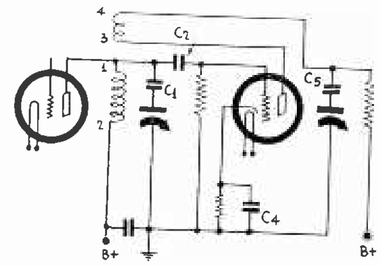
TYPES; 6-PIN FORM IS WELCOME

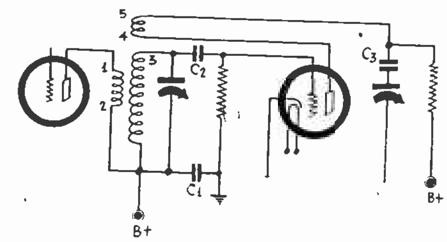
Bernard

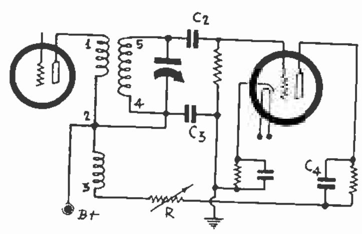
same reason that the high d-c potential is exposed at the front panel, perhaps by some metal on the dial, and also it is noted that the regeneration control is a resistor both sides of which are "hot," that is, at a high radio frequency potential.

Both Figs. 3 and 4 apply to the UY form, but the intention is to encompass three individual windings.

It is only natural to suppose that with six-prong sockets now available, and forms to match, that the preference will be for circuits similar to Fig. 5, if three separate windings are to be used—primary, secondary and tickler. The choice really lies between Fig. 2 and Fig. 5, for all-around dependability, for Fig. 2 is an excellent circuit. However, the six-pin base permits of six different connections, hence fewer parts are needed for Fig. 5 than for Fig. 2.







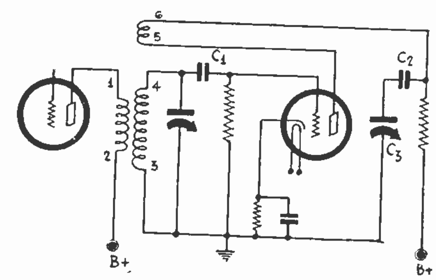


FIG. 2 (Top Left)
An excellent hookup, using the tuned grid type of oscillator, requiring a UX form.

FIG. 3 (Top Right)
Three separate windings are achieved with a UY form by making two terminals common.

FIG. 4 (Lower Left)
This circuit, like Fig. 3, exposes the high B voltage to the front panel, and is also a compromise.

FIG. 5 (Lower Right)
With the new six-pin forms, and sockets to match, three separate windings may be used readily.

R.C.A. Demonstrates Television

The Radio Corporation of America issued the following statement:

"Experimental work in television reception was demonstrated to its licensees by the Radio Corporation of America. About one hundred executives and engineers, representing approximately fifty radio set and radio tube manufacturers, attended the demonstration.

"Although continued progress has been made with television, this development is still in the laboratory stage. The demonstration was held for the purpose of showing RCA licensees the present status of research and development being carried on by the RCA and its subsidiary companies in this field.

"W.L." and "Osc." Are Plug-in Coils

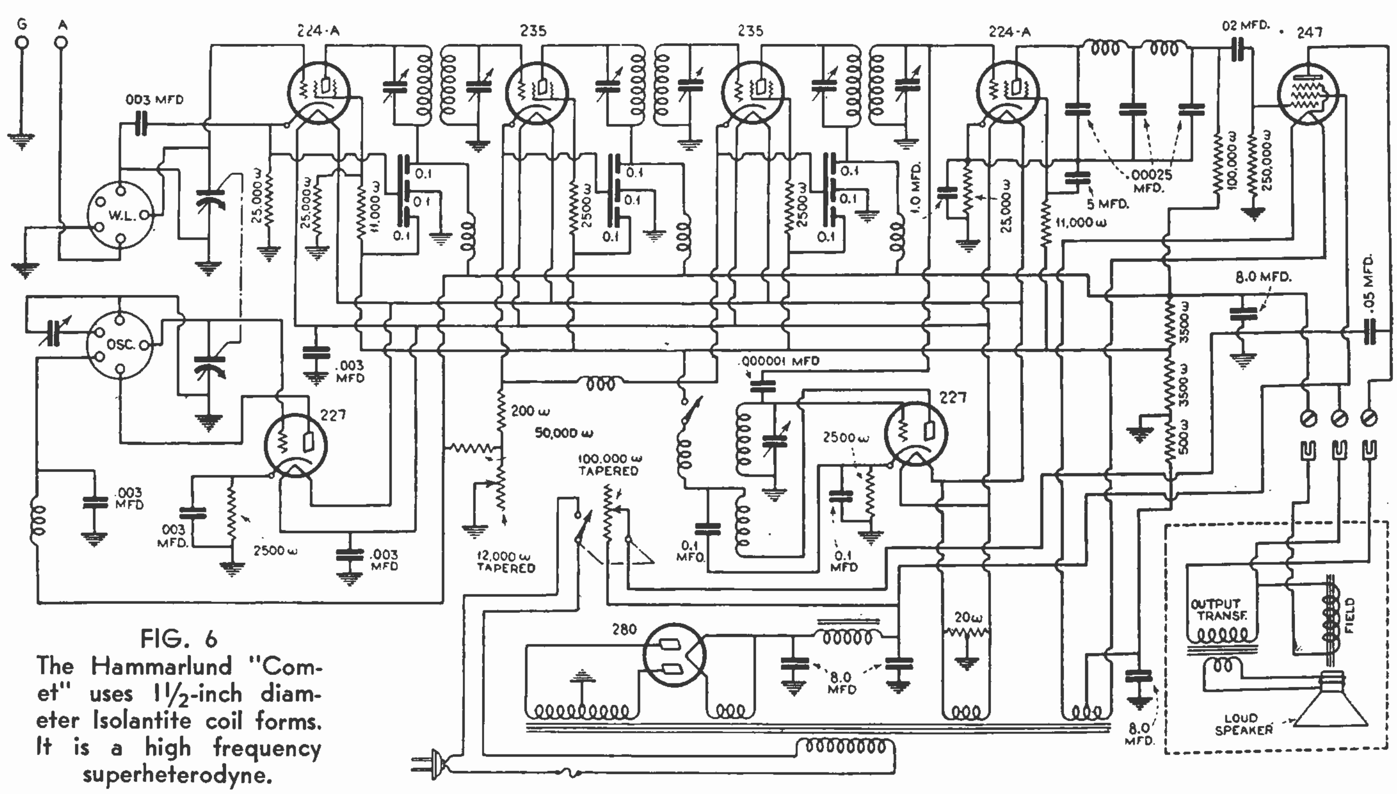


FIG. 6
The Hammarlund "Comet" uses 1½-inch diameter Isolantite coil forms. It is a high frequency superheterodyne.

NEW CIRCUIT INVENTED BY MULT

By Bruns

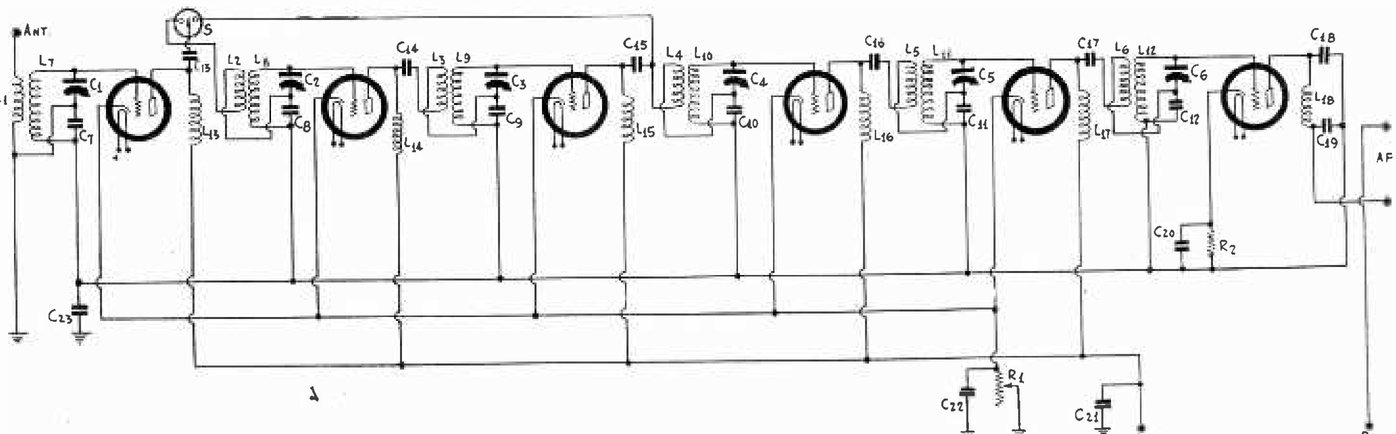


FIG. 2

The circuit of a six-stage r-f amplifier embodying the invention of the Rev. J. J. Daley. It is a unidirectional amplifier with complete absence of feed back. Enormous stable gain is possible as well as uniform sensitivity over the entire tuning range.

A NEW CIRCUIT has been invented by the Rev. Joseph J. Daley, of Boston, the characteristic features of which are uniform amplification over the entire tuning band, strictly uni-directional transmission of voltage or complete absence of feedback, almost limitless amplification without oscillation, and absence of circuit noises.

Uniformity of amplification has been secured by combining inductive and capacitive coupling in the correct proportion, and absence of feedback has been achieved by arranging the circuit elements so that there is a "zero difference of potential with respect to undesired currents." This is the uni-directional feature and means that there is absolutely no voltage feedback from the plate circuit of a tube to its grid circuit, or from any plate circuit to any preceding grid.

A Six Stage Tuner

The principle can be applied to almost any number of stages at any frequency up to about 25,000 kc. In Fig. 1 is shown the circuit diagram of a radio frequency amplifier and detector comprising six tubes and six tuned circuits, with an option for cutting out two of the stages.

The circuit is a network or regularl condensers, C3 and C9, which, in serie plain one stage, all are explained.

Let us start with the plate circuit c the second tube. We first meet a radi frequency choke L14 and a stopping cor denser C14. In this particular exampl of the new circuit, which is for broadca: reception, L14 has a value of 175 mill henries and C14 a capacity of 870 mmf On the right of the condenser the lea picks up the primary L3 of a radio fr quency transformer which, of course, inductively coupled to the secondary L The low potential side of the primar

Time Table of Tel

Call	Watts	Owner		Lines	Frames	Schedule
		1,600-1,700 kc 187.4 to 176.4 meters				
W1XAV	1,000	Shortwave and Television Laboratories, Inc.	Boston, Mass.	60	20	3 to 5 p.m., 9 to 11 p.m. EDST daily except Sunday. Sound, 1,550 kc, 10 to 11 p.m., Mon., Thurs., Fri.
W2XR	500	Radio Pictures, Inc.	Long Island City	60	20	4 to 10 p.m., EDST daily except Sun. and holidays. Sound W2XAR, 1,550 kc, daily except Sundays and holidays, 8 to 9 p.m. EDST.
		2,000-2,100 KC 149.9 to 142.8 meters				
W3XK	5,000	Jenkins Laboratories	Silver Springs, Md.	60	20	9:00 to 11:00 p.m., EDST; sound track, W3XJ, 1550 kc, same time.
W2XCR (WINS)	5,000	Jenkins Television Corp.	New York City	60	20	4 to 6 p.m., 7 to 9 p.m. EDST, daily; 6 to 10 p.m., EDST Sunday; sound track over WINS; 1,180 10 to 11 p.m., daily. W2XCR temporarily off air.
W2XAP (WMAL, Wash'ton, D. C.)	250	Jenkins Television Corp.	Portable	60	20	
W2XCD	5,000	De Forest Radio Co.	Passaic, N. J.	60	20	2 to 5 p.m., EDST daily; experimental.
W9XAO (WIBO, Chicago)	500	Western Television Corp.	Chicago, Ill.	45	15	Varies. Generally (with sound track, WIBO, 570 kc) 1 to 2:30 a.m., 5:15 to 6:15 p.m., CDST; (without sound track) 8 to 9:30 p.m., CDST.
W6XAH	1,000	Pioneer Mercantile Co.	Bakersfield, Cal.	96	20	5 to 6 p.m., DST daily, except Sat. and Sun. Sat., 5 to 6 and 7 to 8 p.m. PST. Single sideband; 1,550 kc sound track soon.
		2,100-2,200 KC 142.8 to 135.1 meters				
W3XAK	5,000	National Broadcasting Co.	Portables: Bases: Bound Brook, N. J., and N. Y. City			
W2XBS	5,000	National Broadcasting Co.				
W3XAD	500	RCA Victor Co.	Camden, N. J.	..	..	Irregular.

