AUG. 5
1933

SUPER-REGENERATORS

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RADIO WORLD
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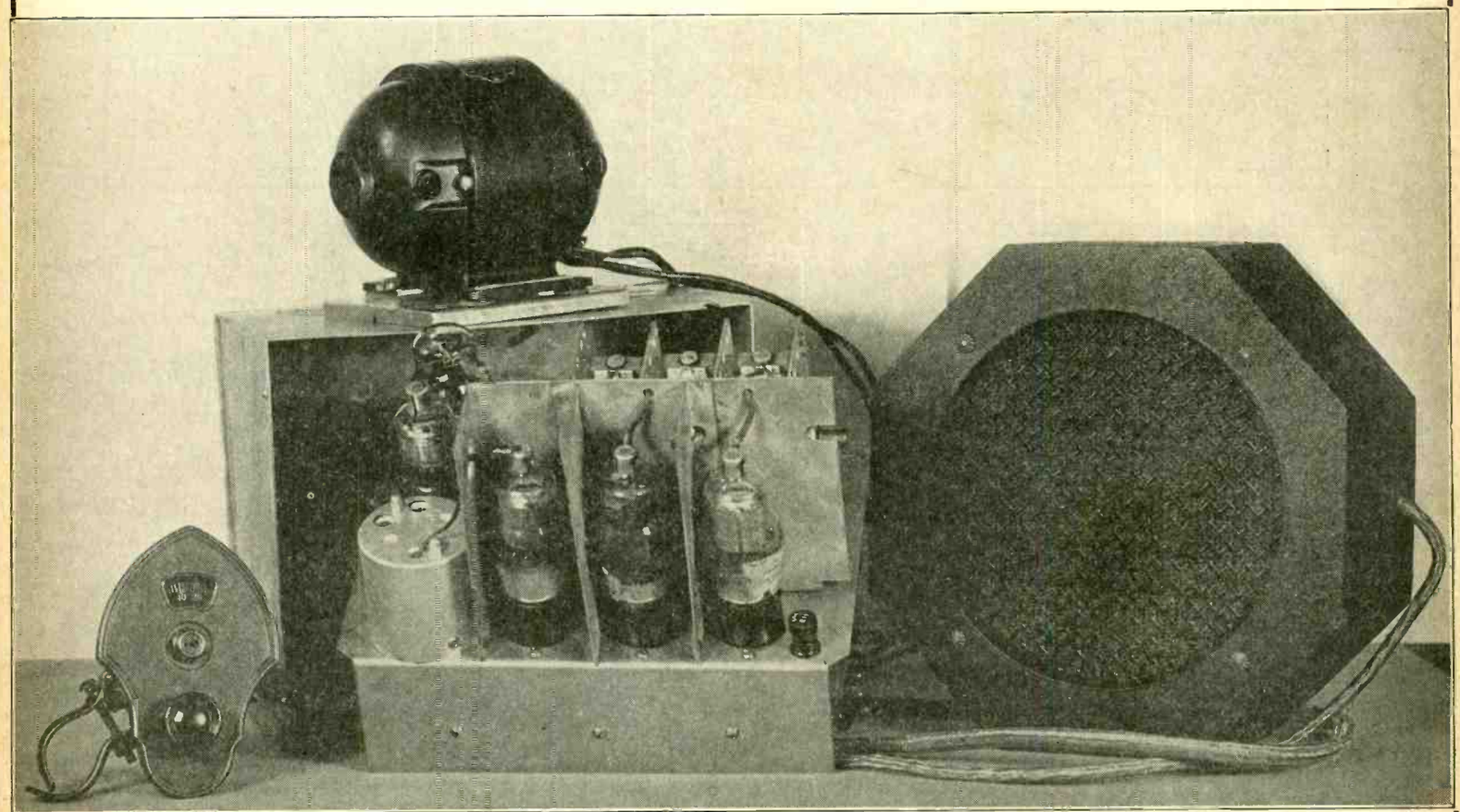
The First and Only National Radio Weekly
Twelfth Year *593d Consecutive Issue*

SWITCH-TYPE ACCESSOR FOR ALL TUBES SO FAR

MOTOR-GENERATOR AUTO SET



A five-tube all-electric auto set, with automatic volume control and latest tubes. It is a 175 kc. superheterodyne. See page 3.

RECOVERY CODE SEEKS TO END "GYP" SELLERS

DIAGRAM FOR USE OF 6F7 AS A MIXER

WAVEMETER CONFIRMS REALITY OF SIDEBANDS

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SUPERTONE NEW ALL-ELECTRIC "ROAD KING" WITH MOTOR GENERATOR OR "B" VIBRATOR

FIVE-TUBE "ROAD KING" KIT consisting of all parts, chassis, shield box, remote control, spark suppressors, 8" Rola dynamic, and the tubes (two 78, one 6A7, one 6B7, one 41).....$24.27

[No motor generator or "B" eliminator-vibrator supplied at this price, as batteries may be used, or choice of electric adjuncts made. See prices at right.]

Wired model 5-tube "Road King", less electric adjuncts.....$26.87

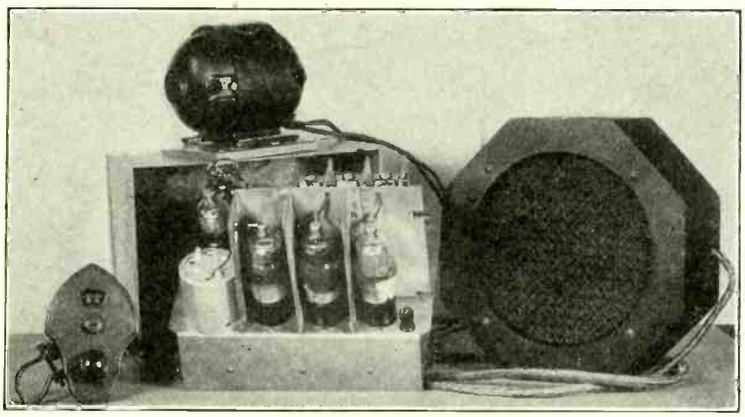
Motor generator, for use with kit or wired model "Road King." Works off car storage battery to supply B power at 180 volts max. The Motor generator is the latest development for all-electric car set operation $9.95

Vibrator type B eliminator for the five-tube "Road King".....$5.45

After many months of experimental work in laboratory and on the road Supertone offers its perfected Five-Tube "Road King" car receiver, a sensitive and selective super that also affords excellent tone. No "saucer" speaker is used, but an 8" dynamic. High-gain prevails throughout. Newest tubes used—including the 2B7 and 6A7. Right up to the minute in every last detail.

Wired 5-Tube Road King, complete, including everything, WITH MOTOR GENERATOR $34.22

Wired model with Vibrator Type B supply.$29.72



The speaker, chassis, remote control and motor generator of the sensationally-performing "Road King 5."

Note that five tubes are used and that two of them, the 6A7 and the 6B7, are two tubes in one envelope, thus seven-tube performance is enjoyed.

The "Road King" is equipped with automatic volume control, manual volume control, remote control dial-switch for steering post mounting, and complete shielding.

Compactness is another feature. The cadmium-plated shield box for chassis is 6½ x 7½ x 9¼ inches. Antenna lead is shielded. Three sockets for battery or motor generator cable, speaker and remote control. Three-bolt mounting.

An original and tested circuit is used for its proved performance, and results are far superior to those from four-tube car sets in the same price class. A wire strung under the running board suffices for aerial, or a copper screen under the car from side to side, either as far below car chassis as practical.

The "Road King" has "floating heaters," so that it may be used with cars having either negative or positive of "A" battery grounded. In ordering wired models please state which side is grounded.

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Designed by J. E. ANDERSON

FOREIGN RECEPTION ON 6-INCH AERIAL

This new auto set is the most sensitive car receiver we have ever come across. Mexican and Canadian stations were tuned in from New York City on a 6-inch aerial. The circuit, an 8-tube superheterodyne, with automatic volume control.

The complete parts, including set chassis and set shield, battery box, remote control, battery cable, all condensers, resistors and coils, speaker with shielded cable; and a kit of RCA tubes (two 239, two 236, two 237, one 89, and one 55), are supplied less aerial. Cat. 898-K @ $34.66

Wired model, licensed by RCA, with complete equipment, less aerial, but including RCA tubes. Cat. 898-W $37.46

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Complete data include schematic wiring diagrams; chassis wiring diagrams; parts layouts; photographic views of chassis; socket layouts; voltage data; resistor values; condenser values; location of alignment and trimmer condensers; alignment and trimmer adjustment frequencies; intermediate-frequency amplifier peaks; alignment and intermediate-frequency adjustment instructions; color coding; transformer connections; point-to-point data; continuity test data; parts list with prices; special notes.

Complete tabulation of tube data showing electrical characteristics and constants for all of the tubes employed in radio receivers and amplifiers since 1921. Also a table of interchangeable types.

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145 WEST 45th STREET, NEW YORK CITY

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ROLAND BURKE HENNESSY
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RADIO WORLD

J. MURRAY BARRON
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The First and Only National Radio Weekly
TWELFTH YEAR

Vol. XXIII | AUGUST 5th, 1933 | No. 21. Whole No. 593.

Published Weekly by **Hennessy Radio Publications Corporation,** 145 West 45th Street, New York, N. Y.

Editorial and Executive Offices: 145 West 45th Street, New York
Telephone: BR-yant 9-0558

OFFICERS: Roland Burke Hennessy, *President* and *Treasurer*; M. B. Hennessy, *Vice-President*: Herman Bernard, *Secretary*.

Entered as second-class matter March, 1922, at the Post Office at New York, N. Y., under Act of March 3, 1879. Title registered in U. S. Patent Office. Printed in the United States of America. We do not assume any responsibility for unsolicited manuscripts, photographs, drawings, etc., although we are careful with them.

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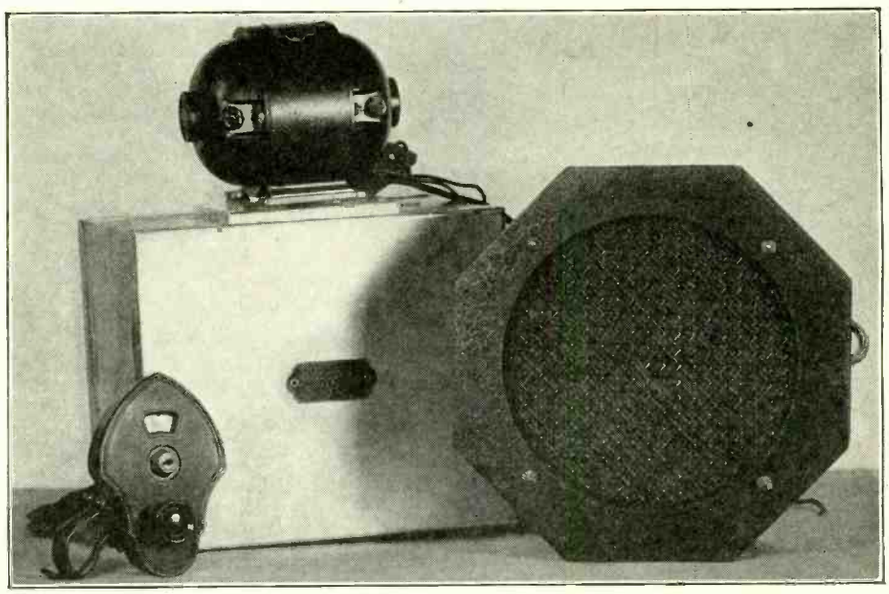
Five-Tube All-Electric Auto Set Using MOTOR GENERATOR

Superheterodyne develops high Sensitivity, Excellent Selectivity, and Reproduces Audio Realistically—Chassis May Be Worked on Batteries, Generator or Vibrator Type B Eliminator—A Minus or Plus May Be Grounded on Car

By Edwin Stannard
Supertone Products Corporation

IN no form of receiver is sensitivity of such real importance as in a portable set. At home it is not necessary to confine oneself to a very small antenna pickup, but in portable devices like a car set this is imperative. One cannot carry with him on his back or in a car towers and other facilities for high-strung aerials. So one of the first considerations in a car set is sensitivity, and the designer, knowing that, does his best to build it up beyond the 10 microvolts-per-meter value generally acceptable for home use.

While in the design of car sets using few tubes the problem is accentuated, a saving grace is the type of tube that really consists of two tubes in one envelope. Therefore the author, in designing the five-tube Road King car set, selected the 6A7, which enables the mixer function in one glass enclosure, and the 6B7, which, while a critical tube, as will be explained, enables enormously greater voltage gain than any other automotive series tube, or any other tube, save its almost identical 2B7. Thus two pieces of blown glass equal four tubes, and the performance of a five-tube set equals that of seven of the tubes such as were used in last year's car sets. The 6B7 and the 6A7 are of this year's bumper crop of tubes.



The chassis of the car set fits into a cadmium-plated shield box, which has the three accessor sockets in it. The speaker used has 8-inch cone diameter. The remote control and motor generator units are shown.

High Conversion Conductance

Naturally, the number of tubes is to be kept within the smallest possible limits consistent with fully adequate performance. It is true that good results are obtained from four-tube sets. Some of these are reflexed. But it was found better, in the long run, to avoid reflexing, for despite the advance in the science since reflexing was the vogue, the troubles inherent in a reflex are greater than those in a straight cascaded circuit, the distortion is likely to be higher, and the economy is not striking.

Since a mixer tube with a high conversion conductance is available, the old argument against the "loss" in the mixer does not hold, for this conductance will exceed 400, which is considerable. The conversion conductance may be defined as the intermediate frequency output voltage's ratio to the radio-frequency input.

Therefore the superheterodyne circuit, now virtually standard, as against tuned radio frequency systems, well may be used, and if in addition the gain in the single radio-frequency amplifier, the single intermediate stage and the output tube itself is maintained high the necessary degree

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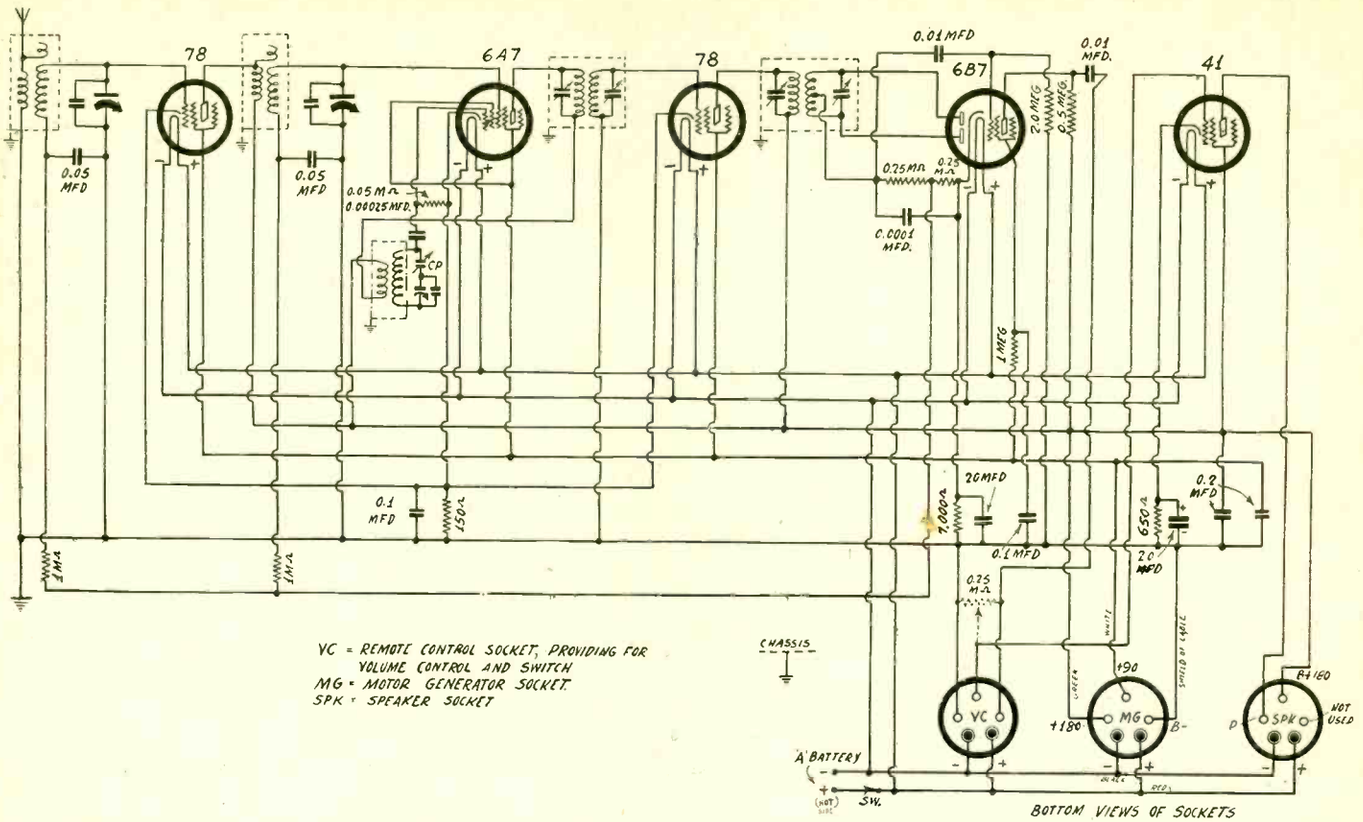

An unusual method of using the 6A7 is included in the diagram of the Road King five-tube auto set. The primary of the first intermediate transformer, instead of going directly to B plus, goes to the feedback coil to B plus. Therefore the anode of the oscillator is connected directly to screen. The circuit is useful on cars having either negative or positive of A battery grounded, as the heaters are not related to the radio or audio circuit, and the chassis of the set is at ground potential in either instance.

(*Continued from preceding page*)
of sensitivity is achieved. While the general impression is that the sensitivity relates to the radio-frequency and intermediate-frequency levels, of course it refers to all levels of amplification, thus including audio.

Aerials for Set

So the best that is available to achieve sensitivity is combined into one co-related whole, to insure that type of performance that a man not only expects but must have, if his car set is to render satisfactory service.