PRIEST;
-STAGE T-R-F, NO FEEDBACK

en Brunn

winding connects to the junction of two condensers, C3 and C9, which in series are connected across the tuning coil. The lower condenser, C9, provides the capacitive coupling.

The primary L3 has an inductance of 22.5 microhenries and the secondary an inductance of 275 microhenries. The tuning condenser C3 has a maximum capacity of 350 mmfd. and the coupling condenser C9 a capacity of 10,000 mmfd. (0.01 mfd.)

Extra Elements

If we assume that the bus bar to which the low potential sides of the secondaries is the chassis, this is not grounded. There is a condenser C23, capacity 0.005 mfd., between the chassis and ground. One detail is not given in the circuit as supplied by the inventor, and that is where B minus is connected. Presumably, the chassis is B minus, since a common bias resistor R1, maximum value 300 ohms, is used. But this goes from the chassis to ground, which suggests that the chassis should be grounded to complete the circuits. But this would short-circuit C23. No information is given on this difficulty but it is possible that a high resistance, say 0.5 meg., or a radio frequency choke coil is supposed to be connected across C23. Either would establish a return for the grids without greatly changing the effectiveness of C23. If this is the connection intended, ground would have to be B minus.

The condenser across R1 is a 0.05 mfd. unit and that across B plus, C21, is 2 mfd. Condensers C20 and C21 are 2 mfd. units. The bias resistance R2 in the detector cathode lead is 25,000 ohms. C18 and C19 are 0.001 mfd. units.

Constancy of Coupling

The constancy of the coupling comes from the fact that inductive coupling increases with frequency and capacitive coupling decreases with frequency. In our typical coupler, the inductive coupling between L3 and L9 increases with the frequency and at the high frequency end of the dial it greatly predominates. In fact, the coupling due to the condenser C9 is negligible. As the frequency is lowered the mutual between L3 and L9 becomes less and less and the coupling due to the condenser C9 becomes greater in proportion. The mutual coupling is phased so that it aids the capacitive coupling. The result of the combination is that the sensitvity of the receiver is very nearly the same at all frequencies within the tuning band. There is a slight maximum at about 1,000 kc but it exceeds only by a fraction of a microvolt per meter the sensitivity at either end. The mean sensitivity over the entire band is better than a quarter of a microvolt per meter.

The switch S over the first tube is for cutting out two stages when all the amplification is not needed. As will be noted, all the switch does is to throw the plate of the first tube to the regular output device of the third tube.

All the tubes in the circuit are of the three-element type, like the 227 or the 56, although Father Daley used special tubes of 30 mu. The 227 has a mu of 9, the 56 a mu of 13.8.

It is clear that thorough shielding of stages is necessary. If there were any coupling between coils through the air all the careful design would be nullified. It would only require a very small amount of coupling to start oscillation.

It is not sufficient to shield the individual coils, for that would leave the capacitive coupling between high potential plate and grid leads, and such coupling often causes more trouble than inductive coupling. Hence the stage-box type of construction is recommended. If with this construction there is danger of coupling between the antenna and the output circuit of the detector, of course the filter in the detector plate circuit, consisting of L18, C18, and C19, minimizes the danger. All shielding should be grounded.

It will be noted that only one of the variable condensers is connected to ground. This is another difficulty not made clear by the inventor of the circuit, for the built-up model of the receiver shows the usual ganged condensers. Incidentally, this suggests the possibility that the grounding of the first condenser is an error in the drawing. This is strengthened by the fact that if the first condenser and the coil L1 are grounded as shown the first coupler is not like the rest. The circuit would be sufficiently grounded if the ground connection to L1 were omitted.

But even with this change it would not be possible to gang the tuning condensers with a common metal shaft. Each variable condenser would have to be insulated from the chassis and from the others.

evision Transmitters

W2XVW (WGY)	20,000	General Electric Co.	Schenectady, N. Y.	60	20	4:30 to 5:30 p.m., EDST Friday.
W8XAV (KDKA)	20,000	Westinghouse E. & M. Co.	Pittsburgh, Pa.	60	20	3:30 to 4:30 p.m., EDST. Friday only. Sound track temporarily discontinued.
W6XS (KHJ, Los Angeles)	1,000	Don Lee Broadcasting System	Gardena, Cal	80	15	6:00 to 7:00 p.m., PST.
W9XAP (WMAQ)	2,500	National Broadcasting Co.	Chicago	45	15	12:30 to 1:30. 3:00 to 4:30. 5:45 to 6:45, 7:30 to 8 p.m., CDST. Uses 2150 kc.
2,750-2,850 KC 109.0 to 105.2 meters						
W9XAA (WCFL, Chicago)	500	Chicago Federation of Labor	Chicago			Starts June 24th.
W9XG, Lafayette, Ind.	1,500	Purdue University	W. Lafayette, Ind.	60	20	Tues. and Thurs., 2:00 to 2:45; 7:00 to 7:45. 9:00 to 9:45 p.m., CST.
W2XAB (WABC, New York City; sound over W2XE)	500					8 to 10 EDST. daily. Uses 2.800 kc. Sound on W2XE, 6,120 kc. temporarily discontinued.
43,000-46,000, 48,500-50,300 AND 60,000-80,000 KC 6.973 to 6.518 m. 6.182 to 5.961 m. 4.997 to 3.748 m.						
W1OXG	500	De Forest Radio Co.	Portable	Not operating yet.		
W9XD (WTMJ, Milwaukee)	500	The Milwaukee Journal	Milwaukee, Wis.	45	15	Irregular
W3XAD	2,000	RCA Victor Co., Inc.	Camden, N. J.	..	..	
W2XBT	750	National Broadcasting Co.	Portable	..	..	
W1XG	30	Shortwave & Television Co.	Portable	Irregular	45 mgc.	
W2XF	5,000	National Broadcasting Co.	New York City	Irregular		
W2XDS	2,000	Jenkins Television Co.	Portable	Not operating yet		
W6XAO	150	Don Lee Broadcasting System	Los Angeles, Cal.	80	15	6 to 7 p.m., except Sun. and holidays—using 44,500 kc.
W3XK	1,000	Jenkins Laboratories	Silver Springs, Md.	60	20	
W3XE	1,500	Philadelphia Storage Bat. Co.	Philadelphia	Not operating yet		
W2XDV	50	Atlantic Broadcasting Corp.	New York	Not operating yet		51.4, 60, also 400 and 401 mgc.

YOU HAVE MOST OF THE TO BUIL

By Fred

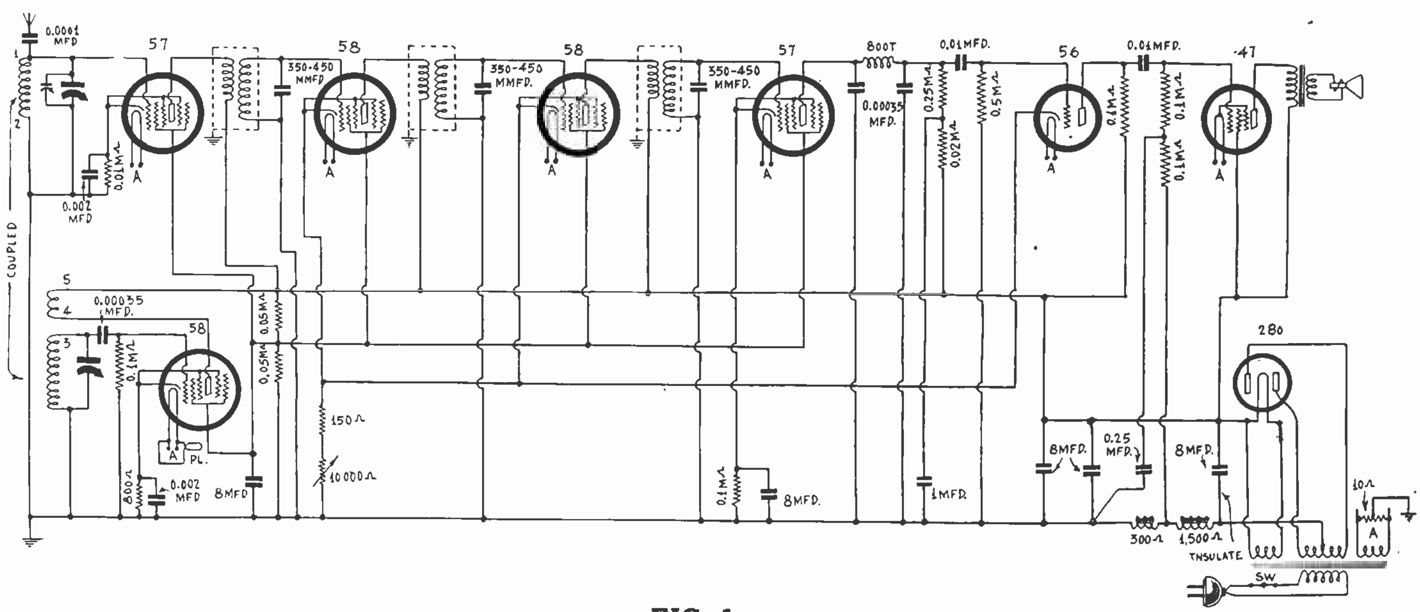


FIG. 1

See how many of the parts described for this circuit you have on hand. You will find the number surprisingly large, especially after reading substitution directions. Then you may be tempted to build this short-wave superheterodyne. It's a good one.

EVERY one who has been experimenting with radio circuits has a stack of parts on hand, and the problem sometimes arises how to use them advantageously in some new hookup you desire to try. Therefore the present circuit, a short-wave superheterodyne, is readily made to include parts you have, as will be disclosed.

The mixer tuning coil is wound on a UY type form, both modulator and oscillator on the same form, inductively coupled. If a two-gang 0.00035 mfd. condenser is used, only three coils are needed to cover from 15 to 200 meters, whereas if the tuning condensers are 0.00014 mfd. or 0.00015 mfd. (the same coil data applying to these two capacities), a total of four coils will be needed. Therefore the plug-in operation is halved, since normally two separate coils are used, one for modulator, the other for oscillator.

T-R-F Coils As Intermediates

The intermediate channel consists of two stages. This requires three coils. It will be noticed that the secondaries are tuned, the primaries are not. In fact, these coils are of the same type used in tuned radio frequency receivers, and no doubt you have such a set around the house or laboratory. They may be for 0.0005 mfd. or for 0.00035 mfd., it making small difference which, and the primaries may remain just as they are. The only difference now is that instead of being variably tuned they are permanently tuned, 350-450 mmfd. padding condensers serving the purpose. These padding condensers no doubt you will have to obtain.

Thus the intermediate frequency may be established lower than the lowest in the broadcast band. You can reach to about 425 kc, but it does not make much difference what intermediate frequency you choose, so long as you stay off one, like 600 kc, that develops interference. In that case distress calls might be heard directly.

Due to the large minimum of the intermediate condensers you will be outside the broadcast band probably if the coils were intended for 0.00035 mfd. tuning (350 mmfd.), whereas if for 0.0005 mfd. you will have to turn down the setscrews to get outside the broadcast band. When the set is finished the intermediate channel can be lined up by ear, for loudest response.

Substitutions Outlined

So, if you have the t-r-f coils that will be used for intermediates, and can wind the three or four plug-in coils yourself, you have made a good start and not spent any money yet, except for the padding condensers. If you haven't a two-gang condenser of any of the capacities stated you may use separate condensers, with a knob on the modulator and a dial on the oscillator.

The antenna series condenser of 0.0001 mfd. may be a 20-100 mmfd. equalizer, set at maximum, or instead you may use two 0.00025 mfd. condensers in series. The manual trimming condenser across the modulator should be at least 50 mmfd. for a two-gang of either type. If you have much larger condensers and want to press one of them into service you may put a 20-100 mmfd. equalizing condenser, set at maximum, in series with the stator of this large condenser. If the large one is 0.00025 mfd., 0.00035 mfd., 0.0005 mfd. or larger the purpose will be served.

The bypass condensers marked 0.002 mfd. may be of that capacity or larger or smaller, but should be of mica dielectric. No smaller than 0.0005 mfd. should be used, and of course larger than 0.01 mfd. are not readily obtainable in mica dielectric. The grid condenser in the oscillator, marked 0.00035 mfd., may be 0.00025 mfd. or 0.0001 mfd., and with the 0.1 meg. leak (which may be 0.05 meg., 50,000 ohms, instead), constitutes a frequency-stabilizing device, and not a detector circuit. The bias on the grid is considerably negative, you will note.

Second Detector Plate Bypassing

The resistors marked 0.05 meg., for voltage division, may consist of two 0.1 mfd. in parallel, requiring four resistors, but if you have the four you'd rather use them than buy two more of half the resistance value. The volume control, marked 10,000 ohms, may be more, up to 25,000 ohms, but if much more than 10,000 ohms may confine control to three-quarters of the angular displacement or rotation. Much less than 10,000 ohms should not be used.

The radio frequency choke coil in the second detector plate circuit is of the small 800-turn type, about 1 inch total diameter of winding, but if you have 300 turns you may use that. In this particular instance much less inductance than the few millihenries represented by the run of 300-turn coils should not be used, as the bypassing of the intermediate frequency should be good, to reduce images. The bypass condensers of 0.00035 mfd. in the detector circuit may be of higher capacity, up to 0.001 mfd., but values that high will reduce the high audio note response somewhat. At the same time, however, they would reduce circuit noises that are in the high audio frequency region.

Leak Values

The second detector plate load resistor, marked 0.25 meg., may be from 0.1 meg. to 0.5 meg., and the 0.02 meg. may be replaced with any higher value up to 0.1 meg., but the filter condenser in this circuit should be 1 mfd. for its pronounced effect on hum reduction.

Instead of audio grid leaks of 0.5 and 0.1 meg., any high value may be used in the first audio grid circuit, up to 5 meg., but to counteract this the leaks in the pentode grid circuit may have to be smaller than specified, say, 0.05 meg., the rule being to make audio grid leaks as high as practical, without motorboating. If motorboating is present reduce the leak value in either audio stage, it makes no difference which.

The power transformer you are assumed to have. If you use the new tubes, as suggested, then the 6-tube rating of the 2.5-volt secondary will suffice for this receiver, because the new tubes at 2.5 heater volts draw 1 ampere each, as against 1.75 amperes for the older tubes. It is not imperative to use the new tubes, the 57 detector type five-

PARTS
D THIS SHORT-WAVE SET

Warren

element tube, the 58 variable mu five-element tube and the 56 audio amplifier. The new screen grid tubes, because of the fifth element, or suppressor, which is brought out to a separate pin, require special sockets with six prongs, but the more familiar '24, '35 and '27 tubes may be used, following the diagram as shown, but omitting the suppressor connection. Then UY sockets would be used.

The B supply is shown as using a dynamic speaker field for B choke, but if you have a separate B choke and some other than d-c type of dynamic speaker, you may put the choke in the positive leg, interrupting the lead from the 280 filament with the choke where the lead runs from the first 8 mfd. condenser at right to the pair of 8 mfd. just to the left.

Reasons for Extra Capacity

While two 8 mfd. condensers are shown at the end of the filter chain, you can get along with one. The extra bypassing is helpful on a short-wave set. Signals are certainly louder and also somewhat clearer.

The 8 mfd. capacities across the second detector biasing resistor and the screen voltage lead are due to the audio component in these branches. The second detector tube alone is responsible for these high capacities, for audio should be removed from the screen and cathode circuits of this tube. Still, since large capacity is advisable for the one tube it may as well be used for the other tubes, and this results due to the common connection of screens, although the second detector bias is independent.

The resistor biasing the second detector is large—0.1 meg.—but that is because the screen voltage is high. It is the same voltage as is applied to the other screens, around 100 volts apparently, although reading somewhat less on current-drawing meters. The screen voltage effective on the second detector is the voltage between cathode and screen, and by lifting the cathode voltage the effective screen voltage is lowered. Still, the tube will detect fairly well even with much smaller value of resistor, even 20,000 ohms giving results.

You have probably found by this time that you have so many parts on hand that would fit into this set, and could make some others, that it would not be a bad idea at all to see what will happen. Plenty will happen, for, built with either the older or newest tubes, the circuit will work well. It has pep far beyond that found in the t-r-f types of short-wave sets, and rates such a respectable selectivity that little trouble in separation is encountered even on the crowded amateur phone bands (80 and 20 meters).

May Be Logged

The circuit can be logged accurately, as the volume control, although a d-c voltage-changing device, is in a circuit where the frequency is low, and the frequency change resulting from voltage variation is slight.

It is recommended by tube makers that the volume control be in the cathode leg of the modulator, and that the modulator be a 58 tube, instead of a 57, but this recommendation applies to broadcast frequencies, where the detuning is not only serious but may be helpful as of the same effect as a trimmer capacity. Here, however, signal is hardly likely ever to overload the first detector, or modulator, and a variable mu tube is not needed. The other type is more sensitive for the purpose at hand—that is the '24 or 57, its new and improved companion.

The intermediate frequency coils, if you wind them, may consist of 127 turns of No. 32 enamel wire on 1 inch diameter, with primaries of 30 turns wound over the secondaries about at their center, with insulation fabric between. However, if you have differently made coils, you may still use them, or if you like, rewind the primaries over the secondaries as prescribed. Any diameter insulated wire may be used for the primaries, even finer wire than No. 32 enamel.

The tube base diameter is assumptively 1.25 inches, although actually ordinary tube bases have slightly different diameters. For these coils the bases knocked off tubes won't do, but the UY plug-in coil forms must be used. These commonly have a 2-inch winding space.

Coil Information

Assuming 0.00035 mfd., the antenna winding for the first of three coils has 30 turns of No. 32 enamel wire at one end, 20 turns (for oscillator) at the other end. Wind a 15-turn primary tickler (any kind of wire) over the oscillator secondary. For the second coil use 12 and 10 turns respectively, No. 24 silk covered wire, with 5-turn tickler, and for the third coil, equal windings of 4 turns of No. 18 enamel wire.

For Smaller Condensers

For 0.00014 or 0.00015 mfd. the windings are 60, 40, 15; 25, 20, 10; 10, 9, 5; 4, 4, 4. The same size wire is used as previously stated for the groups, except that No. 32 applies to secondaries of two coils, No. 24 to one and No. 18 to one.

The separation between secondaries is as it comes on a form as described.

Five English Notables on Forum Committee

Five distinguished English leaders have been named members of the British committee of the International Radio Forum, according to a radiogram from Ira Nelson Morris, former United States Ambassador to Sweden, and organizer of the Forum.

Those already named are the Honorable Winston Churchill, statesman, and former Chancellor of the Exchequer; H. G. Wells, author; Lord Howard of Penrith, former ambassador to the United States; Sir William Bragg, head of the Royal Institute of Scientists, and Lady Muriel Paget, humanitarian worker.

Morris will act as chairman of the committee, as he does also on the committees already formed in the United States, Germany, France and Sweden.

The International Radio Forum was organized to promote better understanding among nations through exchange of talks on various topics by leaders in the member countries. The programs are heard in the United States over National Broadcasting Company networks.

SCHULLINGER APPOINTED

Karl W. Schullinger is now manager of the NBC Artists Service, Pacific Division. Rudolph Vavpetich, former manager, resumed his activities in the national concert field in the East.

Tube Chart for Amateurs

TYPES FOR AMATEUR AND EXPERIMENTAL RADIO USES, IN NUMERICAL ORDER

Type Number	Purpose		Type Cathode	Filament Volts	Filament Amps.	Filament Supply	Normal Plate Volts	Voltage Amplification Factor	Negative Grid Bias Class B Approximate Volts	Negative Grid Bias Class C Approximate Volts	Screen Voltage Class B Approximate Volts	Screen Voltage Class C Approximate Volts	Plate Current Class B Maximum Ma.	Plate Current Class C Maximum Ma.	Plate Dissipation Class B Maximum Watts	Plate Dissipation Class C Maximum Watts	Power Output Peak Watts	Power Output Class B Carrier Watts	Power Output Class C Watts
841	Oscillator of RF Amplifier	UX	Filament	7.5	1.25	AC or DC	250	30	...	20	...	...	...	60	15	15	...	...	6
							350	30	5.1	25	...	...	50	60	15	15	12	3	10
							450	30	5.1	30	...	...	50	60	15	15	16	4	13
RCA-852	Oscillator or RF Amplifier	UX	Filament	10.0	3.25	AC	2000	12	150	250	...	...	85	100	100	100	120	30	100
RCA-865	Oscillator or RF Amplifier	UX	Filament	7.5	2.0	AC	500	500	40	75	125	...	30	60	15	15	7.5	1.9	7.5
RCA-866	Half-Wave Rectifier	UX	Filament	2.5	5.0	AC							Maximum Peak Voltage—7500 Volts Maximum Peak Plate Current 0.6 Amperes Approximate Tube Voltage Drop—15 Volts						

NEW TUBES IN A BROADCA
PRE

By J. E.