It is the degree of sensitivity that yields desired reception even with a running board aerial, 6 inches or so below the under side of the board, and stretched taut on insulators. Greater pickup is afforded by a copper screen similarly spaced from the under side of the car chassis, run approximately from the trim of the running board on one side to the trim of the board on the other side.

The high gain at the radio-frequency level is achieved by a combined advantageous use of coil and tube, whereby the coil has a honeycomb primary, coupled only by the capacity resulting from a turn or two of wire from this otherwise isolated honeycomb to the secondary. The advantage lies in the frequency discrimination, in that the lower radio frequencies are favored, whereas otherwise the small pickup from a car aerial would result in a sharp example of the rising characteristic, that is, greatly increased sensitivity at the higher broadcast frequencies, as compared to the lower broadcast radio frequencies. Thus a form of equalization of sensitivity exists, which might not be so important were not so many of the better-grade stations on the lower frequencies.

The same type of coil is used for antenna coupler and for inter-stage coupler. The radio-frequency amplifying tube is a 78, which is the automotive equivalent of the 58, hence a remote cutoff tube, and yielding nicely to automatic volume control, which is applied in this particular stage.

The cap of the 6A7 is the control grid and receives the radio-frequency input, and as this tube, while not exactly of the remote cutoff type, has an extended characteristic on its pentode side, automatic volume control is applied here, too, thus preventing the overload of the modulator by the oscillator.

In the same envelope is the triode oscillator, and the bias on this particular section is derived from current through the grid leak. Since the leak is returned from grid to cathode, the bias is independent of that on the pentode, for it will be remembered that the bias is measured in all instances between cathode and grids.

Instead of tying the oscillator anode to one side of the feedback winding, the other side of that winding to B plus, another method was used, one that renders the frequency stability somewhat better. The return of the plate winding of the first intermediate transformer is made through the oscillator tickler winding, practical because the cathode of both tubes in the same envelope is common. In fact, it is in this cathode circuit that the emission coupling or electron coupling takes place.

There remains, then, only the necessity of applying a positive voltage on the oscillator anode, which in socket diagrams is referred to as Grid No. 3.

Limited A. V. C.

The 6A7 and the 6B7 both take the small-sized seven-pin socket, and due to possible unfamiliarity with the connections they will be given as the tubes are discussed. Therefore the 6A7 has the following socket terminals, with heater pins toward you, clockwise rotation, bottom view of socket or tube: heater, heater, plate of pentode, screen of pentode, anode of oscillator, grid of oscillator, cathode. The metal cap at top is the pentode control grid.

The receiver uses an intermediate frequency of 175 kc, and the padding condenser, Cp, when the oscillator secondary inductance is 190 microhenries, and the tuning capacity 0.00035 mfd., is 1,350 maximum, set at the proper value when the receiver is lined up at the 600 kc level.

The 6B7 is a duo-diode pentode, and full-wave detection is used. The diode load resistance consists of two 0.25 meg. series resistors, the joint being connected to the controlled tubes, so that the extra bias as furnished to the grid return connections will not be equal to the full rectified voltage but only to half of it.

Valuable to Have A.V.C.

The reason for this compromise is that automatic volume control is desirable, to reduce greatly the fading effects, and the loss of signal when travelling through partly-shielded areas, while any inclusion of a.v.c. is at the expense of sensitivity. Both high sensitivity and useful control of fading effects are desired, but as one can not have 100 per cent. of both (due to the laws of nature, with which we must not quarrel), the compromise is struck in a manner that has been found favorable by the author and also by several manufacturers of car sets. Without any a.v.c. the set would be less desirable, because of lowered performance under conditions of otherwise sharply-changing intensity. With what might be termed a relative excess of a.v.c. there would be a paucity of sensitivity.

The 6B7 is critical, not in operation, but in the determination of the voltage to be applied to the screen. It is well known by now that if the voltage on the screen

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is far off there might be no signals heard. Actually what the voltage is the builder may not know, for lack of sufficiently sensitive measuring equipment, say a 0-10 microammeter with voltage multiplier, but in practice the results are achieved by selecting the proper value of resistor series limiting. Thus the resistor is shown as 1.0 meg. and is interposed between screen of the 6B7 and the 90-volt line. The actual voltage on the screen is close to 20 volts.

Precautions

The plate of the tube has the usual load resistor, there is the familiar stopping condenser, and then on the grid side of the power tube (the very excellent 41) is the potentiometer of 0.25 meg. that is built into the remote control. One extreme of the potentiometer goes to ground, the other side to the stopping condenser, while the arm goes to the grid.

The remote control also has the line switch built in.

As to both the potentiometer and the switch, precautions must be taken. The potentiometer may cause increased resistance when rotated one way or the other, so if the control works the wrong way, reverse the connections to extreme terminals. The switch, first, has to be between the A battery and all the load on the battery, that is, speaker field, motor generator unit and heaters. Also, the switch should be in the "hot" or ungrounded A battery lead. In some cars A minus is grounded, therefore the switch would go in the positive leg, between A plus on battery and A plus on the VC socket. The designation VC is used for the remote control unit on sockets because the volume control is in this unit.

The remote control used comprises a geared dial of exceedingly sturdy action, enabling correct tuning even under conditions otherwise difficult, perhaps even due to the complexity of tuning while driving. While it may not be good practice to tune then, at least if the tuning is done while one is at the wheel, the dial has to be such as to stop at the desired point, that is, not have critical aspects.

The speaker used is a dynamic with 8-inch diameter cone. It is therefore relatively large for a car set, a favorable circumstance, as much of the tinny reception heard in cars is due to toy-saucer type speakers. The output transformer and field coil are both built into the speaker, and the field coil is excited by the storage battery, as is the motor generator.

Probably the most outstanding development in the electrification of the car set is the introduction of the motor generator. This is a device that is supplied with all its necessary power by the A battery, and which yields sufficient B voltage at current drains existing. For the present receiver two positive voltage taps are required, and are found on the motor generator. These are 90 and 180 volts. There is also a negative lead. The two other leads go to the storage battery, but one of these *through the switch*. This fact is confirmed in the diagram.

Motor Generator a Hit

While the use of a motor generator is stressed, of course it is practical to use batteries, and the socket is therefore marked "BAT" on the actual chassis, although the same socket is to be used whether batteries, motor generator or vibrator unit supplies the B voltage.

As stated, the motor generator is making a hit. However, it costs about twice as much as the vibrator type of B eliminator, and there will always be some little noise from the vibrator. If an 8 mfd. electrolytic condenser is connected from B plus 180 to B minus on the vibrator type's output, the noise will be so slight that it may be honestly rated as "not bad." The motor generator, however, is superior from the viewpoint of silent operation. This does not mean that vibrator types are not good. Certainly they're good, and many thousands are in contented use throughout the land. Moreover, I am not interested in advancing the sale of either type, but interested only in stating the results of long and patient experience, and the expenditure of considerable money on samples, samples and samples. In my town car I use a motor generator, but in my seashore flivver I use a vibrator type.

Accessory Sockets

The accessory sockets sometimes prove confusing to those desiring to wire an auto set. Therefore the diagram has been made pictorial to the extent that these sockets and connections thereto are involved. VC, as stated, is the remote control socket, and picks up the volume control (three connections), the set side of the A switch, and the other A lead direct from battery. The socket marked BAT. on the chassis itself, and designated MG for motor generator on the diagram, picks up grounded B minus, the A supply *after* the switch, and the two B voltages, 90 and 180 volts. The speaker socket is the same no matter what type of remote control or power supply is used. It accounts for the A voltage, one side picked up *after* the switch; the plate of the output tube and B plus 180 volts. One terminal of this socket (equivalent to cathode) is not used. Therefore all three sockets are UY.

The Road King may be built up from a kit or obtained in wired form. The diagram shows the actual connections used in hundreds of successful sets of this kind, now being distributed, with, it is hoped, thousands of more to follow. The satisfaction resulting from the use of such a receiver is due to the design, in part; to the tube laboratories for furnishing helpful data as well as producing tubes that fit to needs, to an excellent speaker, and to the proper voltaging and loading of the circuits.

Besides, the usual precautions are taken. The thick aerial lead-in wire is shielded and the sheath net soldered to the shield box into which the set chassis fits. This helps get rid of stray pickup from the ignition system. Besides, spark suppressors are used on the spark plugs, in series with the leads from the distributor, that is, between the respective plugs and the distributor connections therefor. Besides, a 1 mfd. condenser is placed across the car's generator. One side of the condenser goes to the chassis of the car and the other side to the plus lead from the generator. The frame of the generator is grounded to the car, and the car's generator also has one side grounded to car chassis. Therefore only one wire is accessible, and this is the one to which the ungrounded side of the 1 mfd. condenser is connected.

Suppression of extraneous noises, of course, relates to quality. So does the type of output tube, the speaker and the treatment of the audio circuit. The output tube is one of the favorites in present-day auto sets, and yields fine tone when worked into a quality speaker.

Large Bypass Capacity

The reduction of negative feedback through the self-biasing resistors in the audio channel makes the low-note reproduction realistic. Electrolytic condensers of 20 mfd. are used individually across the 7,000-ohm resistor of the 6B7 and the 650-ohm biasing resistor of the 41.

As for the 6B7, concerning which socket data were promised, they are, according to the previously described location and procedure: heater, heater, plate of pentode, screen of pentode, anode of one diode, anode of the other diode, and cathode. The metal cap at top of tube is the control grid of the pentode.

Industry Paid Tax Exceeding $2,000,000

During the first year's operations of the Federal 5 per cent. excise tax on radio and phonograph records, the industry has paid $2,206,763.39 to the Government, much less than the estimates of the Treasury Department to Congress when the law was under consideration.

Internal Revenue Bureau collections during June of the 5 per cent. tax amounted to $165,646.40, according to an official statement just released in Washington. June collections on mechanical refrigerators were $542,727.48.

Treasury experts originally estimated that between ten million and eleven million dollars would be obtained from the 5 per cent taxes on radio and phonograph apparatus. The new law became effective June 20th, 1932, and following are the records of government collections for the past year:

1932	
June 20 to July 31	$32,848.57
August	76,445.47
September	165,710.65
October	218,722.70
November	298,577.86
December	392,204.81
1933	
January	$283,425.27
February	173,987.28
March	149,859.66
April	138,587.02
May	110,747.70
June	165,646.40

Spot News Relay Suggested for Sets

A suggestion for extension of the usefulness of a radio set has been made by Orestes H. Caldwell, former Federal Radio Commissioner, and at present a radio editor, whereby the stations would send out a special signal whenever there was a news "alarm" to be broadcast, and some device in the set would respond to it.

Mr. Caldwell points out the growing tendency toward the sending of unscheduled material, as when some event of great news importance is taking place, and the station is able to give first-hand information concerning it, or have a news dispatch read that it receives from some cable, radiotelegraph or radiophone system.

It is suggested that, for instance, during notable air flights, as that of the Balbo squadron recently, the set might be kept turned on, even if one is not listening to it (speaker not actuated) but after a "flutter" or signal from the station would start the speaker going.

Another method that might be used would be to have the special signal actually turn on the set, which already is tuned to a particular station, and this might be done by some relay system whereby the resonance phenomenon is used to throw the relay.

While Mr. Caldwell merely submitted an idea, which would enhance the value of a set, the details have not been worked out. It would be fine if the system could be made to turn on the set and at the same time tune in the station that is about to send out the "flash" news, even though the set might not have been tuned to the frequency of that station when the set was urned off following the last previous use.

THOR IN PRODUCTION

The Thor Bargain Basement, 167 Greenwich Street, N. Y. City, announces that it is now in production on the Thor Communicator. This new unit for retail sale has met with instant approval and adapts itself to many uses.

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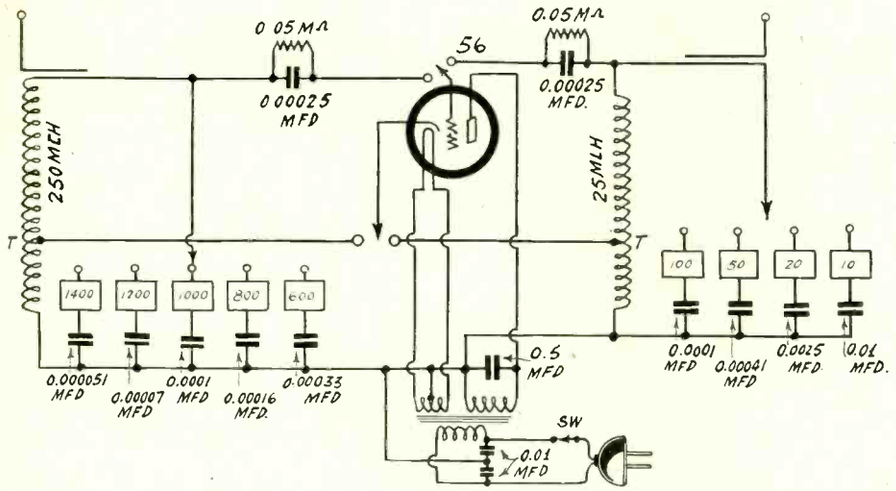
A SWITCH OSCILLATOR

for Broadcast and Low Radio Frequencies

By Louis Pouy



A test oscillator, using switching only, and no tuning dial. The Hartley oscillator is used in the manner devised by Edward M. Shiepe. The fixed frequencies generated are 600, 800, 1,000, 1,200 and 1,400 kc in the broadcast band (harmonics useful also), and 10, 20, 50 and 100 kc in the low frequency region (harmonics useful here too).

ANYBODY doing considerable radio frequency work seems unable to have enough oscillators, and often an oscillator that has just been built does not suit the purposes of the first subsequent test to be made. Therefore the same will probably hold true of the oscillator under discussion, although it affords some advantages not found elsewhere.

It is entirely a switch-operated device, enabling the generation of the standard test frequencies in the broadcast band as well as four low frequencies.

Suppose you have a broadcast receiver you desire to line up and calibrate. If it is a superheterodyne the 600 and 1,400 kc settings of the test oscillator may be used for padding tests. Suppose, also, that you desire to calibrate a set dial in frequencies. Use end frequencies, 600 and 1,400 kc. Using a 20 kc oscillator, by its thirtieth harmonic, the previously located 600 kc position is duplicated, and the set dial moved to extremes first to one side, then to the other side, of 600 kc, for its full span, with the oscillator unmolested. Now the points for the entire spectrum covered by the receiver are registered 20 kc apart.

For the higher frequencies of the band, say, 1,000 kc up, it is doubtful if the points 10 kc apart could be registered on an ordinary dial with anything akin to satisfaction, but from 1,000 kc down, though the points are found 20 kc apart, the in-between 10 kc points may be derived from the 10 kc oscillator, or by locating an in-between channel by station reception and repeating the 20 kc process.

Broadcast Calibration

By this method it is not necessary to have a dial on the oscillator, and the accuracy will be a little greater than is present in oscillators with frequency-calibrated dial. There is no dial to be adjusted to a coil-condenser circuit, or coil-condenser circuit to be adjusted to the dial. Moreover, the actual frequencies may be counted.

For instance, suppose the setting is 600 kc as determined by the first test. Then the dial is moved to the left, say, for higher frequencies, while the 20 kc oscillator is functioning. The harmonic is known. It is 600/20 or the thirtieth harmonic. So as one moves away from 600 kc one hears the modulation again. This is the next highest harmonic, or the thirty-first, and the frequency of the harmonic is 620 kc. So with 640, 660, 680, 700 kc, etc. And in the opposite direction, that is from 600 kc to lower frequencies, the same effect is present, except that the sequence of frequencies is opposite, 600, 580, 560 and 540 kc.

So, too, any one of the other broadcast frequency points may be registered, i.e., 800, 1,000, 1,200 or 1,400 kc, and the same method followed, in either direction. To get 10 kc separation for dial location or curve-plotting, a broadcasting station tuned in on the tested receiver, at a frequency an odd multiple of 10 kc, will permit the total location of all the channels 10 kc apart, as suggested earlier. Or, the 10 kc oscillator may be used for this purpose.

Feeble from 10 kc Harmonics

However, at 10 kc the order of harmonics is approximately doubled, the signal strength of the harmonics is weaker, and one has to have a sensitive receiver or sensitive indicating system to register the points.

The low frequencies of oscillation are 10, 20, 50 and 100 kc. The 20 kc use has been explained, and the 10 kc auxiliary purpose has been suggested, without stressing any other particular worth of the 10 kc circuit, and admitting the feebleness of the radiation. These two are most useful in the broadcast band, for it is there that 10 kc and 20 kc separation are most important. If, however, there is any reason for testing devices responding to lower than broadcast frequencies, for tuning over a wide range of frequencies, a location point has to be established by independent means, and then the 10 and 20 kc oscillators are useful.

But for higher than broadcast frequencies a separation of 10 kc means very little indeed, and therefore the 50 kc separation is afforded by the oscillator at that frequency, while for still higher frequencies the 100 kc oscillator may be used. In the short-wave region it is necessary to get a reference frequency before the harmonic effects of the test oscillator become significant.

Low Frequency Calibration

In a sense there is some calibration of every broadcast receiver, in that it is known where particular local stations come in on the dial, and the frequencies of those stations are known or readily ascertainable. It is common practice in local station separation for the Commission to adhere more or less to 50 kc separation.

While nothing has been said about attaining the inductive and capacity values necessary for producing the specified frequency results, assuming these constants are used the problem would be to calibrate the low frequency oscillators. Let us start with the highest of the low frequencies, 100 kc.

Select two broadcasting stations of that are 100 kc apart, preferably as near the low frequency end of the set's dial as possible, as the mechanical separation is better then.

When the intended 100 kc oscillator beats with one of these stations, preferably zero beats, and then does not produce any audible result until the set's dial is turned to the frequency of the second station, 100 kc removed from the other, then the test oscillator is generating 100 kc. This is true because some harmonic, n, of the fundamental test oscillation is beating with a station in the first instance, and the next higher harmonic, $n + 1$, or next lower harmonic, $n - 1$, is beating with the second station 100 kc removed. The frequency separation between the stations marks the span between the two oscillator harmonics, and that span is always equal to the fundamental of the test oscillator.

Accuracy of Standard

Moreover, this method lends itself to excellent accuracy, because the frequency of the station is accurately held, in the extreme instance to 50 cycles or less out of 1,500,000 cycles, and at the other end to 50 cycles out of 540,000 cycles. In the first instance it is to one part in 30,000 and in the second to one part in 10,800.

The Repeated Response Method

The 50 kc test oscillator is adjusted the same way, only the stations selected are 50 kc apart. For the 20 kc oscillator a distant or semi-distant and a local station may have to be selected, and thus a sensitive and selective receiver used in the first instance, the procedure, however, being the same. The 10 kc oscillator may be set on the basis of stations 50 or 100 kc apart, a beat being struck, preferably zero beat, between the test oscillator and the station, and the set tuned slowly in the direction of the frequency of the second station, while the number of responses, including the first, is counted. For stations 50 kc apart the number of responses would be six, in-

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cluding that of the beats between the test oscillator and both stations, while for stations 100 kc apart the number of responses would be 11. The number of responses is always [(f1 — f2) / f3] + 1, where f1 is the higher frequency station, f2 the lower frequency station and f3 the correctly calibrated fundamental frequency of the test oscillator. If the number of responses is too many the inductance is too high, or the capacity too high, hence fundamental too low in the test oscillator, or both L and C may be too high in a sense, although the correction may be applied by reduction of either L or C. If the number of responses is too few the opposite is true as to the cause, and L or C, or both, should be increased.

Coil Values

Low frequency oscillation may not be worked in conjunction with higher or other frequency oscillation in the diagramed oscillator, as the circuit consists of one tube, and only one LC system is in the tube circuit at a time. But in conjunction with the tested circuit, low frequency oscillations in the tester may be checked against high frequency oscillations, and vice versa.

The condensers are shown connected as to one side permanently to ground. This puts the switching at a "hot" potential, but there is an advantage in the permanent grounding of the condensers, if either side of them is to be connected anywhere permanently, for then there is no danger of stray capacity to ground from the "hot" side of the condenser to offer disturbing factors rendering calibrations a bit insecure.

Now, as to the values. The inductance for the broadcast band was selected at 250 microhenries, as that could be used with suitable capacities for the five frequency points. Likewise in the low frequency region, an inductance a hundred times as great renders feasible the attainment of the four low frequency oscillations with suitable capacities.

Capacities Selected

In both instances the coils are tapped about one-quarter the number of turns up from the ground end. The tap goes to cathode.

Moulded fixed condensers of the wax-impregnated type may be used for the tuning capacities, a bit smaller than the capacities required, and the extra capacity obtained from some air-dielectric condensers, which may be of the junior or midget type for the broadcast band frequencies and the two higher brackets of the low frequencies, whereas the remaining capacities (0.0025 mfd. and 0.01 mfd.) may be built up from fixed condensers, the test being applied on the basis of known inductance, and the number of response points previously discussed. The known inductances are commercially obtainable, the large coil being a honeycomb of 1,300 turns and the small coil either a honeycomb of the required inductance (usually obtained from about 300 turns) or, a solenoid.

The power transformer has the usual primary winding and two secondaries, one at 2.5 volts for the single 56 tube used, the other a 1-to-1 ratio, thus affording about 110 volts a.c. for the plate, which is sufficient. The modulation results from the use of the line a-c on the plate. An ordinary filament transformer could be used, but not without danger due of contacting opposite potentials of the a-c line. The danger may be reduced by a limiting resistor between line and oscillator, but the independent secondary is preferable.

Line Blocked

The 0.5 mfd. condenser is for line-blocking, to stop radio frequencies from getting to the tested device by way of the a-c line, while the two 0.01 mfd. condensers are to the same general purpose and also aid in keeping out line noises that attain radio frequency values and that differ from the hum frequency and therefore would add some uncertainty as to what actually constituted the modulation.

The output is taken from a single post for the broadcast frequency fundamentals and from another single post for the low frequency fundamentals and harmonics of these low frequencies. The fact that harmonics of the five broadcast test frequencies may be used has not been stressed, but of course this may be done. The second harmonic of 800 kc is handy for use in determining whether a set tunes to 1,600 kc, and if it does, how much higher its tunes may be determined by the now familiar method using the 20 kc oscillator.

The oscillator should be shielded and the shield grounded. Aluminum does not shield such an oscillator very effectively, and neither does copper, so far as the fundamentals of the five broadcast frequencies are concerned, but a so-called "steel box" was found to do the work more satisfactorily. Of course if the aluminum or copper were thick enough that, too, might suffice. The "steel box" was a nearly one-eighth inch thick, and it happened to be nothing other than iron.

New Wavemeter Proves Sidebands a Reality

Chicago.

Development of a new electro-acoustical wavemeter which accounts for the phenomena of so-called combinational tones in music and "sidebands" in radio was reported recently from the Indiana University physics laboratories in a paper read before the American Physical Society and the American Association for the Advancement of Science.

For 60 years some of the world's leading physicists have been divided as to whether combinational tones really exist, and if they do exist, what the conditions are for producing them.

Sidebands Proved

With a new wavemeter, which allows sound waves to actuate a delicately tuned circuit, and thus cause deflections in a sensitive ammeter, Dr. Herbert C. Hazel, research worker, and Dr. R. R. Ramsey, radio authority, have proved that combinational tones and "sidebands" really exist. They have also shown the exact conditions under which they are produced.

Their findings are expected to have significant application to optics and to the phenomena of fluorescence and re-radiation. It may be possible now in the light of new data to combine two light waves in such a way as to produce a radio wave as a "sideband" frequency, or to get visible light from X-rays. New light may be thrown also on some forms of radio static.

The combinational tone controversy started in Europe about 1870 between Helmholtz and Koenig, the two outstanding acousticians of that time.

Helmholtz Stressed Reality

Helmholtz maintained that the combinational tone that's produced when two loud, sustained notes are sounded continuously together has objective reality as shown by the sympathetic response of tuned plates and resonators. Koenig denied the existence of these tones external to the ear.

These two leading physicists gathered a host of followers and both rival opinions were abundantly confirmed. The question engaged the attention and work of such eminent scientists as Lord Rayleigh, Bonanquet, Preyer, Rucker, Edser Hermann and Waetzman, without any generally accepted conclusion being reached.

With the development of radio communication during the last decade, the question arose again, this time in the disguised form of the "sideband" controversy. One school of radio engineers maintained that "sideband" frequencies, produced when music or voice modulation occurs in radio telephone transmitters, actually exist and that selective radio receivers tuned to them respond.

Sidebands with Linearity

Another group has argued that "sidebands" are merely mathematical fictions. These disagreeing groups include such radio authorities as Sir Ambrose Fleming, inventor of the two-electrode radio vacuum tube; Joseph Robinson, inventor of the stenode receiver; Prof. G. W. O. Howe, one of the leading British engineer-physicists; and a host of radio engineers both in America and in Europe.

The new research by Hazel and Ramsey settles both the Helmholtz combinational tone controversy and the radio "sideband" question. Whereas Helmholtz and Koenig and others depend upon hearing the response of resonators or listening to the tones directly, the two Indiana University investigators designed their highly-sensitive electro-acoustical wavemeter and used it to solve the problem. Contrary to the views of many authorities, Hazel and Ramsey show that the combinational tone and "sideband" frequencies can be produced without any non-linear circuit element being involved in the process.

Marconi Seeks Greater Use of the Ultra Waves

Rome.

Guglielmo Marconi is conducting new experiments with ultra frequencies, using greater power than has been generally tried in this spectrum, and also attaining greater distances of penetration. The increased distances are not due alone to the increased power but also to the angle of radiation, which he controls, and the beam transmission, that is, closely directed carrier along a given path. The concentration makes for the greater effectiveness of radiation and penetration.

About a year ago Marconi announced that he was able to send and receive on ultra frequencies over a distance of many miles beyond the horizon, and this was hailed as an important contribution, even though the present use of such frequencies is for local transmission and reception, and it is not expected that great distances will be covered, due to the limitation of control of the angle of radiation.

Marconi is keeping his experiments secret, as to details, but it is said that he is satisfied with the results achieved thus far. As a starting point he used the 170-mile range achieved last year on wavelengths below one meter, and is said to have almost doubled this distance in his recent experiments.

In general these waves are regarded as behaving something like light waves, being subject to similar obstruction by intervening objects, reflection by bright surfaces, and coursing according to the curvature of the earth. However, by transmitting from an elevation the distance to the horizon is increased, as the hypotenuse becomes longer, but Marconi has added some real accomplishments that still further increase the distance covered.

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A NEW A

Using the Tally Method

By Herman

AN accessor using the standard code for socket terminals, to enable current, voltage and even resistance measurements of a receiver, is diagrammed in Fig. 1. Two sockets are used in the accessor, one to take UX, UY and six-pin tubes, the other to take either the medium or the small seven-pin tubes. Whichever seven-hole socket is included there is a 7-to-7 adapter to take of the other type with the same number of holes. When and if eight-pin tubes are announced, an eight-hole socket may be used in this position, and by adaptation will accommodate both of the seven-pin tube bases.

The object of the accessor is merely to give access to the circuits of the receiver. There are no meters included, no shunts, no multipliers, no batteries. These would have to be external.

Cabinet 5 x 4½ x 2 Inches

The device was built in a metal cabinet 5 inches wide by 4½ inches front to back by 2 inches high. On top were the two sockets, two switches, and a twin jack for test leads from whatever meter or meter-resistor-battery combination is to be used. Besides, a binding post conductively connected to the cabinet is used, for picking up chassis of a receiver for resistance or even voltage measurements, and besides a tip jack for accommodating the overhead grid lead of a capped tube to the analyzer plug.

The sequence of the operation of the accessor is as follows:

The receiver local circuit to be tested is selected, the tube is removed from the receiver and put into the proper accessor socket, while the analyzer plug that is wired to the tester sockets through one of the switches is inserted in the vacant socket of the set. If the analyzer plug hasn't the same pins corresponding to the holes in the socket where the test is to be localized, an adapter is used. The plug has a seven-pin base, a lead from each going out through the top, while the grid caps on the plug, common to each other and to a latch in the plug base, are brought out to the eighth lead. Thus there is an eight-lead cable, and the color code is on the diagram.

Safety Position

The set is turned on. The current will flow through all circuits except the one circuit set for current reading, with the further exception that the filament reading has been omitted, because the current is so much higher than most meters will stand.

There are two switches. One of these consists of two sections: (1) circuit opener and (2) circuit closer. This is the left-hand switch in the top view photograph and is represented on the diagram by the two block enclosures. Since the operation is simultaneous, these two switches will be referred to as if one.

The other switch is for picking up voltage points. So, in general, the left-hand switch is the current switch and the right-hand switch is the voltage switch. Exceptions are that the ninth position on the current switch (E9) is to pick up the meter for voltage reading purposes and the ninth position (X9) on the voltage switch is the position for the meter when the accessor is not in use, for the jack terminals intended for test leads from the meter are then shorted, the meter is out of the emf circuit even if connected to the jacks and no injury could be done to the meter. This same lead is connected to the metal case of the accessor, and a binding post or jack used, so that the case may be made common with the chassis of a receiver that is under test.

Cathode Different

The accessor lends itself to the use of switches commercially obtainable, since nine position switches are common. Fortunately only eight positions are required for current, the ninth being used for voltage, and even two of the previous eight are shorted (fila-

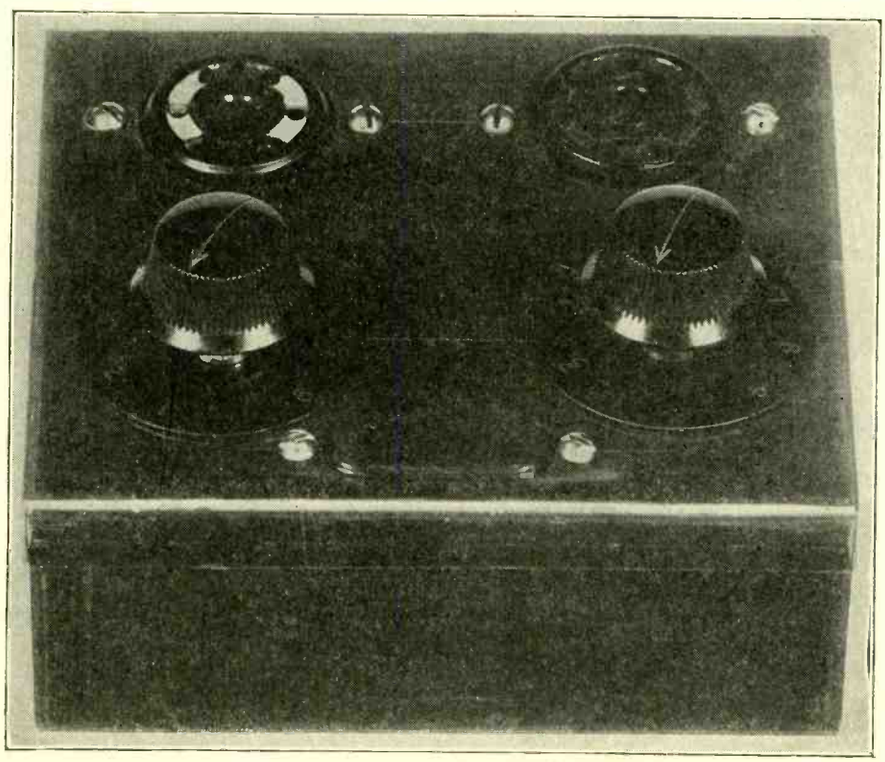
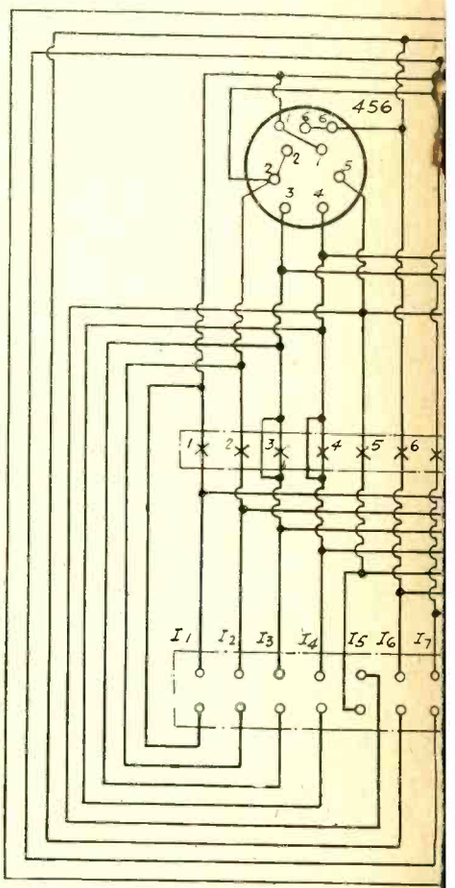


FIG. 1

Top view, with current switch at left and voltage switch at right.



FIG

The circuit diagram of an accessor, a currents and voltages in an operating point resistance measurements in a ing circuit is external and therefo useful to those who already have a m the desired measurements. The bott and the springs are numbered a

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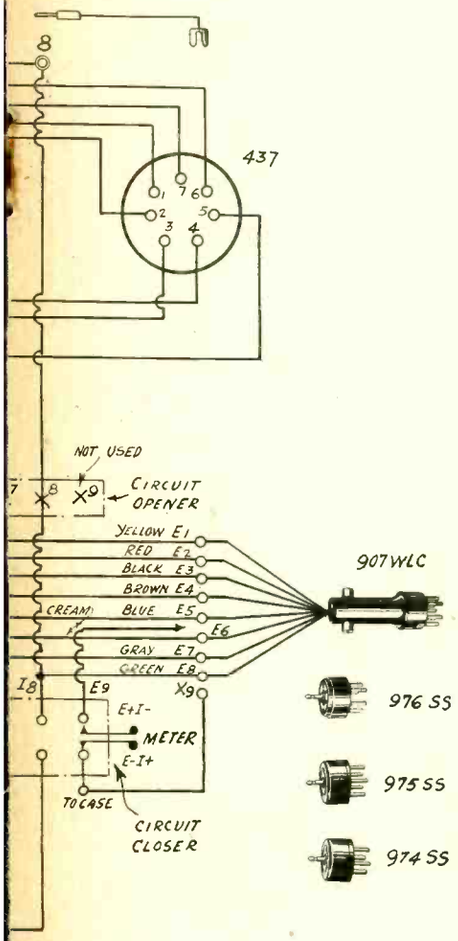
ACCESSOR

of Significant Switching

Bernard



. 2
device for rendering accessible the receiver, and also enabling point-to-on-operated receiver. The measur-e the accessor will be particularly er or meters and adjuncts to enable m views of the sockets are shown ccording to the standard code.

ments), reasons explained already. In this connection it may be said that a voltage test of the filament is sufficient. If the voltage is correct, no concern need be felt about the current.

The polarities are such that, in general, the high-voltage elements of tubes are negative in respect to the source of that voltage. That naturally follows from the fact that the maximum voltage is the source. Any load on the circuit drops that voltage. The direction of the load is from B plus to B minus, is another way of looking at it. The cathode current is an exception, so for 15 the terminal lugs are connected in reverse.

Looking at the circuit diagram, we see that the upper side of the circuit closer, representing one side of the meter, is negative as to current, and so marked to the right, while the lower post is positive as to current. For voltages the signs are reversed, also marked. There is no need for a reversing switch because the meter is independent, and the test leads to the jack assembly may be reversed; in fact, must be, in distinguishing current and voltage readings, unless a galvanometer type instrument is used.