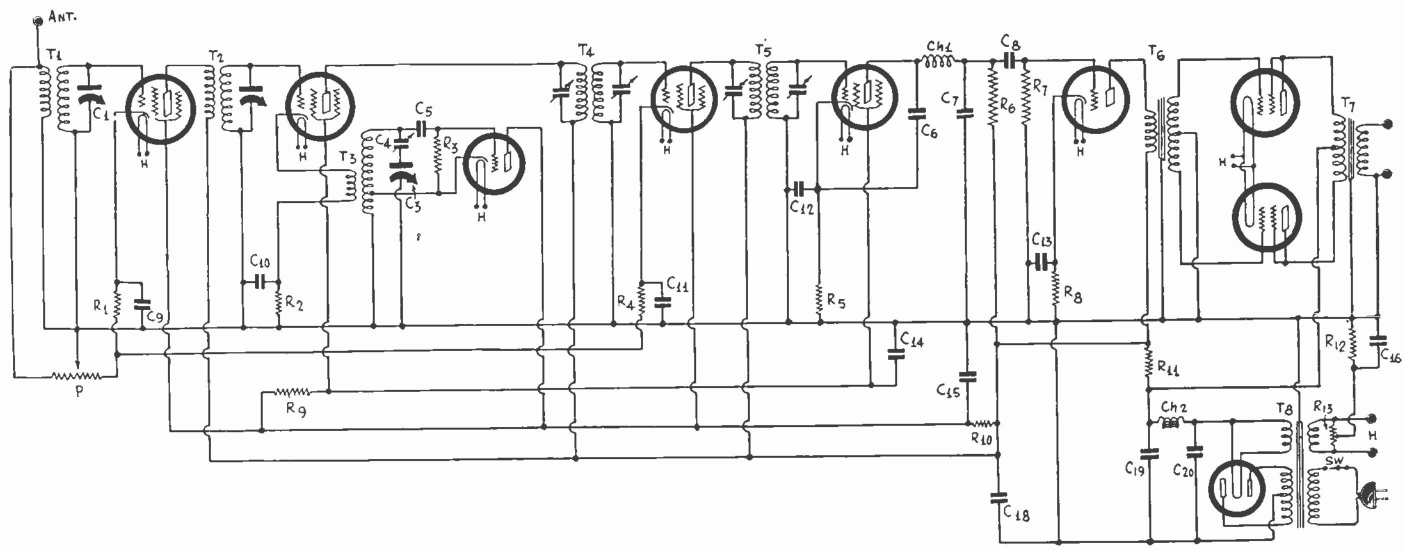


FIG. 1

A nine-tube superheterodyne incorporating 465 kc. intermediate, the new 2.5 volt tubes, and the 82 mercury rectifier. Circuits of this type will be contained in coming commercial models.

SEVERAL new developments have taken place in radio during the last few months that will be reflected in most receivers for the coming seasons. One of these is a new series of tubes comprising the 56, 57, 58, 46, and the 82. The characteristics of these tubes have already been given in previous articles. Another development is the 465 kc intermediate frequency for superheterodynes. While this is not a recent development as applied to radio in general, it is quite recent in respect to broadcast receivers. There appears to be little doubt that practically all superheterodynes in the Fall will have this intermediate frequency, or at least that it will predominate just as the 175 kc intermediate has predominated during the last two or three seasons.

The object of this article is to work out a design of a nine-tube superheterodyne employing the new tubes as well as the 465 kc intermediate frequency. The 46 tubes will be used in the output stage, not as a Class B amplifier, but as a Class A because success in building the set will be more assured with this type of amplifier and the output will be ample for all ordinary requirements. Indeed, it will be greater than any one could reasonably use in a home.

The Circuit

The circuit follows standard practice and omits all "tricks" of the penny-wise nature. It consists of one radio frequency amplifier, a mixer, an oscillator, an intermediate amplifier, a grid bias detector, and intermediate audio amplifier, one stage of push-pull, and a power supply using the 82 mercury rectifier. There are two radio frequency tuners in addition to the oscillator tuner and two doubly tuned 465 kc intermediate transformers. The volume is controlled by the customary combination of input signal variation and grid bias variation on the r-f and i-f amplifiers.

The tuning is done with a three gang condenser, each section having a capacity of 350 mmfd. and a trimmer. This is a standard size and r-f tuning coils are available for it. However, at this time there is no oscillator coil available for the high intermediate frequency. We shall give the specifications for the oscillator coil and the padding condenser to make it track at 465 kc.

On the assumption that the variable oscillator condenser C3, Fig. 1, and the padding condenser C4 are connected as indicated and that the trimmer condenser is across C3 alone, careful computation has shown that the effective value of the inductance of the tuned winding of T3 should be 141 microhenries and that the value of C4 should be 345 mmfd. There is an adjustable condenser for padding having nominally a range of 350 to 450 mmfd. which will just about cover the case since its minimum is slightly less than 350 mmfd. However, if it should fail to effect trimming a condenser of about 0.0025 mfd. can be connected in series with C_4 and C_3 on the grid side of C_4.

Winding of Oscillator Coil

The inductance of the coil should be 141 microhenries when measured inside its shield. Since the shield reduces the inductance a little it should measure a little more outside. The reduction of inductance in a coil of this inductance wound on a one-inch form with No. 32 wire and placed inside a 2.5 by 2.125 inch aluminum shield is about 3 microhenries.

If we use No. 32 enameled wire on one inch tube we need 83 turns. As will be noted, both the tickler and the grid windings are included in the tuned circuit, the coil being divided by a tap for the cathode connection. The tap should be placed so that there are about 30 turns below it and 53 turns above it. The position is not at all critical and if there is a deviation of a turn or two in either direction it does not matter. The axial length of the winding should be nearly 0.75 inch. Before the winding is started holes should be drilled in the form about where the terminals will be. Start winding near the bottom of the form so that there will be room at the top for the pick-up winding. This should contain only 10 turns of fine wire, or of the same wire as is used for the tuned winding. A space of about 1-16th inch should be allowed between the grid end of the tuned winding and the nearest end of the pick-up. The spacing is not at all critical.

This coil avoids one of the most common difficulties with oscillator coils, high capacity between windings and consequent low maximum frequency. If this receiver is to tune up to 1,500 kc, the oscillator must tune up to 1,965 kc, which is not possible unless the maximum capacity be kept low. While the minimum capacity across C3 will be considerably greater than the minimum across either C1 or C2, the minimum must be across C3 alone and not across C3 and C4, which it would be if it were across the coil. The construction of the coil insures against high minimum capacity.

Oscillator Tube

The proper oscillator tube is the 56, which is a three-element tube like the 227. The grid condenser C5 should be 0.001 mfd. and the grid leak 100,000 ohms. In case blocking should occur the resistance can be reduced until it stops.

The modulator tube may be either a 57 or a 58 but the 57 is recommended for this circuit. The operating bias for this tube when used as a detector should be 6 volts and the proper bias resistance is 50,000 ohms. This is R2 in Fig. 1. The shunting condenser C10 across it should be 0.1 mfd. or more.

The first and the fourth tubes in the circuit should be 58s. The correct bias for one of these tubes is 3 volts. At this bias and the plate and screen voltages later to be specified the screen current is 3 milliamperes and the plate current 8.2 milliamperes. Hence the cathode current is 11.2 milliamperes. Therefore the bias resistance should be 268 ohms. Values of 300 ohms could be used and they are available. Hence R1 and R2 should be units of this value. Each should be bypassed by a condenser of 0.1 mfd.

Second Detector

The best tube for second detector in the new series is the 57. This should have a load resistance of 250,000 ohms and the bias should be adjusted to 6 volts. The sum of the screen and plate currents will be nearly

ST SUPER; SENT TREND IS TO 465 kc I-F

Anderson

LIST OF PARTS

Coils

T1, T2—Two shielded radio frequency transformers for 350 mmfd. tuning condensers.
T3—One special oscillator coil as described.
T4, T5—Two doubly tuned, 465 kc, intermediate frequency transformers.
T6—One 3.5-to-1 push-pull input transformer.
T7—One push-pull output transformer, preferably a part of loudspeaker.
T8—One power transformer as described.
Ch1—One 800 turn duolateral r-f choke, about 10 millihenries.
Ch2—One 30-henry filter choke, preferably 200 ohms.
Two one millihenry, or higher inductance, chokes in rectifier.

Condensers

C1, C2, C3—One gang of three 350 mmfd. tuning condensers.
C4—One 350-450 mmfd. padding condenser, or slightly smaller.
C5—One 0.001 mfd. condenser.
C6, C7—Two 0.00025 mfd. condensers.
C8—One 0.1 mfd. condenser.
C9, C10, C11—Three 0.1 mfd. bypass condensers in one case.
C12—One 0.5 mfd. bypass condenser, or larger.
C13—One 1 mfd. bypass condenser.
C14, C15—Two 2 mfd. by-pass condensers.
C16—One 4 mfd. or larger bypass condenser.
C18, C19, C20—Three 8 mfd. electrolytic condensers.

Resistors

P—One 10,000 ohm volume control potentiometer.
R1, R4—Two 300 ohm bias resistors.
R2, R5—Two 50,000 ohm resistors.
R3—One 100,000 ohm resistor.
R6—One 250,000 ohm plate resistor.
R7—One 500,000 ohm grid leak.
R8—One 2,700 ohm bias resistance.
R9, Ro—Two 5,000 ohm resistors.
R10—One 7,500 ohm, 3 watt resistor.
R11—One 1,000 ohm resistor, 3 watts.
R12—One 750 ohm resistor, 3 watts.
R13—One 20 or 30 ohm center-tapped resistor.

Other Requirements

Four UY (5-pin) sockets.
Four 6-pin sockets.
One UX (4-pin) socket.
One line switch.
Four grid clips.
One close adjustment dial.

0.12 milliamperes and the bias resistance should therefore be 50,000 ohms. However, it is not critical and any value between 25,000 and 75,000 ohms will cause detection. This is R5 in the drawing. The condenser C12 across it should be at least 0.5 mfd.

In view of the fact that there will be present in the plate circuit of the detector considerable r-f current, which might cause oscillation notwithstanding shielding, a filter must be used. This consists of one 10 millihenry choke Ch1 and two 0.00025 mfd. condensers C6 and C7. The manufacturers of the tube recommend even one more such filter consisting of one more choke and one more bypass condenser. In case another is added the choke should be connected between the plate and the junction of Ch1 and C6 and the extra condenser should be connected from the plate to the cathode.

The Audio Amplifier

The condenser C8 should have a value of about 0.1 mfd. and the grid leak R7 500,000 ohms.

The best tube for audio amplifier is the 56 because an audio transformer must follow it. It requires a bias of 13.5 volts. The plate current will be 5 milliamperes, assuming a plate voltage of 250 volts. Hence the bias resistance R8 should be 2,700 ohms. A condenser C13 of at least 2 mfd. should be connected across it.

This tube is coupled to the push-pull stage by a regular push-pull input transformer T6. Following the 46 output tubes is a push-pull output transformer that should fit the tubes to the speaker used. It will do little good to specify this transformer without knowing the characteristics of the speaker. It is better to specify a speaker that has been designed for these tubes when working in push-pull as a Class A amplifier. The nearest speaker is one wound for 245 tubes in push-pull, or 171A tubes. Since the transformer design depends as much on the speaker as on the tubes, the transformer should be an integral part of the speaker.

When the 46 tubes are used in Class A service the grid bias should be 33 volts. The plate current in each tube will be 22 milliamperes. Hence the current for two tubes will be 44. Therefore the bias resistance R12 should be 750 ohms and of a rating at least 3 watts.

The bias resistance has a condenser C16 across it. It is usually said that a bypass condenser is not needed because there is no signal current in bias resistance and hence no degenerative feed back. This is true provided that the circuit is truly balanced. Moreover, if it is not, the bias resistance will help to equalize the unbalance. But there is another factor. The balancing is only for the odd harmonics. There is current in the bias resistance on the even harmonics. Experience has shown that when a large bypass condenser is used across the bias resistance the quality is appreciably better. This may be due to the removal of harmonics from the bias resistance. C16 should not be smaller than 4 mfd. and may well be as high as 16 mfd.

Heater Supply

Since the 46 tube has a filament cathode it is necessary to return grid and plate to the center of the filament. For this purpose we have a 20 ohm center-tapped resistance R13 across the 2.5 volt winding H serving the tube. Since this winding also serves to other tubes the resistance also serves to ground the heaters of these tubes. The use of a common heater winding for all the tubes is economical but it is not the best in practice. The tube manufacturers recommend that the voltage be zero between the cathodes and heaters, or if not zero, that the heater be negative with respect to the cathodes. The use of a common heater winding makes the cathodes negative with respect to the heaters. Hence it is better to use a separate winding for all the cathode tubes.

The voltage on the plates of the output tubes should be 250 volts and the bias should be 33 volts. That is, the voltage between ground and the center of the output transformer primary should be 283 volts. This should also be the total drop in the voltage divider. The voltage on the plates of the other tubes, with the exception of the oscillator, should also be 250 volts. Since the bias on these tubes is low we may assume that the voltage drop in the divider exclusive of R11 should be 250 volts. Thus the drop in R11 should be 33 volts. The recommended screen voltage in the amplifiers is 100 volts. Hence the drop in R10 should be 150 volts. The oscillator plate voltage may also be 100. The voltage on the screens of the detectors may be considerably less, say 50 volts. Therefore the drop in R9 should be 50 volts.

Another resistor should be connected between the screens of the detectors and ground to establish a bleeder current, the drop in which should be 50 volts. Now if we choose a bleeder current of 10 milliamperes, the value of the bleeder resistance, which we shall call Ro, will be 5,000 ohms. The current in R9 will be nearly the same and therefore R9 will be nearly the same and therefore R9 should also be 5,000 ohms. In R10 the current is 10 milliamperes plus the screen currents of the two 58 amplifiers plus the oscillator current. The total is about 20 milliamperes. Hence R10 should be 7,500 ohms. The dissipation in it will be 3 watts. The current in R11 will be about 36 milliamperes. Hence its value should be 900 ohms. It is quite permissible to use 1,000 ohms.

The B Supply

If an 82 type rectifier tube is used in the B supply the transformer T8 should have one center-tapped 2.5 volt, 3 ampere winding for the filament of the rectifier. The drawing does not show this to be center-tapped, but it should be for best results. It should also have a high voltage centertapped winding for the plates. The voltage across each half should not exceed 500 r.m.s. volts. Then the transformer should have two other 2.5 volt windings, though only one is shown. One of these, the one heating the two 46 tubes, should have a current capacity greater than 3.5 amperes and the other should have a capacity of more than 6 amperes. If the 6-ampere winding is center-tapped the center should be connected to the chassis. If it is not tapped, the center should be provided as shown on the H winding.

The rectifier tube should be completely inclosed in a perforated metal container, or it should be placed inside metal gauze. In each lead from the plate of the 82, and inside the shield, there should be a radio frequency choke coil of one millihenry or more. If the shielding and choking precautions are not taken noise generated in the rectifier will cause interference with radio signals.

Only one filter choke, Ch2, is shown in the B supply. This should have as high inductance as practicable and as low resistance as is consistent with the dimensions of the coil. Thirty henries and 200 ohms are suggested. However, a higher resistance can be tolerated. Most of the filtering is obtained by means of condensers. Each of the three condensers C18, C19, and C20 should have a capacity of 8 mfd.

A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. Answers printed herewith have been mailed to University Members.

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Annual subscriptions are accepted at $6 for 52 numbers, with the previlege of obtaining answers to radio questions for the period of the subscription, but not if any other premium is obtained with the subscription.

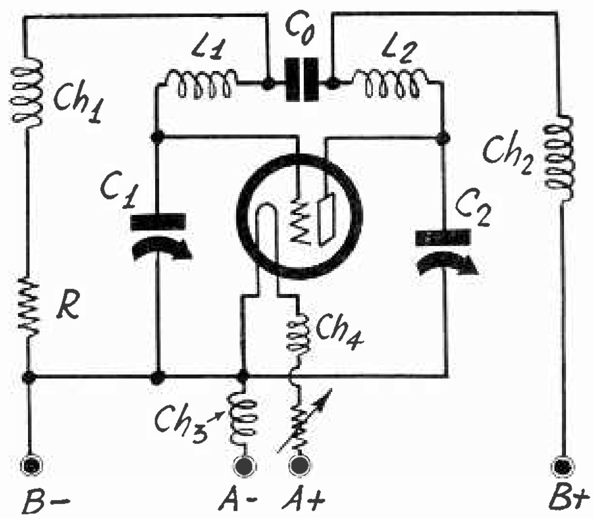

FIG. 1011
A high frequency oscillator. The chokes in the filament legs are for stabilizing the tube operation. R is the grid leak, which may be 100,000 ohms. Co is large —say, 0.01 mfd. or any other large condenser of mica dielectric—and its effect on frequency is then too small to be considered. C1 and C2 may be dual gang condensers, 0.00035 mfd. or 0.00025 mfd. each section, or even smaller.

PLEASE show an oscillator for ultra frequencies, using tuned grid and tuned plate. —J. W. A., New York, N. Y.

Such a diagram is printed herewith, Fig. 1011. Also it happens to be a modified Hartley oscillator. The tube is battery-operated. The tuning condensers could be ganged. Radio frequency chokes, it will be noticed, are in the filament legs, as well as in the grid and plate circuits. Those in the filament circuit of course must carry readily the heavy direct current flowing. Only a few turns of heavy wire on a small diameter will be sufficient. Chokes Ch1 and CH2 may be of wire not quite so coarse. L1 and L2 may be regarded as a continuous coil, electrically, although separated at the halfway mark by a condenser, Co. The capacity of this condenser is so large that impedance at the frequencies under consideration may be neglected. L1 and L2 would depend on the capacities of C1 and C2 and the frequencies to be generated. If L1 and L2 were each of 1 turn of 3-16ths inch diameter hollow tubing, the winding 3 inches in diameter, and C1 C2 a double condenser, each section 0.00025 mfd., the tuning would begin at about 30 kc and go beyond 40 kc (from about 10 meters to 5 meters). The front panel would have to be shielded against body capacity, and an insulated shaft extension used on the condenser.

* * *

High Frequency Resistance Standards

WILL YOU kindly explain how I can make resistance standards which when adjusted with direct current will also be reliable at broadcast frequencies? Is it possible to use resistance wire?—F. W. C., Pittsburgh, Pa.

Resistance wire can be used provided the material of the wire is not magnetic. Manganin wire is suitable and is ordinarily used. Resistance wire containing nickel is not suitable because nickel is magnetic and also because it has a high temperature coefficient. Manganin has a very low coefficient and that is the main reason why it is used for standards at low frequencies and steady currents. It is so low that it may be considered zero. Another precaution is that the wire used should be fine so that the skin effect will be negligible. In other words, the wire should be so fine that it is mostly surface or skin. Another reason for using fine wire is that a given resistance is obtained with a relatively short wire, and that is important in order to reduce capacity and inductance effects. The inductance of the resistance unit is reduced by making the wire into a loop with the go and return portions close together. But this increases the capacity so they must not be too close. Manganin wire can be obtained in all sizes.

* * *

Measuring Capacity

I HAVE a calibrated oscillator and an inductance coil that has been adjusted to 245 microhenries. With these can I measure capacity, for example, the capacity of the tuning condenser at any given setting?—W. H. C., Chicago, Ill.

You can very easily. Just find the frequency at which the coil and the condenser resonate and then use the frequency formula for computing the capacity. In your particular case, that is, with a coil of 245 microhenry inductance, the capacity is $103.3/F^2$, in which F is in megacycles and the capacity is given micromicrofarads.

* * *

Coils in Converters

IN A SHORT-WAVE converter that has two condensers independently adjustable, should the r-f and the oscillator coils be of the same inductance or should one be larger than the other?—S. G., New York, N. Y.

If the condensers are independently adjustable the coils may be equal or different. If they are equal the dial readings of the two will be entirely different, especially on frequencies near the broadcast band. On higher frequencies they become more nearly equal. If the same dial settings are desired, the r-f coil should be considerably larger than the corresponding oscillator coil. Just how much larger depends on the frequency received and on the intermediate frequency selected. Suppose that the intermediate frequency is 750 kc. and that the lowest signal frequency to be received is 1,500 kc. Then, if the tuning condensers are equal the ratio of r-f to oscillator inductance should be 2.25. If the coils are short compared to the diameter the ratio of turns should be 1.5. In any case the ratio of the inductances is the square of the oscillator frequency to the signal frequency when the condensers are fully meshed.

* * *

Design of Oscillator Coil

HOW MANY turns of No. 24 enameled wire will be needed for an oscillator coil to cover the broadcast band with a 350 mmfd. condenser? The tubing on which I will wind the coil is 2 inches in diameter. If the oscillator is to be of the Hartley type with the cathode of the 227 tube connected to a tap, where should that tap be placed?—G. W. L., Harrisburg, Pa.

You will need 81 turns. This assumes that the capacity is actually a little more than 350 mmfd. so it would be safer to add a couple of more turns in case the distributed capacity is not quite as much as was assumed. It also assumes that there is no metal shield around the coil.

* * *

Constant Impedance Volume Control

CAN YOU suggest a volume control of the potentiometer type that does not change the tuning characteristics as it is turned? I have heard that there is a constant impedance type which should do the trick, but I don't know how to hook it up.—W. H. B., Atlantic City, N. J.

Take two equal potentiometers each of about 500,000 ohms. Connect the sliders together and run them to the grid of the first tube in the set. Leave one terminal on each open. Connect the other terminal of one to the stator of the tuning condenser ahead of the controlled tube and the other terminal of the other potentiometer to ground. The terminals must be chosen so that the resistance variation in the two is opposite, that is, so that the resistance of one decreases while the other increases. The same thing can be done with a couple of equal variable resistances provided that one is left handed and the other right handed. They would be mounted on one shaft. In case potentiometers are used there should be no taper on the resistance elements.

* * *

Pick-up in Television

WHAT IS the difference between direct and indirect pick-up in television? When a camera is used for forming an image and that image is scanned, is that direct or indirect pick-up?—P. C., Brooklyn, N. Y.

In indirect pick-up an intense beam is played on the subject and the light from this beam is reflected to the photo-electric cells. Only the light from the beam counts. In direct pick-up the entire subject is brightly illuminated and the subject is scanned so as to pick up the light from the various points. Only the flood lighting counts here. When a camera is used it is natural that the direct method should be used, and it is ordinarily. However, it is conceivable that even with the camera the indirect, or flying spot, method could be used. The flying spot method is not satisfactory because it develops intense highlights and deep shadows.

* * *

The 56 Oscillator

WHICH of three new tubes is the best for an oscillator in a superheterodyne, the

56, 57, or 58? I notice that the 56 is very much like the 227 and I presume that it would make a good oscillator for that reason. How about the 57 as a combined oscillator and detector in a superheterodyne?—W. B., Ryne, N. Y.

As a straight oscillator the 56 is the most suitable, just as the 227 is the most suitable in the series of tubes to which that belongs. As a combined oscillator and detector in a superheterodyne either the 57 or the 58 would be all right, in so far as a combination can be all right. The 58 is specifically recommended as a modulator in a superheterodyne, but nothing is said in the recommendations about the combination of the functions of oscillator and detector.