The Sandwich Action

It has been explained that the circuit is made from voltage and current sources in the receiver through the analyzer plug cable to the current switch. The completion of the explanation is that the circuit-opening part of the switch interrupts the feed to the accessor socket, and therefore the tube element would be unvoltaged (for the tube is in the accessor now) unless something were interposed in this open circuit. We realize that to measure current the instrument must be in series with the line, and to measure voltage in parallel with it. If we visualize the diagram we notice that the circuit-opening part of the switch is in parallel with the circuit-opening part, and that the meter is represented by sliders that affect the closing section. Hence at any particular position for current, for instance, I2, the moment that contact is made on the switch the circuit is opened by the upper element and at the same time closed by the lower element. Since the meter is across the sliders below, it is the meter that is put into the otherwise open circuit, and continuity prevails, also reading.

Non-Antiquating

The use of the standard code in conjunction with the accessor eliminates the possibility of antiquation of the device, for no matter what tubes are brought out there will be numbers for the elements corresponding to numbers included in the present set-up, excepting tubes that have more elements that the most-numerous-elemented present tube, but even then a departure from the code would be permissible to the extent of using the numbers 3 and 4 on the current switch not servicable in the present arrangement, and X9 on the voltage switch may be brought to an extra element instead of being made common to one side of the meter and case or cabinet.

Otherwise, and as at present constituted, to take care of existing tubes, the code may be deduced from the diagram. The bottom views of the sockets are shown. Therefore negative filament is to lower right and positive filament to lower left. Positive filament, or equivalent side of heater in indirectly-heated type tubes, is the datum, number 3. The rotation is counter-clockwise in ascending order, provided the bottom view is maintained, whether heater or filament or other element is toward you or not.

Plate is practically always 2, since it virtually always adjoins the positive filament or equivalent, the exceptions being tubes with two plates, when some other number is plate, and also plateless tubes. However, the number of elements always is known, positive filament is 3, the direction of progression as well as the order are known, so the other numbers can be written in by anybody.

Numerology

Then, to know what the numbers represent all one has to do is to be familiar with the tubes elements' identities. This is too much to ask, in regard to all existing re-

(*Continued on next page*)

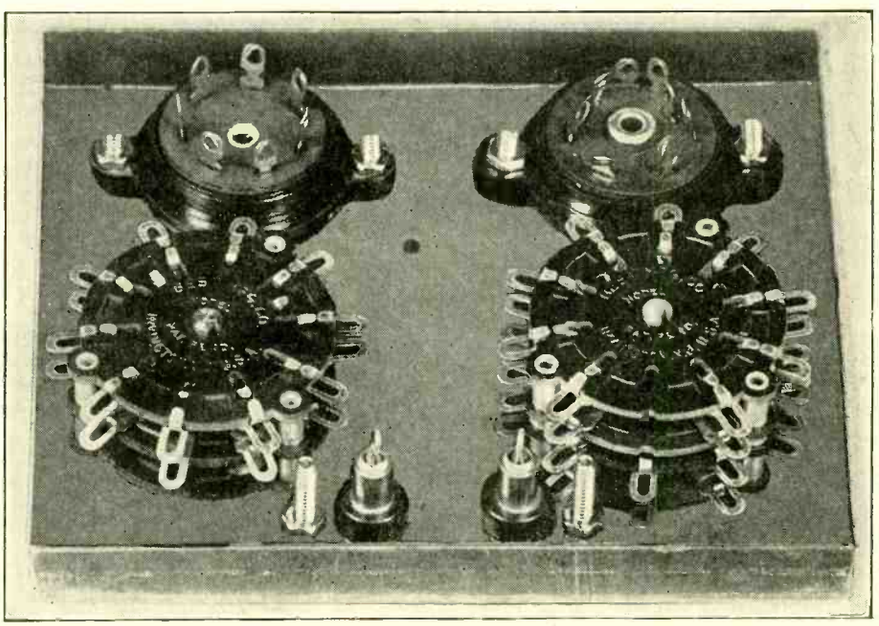


FIG. 3

Under view of the accessor, before wiring, showing the two switches and twin jack assembly. The current switch (to left) has four tiers of lugs, of which the tier nearest the knob has its corresponding or aligned lugs connected to the tier farthest from the knobs, and the remaining two tiers of respective lugs are themselves interconnected. This puts the meter between two points otherwise left open by the circuit opener, for the meter is attached to the circuit-closer. The voltage switch is at right.

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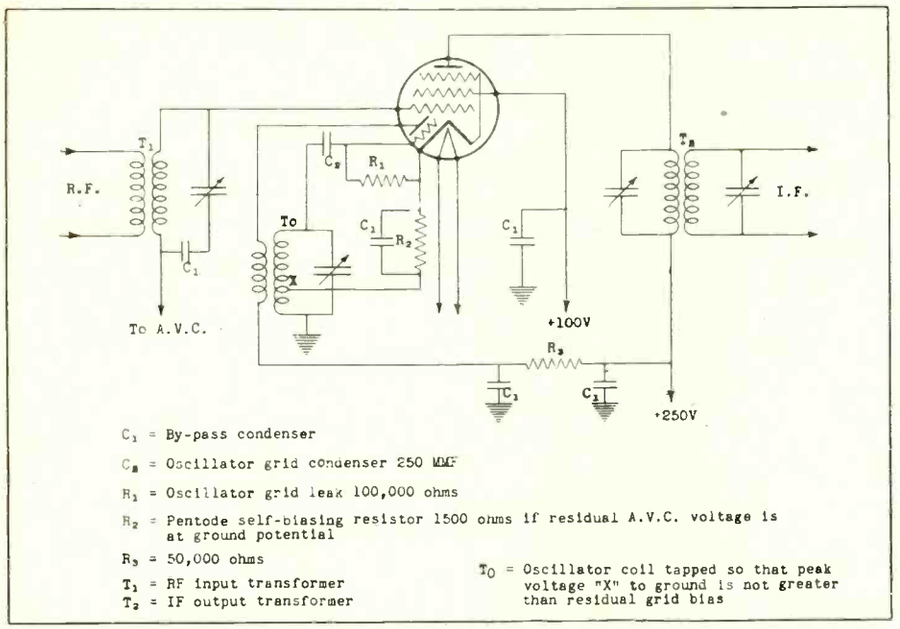
Cathode Separately Used in New 6F7



Typical circuit of the 6F7 in a mixer. The coupling between oscillator triode and modulator pentode is externally provided at X.

The Ken-Rad Corporation, Owensboro, Ky., in announcing the 6F7, said:

"The Ken-Rad 6F7 is a heater type of tube designed to serve the double purpose of oscillator and first detector in superheterodyne circuits. It is somewhat similar to the 2A7-6A7 in its function but differs considerably in mechanical construction, as the triode and pentode elements are separate from each other except for a common cathode sleeve. However, the pentode and triode units each utilize a separate portion of the emitting area of the cathode.

Remote Cutoff Pentode

"The pentode portion of this tube utilizes a remote cut-off control grid which permits the output of the first detector unit to be volume controlled. As the pentode and triode units of this tube are not electron coupled as in the 2A7 and 6A7, it is necessary to provide an external means for accomplishing the coupling. This can be conveniently done by returning the cathode circuit through a portion of the oscillator coil to ground, or otherwise introducing some of the oscillator voltage into the pentode circuit."

Operation

Under the heading "Operation," Ken-Rad set forth:

"The circuit drawing illustrates a representative circuit utilizing this tube. The use of a series resistance to feed the triode plate voltage through is highly recommended and such a resistance will tend to smooth out variations in oscillator performance occasioned by differences in triode characteristics. Referring to the circuit diagram will show that when the supply voltage is 250, the series resistance should be approximately 50,000 ohms.

"This tube can also be utilized as a detector-amplifier. When used this way the triode unit operates as detector and the pentode unit as amplifier."

Key Numbers for Set Testing

(*Continued from preceding page*)

ceiver tubes, of any one not constantly engaged in just such work, but the most important tubes are intimately known, and no reference is needed for them, but for the other tubes a chart may be consulted. Such a chart was printed a few weeks ago, but some new tubes have come out since then, and the connections for these have been included, and the augmented chart is therefore printed herewith.

The voltages will be read from grounded chassis, not because the effective plate voltage or screen voltage, for instance is actually the potential difference between grounded B minus chassis and plate, but because manufacturers' specifications issued in conjunction with their circuits for service men nearly always give voltages taken from grounded B minus chassis and so stated.

It should be remembered that these voltages for heater type tubes is that between cathode and measured element, and for battery type tubes that between negative filament and measured element. The actual condition, within limitations of the meter, may be obtained by reading the drop between cathode and ground as voltage and subtracting this from the voltage reading obtained between other element and ground. For battery tubes measure the drop between negative filament and B minus and subtract that from the other reading.

Such a device comes in mighty handy, especially as it permits current readings without cutting wires or otherwise monkeying with a receiver. Moreover, it is applicable to all the important measurements, since these are encompassed within the original definition of current, voltage and resistance readings. The current and voltages readings are taken with the set turned on; that is, operating or "hot." The resistance measurement is made when the set is not turned on; in other words, is non-operating, or "cold." There are some who assert that point-to-point resistance method is quite the thing; others who much prefer the current and voltage measurements, but in fact neither method is complete and sufficient unto itself, and it is well indeed to have the option herewith presented.

The resistance measurement is made by inserting the series circuit comprising meter, limiting resistor and battery in the jack assembly, using the test leads, and otherwise actuating the switches as for voltage readings.

TABLE RELATING TUBES WITH FIGURE NUMBERS OF SOCKET DIAGRAMS.

200A	FIG. 1	36	FIG. 9	59	FIG. 15
WD-11	FIG. 12	37	FIG. 8	71A	FIG. 1
201-A	FIG. 1	38	FIG. 14	75	FIG. 13
45	FIG. 1	39	FIG. 14	77	FIG. 11
47A	FIG. 17	31	FIG. 1	78	FIG. 11
2A7	FIG. 20	53	FIG. 6	79	FIG. 19
2B7	FIG. 21	41	FIG. 15A	80	FIG. 2
6A7	FIG. 20	42	FIG. 15A	81	FIG. 3
6B7	FIG. 21	43	FIG. 15A	82	FIG. 2
WX-12	FIG. 1	44	FIG. 9A	83	FIG. 2
UX-12	FIG. 1	45	FIG. 1	84	FIG. 23
27	FIG. 8	46	FIG. 7	85	FIG. 15
24-A	FIG. 9	47	FIG. 6	89	FIG. 14
26	FIG. 1	48	FIG. 15	1-99	FIG. 12
27	FIG. 8	49	FIG. 7	2-99	FIG. 1
30	FIG. 1	50	FIG. 1	864	FIG. 1
35	FIG. 4	55	FIG. 15A	866	FIG. 16
34	FIG. 44	56	FIG. 13	874	FIG. 2
35	FIG. 9	56	FIG. 8	2525	FIG. 3
246	FIG. 13	57	FIG. 11	1	FIG. 22
6A6	FIG. 6	58	FIG. 11	2A5	FIG. 15A
10	FIG. 1	10	FIG. 1	1A6	FIG. 15B
6F7	FIG. 20A	19	FIG. 21B		

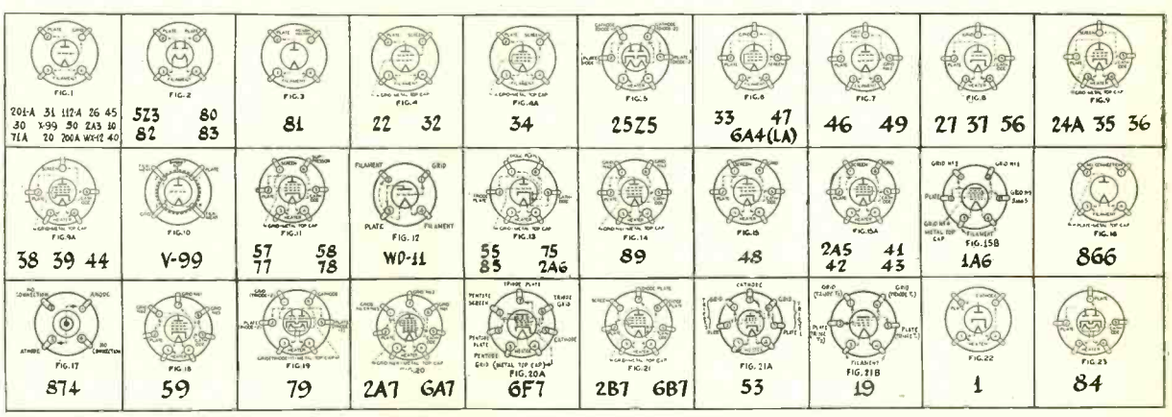


FIG. 4 (bottom views)

Tabulation of the existing receiver tubes, in reference to the standard code for socket terminals (or base pin connections of tubes). Select the tube concerning which information is desired, derive the figure number, refer to the figure for the numerical equivalents of elements, and these numbers will correspond to those on the plates of the two switches used in the accessor. The author'stally method of significant switching is used (center).

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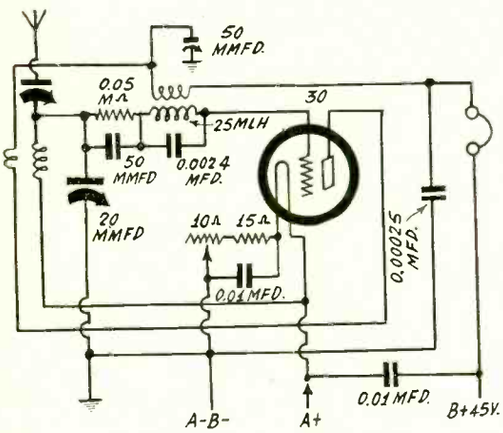
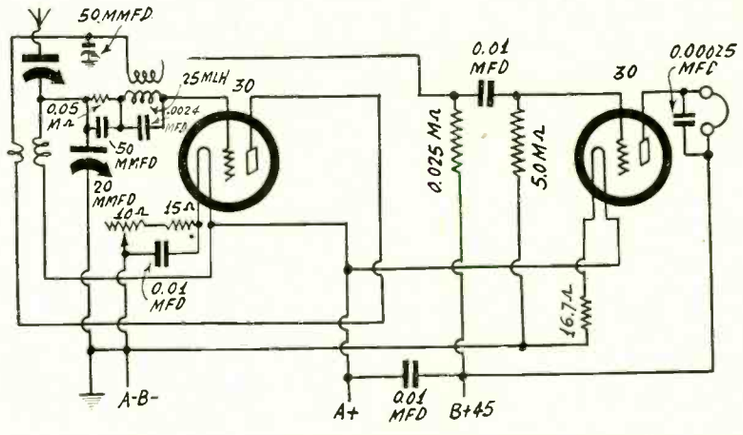
SUPER-REGENERATION

For Reception on the Ultra Frequencies

By Jack Tully



A super-regenerative receiver, using the 30 tube, to bring in ultra frequencies. With a three-turn secondary as described in the text the frequency struck at maximum capacity was the lowest in the ultra region, 10 megacycles. For higher frequency maximum the capacity 20 mmfd. may be used, likewise the secondary inductance reduced.



The same circuit as shown to the left, but with a stage of audio added. The plate load resistor has an effect on feedback, particularly at the signal frequency, and therefore it may be necessary to lower the resistance. For improved intensity of signal the leak in the output tube circuit should be high, so 5 meg. are specified. If there is any grid current in the audio tube the bias may be increased by interposing a biasing battery between ground and the return of the grid (lower end of the 5.0-meg. resistor). This battery may be 3 volts.

RECEPTION of 'phone and code on ultra frequencies is generally accomplished by experimenters by using a super-regenerative circuit. The idea of such a circuit is to have a regenerative detector and introduce an auxiliary oscillation which will permit pressing the orignal regeneration to a greater degree without spillover. Therefore the auxiliary oscillation is of a lower frequency. In the early days of the use of such a system the auxiliary frequency was at an audio level, but this creates most unpleasant and constant interference, and while sensitivity may be reduced a bit, it is generally agreed that an auxiliary frequency that is inaudible is preferable.

In the circuit shown the 30 tube is used for the dual frequency purposes, in one instance a single-tube outfit being used and in the other a stage of audio added. A radio-frequency choke coil is put in series with the grid, with a condenser across it, to resonate at the auxiliary frequency. If the coil has an inductance of 25 millihenries and the condenser across it is 0.0024 mfd., the frequency attained will be just a bit higher than 20 kc., so any capacity approximately as stated may be used, as the particular frequency, so long as inaudible, is of no great consequence.

Constants Explained

Coupled to this tuned system is another and similar r-f choke coil in the plate leg, but the value is not critical. Since honeycomb coils will be used for this coil system, the coil in the grid circuit may be of the 1300-turn type, about 1.25 inches overall diameter, and the other may be 800 turns or so, coupled as tightly as required to assure oscillation. Since the frequency is low, the two coils have to be fairly close together. It is suggested they be not much more than one-quarter inch apart.

The small condenser across the resistor in the grid circuit is the conventional grid condenser, and this may be as specified, although it is possible that the grid leak will have to be smaller, a fact determined by the presence of a steady note that might be wrongly ascribed to audibility of the auxiliary oscillation. It is really audio-frequency oscillation due to grid blocking, that is, starting and stopping, or interrupting, of plate current at an audio frequency. As the tube will oscillate at the signal frequency and also at the auxiliary frequency, if the grid blocks as stated, we have the example of a single tube oscillating at three different frequencies.

The tuning condenser has to be small, of course, and 20 mmfd. is suggested as a suitable capacity. By careful arrangement of parts and construction of the receiver the condenser and coil will yield a frequency ratio of about 2 to 1.

Coil Construction

The signal frequency coil consists of two windings, the one from a branch of the grid circuit to A plus, the other the feedback coil or tickler. No data can be given on the coils for an exact attainment of frequency values, as the inductance is small compared to the capacity, and the capacity is unknown. While a certain value is specified for the tuning condenser (20 mmfd.), it is not known what the distributed capacities are, although it is assumed the total of the minima will not exceed the square root of 2.

It is fashionable to wind the coils air-core fashion in rather large diameters, say, around 3 inches, and have the wire ⅜-inch diameter hollow copper, spaced at least the thickness of diameter of the wire. Three turns may be used as grid winding, 2½ turns as tickler, if the two are close together, otherwise the tickler may have even a greater number of turns than the grid winding, but the separation must be greater. The main consideration is that the circuit must oscillate at the signal frequency. This should be achieved by building the circuit first with the auxiliary oscillator part omitted, except for the feedback winding for the low frequency oscillator, which serves as r-f choke for regeneration purposes in the signal tuner circuit.

Even on a 1-inch diameter, using No. 14 soft copper solid wire, results are obtained at 56 mgc. on 1¼ turns on secondary.

Voltage Sources

The antenna series condenser has no value prescribed, but it should be a small condenser, and its capacity setting will have a great effect not only on frequency, but also on regeneration. If the condenser is too large the circuit will not oscillate. A few micro-microfarads of capacity usually will be found sufficient.

The 50 mmfd. variable condenser is the regeneration control, and may prove too large, in which instance put in series with it, between stator and the coil connection, a fixed condenser of about the same capacity, or somewhat less.

Two No. 6 dry cells may be connected in series, and serve as the 3-volt A battery source. This combination has long life, since the tube filament draws only 60 ma. at 2 volts, and such a combination would stand up to 250 ma., although at shorter A battery life. The B voltage is obtained from a 45-volt battery.

Since the A voltage at the source is 3 volts, and the tube requires only 2 volts, the difference of 1 volt is dropped in the filament resistance network. This consists, for the detector, of a 15-ohm unit in series with a 20-ohm rheostat. The rheostat may be varied for adjustment to a drop of 2 volts across the filament itself. In the two-tube set the resistor shown as 16.7 ohms also may be only a 20-ohm rheostat set so that the drop across the filament of the second tube is just 2 volts. The audio tube is biased by the drop in this resistor, the 1-volt bias being sufficient in most instances.

Plate Load Resistor

In the two-tube set an extra condition arises that affects regeneration, and that is the resistance of the plate load resistor. While a value of 0.025 meg. (25,000 ohms)

(Continued on next page)

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Radio University

A QUESTION and Answer Department. Only questions from Radio University members are answered. Such membership is obtained by sending subscription order direct to RADIO WORLD for one year (52 issues) at $6, without any other premium.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK, N. Y.

Trouble in the 55

AFTER MY SET had been working fine for a few weeks it suddenly stopped giving forth reception and instead makes only a steady hum. The radio-frequency end seems to be all right, by earphone test. Also a sound put into the audio at the first tube does not get by but does get by when put into the output stage. The detector is a 55, using the diode-biasing method, that is, amplifier grid tied to negative side of the diode load resistor. —U. G.

The wire connecting the control grid (cap) of the 55 to the diode load resistor evidently has become disconnected, so repair it and enjoy your set once more.

* * *

53 Detector-Amplifier

SINCE THE NEW 53 tube as a biased detector takes 7.5 volts negative bias at standard B voltage on the plate, and the amplifier takes 3 volts, while the cathode is common, I do not understand how the different biases are obtained.—K. E.

The usual way to obtain the different biases is to ground the cathode to B minus and have a bleeder resistor through which enough B current flows to furnish the maximum bias, for detection. The grid returned to negative gives 7.5 volts negative bias. The other grid, returned to about the midpoint of the bleeder resistor, gives around 3 volts negative bias.

* * *

Resistance Push-Pull

WILL YOU PLEASE enlighten me on the most practical method of resistance-coupled push-pull audio?—M. D. C.

The most practical method is one whereby the operation point is fixed, and is selected about half-way down the plate current-grid voltage characteristic, in the case of a triode or other amplifier, or the midpoint of a load resistor in a diode. Consider the diode first. If the center of its load resistor is grounded, a stopping condenser to the respective grids of the push-pull stage, with leaks from those grids to ground, will afford push-pull action. If the push-pull effect is to be introduced after detection, then a phase-shifting tube is used. For instance, one side of the line would be single-sided-coupled as usual. The other side also would be single-sided-coupled, but with an extra tube in the chain, to shift the phase 180 degrees. Less than the full output of the phase-shifting tube would be used, so that there would be equal signal voltage drop across the first push-pull stage, or across the input of the power tube stage, if the power stage follows directly. This is called dynamic balance. If this is done at 60 cycles, which is readily accomplished with a line-frequency-modulated oscillator, then static balance is not needed additionally, for the two are approximately the same. In the diode instance there can be no amplifier tube in the same envelope, as there is no plate voltage. The 53 lends itself to the phase-inverting purpose.

* * *

Remedies for Super Troubles

IN A SUPERHETERODYNE I built from a magazine circuit I have the following troubles: the intermediate amplifier oscillates, and I can not stop it even though I halve the plate and screen voltages; the r-f and oscillator coils do not line up, or the padding condenser is away off, or something, because I can not tune high enough in frequency, but must stop at 1,400 kc, no matter what I do; there is some steady hum in the set, also a much louder hum as each station is tuned in. —P. O'T.

Put a high inductance radio-frequency choke in the plate leg of each intermediate coil, 25 millihenries or more, between plate return of the transformer and B plus, and put a condenser of 0.002 mfd. or higher capacity from the plate return of the transformer to ground or cathode. If you are using 58 tubes in the intermediate amplifier, disconnect the suppressor from the cathode and instead connect the suppressor to grounded B minus. Use larger bypass condensers across the biasing resistors in the i-f amplifier. It is suggested 0.5 mfd. be used. The steady hum may be sufficiently reduced by doubling the capacity next to the rectifier (from filament of rectifier to B minus), and the tunable hum usually yields to two 0.1 mfd. condensers connected from the set side of the a-c switch to grounded B minus, and from the otherwise uninterrupted a-c outlead to B minus. Carefully insulate these condensers, so as not to expose the line voltage to accidental connection. To hit 1,500 kc lower the i-f.

* * *

Cathode-Biased 2A7

IS IT PRACTICAL to use the 2A7 in the following manner: triode as a self-biased tube (not grid leak); pentode as the mixer. Please give an idea of resistance values when the B feed is 200 volts. —I. O. J.

Yes, the 2A7 may be used that way, and the harmonics will be less intense. This reduction of harmonic intensity is even better when the tickler is loosely coupled to the grid winding. Omit grid leak and stopping condenser and return the oscillator grid (Grid No. 1, adjoining cathode connection on socket) to grounded B minus. Resistance values that will work well are: cathode to B minus, 800 ohms; screen to B plus, 50,000 ohms. These resistors should be bypassed, the screen by 0.1 mfd. or higher capacity, the cathode by the same general capacity value.

* * *

Beat Oscillator Tube

AS I DESIRE to construct a beat oscillator, using batteries, is there any battery-operated single-envelope type tube, in reality two tubes, that will suit the purpose?—J. E. M. G.

Yes, the 19, a new tube, has a single filament and two separate triodes. One triode may be used for one oscillator and the other triode for the other oscillator. Some external means of coupling the two should be provided.

* * *

Hum in Push-Pull

IN A PUSH-PULL amplifier I built there is considerable hum. How shall I reduce it?—G. S. C.

The first thing to do is to unfasten the audio transformer or transformers and put them approximately at right angles to each other and also so dispose them in respect to the power transformer as to have minimum, preferably zero, coupling among them. A very slight shift will make quite a difference. Exact right angles probably will not do, as the phase is not quite the same in the respective transformers, certainly not those in the audio proper. Then restore the circuit electrically, and connect a resistor from the grid of one push-pull tube to the grid of the other, in the same stage. There will be a considerable reduction in hum, and also some reduction in volume. If the resistance is high the volume drop is small, but the lowering of the hum may not be to your satisfaction then. A value of 50,000 ohms is suggested as the low-resistance extreme.

* * *

Soldering to Chassis

IS IT ALL RIGHT to solder to a cadmium-plated chassis? In using rosin-core solder, is the rosin sufficient for fluxing purposes, and should it be used sparingly? —B. D.

It is bad practice to solder to a cadmium-plated chassis, due to the danger of corrosion, as such joints almost invariably work loose after a while. Sometimes they last weeks or months but finally they may be expected to "go." Of course if the chassis is perfectly cleaned of the cadmium this would not be true, but in practice it is almost impossible to make this cleaning process perfect. What is done in commercial practice is to scrape or file off as much as possible of the plating, then put a large amount of separate flux at this point (no matter if self-fluxing solder is used also), then heat the chassis with a very hot iron, at least 125-watt type, and, when about to apply the solder to the intended joint, put on more flux, quite an amount of it, and leave the solder and the flux sizzle until the flux has almost entirely disappeared. The only justification for such chassis-soldering is as an auxiliary mechanical joint, not as an electrical connection. If the work to be done is oily or otherwise impure from a soldering viewpoint, the rosin in the self-fluxing solder is not enough, and a generous amount of additional flux should be used. In receiver factories resin-core solder is used and besides many wiremen dab the hot iron into the can of extra flux each time before making a joint. It is imperative to keep the iron clean and this helps do it. When starting any soldering operations file down the copper tip to get rid of pits, heat the tip, dip it into the flux can, and completely cover the tip with molten solder, the process called "tinning." You are then ready to proceed. See that joints are made mechanically secure before they are soldered.

* * *

Confused by Code

WILL YOU KINDLY tell me why the manufacturers of fixed resistors do not code them completely at all times, but sometimes omit the number of ciphers from the code? For instance, I have a

THE SUPER-REGENERATOR

(*Continued from preceding page*)

is specified, if regeneration at the signal frequency can not be obtained, this resistor may have to be reduced in a value, even to 10,000 ohms.

As can be seen, such a circuit is considerably experimental. In fact, sometimes it is necessary to put radio-frequency choke coils in the detector filament, on both sides, from the filament terminals of the sockets to where the lines otherwise would be connected, but it must be remembered these chokes will have to pass 60 ma, and therefore should be wound of heavy enough wire. They need not have more than a dozen turns on any convenient diameter, but they should not be inductively related to each other.

Nothing but mica dielectric condensers should be used for bypassing, and of course air dielectric condensers for tuning to the signal, and for feedback.

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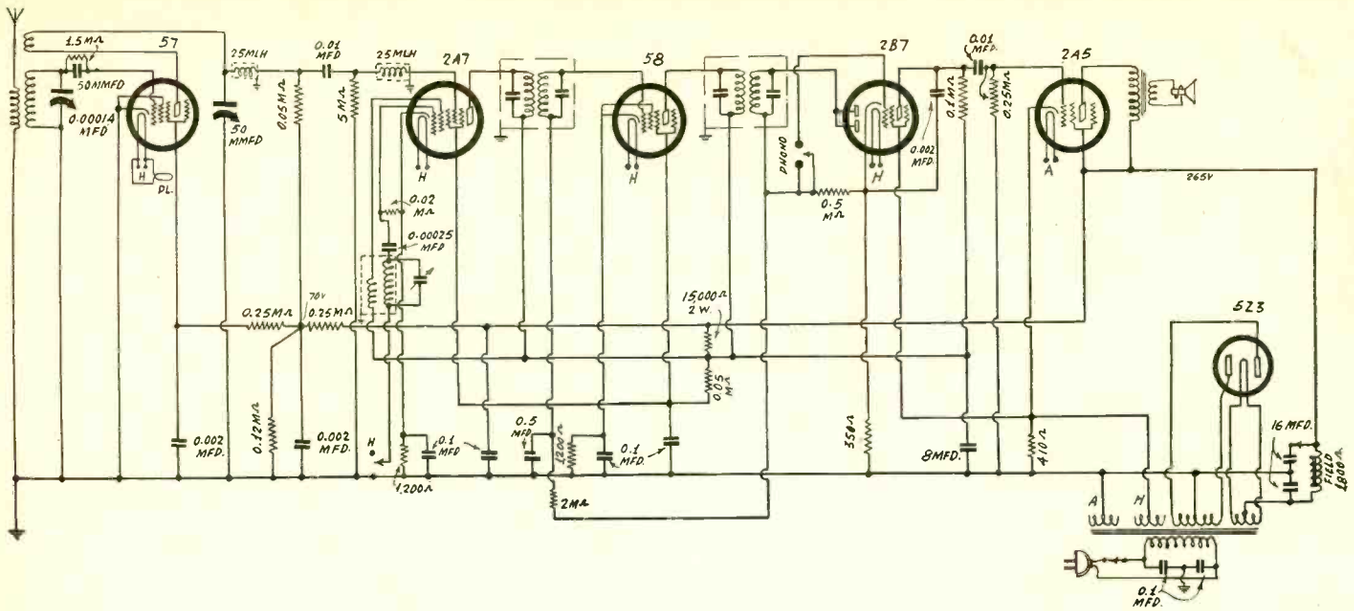

The system of first reducing the carrier to its modulation, then sending a new carrier with that modulation on it.

resistor that has only two factors on it, an orange body, a red end but no dot on the body. Orange stands for 3, red stands for 2, so I would assume the resistor, which I have not measured, is 32 ohms. —H. E.

The lowest resistance that the code could express is 10 ohms, and the other values upward are in steps of 10 ohms, so obviously you misread the coding. Since the first significant figure is 3 (orange) and the second significant figure is 2 (red), the number of ciphers would be represented by a color dot on the body color. If it were any other figure than 3 (orange) the dot could be put on, but one can not put orange on orange and see the dot, can one? Therefore when only two colors appear, the third is the same as the first. The resistance is therefore 32,000 ohms.

* * *

Frequency Stability

HAS THE SUBJECT of oscillator frequency stability been settled, or is it still up in the air? Is there agreement as to the cause and cure of instability?—H. W.

Much work is being done on frequency-stabilized oscillators, and considerable advance has been made in the past few years concerning variably tuned oscillators. These are used for measurement purposes. However, a generally accepted theory has not been achieved yet, although some practical means of stabilizing oscillators, though the theories of stabilized circuits differed, have been worked out. Some fundamental concepts that are gaining headway may be cited. One is that the stabilization results when the tube is made to behave as a pure resistance. This is akin to saying that the relationship of output to input should be linear. The linearity has been stressed by several. Now it is asserted, also, as a new angle, that frequency instability is due to the presence of harmonics, and if these can be suppressed there will be no shifting. Of course a linear amplifier and a non-harmonic producer are the same thing, but the remedy proposed under the harmonic theory is to have a coil associated in series with the tuning condenser itself, and not inductively related to the parallel-tuned circuit. If the constants are properly chosen, it is said, frequency stability will result, because the balance between condenser and coil reactance will be a constant for a given frequency, the condenser not having an over-charge on it, which shifts phase, due to harmonic values to which it offers a higher impedance than does the coil. All over the world scientists are working on the frequency stability problem.

* * *

Wire at High Frequencies

IS A PIECE OF WIRE three feet long an inductance, a resistance or a capacity to high frequencies?—J. F. D.

It is something of all three of them. It is more of a resistance than at lower frequencies.

* * *

Sensitivity Results

HOW is it possible (as they claim) to get the required high sensitivity in auto sets, with few tubes, say five, when home a-c sets with six and seven tubes are not that sensitive? Is it permissible to receive police broadcasts on a car set? Can the motor noises be sufficiently suppressed without taking pep out of the motor? —E. A. D.

It is possible to get the high sensitivity as stated, but the a-c home sets of equal sensitivity could have an extra tube, the rectifier. Therefore compare 5-tube car sets with 6-tube home sets, etc. It is permissible to receive police frequencies on car sets unless prohibited by local law. Only a few localities have passed such prohibitive laws. Motor noises are reduced by suppressors, and there is a small reduction of motor power, also, equal to the power dissipation in the suppressing resistors. Suppression results vary. In general they are pretty good.

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Station Sparks

By Alice Remsen

Dreams

FOR PHIL DUEY AND HIS FIRESIDE SONGS

WJZ, SUNDAYS; 10:45 p.m., EDST

When the silver hour of twilight
Comes to finish out the day,
And the stars in all their glory
Sparkle through the Milky Way,
Then in tender retrospection
By the fireside's ruddy glow,
I relax—and dream of you, dear,
With the lamplight burning low.

Dream of you—as first I met you,
When our love was young and fair;
When your eyes were bright and shining
As the star-gleam in your hair;
When your lips were trembling blossoms
And I plucked them for my own—
Just a dream, for you are gone, dear,
And I'm dreaming here alone.

—A. R.

* * *

And if you tune in on Phil Duey and listen to his glorious baritone voice singing those tender fireside songs, you too, will dream—dream of other days when life was sweet and romance was young, and your heart was full of youthful desire. Tune in and listen; you'll like him!

* * *

THE RADIO RIALTO

THE BIT IN THEIR TEETH

Sorry to hear that Frank and Flo, two of the most popular of metropolitan radio stars, are very ill. These two have been heard in Salada Tea broadcasts over Station WOR and they have endeared themselves to many thousands of listeners; here's hoping they both soon recover and return to the air. . . . The powers that be in radio have decided censorship is the thing, and now every script, song or bit of business is more thoroughly scrutinized than ever before—and well-cleaned up before being allowed to contaminate our beautiful air; even the advertising nonsense must be disinfected and freed from such unmentionable and embarrassing problems as halitosis and kindred ailments; well, I don't blame those in authority; the advertising ballyhoos have been going the limit recently; I have heard health spiels in connection with certain well-known patent medicines that would be taboo in polite society; after all, there is such a thing as good taste. . . . Taylor Holmes was stepping into Studio X, up at NBC, one day last week for rehearsal with the Texaco broadcast; he stopped to chat for a moment, and modestly inquired if I'd heard him yet; when I praised his work he actually blushed; he can't seem to realize that his microphone personality is causing thousands of listeners to comment on what a great comedian he really is; a very quiet, unassuming, great little man, is Taylor Holmes. . . .