* * *

The 46 as Detector

AS THE 46 tube has an enormously high amplification when the two grids are tied together, would it not make an excellent power detector? It would seem that if it is so used and enough is put into its grid that the speaker could be connected directly in its plate circuit without using any audio frequency amplification.—W. B. R., Oakland, Calif.

There are two things against using the 46 as a detector. The first is that it is a filament type tube, which would cause a great deal of hum if it were used as detector. Of course, it could be heated with direct current, which would remove this objection. The other thing against it is that it takes a great deal of power, relatively speaking, to drive the grid. It would not be practical to use a tuner in front of the tube, and a driver stage would be needed just as it is needed for Class B amplification.

* * *

Full Wave Detection

RECENTLY you described how a full-wave detector works, but I am unable to see how you can get any detection at all. It is easy to see how one tube detects, or how one grid in the Wunderlich tube detects, but I don't see why the other, working in opposite direction, does not kill off the detection entirely. If there is some other way of explaining the action will you kindly present it?—L. R. W., Youngstown, Ohio.

Well, there is a mathematical way of explaining the action, but there is no room here for the formulas. However, you should remember that the tubes are biased negatively so that if either grid swings with any appreciable voltage there will be an increase in the plate current. The increase is much greater than the decrease when the voltage changes by the same amount in the opposite direction. It does not make any difference which grid you consider. The action is the same for both. Therefore both contribute to the increase in the plate current during every cycle. One contributes to the plate current during one-half cycle and other during the other half. You might consider an analogy. Suppose there is a tank to be filled with water. Two men with equal buckets do the work. While one moves a bucket of water from the source to the tank the other moves in the opposite direction. Each time a bucket is withdrawn from the tank a few drops of water cling to the bucket. Will the tank be filled, or will the level remain the same just because a few drops of water cling to the buckets on return to the well? The tank in the detector case is the by-pass condenser in the plate circuit. To make the analogy more complete let us suppose that the tank leaks so the level in the tank will depend on the rapidity with which the men bail the water, or with the amount the two men carry each time. The variation in the amount is the modulation. The rapidity is the radio frequency.

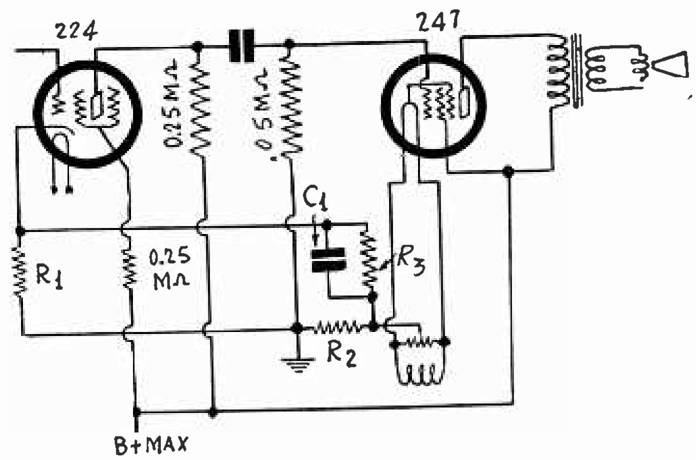

FIG. 1012

Audio regeneration may be introduced by means of R3. If R2, the power tube biasing resistor, is around 400 ohms, R3, the feedback resistor, should be about ten times as great, or around 4,000 to 5,000 ohms. R1 is not at all critical and may be 10,000 ohms.

Change in Frequency with Inductance

IF A COIL that is supposed to have an inductance of 245 microhenries actually has an inductance 0.6 microhenry greater than this, what is the change in the natural frequency of the circuit at 1,500 kc? Is it enough to throw the circuit out of tune with other tuners in which the inductance has the right value? If there are two circuits and the coil is held to an accuracy of 0.6 microhenry in 245, what is the maximum possible mistune of the two at 1,500 kc?—E. W., Philadelphia, Pa.

If dF is the change in frequency, F the frequency, dL the change in inductance, and L the inductance, then $dF = -FdL/2L$, provided dL is very small compared with L. In your case it is. We have $F = 1{,}500$ kc., $L = 245$ microhenries, and $dL = 0.6$ microhenry. Hence $dF = 1.84$ kc. The negative sign means that the frequency changes in the opposite direction to the inductance. Thus if dL is positive the frequency of resonance is 1.84 kc. less than 1,500 kc. If dL is negative the frequency is the same amount more than 1,500 kc. The change is quite negligible. Now if we have two circuits it is possible that one coil will be less than 245 microhenries and the other greater than the same value by 0.6 microhenry. Hence the greatest possible frequency deviation between the two tuned circuits, assuming equal capacities, is the sum of the deviations of both. That is, the greatest possible deviation is 3.68 kc., if the coils are held to an accuracy of 0.6 microhenry in 245. The same law applies to capacity change if the inductance is held constant. To change the formula to capacity all we have to do is to substitute C for L. The formula does not hold closely unless dL is less than 4 per cent of L. In the case in point it holds accurately for the ratio is about one-fourth one per cent.

* * *

Regenerative Audio

IS IT practical to use any of the bias for the output tube in an a-c set, also for building up the bias on the preliminary audio tube?—U. F. O., Detroit, Mich.

Yes. Fig. 1012 shows R2 as the biasing resistor for the pentode output tube. This bias results because the filament center is lifted above the B minus d-c potential by the amount of potential across the resistor. The biasing resistor of the previous tube, R1, is standard. However, from cathode to filament center the power tube another resistor, R3, is run. This resistor would decrease the bias on the pentode by about the same amount it increases it on the previous tube. The a-c feedback through R2 is negative, as the phases are inverted from one tube to another, audio regeneration results. R3 should be large in respect to R2.

LIST PRICES OF TUBES

Type	*List Price*	*Type*	*List Price*
11	$3.00	'38	$2.75
12	3.00	'39	2.75
112-A	1.50	'40	3.00
220	3.00	'45	1.10
'71-A	.90	46	1.50
UV-'99	2.75	47	1.55
UX-'99	2.50	'50	6.00
200-A	4.00	56	1.25
'01-A	.75	57	1.60
'10	7.00	58	1.60
'22	3.00	'80	1.00
'24-A	1.60	'81	5.00
'26	.80	82	1.25
'27	1.00	'74	4.75
'30	1.60	'76	6.50
'31	1.60	'86	6.50
'32	2.30	841	10.00
'33	2.75	868	7.50
'34	2.75	864	2.00
'35	1.60	852	28.00
'36	2.75	865	15.00
'37	1.75	866	7.50

Quartz Crystal Used as Speaker Armature

Montgomery Carrott, president of the Radio Products Corporation of Newark, N. J., demonstrated a miniature receiver with a circuit utilizing tiny tubes and incorporating a new speaker.

The patented diaphragh extends over the entire inner surface of the cabinet and it is claimed for it that it faithfully reproduces all radio broadcasting, with a wider frequency range. This diaphragm is actuated by a patented piezo electric crystal placed at the bottom of the cabinet, eliminating magnets, dynamic coils, and other mechanisms. Mr. Carrott declares:

"The vibratory action of the crystal is such that the tone quality produced by the speaker is of the highest order."

A composition featuring the use of rochelle salts forms the basis of this unit.

The tubes, only ¾ inch diameter, about 2½ inches long over all, were developed by J. V. Capicotto.

The entire receiver is only 11 inches high. It is uni-controlled and the single knob and dial are placed directly underneath the electric clock.

A THOUGHT FOR THE WEEK

CAN it be true that Mayor Damp of Google Centre, Wisconsin, is to father a Coca Cola Parade next month? Perhaps he has heard that "I Love a Parade" is one of the biggest sheet music sellers of the year. It is, anyway.

RADIO WORLD

The First and Only National Radio Weekly

Eleventh Year

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Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. E. Anderson, technical editor; J. Murray Barron, advertising manager.

Tradiograms

By J. Murray Barron

Supreme Specialties Co., manufacturers of dry electrolytic condensers, has moved to 136 Liberty Street, N. Y. City.

* * *

Jenkins Music Company, dealers in musical instruments and radio, recently opened an 8-story building in Kansas City, Mo. It is said to be one of the largest buildings devoted exclusively to music and radio.

* * *

Majestic New York Inc., distributors for Majestic Radio, is now distributing the Majestic refrigerators.

* * *

The appointment of H. E. Ward as president and H. C. Abbott as vice-president in charge of sales and advertising has been announced by Columbia Phonograph Co., New York. An intensive merchandising campaign is now under way. Both radio and records will be featured.

* * *

Hal P. Shearer, former vice-president and general manager of Splitdorf-Bethlehem, Newark, N. J., has been elected president of Connecticut Telephone & Electric Corp.

* * *

Federated Purchaser Inc., 23-25 Park Place, announces a new product of the Acratest Products Co. This new unit is a home-recording device and has been used for recording auditions in broadcasting stations.

* * *

Supertone Products Corporation is making a short-wave condenser and a precision type laboratory dial.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers concerning standard parts and accessories, new products and new circuits, should send a request for publication of their name and address. Send request to Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

Lawrence Ciervo, 235 Hull St., Brooklyn, N. Y.
Weldon Simpson, 5136 - 12th St., Frederick, Okla.
Coleman Egbert, Box 1147, San Antonio, Texas.
Joseph Vila, 1300 - 13th St., Eddystone, Penna.
J. W. Myers (used Radio Books), Vandalia, Missouri.
F. H. Paton, 90 Victoria St., Ashfield, Sydney, Australia.
Julius J. Heinrich, 6360 Minerva Ave., Chicago, Ill.
Thos. R. Scothorn, Hermain House, E. Lansing, Mich.
Chester Geppert, 37 Central Ave., Webster, Mass.

SPAIN RAISES WORLD VOICE ON 30 METERS

For the past four months Transradio Española S. A. has been carrying out broadcasting tests through its short-wave station, EAQ, Aranjuez (Madrid), Spain. This station is of the Marconi beam type, 20 kw. power, wavelength, 30.4 meters, frequency, 9,868 kc.

The transmissions thus effected have proved extremely successful and are received with enthusiasm by listeners throughout the world, but mainly in the United States, England, Canada, Central America, and above all, by the amateurs of the South American countries.

Transradio Española has decided to create a department to improve and lengthen the programs broadcast, in accordance with repeated requests from radio enthusiasts all over the world.

The principal object of the activities is to convey to other lands some idea of the artistic and intellectual life of Spain and for this purpose arrangements have been made for the greatest personalities of the land to speak on subjects in which they are specialists. The musical programs will be chosen from the masters, preference naturally being given to the Spanish composers. The artistic treasures of Spain will be described and explained and, in short, all matters pertaining to Spain will be treated in a series of lectures, etc. The announcement sets forth:

"It is sincerely hoped that these transmissions will serve to strengthen the natural bonds existing between Spain and the South American republics and to convey to other lands a true conception of Spanish culture, and thus constitute another link between the peoples of the world.

"We are broadcasting daily programs specially intended for America, between 12.30 and 2.00 a.m. GMT (7.30 to 9.00 a.m. EST, 8.30 to 10.00 a.m. EDST) we broadcast another program dedicated to all Europe and the Canary Islands."

Washington Monument Used in 5-Meter Test

Washington

A successful two-way communication between two groups of government radio officials, one group on top of the Washington Monument and the other in their offices in the National Press Building, was conducted with a transmitter-receiver operating on 56,000 kc. (about 5.35 meters) weight only 8 pounds without batteries and 20 pounds with batteries. Later a man took one of the sets and strolled down one of the streets, and again communication was established with the group on top of the Washington Monument. Again the test was made successfully with one of the instruments in an automobile.