FOAM ON THE AIR

King's Beer will start a series of broadcasts via WABC the first week in October; twice weekly, half-hour spot; talent will consist of Patsy Flick, Charles Carlisle, Helen Daniels, Round-the-Towners Quartet and a dance orchestra under the direction of Freddy Berrens. . . . Another new show, Scott's Emulsion, will make its air debut at NBC via WJZ and thirteen stations on October 19th. It's to be a kid program written around stories of circus life by Courtney Riley Cooper. . . . Goldy and Dusty program has been renewed for another fifty-two weeks. . . . Clara, Lu and Em, have also renewed for another year. . . . Old Gold comes along for twenty-six weeks. . . . Larry Spier is now with T. B. Harms as professional manager, which leaves Abe Frankl in sole charge of the professional end of Famous Music, Inc. Abe deserves it; he is a hard worker and a faithful one. T. B. Harms will expand its interests now that Max Dreyfus is active once more; this will make no difference over at Harms, Inc., which is an entirely different firm; Henry Spitzer will still be general manager there, and Will Rockwell will be the debonair professional man. . . . Reilly and Comfort, those two high-voiced boys heard over the air from Greenwich Village last year, are now in London playing a few vaudeville and club dates. . . . The Mills Brothers will return to the air September 15th for Procter and Gamble; meanwhile they are playing the Loew circuit. . . .

JOHN F. ROYAL GOES ABROAD

John F. Royal leaves these shores for Europe in quest of new radio talent about August 15th. He'll be gone for six weeks or so. Will also scout for live acts to book into Radio City Music Hall and what there is left of the R-K-O vaudeville houses. He'll visit England, France, Italy, Germany, Norway, Sweden and Poland. . . . Goodness gracious! Have just learned that John Gambling, who keeps the WOR morning audiences in good physical condition, used to be a cabbage cultivator over in England; that's the first time I knew you had to cultivate 'em; usually cabbage intrudes itself, especially after cooking. . . . Alice Joy is in Chicago playing at the Cafe Chez Paree. . . . Brook Allen, WMCA's songster from the South, is hardening himself up in preparation for the radio entertainers football team which is being organized by Sleepy Jim Crowley, famous coach of Fordham University, and Ozzie Nelson, the popular orchestra leader. . . . Thornton Fisher's WMCA Art Club now exceeds 22,000 members. Fisher is a cartoonist and sports columnist. . . . Nino Martini, brilliant young Metropolitan Opera House tenor, and recipient of the 1933 Columbia Medal for distinguished contribution to the radio art, is now on a once-a-week schedule of WABC-Columbia broadcasts; each Tuesday from 9:30 to 10:00 p. m. . . . Tangee Musical Dreams has renewed once again over Station WLW, with Bill Stoess conducting the orchestra and Morrie Neuman doing the vocal work; each Thursday evening at 9:30 p. m., EST. . . . Marion Clark, one of WLW's Three Moods in Blue, got her first start in the world selling music and plugging songs in a Cincinnati music store. . . . Irvin S. Cobb's new contract with the Gulf Refining Company will keep this rotund humorist on the air until November; good news to the army of Cobb fans throughout the country. . . .

AL JOLSON GOES AD LIB

Al Jolson made so good on the Whiteman program when he was allowed to do as he pleased that they have given him a very unique contract—he is to appear when and how he pleases, say what he likes and sing what he wants any time he feels like it; if Al doesn't feel like working each week, well, he just won't, that's all. . . . Cab Calloway now owns the key to the city of St. Louis; it was given to him by the Mayor when Cab played there recently. . . . Fred Allen is coming back to the air-waves, this time via NBC-WEAF, when he provides the new set-up for the Best Foods Grocery Store; with Fred will be his wife, Portland Hoffa, and Jack Smart, and Ferde Grofe's orchestra. . . . The last NBC build-up to fade away is Ethel Waters, the colored singer; she was doing fine; why is it the NBC build-ups so often don't build up? . . . Dolph Martin, Columbia's popular Tydol Jubilee conductor, is having a good time these days catching lobsters near Provincetown, Mass.; after he catches the sprawling crustaceans, he dumps them in a pot of boiling water and feeds them to his friends. . . . Lou Holtz once worked as a clerk for the Southern Pacific Railroad for the manificent sum of twenty-five dollars per month. . . . Edwin C. Hill, Columbia's "Human-side-of-the-news" broadcaster, began his career as a newspaper reporter in Indiana at exactly "nothing" per week. . . . Eli Dantzig has returned to the air via WINS; he and his St. George Banqueteers may be heard daily from the St. George Hotel, Brooklyn, over that up-and-coming station in the Ritz Tower. . . .

DON ROSS OVER WABC

Don Ross, baritone, may now be heard as the Pontiac Minstrel each Tuesday and Thursday, over WABC, at 2:30 p. m. EDST, with a repeat broadcast to the Pacific Coast at 4:00 p. m. . . . There is another kid series on WABC, "Jack Armstrong—the All-American Boy," a six-a-week dramatic series for both boys and girls of high school age; under the sponsorship of General Mills, the company that for two years produced "Skippy." The new program occupies the time spot formerly filled by "Skippy," 5:30 to 5:45 p. m. EDST for stations east, and 6:30 to 6:45 p. m. EDST for stations west, daily except Sunday. . . . And now I think it's time for me to make trek for town and the editorial sanctum if this is to get in on time.

BUSY ADA PATTERSON

Ada Patterson, noted in journalism and on the air, is a busy person these times. In "Psychology" for August is the conclusion of an article that represents her collaboration with George M. Cohan on "The Cure for Worry." In the preceding issue, besides the installment of the Cohan story, was her essay on "The Garden of Friendship." The next issue of "Screenland" will contain an unusually intimate story by Miss Patterson about Barbara Stanwyck and Frank Fay, from material gathered in an interview with these screen stars.

Last month WMCA won a Pyrrhic victory in its two-year battle with WNYC, the city station. It gained its long-sought hours from WNYC, but the Federal Radio Commission robbed Peter to pay Paul. It took the same hours from WPCH, the WMCA sister station, giving them as a consolation prize to WNYC, thus crippling the sister station and destroying it. Its program director invited Miss Patterson to go with him to the service of the New Jersey Broadcasting Company. Although WMCA asked her to talk for it, the first offer seemed more advantageous, and she accepted it and has been talking on Thursdays at 10:30 a. m. on WHOM. She is introduced as "The Gracious Lady of the Radio."

A THOUGHT FOR THE WEEK

RADIO is furnishing the speaking stage with drawing programs these days, whereas only a short time ago the proposition was reversed. And some surprises are in store for artists and audiences. For instance, Myrt and Marge, popular on the air, played an engagement in the flesh in a Western city and drew crowds. Yet critics seemed to agree that they would not have been a hit if it had not been for their ether popularity—again proving that you never can tell.

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END OF "GYPS" SOUGHT IN CODE FOR RECOVERY

The national radio industry code is nearing completion and will be hastened even more rapidly as a result of the Government's request for submission of voluntary codes by individual employers.

The radio industry code is being prepared by the Radio Manufacturers Association, Inc.

The code, applying nationally to all the manufacturers of all radio products, underwent preliminary negotiations with the Government. After the Government's reactions the industry code will be submitted to the RMA membership.

Voluntary Codes

Action by manufacturers on the voluntary code presented to the nation by President Roosevelt and General Johnson, Industrial Recovery Administrator, is entirely left to the judgment and action of each employer.

Attention is called to the fact that the voluntary codes are applicable only if signed by each individual manufacturer and until his own industry code, such as that of the RMA, is adopted, and trade association members are urged to assist in early adoption of their own industry's code.

It is virtually assured that there will be a separate code for the radio industry.

The radio code, drafted by the RMA Industrial Recovery Committee, of which W. Roy McCanne, of Rochester, N. Y., is chairman, was generally approved by the RMA Board of Directors at a special meeting at the Commodore Hotel in New York. There was no dissenting vote.

End of "Gyps" Sought

While the tentative code is in existence no detailed data on its contents are being published in the press, but the statement of objectives to include suppression of the "gyp' manufacturer and seller holds forth much interest to a vexed industry. Not only shoe-string manufacturers are selling sets to the public for under $6, but some stores are co-operating with them, and affecting licensed manufacturers with quality apparatus, though still in the medium-price field. It is one aim of the code to put such manufacturers out of business and thus also end the source of "bootleg sets" supply to venturesome stores, as the sets are of very poor quality and unlicensed.

$35,000 in Sight for Prosperity Campaign

Manufacturers, jobbers, dealers and also broadcasters are uniting with enthusiasm and active work in promoting the Radio Manufacturers' Association's Radio Prosperity Campaign and its culmination in "Radio Progress Week" next fall. Many trade meetings are scheduled for active promotion of the fall campaign.

Two leading manufacturers already have pledged $5,000 each to a special broadcasting fund and additional pledges, besides $25,000 already appropriated by RMA, are on the way.

Community leaders in all large cities have been appointed and many local meetings are being planned. Distributors and dealers are urged to get information from Director Earl Whitehorne, at 330 West 42d Street, New York.

TRADIOGRAMS

By J. Murray Barron

From the number of young men of high school age and even younger who are showing an interest in the small set building, both broadcast and short-wave, and who are so frequently seen shopping in the parts stores, it must be assumed there is a larger number than is ordinarily figured. Two chaps who had a diagram and knew what they wanted, inquired regarding the prices and found them to be nearly half of what they figured, so bought immediately. From this the thought naturally arose as to whether many others possibly had some idea or desire of constructing some set, but may have figured the price higher than they could conveniently spend right now, whereas if the known price was within their reach, there might be no sales resistance, in fact, a reasonable price might turn the desire into an actual immediate sale. From a shopping tour of windows of a number of retail stores that specialize in radio parts and kits, and who display them in large numbers in these windows, with individual show cards, the very important question came to mind as to whether all the offerings were quite clear to the average man who might attempt to get some idea from the display before entering. When one figures out the vast number who window shop and the small percentage who buy, might it not be possible to create an interest that would invite the window shopper to enter? It is from only those who come in that the sales arise. Possibly a clean-cut statement of some particular merchandise might be the means. It's worth trying as a test and in no way can detract from the value of a window display, nor create an unfavorable impression, where as a confusing show card puts the merchant in a bad position, even though it may not be his intention to deceive.

* * *

A favorable report from the General Electric shows the first gain in any quarter over the period the year before since 1930. Such statements from the nation's major industries speaks well for general pick-up in business.

* * *

Wrought Washer Mfg. Co., 2104 South Bay Street, Milwaukee, Wis., announces the appointment of H. M. Swain, 52 Maypole Road, Quincy, Mass., as distributor and direct representative in New England States for its entire line of standard and special washers, stampings, etc.

* * *

Those in touch with the general conditions throughout the United States are even now making actual preparation for the early fall business. To wait until Labor Day is to miss much of the September and early October business. This applies greatly to mail order houses and those out-of-town concerns who may act as representatives for organizations in the larger cities. To those seeking agents or distributors it is none too early to get plans under way within the next few weeks. It's better to get the jump on business than to find that lines and territories are no longer available. The ground work should be started by August 1st or, at the latest, the early part of the month.

* * *

News comes from the factories of several radio manufacturers that the ac-dc midget sets are to be featured in the fall 1934 models. This "little fellow" has too many advantages to be passed as a fad. Never perhaps has any type of radio receiver proven so satisfactory and taken such a hold on the public, and with the ever-increasing lists of unemployed joining the ranks of the regular payroll crowd, one does not have to stretch his imagination to realize the potential market. One should not be misled by price alone, but rather be guided by what might be expected in performance with a reasonably-priced line.

National Union Raises List 10 Cents a Tube

National Union Radio Corporation announces a general advance in list prices of ten cents per tube over the general level.

H. A. Hutchins, general sales manager, said:

"Although National Union list prices are now the highest in the industry, we have felt the move fully justified in view of the National Union sales problems which differ from those of other tube manufacturers. The majority of National Union tube replacement sales are made by radio servicemen and service dealers whose selling costs are necessarily high. In addition to the necessity for making a higher profit to cover operating expenses, these outlets must be assured of consistently high quality to be able fully to guarantee their work.

"Radio tubes are the most important items sold by the service dealer; his biggest source of revenue. We have felt that the radio public needs competent service and are willing to pay a fair price. In our opinion the service dealer merits help to protect his position.

"Due to constant price deflation in radio tubes, we have recognized for some time that it would eventually necessitate some change in our policy. For nearly a year we conducted surveys both through questionnaires and by actual field contacts. We checked the needs of our service dealers carefully. As a result we decided to raise list prices rather than sacrifice any of the service dealer advantages in the current National Union sales program."

Government Control Satisfies the Danes

Washington.

Governmental control over radio broadcasting operation in Denmark, which ranks first among nations in the number of receiving sets in proportion to population, is said to be giving complete satisfaction. Furthermore the control system is self-supporting financially, says the Department of Commerce.

Danish broadcast programs are controlled by a supervisory board of 15 members which accepts suggestions from civic organizations which have been formed for the purpose of seeking an improvement in radio programs.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers should send a request for publication of their name and address. Address Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

B. C. George, 22 King Edward Road, Oxhey, Watford, Herts, England.
Leslie E. Bailey, Du Quoin, Ill.
Julius Sanna, 1901 Ware St., Toledo, Ohio.
Thos. H. Smith, Box 203, New Kensington, Penna.
David Cramond, Box 296, Bristol, Conn.
Lorenzo Riggins, Jr., Stephenville, Texas.
Henry Miller, 5124 58th Place, Woodside, L. I., N. Y.
D. Baselice, Geneva, N. Y.
C. L. Moyer, 612 23rd St., Altoona, Pa.
Lt. Comdr. H. L. Maples, U.S.S. Texas, Puget Sound Navy Yard, Bremerton, Wash.
Arduino Carocari, R.F.D. No. 1, Evest St., Stafford Springs, Conn.
Ed. C. Johnson, 677 Kent St., St. Paul, Minn.

CORPORATION REPORTS

Cutler-Hammer, Inc.—Net loss for six months ended June 30th, $201,616, after depreciation, taxes and other deductions. Net loss for first six months of 1932, $444,747; net sales, 1933, $1,436,940, against $1,608,872, in 1932.

Rudolph Wurlitzer Company and Subsidiaries—Net loss for year ended March 31, 1933, $926,834, compared with $1,937,006 in preceding fiscal year.

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NEW MODEL SHIELDED TEST OSCILLATOR!

Either 50-150 kc Fundamental Model, a-c or battery; or 500 to 1,500 kc Fundamental Model, (broadcast band) a-c or battery, available.

Either model FREE with two-year subscription for Radio World (104 issues) $12.00

AN improved modulated test oscillator, fundamental frequencies, 50 to 150 kc, enabling lining up of intermediate frequency amplifiers, t-r-f and oscillator circuits, is now ready. It is shielded in a metal box 9⅜" wide x 6¾" deep x 4½" high, with beautiful Japanese finish. The test oscillator is obtainable in two models, one for a-c operation, the other for battery operation. The same cabinet is used for both.

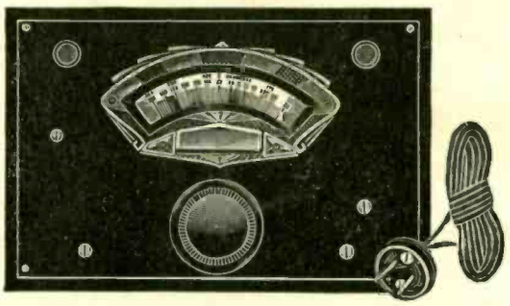
The a-c model not only is shielded but has the line blocked, that is, radio frequencies generated by the oscillator cannot be communicated to the tested set by way of the a-c line. This is a necessary counterpart to shielding, and a special circuit had to be devised to solve the problem.

The modulation in the a-c model is the a-c line frequency, 60 cycles, effected by using the line voltage on the plate of the tube. In the cabinet there is a very high resistance between the shield cabinet and the a-c, a double preventive of line-shorting and application of a-c line voltage to the user.

The oscillator is equipped with an output post. No ground connection need be used, as the circuit is sufficiently grounded through the power transformer capacity to prevent body capacity effects in tuning.

The frequencies are more accurately read than normal use requires, being never more than 2% off, and usually not more than 1% off, many readings being right on the dot (no discernible difference). The frequency stability is of a high order from 100 to 50 kc, and somewhat less from 100 to 150 kc. Zero beats are guaranteed at all frequencies.

The oscillator was designed by Herman Bernard and is manufactured under the supervision of graduates of the Massachusetts Institute of Technology.



The test oscillator has a frequency-calibrated dial, 150 to 50 kc, with 1 kc separation between 50 and 80 kc and 2 kc separation between 80 and 150 kc. Intermediate frequencies are imprinted on the upper tier. Broadcast frequencies are obtainable on tenth harmonics (500 to 1,500 kc).

RADIO WORLD
145 West 45th St., New York, N. Y.

THE a-c model is completely self-operated and requires a 56 tube. The battery model requires external 22.5-volt small B battery and 1.5-volt dry cell, besides a 230 tube. The use of 1.5 volts instead of 2 volts on the filament increases the plate impedance and the operating stability.

The battery model is modulated by a high-pitched note. Zero beats are not obtainable with the battery model.

Directions for Use

Remove the four screws and the slip cover, insert the 56 tube in its socket, restore the cover and screws, connect the a-c attachment plug to the wall socket, and the a-c test oscillator is ready for service.

For testing some particular set, follow the directions given by the designer or manufacturer. In the absence of such directions, use the following method.

Mentally affix a cipher to the registered frequencies on the lower tier (so 50 is read as 500, and 150 as 1,500), and set the dial for any desired broadcast frequency. Connect a wire from output post of test oscillator to antenna post of set. Leave aerial on for zero beats, off otherwise. At resonance the hum will be heard. Off resonance it will not be heard. For testing intermediate frequencies, connect the wire to plate of the first detector socket. The first detector tube may be left in place and bared wire pushed into the plate spring. The intermediates then are tuned for strongest hum response. If an output meter is used, tune for greatest needle deflection.

The battery model is connected to voltage sources as marked on oscillator outleads and is used the same way.

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ALUMINUM BOX SHIELDS, 90c. Other bargains. Utah Supply Co., Box 84, Salt Lake City, Utah.

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A condensed chart in the book itself gives the relationship between frequency, capacity and inductance, while a much larger chart, issued as a supplement with the book, at no extra charge, gives the same information, although covering a wider range, and the "curves" are straight lines. The condensed chart is in the book so that when one has the book with him away from home or laboratory he still has sufficient information for everyday work, while the supplement, 18 x 20 inches, is preferable for the most exacting demands of accuracy and wide frequency coverage.

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There are thirty-eight charts, of which thirty-six cover the numbers of turns and inductive results for the various wire sizes used in commercial practice (Nos. 14 to 32), as well as the different types of covering (single silk, cotton-double silk, double cotton and enamel) and diameters of ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1¾, 2, 2¼, 2½, 2¾ and 3 inches.

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Twelfth Year *594th Consecutive Issue*

INDUSTRY'S RECOVERY CODE

(See Page 15)

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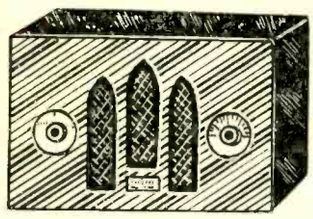

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The First and Only National Radio Weekly
TWELFTH YEAR

Vol. XXIII | AUGUST 12th, 1933 | No. 22. Whole No. 594.

Published Weekly by **Hennessy Radio Publications Corporation,** 145 West 45th Street, New York, N. Y.

Editorial and Executive Offices: 145 West 45th Street, New York
Telephone: BR-yant 9-0558

OFFICERS: Roland Burke Hennessy, *President* and *Treasurer;* M. B. Hennessy, *Vice-President:* Herman Bernard, *Secretary.*

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RESISTANCE PUSH-PULL

Theoretical Considerations and Some Practical Applications

By Herman Bernard

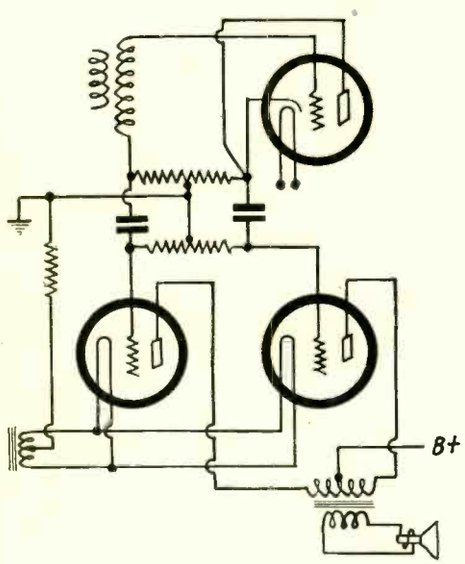

FIG. 1

The 56 is shown, used as a diode. There is no B voltage applied. The secondary of the symbolic transformer connects to cathode through the load resistor. Since this secondary end is not grounded, the system in general may be used for supers rather than for t-r-f sets. The voltage center of the diode load resistor is grounded.

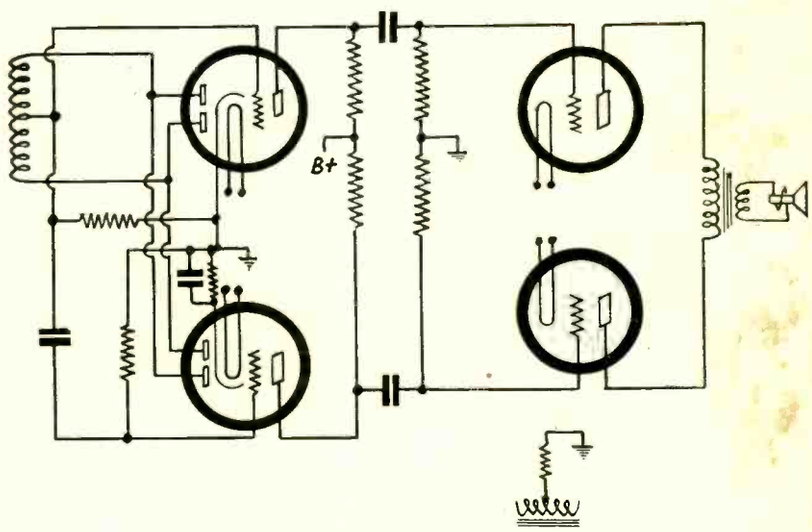

FIG. 2

Here a different method is pursued. Two 55's are shown feeding two triodes. The biasing resistor for the triodes connects from center of the filament secondary, to B minus. The two diodes of the 55's are paralleled in full-wave rectification. In the upper leg the triode unit of the tube is coupled from the diode by the direct method. So increasing signal intensity increases the bias. In the lower leg there are stopping condenser and grid leak, so increasing signal intensity decreases the bias. The voltages in the plate loads are opposite but not equal. But they may be equalized.

THE subject of push-pull resistance-coupled audio-frequency amplification has come to the fore again, due to the recommendation that the 53 tube be used, since there are two tubes in one envelope, and the chassis does not become cluttered up with tubes to support the audio channel.

There is no commercial receiver that uses push-pull resistance coupling, which is a sort of warning, and, moreover, the achievement of good balance is necessary, otherwise the push-pull circuit is not quite so good as the single-sided circuit, because not truly push-pull.

Several attempts to get satisfactory results from push-pull resistance coupling have been made, with incomplete success. Always an easier and steadier result could be attained by including the transformer. More recently better success has been encountered, and while the theoretical considerations have been put forth lately with some gusto, absence of assignment of values of constants always leads to the supposition the circuit has not been built and tested. In any circuit including anything except zero frequency current (d.c.) the experimental results are the things of importance. One can accurately predict d-c results but not a-c results. Nature intervenes with unexpected contributions.

It is highly advisable that those experimentally inclined take up the work of reducing push-pull resistance coupling to practice, and in line with that idea some fundamentals are presented herewith.

In Fig. 1 is a circuit that represents the

(*Continued on next page*)

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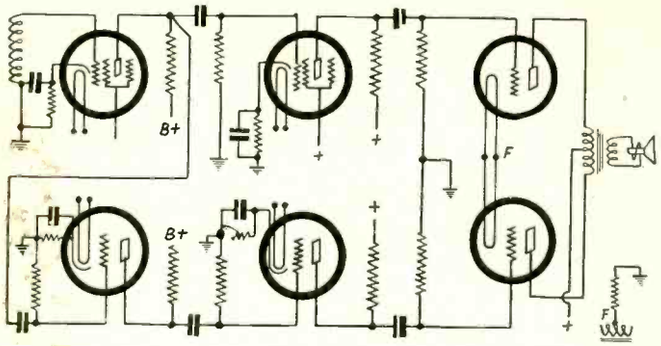

FIG. 3

Phase-shifting is exemplified in this diagram. Assuming that the upper left-hand tube is the detector, there follow on that plane two resistance-coupled stages of audio. However, a companion audio channel of three stages may be used, and then the output will be 180 degrees out of phase as between the two tubes.

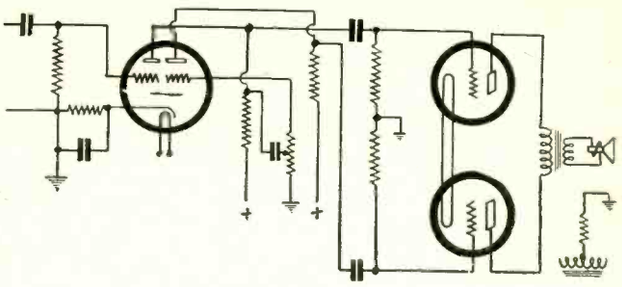

FIG. 4

The 53 tube is used as a phase-inverter. An audio input to the 53 is assumed. The grid and plate to left in the 53 symbol is the first audio amplifier, the output of which is fed to the upper power tube as well as, in part, to the phase-inverting section, or right-hand grid and plate in symbol.

(*Continued from preceding page*)

attainment of push-pull by utilizing a diode detector feeding a push-pull stage. Obviously the detector output will not load up the power tube stage, but the idea remains unchallenged that the push-pull effect is introduced.

The tube may be a 56, with plate tied to cathode, the combined result used as the rectifier's cathode, while the element ordinarily serving as the grid would be the anode. The heater voltage is applied as usual, and the winding may be center-tapped, if a.c. is used for heating. There is no B voltage.

It is essential to prevent some loss of signal that the load resistance be grounded. Fortunately, it is practical to ground the center of this resistance.

Let us consider the signal input between anode and cathode. The tube will rectify only when the anode is made positive by radio frequency.

A seeming contradiction will arise at once. The anode is positive. From anode (grid) through the secondary coil we come to one extreme of the load resistor, and this point is negative. First it is positive, at one instant, and next, but at the same time, it is negative, so which is it?

The Two Factors

We have to consider two factors. One is the effect of the r-f signal. This drives the anode positive and negative, but rectification takes place only during the positive cycle. The moment that direct current flows, due to rectification, as it can flow in only one direction, away from the cathode, as to audio frequencies or pulsating direct current here concerned, the right-hand side of the load resistor is positive, the left-hand negative, and most of the total voltage drop takes place in the load resistor. This serves two purposes, helping to attain linearity of detection and also increasing the voltage available for transfer, that is, improving the quantity of utilizable output from the detector.

If we simply regard the current through the load resistor as direct current, then, with cathode positive, center tap of the resistor would be one-half of the extreme negative value on the load, and the left-hand end would be the full negative value. If the d.c. is pulsating, then if the center is taken as the datum, the voltage betwen grounded center and either extreme would be the same at any instant, but would be oppositely polarized. It is direct current pulsating at the frequency of the modulation. There is really no true a.c. in the load resistor, except radio frequency. It is not necessary, however, to insert a condenser or filter system to remove this, because the load resistor is so high any filter would seriously attenuate the higher audio frequencies, and the capacity inherently across the resistor, due to the wiring, tube, etc., is usually quite enough.

The grounded center of the resistor may be regarded as an operating point, with half the pulsation above it and half below, to present something like a parallel to the usually graphic representation of a sine wave of alternating current.

The stopping condensers at the extremes of the load resistance therefore are charged simultaneously in alternate polarities of equal magnitudes, the familiar push-pull condition of "equal but opposite voltages." They discharge through the grid leaks. These condensers serve a conversion function, in that their discharge is oscillatory, hence there is a.c. in the grid circuits, whereas there was no true a. c. in the anode-cathode circuit, except r.f.

The bias is applied to the output tubes in the usual way, the resistor at left being the one for self-bias. There is nothing theoretically the matter with this circuit, balance may be struck without much difficulty, as the point so far discussed as the midpoint need not necessarily be the mid-resistance point but rather the mid-voltage point between the extremes. Thus a very sensitive a-c voltmeter could be used, with a steady modulation input, and the adjustment made until the voltage drop across one section was equal to that across the other.

The stopping condensers then should be equal, and the grid leaks likewise, if the output tubes are statically balanced, the condition meant when "matched tubes" are mentioned. The dynamic balance is the one that results in equal signal voltage across either leg of a load or tank. The static balance is the existence of the same operating point for both push-pull tubes at no signal, when the d-c voltages applied are the same, as they will be.

If the tubes are not matched, a good approximation is to increase the plate resistance of the tube that requires such treatment, by extra biasing of that tube to a negative value exceeding that of the other, but most of the d-c plate current still should flow through the common biasing resistor. A condenser would be required across the extra biasing resistor, none across the common one.

Another Method

This circuit, or one like it, the author tried some years ago, but there was not enough output from the detector to get real speaker response from the push-pull tubes (nor was it expected there would be), and when pentode output tubes came along, the attempt was not repeated, because push-pull resistance coupling has the sole advantage of quality, and the pentodes would not be consistent.

Even if a driver stage were interposed, the volume of sound would not be enough in the output, without a pentode.

Only the other day the author tried another push-pull resistance-coupling scheme, as in Fig. 2. Regarding the upper part of the circuit, it may be considered as single-sided audio after a diode detector, with the triode of the diode as first audio amplifier or driver, and the next tube as the output (45). We have shown that the cathode is positive to audio frequencies, therefore with grid of amplifier tied to left-hand extreme of the load resistor the bias on the tube is negative by the amount of the rectified voltage. That is, the bias is approximately equal to the signal voltage. The stronger the signal, the more negative the grid.

Some Unbalance

If we put a stopping condenser at this high potential end of the load resistor and feed the signal to a succeeding tube, which may be the triode of the same sort of tube as above, the signal will drive the grid positive. That is due to the operating point. There is a negative bias on the lower triode section of the duo-diode-triode tube, and the signal will drive the grid positive because the positive region, in respect to the operating point, is the large one. Cutoff soon is reached at the negative side, therefore there is much more positive than negative contribution, hence an effective positive result.

In the diode-biased example we drove the grid negative with the signal, now we drive the grid of a companion tube positive with the signal, both at the same instant. Again we have equal but opposite voltages, hence push-pull, although with some unbalance.

It will be noted that in general there seems no great need to worry about dynamic balance in Figs. 1 and 2, because the dynamic and static conditions are the same, and we do not have to equalize equality.

This would seem to be true all right of Fig. 1 when granting equalities of the push-pull tubes, the output transformer sections and the halves intended of the voltage load load resistor of the diode. But in Fig. 2 we can not agree that balance has been struck. In fact, we built the circuit and measured it dynamically and know that balance is absent. The reason is clear enough.

Reason for Unbalance

Consider the duo-diode-triode in the upper half of the diagram, a 55. Taking the standard reference point, the cathode, we find that the plate voltage is the potential difference between cathode and the supply, say, 250 volts. This does not change under any conditions due to the operation of this tube. The bias does vary, going negative as the input is increased, and may run from 0 to 20 or 30 volts. Since the bias does change, this is equivalent to a change in plate voltage supply and there is no limit to the operating point within the specified 30 volts.

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Take the companion tube below. This has a self-bias, but the bias also decreases with the signal, because with greater intensities more current flows through the biasing resistor, but the change is not as great, because made from the operating point, instead of (as in the tube above), nor is the plate voltage supply constant, because the decrease in bias simply apportions the supply voltage differently, increasing the plate voltage as much as it increases the grid bias.

The change is not quite the same in quantity, for in the upper leg the total voltage is 250 x X, while below it is 250 volts.

Dissimilar Voltages

The voltages developed by the signal across the outputs of the 55 tubes were dissimilar, the diode-biased method giving 100 per cent. as against the cathode-biased methods 88 per cent. Equalization may be introduced by putting two resistors in series, in the plate circuit of the upper 55, whereby their total resistance is equal to that of the resistor in the lower 55's plate circuit, and the joint is, in voltage or resistance, 12 per cent. down from the plate. If the resistor in the lower leg is 50,000 ohms, then the two in the upper leg may be 6,000 ohms and 44,000 ohms, respectively. The stopping condenser would be connected to the juncture of the two series resistors, and the smaller resistor would be nearer the plate.

Correction for unbalance in one stage may not necessarily result in balance in a subsequent stage. The voltage may be read on an a-c voltmeter, of proper type, and the necessary adjustment made in each stage.

Use as Current Indicator

A high resistance a-c voltmeter is not common, and exists principally in the rectifier type. If the test is made with a 60-cycle modulated radio frequency put into the tuner, the audio frequency after rectification is low enough to serve for both static and dynamic balance. If the meter is to be used as a grid circuit voltmeter, it would have to be at its high-voltage range, so the current will be small, but the voltage will be low, and an accurate determination becomes difficult as a mechanical or visual act.

However, the a-c meter may be used as a current meter, in series with the grid load, provided the approximate voltage is first ascertained in the usual way, and the resistance of the grid leak checked; or the voltmeter may be used as the total grid load, if the resistance in the companion grid leg is made the same as that of the meter's multiplier that is in service.

A vacuum tube voltmeter would do the whole trick.

The circuit under discussion actually works, and the results are good. However, as intimated, there is considerable work, not of an uninteresting character, however, in balancing the stages, though perhaps instruments are required that the general run of experimenters does not possess.

One fact stood out, that the hum was lower than that experienced with the same type of filtering, in any other audio circuit.

53 as Phase Inverter

In neither of the examples discussed is a tube devoted only to phase-inverting. When such exclusive use is included, the sacrifice amounts to the per-stage gain for such a tube. That is, one tube contributes nothing except inversion of the phase. This will be almost exactly 180 degrees, although it seems necessary to that end that the stopping condensers be smaller than usual. The leaks should be larger, as compensation, unless there is motorboating, when the leaks may and should be reduced, for then the low-frequency accentuation is too great.

The 53 tube is recommended as a phase inverter, tnd as there are two tubes in one envelope, the sacrifice is hidden. That is, so much less is taken out of one triode as is equal to the gain of the other triode.

The circuit, Fig. 4, was built with 100,000-ohm plate loads for the 53, and 0.25 meg. grid leaks, 0.006 mfd. stopping condensers, and standard voltages The negative bias is around 3 volts when the biasing resistor is 200 ohms, the plate loads as stated, and the applied B voltage 250 to 300 volts. The current of both triodes flows through the biasing resistor.

There has been a change from the tentative rating of the tube, so that 3 volts is now the recommended negative bias for amplification, whereas it had been higher, and 7.5 volts is the recommended bias for detection. However, the circuit shown is not wholly stable, and a degree of stability is introduced, if necessary, by heightening the bias to around 4 or 5 volts, although other methods may be utilized, such as lowering the leak values and stopping condenser values, or several methods combined.

The voltage across one plate load is measured, then across the other, and the resistors then are apportioned accordingly, on the basis of the method used with the 55's.

Though the circuit has been built and tested, it is not recommended that it be reproduced except for experimental purposes, as it does not function properly yet. It may be well to investigate the use of low d-c resistance filter choke, instead of the high-resistance speaker field, as this field, used as choke, is an impedance common to the audio tube circuits, and thus provocative of instability.

The filtering in all instances consisted of 16 mfd. next to the rectifier and 16 mfd. at the end of the B choke, which keeps the hum well in check.

Flash-over in the 83 Due to Deposit of Film

Members of the radio trade and amateur station operators have been puzzled by the flash-over which sometimes occurs in the type 83 full-wave mercury vapor rectifier tube. W. M. Perkins, chief of radio application department of National Union Radio Corporation, explains this phenomenon as follows:

"In the handling and shipping of the Type 83 radio tube, the excess mercury often deposits itself in a film across the stem of the tube, thus furnishing an electrical path between the electrode connections. It is the burning away of this deposit which causes the flash-over.

"For really ideal operation, only the filament should be allowed to burn for a period of three to four minutes. After this, the plate voltage may safely be applied. This burning of the filament will warm the tube sufficiently to drive off the condensation of the mercury on the stem. Amateurs should follow this precaution as well as to be careful not to overload.