The apparatus, which has been developed by one of the leading commercial laboratories, is entirely contained in a small box except for two short metal poles which extend outside as antennas. These act both for receiving and transmitting. The apparatus appears to have many possibilities for communication between aircraft in the air, between police cars, and between airplanes and airports, according to William D. Terrell, chief of the radio division of the Department of Commerce, who participated in the tests of the new device.

Bouquets in Brief

Acknowledgement of permission of the copyright owner, in broadcasting restricted numbers, now must be made seriously, as the American Society of Composers, Authors and Publishers has ruled against the flippancy sometimes used. Why any broadcaster should treat this thing in any manner except seriously is hard to understand.

* * *

Composers complain that their outstanding works, if unrestricted, are played to death, hence have a short life. What they want for their compositions is a long life and a merry one.

* * *

Canada will limit advertising talks to 5 per cent. of the time of the sponsored programs. They should have made it 6 per cent., as we have the compound interest tables for that.

* * *

One good thing about nationalized radio stations is that it tends to make them a political issue. Give me the radio chain and you can control the House of Commons.

* * *

The fact that amateurs, as a class, are known not to be endowed with a great deal of the world's goods, and don't make any money out of their activities on the air, has naturally led Congress to propose taxing them.

* * *

The circuits for the coming season are said to surpass anything ever produced before, which leads us to suspect that they must perform much like their predecessors, about which the same thing was said.

* * *

As soon as we stop producing the last word in radio we may begin to make some progress.

* * *

First thing we know some new tubes are announced, and about a year later a fellow with a pull may get the privilege of seeing one.

* * *

When they get around to seven or eight pin tubes, where are they going to find the room on the tube bases to put the pins? And will the socket prongs be pyramided?

* * *

We are all set to get enthusiastic about an automatic volume control as soon as some one comes along with a good one.

* * *

Fading is one of the troubles still remaining in radio, as some of the stars of the air of only yesterday are finding out.

* * *

Stiff drive on crooners results in the number being only doubled.

* * *

The difference between a crooner and a "straight" singer is that a crooner gets much more money and abuse.

* * *

More and more persons are writing letters to radio stations. One often wonders why.

Listeners Send $7,000 to Aid Musicians

Gerard Swope, president of the General Electric Company, turned over more than $7,000 in voluntary contributions to Walter Damrosch, chairman of the Musicians Emergency Aid Committee's drive for $300,000.

The presentation was made at the National Broadcasting Company studios in New York.

The amount represents the contributions of some 3,000 listeners who heard a General Electric Company broadcast made on behalf of the committee's relief work.

The $7,000 came without solicitation, said Damrosch, and represents the public's deep interest in the committee's efforts.

STATION SPARKS

By Alice Remsen

THE CAVALIER

FOR ALEX GRAY

WABC, Tuesdays and Fridays, 10:00 p.m.

**The cavalier came chancing a-down the broad highway.
His crimson plume was dancing, tossed by the wind agley.
His mettled steed a-prancing, to right and left a-glancing,
The cavalier came chancing a-down the broad highway.**

**As he came boldly riding a-down the broad highway,
In daisied meadow hiding dressed in a gown of gray,
A shepherd maiden biding, her lambkins gently chiding,
Looked up and saw him riding a-down the broad highway.**

**The hawthorn buds were blushing, beside the broad highway,
And cooling springs were gushing near where the lovers lay;
The breath of violets crushing, the crickets' chirrup hushing,
The maiden wept a-blushing, beside the broad highway.**

**The maiden still was weeping beside the broad highway,
When on his steed a-leaping he kissed the maid good-day.
His pluméd hat a-sweeping, he rode while night was creeping,
And left the maiden weeping beside the broad highway.**

**The cavalier came chancing a-down the broad highway,
His crimson plume was dancing tossed by the wind agley.
His mettled steed a-prancing, to right and left a-glancing,
The cavalier came chancing a-down the broad highway.**

—A. R.

* * *

THE ROMANCE OF ALEX GRAY'S VOICE on the Chesterfield program is enough to set any maiden thinking of a bold cavalier, dressed in picturesque attire, dashing through the countryside. Tune in; you'll like him!

* * *

News of the Studios

WOR

The most welcome news from this source is the winning, by Philip James, WOR's famous orchestra leader, of the $5,000 first prize, in the NBC's contest for original symphonic works. Mr. James' winning composition, "Station WGZBX," is, as the title suggests, a musical satire on radio in all its phases. It will be played by at least three major symphony orchestras in the near future.

* * *

A new series of piano recitals has been inaugurated by WOR, featuring Lee Cronican, concert pianist, who is also one of that station's ace announcers. For twelve years prior to his radio work, Mr. Cronican toured the country with such artists as Jeanette Vreeland, Reinald Werrenrath, Paul Althouse and Mary Jordan. His programs will include compositions of Beethoven, Grieg, Schuman, Mendelssohn, Von Weber and Liszt. He is heard each Monday at 10:15 p.m.

* * *

Kathleen Gordon, of WOR's music department, has been given a night spot. She will be featured in a new program called "Moonlight and Roses." Her sweet soprano voice will have as accompaniment a string quartet selected from George Shackley's orchestra. Miss Gordon is on every Thursday evening at 9:15 p.m.

* * *

NBC

Spring around the studios has started its usual crop of romances. The first to heed the call is Kathleen Stewart, charming NBC pianist. On May 21st she became Mrs. Everett Martine and is now honeymooning in Canada. Miss Stewart will continue her work at the studios upon her return. Mr. Martine is associated with the Chase National Bank.

* * *

The world's most famous turf event, the English Derby, will again be described over an NBC-WJZ network when it is run on Epsom Downs on Wednesday, June 1st. This half-hour international program will include descriptions of the Derby Day crowds and the horses, as well as the actual running of the event. The Derby, the classic for three-year-olds, which always attracts thousands of racing enthusiasts from all over the world, was first run in 1780. The program will be heard at 9:45 a.m. E.D.S.T.

* * *

Jessica Dragonette will take a three months' vacation from the air this summer. She will sail for Europe the last week in June. She expects to spend some time in both Italy and France, and will return the latter part of September to again take up her microphonic work with the Cities Service Orchestra, with which she has been identified for some time.

* * *

WABC

Heard the lovely voice of Mabel Jackson on a recent Linit Bath Club program. Miss Jackson has one of the few soprano voices registering well over the radio. Her diction is splendid and she reads a song with fine understanding and artistry. Miss Jackson is the unmentioned soloist on the Dupont "Today and Yesterday" program.

* * *

Morton Downey's voice is beginning to sound rather tired—and no wonder! The boy has been on the air six times weekly since January, 1931, without a break. During that time he has sung almost 5,000 songs and in addition has made public appearances in vaudeville and at private affairs. So, the Camel minstrel will soon take a much-needed vacation.

* * *

Sid Gary, Columbia baritone, featured with the Ziegfeld radio show and the Movie Star Revue, is a graduate of New York's East Side. His father was a cantor and it was from him that Sid received his first instruction in singing. As soon as he and his two brothers were old enough they became members of the choir under their father's direction. Sid turned his vocal talents to the stage before he reached his twenties and for nine years played a vaudeville act with one of his choir mates.

* * *

The wife of "Dinny" Dinsdale, production man on the Ziegfeld program, left for Europe last week, where she will compete in the International Automobile races. "Dinny," by the way, has just had a new book on television published in England. He is an authority on the subject.

* * *

Sidelights

TESS GARDEL (Aunt Jemima) will be in the cast of "Show Boat" revival . . . BRAD REYNOLDS was once a gymnasium instructor . . . LOUIS DEAN is making a series of movie shorts with Reis and Dunn . . . GEORGE EARLE is composing a symphony in four movements which he will call "Westchester Suite" . . . AL NEWMAN, pianist for Abe Lyman, is one of California's leading golf amateurs . . . EDWARD REESE was once a South Atlantic swimming champion . . . ANDRE BARUCH and TEDDY BERGMAN were star wrestlers at Columbia University . . . JOHN CARLILE collects music boxes . . . BEN POLLACK started playing drums at the age of nine . . . EMIL SEIDEL used to ride horseback for several miles through the Ozark Mountains in order to get his piano lessons . . . CARRICK DOUGLAS was one of Canada's leading hockey players . . . BELLE BAKER once sewed buttonholes in a shirtwaist factory and was fired for singing at work . . . TITO GUIZAR once sold women's hosiery . . . SHAPIRO and SHEFTER were once rival piano teachers in a small town . . . BRAD BROWNE once worked as a pin boy in a bowling alley . . . JOHN MAYO operated a cosmetic factory . . . LEO REIS made a success of the underwear business for eight years before coming to radio . . . JACK SMART was once a lumber pusher . . . DOUGLAS EVANS was a bellhop on S.S. Leviathan . . . WILFERD GLENN is an epicure . . . ARTHUR ALLEN was born in Buffalo, N. Y. . . . GRAHAM McNAMEE was born in Washington, D. C. . . . MADAME SYLVIA was born in Oslo, Norway . . . ROBERT SIMMONS has gone vaudeville . . . Among the natives of Ohio heard over NBC networks are: CAROL DEIS, who was born in Dayton; NEEL ENSLEN, who was born in Delphos, and HARRY RESER, who first saw the light in Piqua . . . B. A. ROLFE has a wire-haired terrier named "Trouble."

* * *

BiographicalBrevities

About Percy Hemus

Percy Hemus, well-known radio baritone and comedian, has had a notable career as a singer and an actor. His first introduction to the theatre was at the old Crawford Opera House, Topeka. Kansas, where he sold lemonade, peanuts and popcorn. In those days, when theatrical celebrities took to the road, it was customary for the refreshment vendors to go back-stage and sell their wares. It was in this way that Mr. Hemus managed to meet Thomas Jefferson, Mrs. John Drew, Mrs. Thomas Whiffen, Louis James, the Salvanis and many others; and that was the beginning of his long theatrical career, which took him through many of the usual hardships of a beginner, until we find him in 1923 starring as the comedian in Mozart's comic opera, "The Impresario."

From this he went into musical comedy, appearing first in "The Little Dutch Girl," where J. J. Shubert saw him and gave him one of the leading roles in "The Love Song" at the old Century Theatre in New York. Then in rapid succession came a road show of "The Student Prince," in which he played leading comedian; "The Vagabond King," again as comedian, and the revival of "Madame X" at the Earl Carroll Theatre. Then followed a short vaudeville tour and lastly, prior to his introduction to radio, Mr. Hemus played in "The Command to Love," with Mary Nash and

(Continued on next page)

TAX PROTESTED BY AMATEURS; SERVICE CITED

Washington.

Forcefully pointing out that they were the only service in radio contributing gratis to the development of the art, without possibility of material reward of any sort, radio amateurs of the country voiced their opposition to their inclusion in the license fee schedule for all radio stations now pending before Congress.

In a memorandum delivered to all the Senators on Capitol Hill and members of the House Committee on Merchant Marine, Radio and Fisheries, the American Radio Relay League presented the position of the over 25,000 licensed amateur radio stations in the United States in the statement that amateurs are alone in their non-commercial character, and should therefore be tax-exempt, but in any event the tax and fee should be purely nominal. ($1 each for station and operator's licenses.)

Under the scheme now before Congress the fees applied to amateur stations would represent a minimum of $5 per year for station and operator's licenses. A less favorable interpretation of the bill (H.R. 7716) might cause this to reach $50.

In contrast with this proposal, the league denied that amateurs should be subjected to the payment of any fees whatsoever. This, it was held, was indicated by the further fact that amateurs constitute a great national asset.

Memorandum Cites $60,000 Cost

This memorandum is a part of the campaign being conducted by the League both through its headquarters and individual membership, in opposition to the license fee amendment. Hundreds of radio amateurs and radio clubs in all sections of the country have been communicating their views on this subject to Senators and Representatives.

"The objection may be encountered," the League set forth, "that the fees proposed to be charged amateurs are already very modest in comparison with the contemplated charges to be made commercial stations, which in some cases run into thousands of dollars per year. In the aggregate, however, they amount to over $60,000 a year, according to the very conservative estimate of the Federal Radio Commission. This amount cannot conceivably be taken from the limited funds of amateurs without working severe hardship upon their activities. This will be particularly apparent when it is realized that the average age of the amateur operator, despite the number and value of his achievements, is but 21 years.

11.4% Sought from Amateurs

"An analysis of the figures attached to Report No. 564 from the Senate Committee on Interstate Commerce shows that 9.1 per cent of the entire cost of radio administration is to be borne by this class of self-sacrificing volunteers. A recent amendment to the regulations of the Department of Commerce with reference to the authority of commercial operators to operate amateur stations will require an addition to the proposed contribution by amateurs under the proposed amendment of some $18,000, with the result that of a total of $688,500, 11.4 per cent will be contributed by amateur stations . The administrative expenses of licensing these amateur stations and operators is an infinitesimal part of the total, the work in connection therewith being almost entirely clerical. The discipline of amateurs is traditionally self-administered, as has been recognized from the earliest days.

"It is, therefore, respectfully submitted that in the event that Congressional opinion requires the taxation of amateur franchises:

"(1) The fees for amateurs should be so provided for by statute that they do not exceed $1 per year for the station license.

"(2) The fee provided for by statute for amateur operator's licenses should not exceed $1 per year.

"(3) No method of taxation should be resorted to which would result in a total net cost for amateur operation in excess of $2 per year."

Station Sparks

(Continued from preceding page)

Basil Rathbone during its entire New York run.

After a brief preliminary radio career, Mr. Hemus, with Steve Porter, created the original "Dutch Masters Minstrels" and was end-man in the production for more than a year. His sketch, "The Jameses," in which he played as many as eight different characters, was on the air for over a year and was produced on various stations from Coast to Coast. He has a long list of radio successes to his credit, and is, at present, established in his own office writing radio programs and playing some of the outstanding characters on the air.

As a singer, Percy Hemus has an equally unique background. For five years he was soloist at St. Patrick's Cathedral in New York, and has also been soloist at a number of Protestant churches in New York. He appeared with Sousa and his band and with Victor Herbert and his orchestra. He has sung with such prominent artists as Schumann-Heinck, Lillian Blauvelt, Louise Homer and David Bisham. Regularly, for a number of years, the name of Percy Hemus was certain to appear on the program of Carnegie and Aeolian Halls. At one time he was recognized as one of the leading voice teachers in New York City.

Mr. Hemus has a new program, called "Howdy, Old-Timers." It is featured on WOR each Monday at 10:00 p.m. and Fridays at 10:15 p.m. It is an unusual radio program, offering genuine heart appeal. Mr. Hemus sings and talks in a characteristic manner and with a sincerity that appeals to young and old alike.

Tune in: you will like Percy Hemus and his homely philosophy combined with agreeable baritone singing.

(If you would like to know something about your favorite radio artist, drop a card to the conductor of this column. Address: Miss Alice Remsen, care Radio World, 145 W. 45th St., New York, N. Y.)

Tourists in Shanghai Hear U. S. Stations

Seattle, Wash.

Amos 'n' Andy and American jazz and the musical classics of leading orchestras in the United States can be heard today in Shanghai.

Passengers on the President Madison, arrived here from the Orient, report excellent ship radio reception of Pacific Coast programs all the way from China to Seattle. Stations were audible from as far east as New York. In the South China Sea programs were picked up from Manila and from stations as far west as India. The set used was a ten-tube superheterodyne that had been connected with the large aerial used for handling the big liner's communication service.

SAFETY FIRST

NBC announcers broadcasting the Beer Parade from the twelfth floor balcony of the NBC building at 711 Fifth Avenue were wrapped around with wire to keep them from falling as they leaned out over Fifth Avenue to describe the scene. A page held the microphone for the speakers.

EDUCATOR TELLS HOW TO BANISH OFFENSIVE ADS

By LYMAN BRYSON

Director, California Adult Education Association

Beethoven comes to his climax on the air. We have been transported into regions of high delight, we are grateful for what we have been given. And then comes a voice. It may be only an announcement. But often the mere announcement is given in a way to turn our gratitude into angry resentment. "This is the Tite-fitt shoe company, John L. Whoosis speaking. Good *ni*-yight!"

And many advertisers are not willing to let us off so easily. We must pass from music into a sales talk which is lengthy, raucous and aggressive. And yet, we are told, the merchants and manufacturers who pay the high costs of broadcasting think they have a right to what they call their money's worth. Is the answer to this to organize a determined and articulate revolt of listeners who will drive all direct advertising off the air? It may come to that.

Networks Don't Grasp Situation

If the great broadcasting networks think their codes of ethics and their heroic refusal of obviously offensive programs are enough, they do not know their public. If the advertisers who think they must shock and terrify people into running panic-stricken to the nearest retail dealer believe that they are not challenging a resistance which will some day make itself effective, they are mistaken.

After all, we are only asking advertisers to be gentlemen and friends. Lies are lies, even if you are paying $5,000 an hour to tell them to the world. What is more, the worse lies are those which are insinuating half-truths. The broadcasting stations have their rules, but let's be frank about it, are any violations but the most gross and criminal ever ruled off the air?

Plain Remedy Not Workable

Advertising need not be offensive. The pages of any magazine or newspaper will show that it can be amusing, and enlightening, and worth while, as a veritable work of art. There are several New York department stores whose advertisements I always read because they are light comedy of the most delightful sort—and I patronize those stores in appreciation. In my own state, I buy the gasoline of one company in sheer gratitude for the unspoiled music they send into my home.

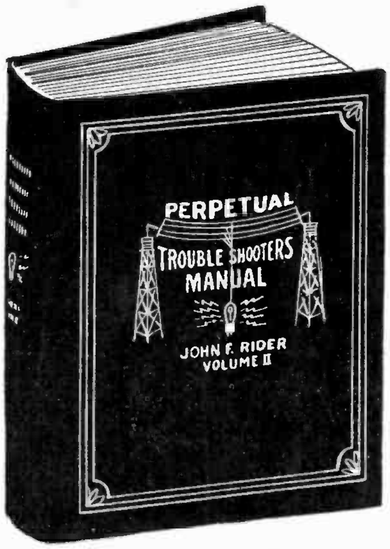
In fact, the remedy for all this lies at our hand if we would use it. If only a few thousands of the great 60,000,000 would send in post cards saying simply—I don't like your air programs and I won't buy your product—offensive programs would vanish from our hearing. But there is small chance of that happening. In all the years of protest against the defacing of outdoor loveliness by billboards, no one has ever been able to summon enough energy to apply that simple cure.

The 60,000,000 might as well confess it. We are inert and lazy; we have had our rebellious independence subdued by the forces of salesmanship.

[From a talk delivered in Buffalo, N. Y., before the National Advisory Council on Radio in Education.]

Volume No. 2 of Perpetual Trouble Shooter's Manual

Ready About June 6th



Having assembled 2,000 diagrams of commercial receivers, power amplifiers, converters, etc., in 1,200 pages of Volume No. 1 of his Perpetual Trouble Shooter's Manual, John F. Rider, noted radio engineer, has prepared Volume No. 2 on an even more detailed scale, covering all the latest receivers. Volume No. 2 does not duplicate diagrams in Volume No. 1 but contains only new, additional diagrams, and a new all-inclusive information on the circuits covered.

All Electrical Values Given for First Time

This new detailed, comprehensive information gives the resistance values from point to point in all circuits in Volume No. 2—such complete information as is unobtainable elsewhere. All condenser values are given. Chassis diagrams (pictorial), schematic diagrams and photographic views of receiver "insides" are included. Parts are identified on photographs. Intermediate frequencies are stated. Socket and tube identities are revealed, color codes given, continuities of sealed units disclosed. The information is painstakingly complete. Rider made personal trips virtually all over the country to obtain the information, and it's now yours.

Everyone who makes his living as a radio service man, salesman, laboratory man or in any other technical capacity, as well as all students and teachers of radio, should possess Volume No. 2.

Volume II and Volume I are loose-leaf editions of 8½ x 11" page size, flexible fabrikoid binding.

Volume No. 2—Perpetual Trouble Shooter's Manual, by John F. Rider. Shipping weight 6 lbs. Order Cat. RM-VT @ $5.00
Volume No. 1 (8 lbs.). Order Cat. RM-VO @ $4.50

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THE FORD MODEL—"A" Car and Model "AA" Truck — Construction, Operation and Repair — Revised New Edition. Ford Car authority, Victor W. Page. 703 pages, 318 illustrations. Price $2.50. Radio World, 145 W. 45th St., New York.

"SERVICING SUPERHETERODYNES," by John F. Rider. A reliable aid to the service man or to organizations in tackling superhet service problems. 161 pages, canvas cover. Price $1.00. Radio World, 145 W. 45th St., New York, N. Y.

"1932 OFFICIAL RADIO SERVICE MANUAL," by Gernsback. Complete Directory of all 1931-1932 Radio Receivers. Full Radio Service Guide. Leatheroid binding, $4.00. Radio World, 145 W. 45th St., New York, N. Y.

"THE CHEVROLET SIX CAR AND TRUCK" (Construction—Operation—Repair) by Victor W. Pagé, author of "Modern Gasoline Automobile," "Ford Model A Car and AA Truck," etc., etc. 450 pages, price $2.00. Radio World, 145 W. 45th St., N. Y. City.

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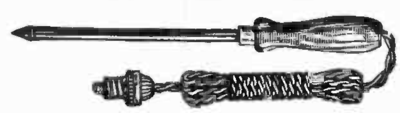

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145 West 45th St. N. Y. City

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235	1.60	.86	230	1.60	.86
226	.80	.43	231	1.60	.86
171A	.90	.48	232	2.30	1.24
210	7.00	3.78	233	2.75	1.48
245	1.10	.59	234	2.30	1.40
247	1.55	.84	236	2.75	1.48
250	6.00	3.24	237	1.75	.94
v199	2.75	1.48	238	2.75	1.48
x199	2.50	1.35	239	2.75	1.48
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Two 0.00014 mfd. junior midline tuning condensers (both) 2.40
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One shielded block containing three 0.1 mfd. condensers (black, common, to a minus; reds interchangeable) .... .57

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One 0.05 meg. pigtail resistor (50,000 ohms) .... .15
Two 4-ohm filament resistors in series, to constitute 8 ohms (both) .... .20

OTHER REQUIREMENTS
One 9 x 7⅝ inch wooden baseboard .... .25
Four UX sockets (two for tubes, two for coil receptacles) .... .40
One 7 x 10 inch bakelite drilled front panel 1.25
Two knobs, one for r-f condenser, other for feed-back condenser (both) .... .10
One vernier dial .... .50
One push-pull A battery switch .... .20
One binding post strip with eight posts on it .... .25
One—34 tube and one—30 tube (both) 2.61
One pair of earphones 1.20

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