"The Type 83 is designed to stand an applied voltage of 500 volts rms per plate and deliver 250 milliamperes d. c. output. Providing the tube is operated within this rating, excellent life will result, but overloading will cause early failure. The application of higher a-c voltage than 500 volts per plate will give rise to electrolysis in the glass of the stem which results in stem rupture."

WIDE RANGES COVERED

An a-c receiver 15 to 2,400 meters, in 110 or 220 volts, is made by the Fanning Radio Labs., 377 87th Street, Brooklyn, N. Y. There are also two models, a-c and battery, covering from 75 to 555 meters, also a d-c model. In ac-dc midgets there are four models covering 15 to 200 meters, 75 to 555 meters, 175 to 555 meters, and 1,000 to 2,400 meters.

EXPLORERS GET VALUED AID OF THE AMATEURS

There are few remote spots on the face of the globe where civilized man has penetrated in recent years that have not also seen the invasion of amateur radio.

Whenever an exploring party goes forth to probe deeper into the mysterious recesses of the earth, or whenever a scientific expedition sets out to uncover new secrets in the history and pre-history of mankind, amateur radio accompanies and provides communication, often the sole link with the civilization left behind.

In the past ten years more than a hundred such expeditions have accepted the cooperation of amateur radio, through the American Radio Relay League, the national organization. It was Captain Donald B. MacMillan, in 1923, who took the first expedition radio transmitting equipment and an amateur operator to run it with him on his Arctic trip of that year, as a contribution of the League. Don Mix, the operator on that historic trip, provided such reliable communication with the homeland that MacMillan has never since ventured into the North without short wave radio equipment and an amateur to operate it.

Three in Field Now

This example was followed by other explorers who noted its success and made inquiries to the League regarding similar arrangements for their journeys. In 1924 another expedition received amateur cooperation; in 1925, three benefited by amateur assistance, and by 1928 the figure had risen to nine for that year alone. And so it went, until the actual total reached more than one hundred. When the Byrd Expedition went to the Antarctic, three of its four operators were amateurs, and amateur stations in the United States furnished a great part of the communication with this country.

At this moment there are three scientific expeditions in the field depending upon amateur contact for their news and messages to and from the homeland. On June 20th the staunch little schooner Morrissey sailed from Staten Island with the Bartlett Northeastern Greenland Expedition aboard, the seventh time Capt. Bob Bartlett has gone into the North with an amateur aboard to operate the radio equipment.

The problem of NX1XL, the station of the University of Michigan Scientific Expedition in Greenland in obtaining reliable communication with the States is a difficult one. Fred W. Albertson, the operator, claims one of the worst radio locations in the world for two-way communication, and for that reason many of the messages are sent "blind." But, even so, they seldom fail to get through.

Off to Arctic

The third American scientific expedition now in the North rejoices in the title "Expedition of Explorers Associated." It sailed off to the Arctic on the Norwegian boat Norkap II with the radio equipment under the call signal LDTE, being operated by a New England amateur, H. E. Mallinckrodt, formerly owner of amateur station W1DHA. The expedition is depending entirely upon amateur radio for communication, and in this as in all other cases the "hams" are maintaining regular schedules and standing by their posts so that the party may never be cut off from the outer world.

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THE 19 IN CLASS B

Drivers Cited, Also Distortion and Power Outputs

TABLE 1

CLASS B COMBINATIONS USING ONE TYPE 19

DRIVER-CLASS A-ONE TYPE 30: PLATE VOLTS = 135, GRID VOLTS = -9, PLATE MA. = 3

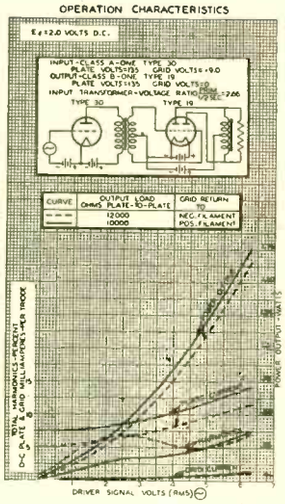
Arrangement	Input Transformer	Output Stage								
	Voltage Ratio Pri. to 1/2 Sec.	Plate Volts	Grid Volts	Total Av. Plate Ma. No Signal	Total Av. Plate Ma. Full Output	Plate-to-Plate Load (Ohms)	Output Watts	Total Distortion % Low Peak	Total Distortion % Full Output	Grid Return Connected To
1	2.66	135	0	10.0	23.5	12000	1.68	6.7	7.1	- Filament
2	2.66	135	0	15.0	28.0	10000	1.74	3.5	7.6	+ Filament
3	1.63	135	-3	2.6	22.5	12000	1.68	6.3	7.6	- Filament
4	1.61	136	+6	0.4	20.0	12000	1.38	16.0	7.6	- Filament

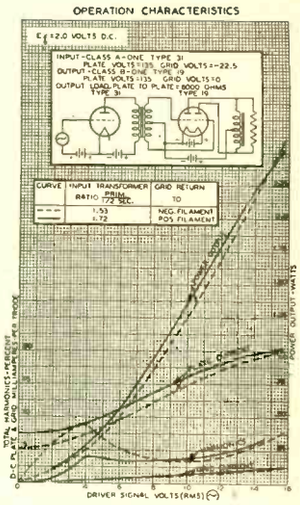
TABLE 2

CLASS B COMBINATIONS USING ONE TYPE 19

DRIVER-CLASS A-ONE TYPE 31: PLATE VOLTS = 135, GRID VOLTS = -22.5, PLATE MA. = 8

Arrangement	Input Transformer	Output Stage								
	Voltage Ratio Pri. to 1/2 Sec.	Plate Volts	Grid Volts	Total Av. Plate Ma. No Signal	Total Av. Plate Ma. Full Output	Plate-to-Plate Load (Ohms)	Output Watts	Total Distortion % Low Peak	Total Distortion % Full Output	Grid Return Connected To
1	1.53	135	0	10.0	40.0	6000	2.59	8.2	7.5	- Filament
2	1.72	135	0	15.0	40.0	8000	2.52	3.9	7.5	+ Filament





The two tables are above. Fig. 1 is next and Fig. 2 is at extreme right. Fig. 1 shows the operation characteristics of the 19 with a 30 driver, Fig. 2 with a 31 driver.

THE type 19 tube is a Class B twin-amplifier designed primarily for use in battery-operated receivers. With 135 volts on the plate the 19 as capable of approximately 2.5 watts output. Combining two high-mu triodes in one bulb, the 19 offers advantages in battery-operated receiver design such as economy in chassis space, high efficiency, good power output at relatively low plate voltages, and good quality. Used in connection with a permanent-magnet type of dynamic speaker, the 19 makes possible the design of battery receivers having performance capabilities approaching those of a-c sets.

In battery receivers, the plate-voltage and plate-current requirements of the output tube are of prime importance. Tubes which require high plate voltages necessitate the use of more battery units, while tubes with high plate-current drains mean frequent battery renewals. The efficiency of the output tube is therefore of first importance when the cost of operation of the set is considered. Class B output systems have inherently high efficiency. Careful design of a Class B output system will insure good quality. The type 19 tube, giving adequate power output with only 135 volts on the plates, merits the attention of set engineers, because of its high efficiency and relatively low plate-current drain.

Operating Conditions Tabulated

In Table 1 and Table 2 are tabulated typical operating conditions for the 19. The combinations of Table 1 employ a type 30 tube as the driver. The combination of Table 2 employ a 31 as a driver.

In arrangement 1 of Table 1, the 19 is operated with zero volts grid bias. The grids are returned to the negative side of the filament. Under these conditions, the power output is 1.68 watts with a total harmonic distortion of 7.1 per cent, at full output. Like many Class B types, the distortion curve of the 19 has a hump at some point below full output. The maximum distortion at this hump is shown in the column headed "Low Peak." In this case it is 6.7 per cent.

Arrangement 2 is practically identical with arrangement 1 except that the grids of the 19 are returned to the positive side of the filament. Under these conditions the power output is increased to 1.74 watts, and the low-peak distortion is reduced to 3.5 per cent. The zero-signal plate current is raised slightly over that in arrangement 1; the plate current at full output is also slightly increased. Listening tests reveal that the higher-order harmonics are reduced when the grids of the 19 are returned to the posive side of the filaments.

Arrangement 3 shows the effect of a negative-bias voltage on the grids of the 19. The power output is the same as that with arrangement 1. The relative amount of higher-order harmonics is also nearly the same as that for arrangement 1. However, the zero-signal plate current is reduced considerably. This reduction in initial plate current may be of considerable advantage in some designs.

Arrangement 4 shows the effect of an increased negative-bias voltage on the grids of the 19. The power output for the same amount of distortion is reduced from that obtained with arrangement 3. The relative amount of higher-order harmonics, as indicated by listening tests, is increased noticeably. The zero-signal plate current is reduced to a neglible amount.

The 30 and 31 as Drivers

Arrangements 1 and 2 of Table 2 show operating conditions for the 19 with a 31 driver. In the first arrangement, the grids of the 19 are returned to the negative side of the filament, while with arrangement 2, they are returned to the positive side of the filament. Although the power output is approximately the same for both arrangements, the relative amount of higher-order harmonics is appreciably less when the grids are returned to the positive side of the filament.

Fig. 1 shows the operation characteristics of the 19 with a type 30 driver. The solid curves show the operation of the output system with the grids returned to the positive side of the filament, while the dotted curves show the operation with the grids returned to the negative side of the filament. The curves of power output, plate current, and grid current are approximately the same for both arrangements, but it will be seen that a much smoother rise of per cent. total harmonic distortion is obtained when the grids are returned to the positive side of the filament.

Fig. 2 shows the operation characteristics of the 19 with a type 31 driver. The curves of Fig. 2 are presented in the same form as those of Fig. 1 so that a comparison of operation characteristics can be readily made.

The power output obtainable from the 19 is considerably higher when the 31 is used as a driver. However, the 31 driver requires a much larger signal input for full output than does the 30 driver. The plate current of the 31 driver is also higher.

Fig. 3 shows the average plate characteristics of a single-triode unit of the 19.

On an attached sheet will be found specifications for a suitable input transformer for the 19. This transformer used with a 30 driver will give operation characteristics essentially the same as those shown in Fig. 1.

R-F Oscillation in Output

As a word of caution regarding Class B output systems, listening tests sometimes show the quality of the output to be very poor, although the circuit apparently has been designed properly. In such cases, the trouble may be due to radio-frequency oscillation in the output tubes. This oscillations occurs only when an audio-frequency signal is applied to the grids. The result of these radio-frequency oscillations is an audible rasp in the output which easily can be mistaken for higher harmonics of the input signal.

To determine if this rasping is due to oscillations, an a-c signal should be applied to the grids of the Class B output tubes, and the grid leads touched with a finger. If the rasping stops when the leads are touched, it is undoubtedly due to radio-frequency oscillations. A remedy for oscillation is effected by connecting small fixed condensers between each grid and cathode of the Class B stage. Tests have shown that 0.0005 mfd. condensers are usually satisfactory. These condensers may not be required if a speaker-correction network of resistance and capacitance is employed between the plates and cathodes.

It may be desirable to employ a speaker-correction network between the plates of the output tube, in order to maintain a uniform load at all frequencies. For a 10,000-ohm plate-to-plate load on the Class B stage, a resistance of 11,500 ohms and a capacitance

(Continued on next page)

Form-Fitting Shields For Tubes Introduced

National Union Radio Corporation of New York announces a new tube shield consisting of form-fitting metal jackets and grounding clip, easily applied to any type tube. Two styles are available so that all requirements for both straight-side and dome-type bulbs are provided for.

The tube shields can be used to replace spray-shield tubes. They are further suggested for trial in noisy receivers and where non-vibrating shielding is desired.

While the tube shields are a National Union development, they are being manufactured by Goat Radio Tube Parts Company, of Brooklyn, N. Y. They have been made available to the trade through National Union distributors.

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Meter Sensitivity Raised in New Way

Developments in supersensitive meters giving scale deflection of 0-20 microamperes and 0-3 millivolts have been announced by the Westinghouse Electric and Manufacturing Company. These refinements are the result of three major improvements: reduction in weight of moving parts, a 3-to-1 increase in magnet strength and a 6-to-1 increase in the possible number of turns on the moving coil. This great sensitivity was achieved by making relatively slight improvements in many of the fundamental parts of the instrument.

Material reductions have been made in the weight of pointer, balance weights and parts used for attaching pivots to the ends of the moving coil, permitting the use of lower spring torques, and also decreasing impact load on the pivots and jewels.

Cobalt Steel Magnets, Too

In the past instruments have been made with magnets of chrome or tungsten steels. More magnetic effect is obtained by the use of cobalt steel. Castings having suitable magnetic properties are finished with simple surface-grinding operations and spot-welded to the pole pieces. All mounting holes are then drilled in the soft pole piece metal. This process permits the use of magnets of any material and of varying size with the same pole pieces, thus permitting flexibility in the choice of magnets.

For ordinary work, a small chrome steel magnet is welded to the pole pieces, while for super-sensitive requirements cobalt steel magnet of three times the strength is substituted. It is thus possible to make super-sensitive instruments having three times the current sensitivity and therefore nine times the watt sensitivity due to use of special magnet steel alone.

The third major improvement applies chiefly to microammeters. The current required for a given angular deflection varies inversely as the number of turns in the moving coil. The moving coil swings in a fixed air gap, and its dimensions are definitely limited by core on the inside and pole pieces on the outside. With these limitations, the only way to increase the number of turns of wire is to use a finer size. Instrument makers had for some time been using No. 44 enameled copper wire which is 0.002 in. in diameter.

Wire Finer Than Hair

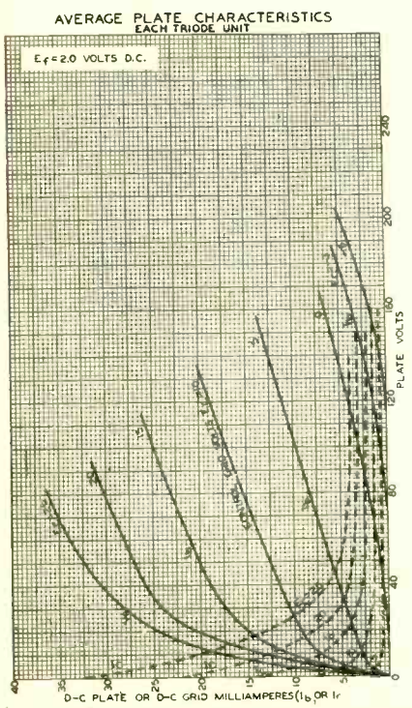
Now the coils are made from wire having a diameter of 0.001 in. and 0.0008 in., gauge numbers 50 and 52, less than half the diameter of the finest human hair. Use of these fine wire sizes allows 4 to 6 times the number of turns for a given coil weight.

These instruments are only 2 in. or 2 7-8 ins. in body diameter, giving full-scale deflection on one or two microwatts. The lowest standard microammeter has a scale 0-20 microamperes, and a coil resistance of about 2,100 ohms.

Small millivoltmeters of hitherto unattainable sensitivity are available with scale of 0-3 millivolts with a resistance of about 9.1 ohms.

A high resistance microammeter has been designed to measure the voltage produced by dissimilar metallic electrodes in extremely weak solutions, such as drinking water. For special requirements, a very highly damped instrument can be obtained by use of the cobalt steel magnet.

The 19 in Class B



The average plate characteristics of a single-triode unit of the 19.

(Continued from preceding page)

of 0.021 mfd. should be connected in series between the two plates. For a 12,000-ohm load, the resistance should be 13,800 ohms and the capacitance 0.017 mfd.; for a 6,000-ohm load, the resistance should be 7,000 ohms and capacitance 0.035 mfd.

Balance to Center Tap

A more effective, but also more expensive, way of apply the correction network is obtained by balancing the network to the center tap of the interstage transformer. The value of resistance between each plate and center tap is one-half that given above, while the value of each capacitance is twice that given above, say RCA Radiotron Co., Inc., and B. T. Cunningham, Inc.

The primary inductance of the output transformer should be high enough to give good low-frequency response; yet, at the same time, it should be kept sufficiently low to obtain good high-frequency response. Close coupling and low leakage reactance are necessary for low distortion levels and good power output at high frequencies.

Major Bowes is Head of New United Station

Four stations in the New York area on 1,010 kc will combine and be operated by a new company under the direction of Maj. Edward Bowes, of the Capitol Theatre. The stations are WHN. WPAP, WQAO and WRNY. Recently WHN applied to the Federal Radio Commission for permission to remove its transmitter from Forty-fifth Street and Broadway to Long Island City.

There will be a new studio for the combination and also a new transmitting plant. The latest type of plant has been ordered, and while the exact location has not been selected, it is said the transmitter will "be somewhere in the suburbs."

The new outfit will be devoted largely to commercial broadcasting. Major Bowes will continue his work at the Capitol, in which he shares a financial interest with Metro-Goldwyn-Mayer, the movie producers and distributors. The combined station probably will have the call letters WMGM.

Major Bowes said that the Federal Radio Commission had issued the construction permit.

No New Tubes, Says Muldowny with Relief

S. W. Muldowny, chairman of the tube committee of the Radio Manufacturers Association and chairman of the board of National Union Radio Corporation, stated that development of new types of tubes, which set such a furious pace during the past year, has definitely slowed down.

"I am sure this slackening in the production of new tube types will be good news to the entire radio trade," said Muldowny. "It is an indisputable fact that the development of new types of tubes, particularly those designed for special adaptations and dual purposes, has had a great deal to do with the remarkable progress made in radio during the past year. This fact is self-evident in the expansion of new markets such as ac-dc compacts and automotive radio. Nevertheless, the introduction of so many types in such a short period of time not only put a severe strain on the tube manufacturer but worked great hardship on the trade.

"As chairman of the tube committee of the R. M. A. I am happy to announce that no new types are contemplated at present, and general opinion among leaders of the industry indicates that no need will appear in the immediate future for a type of tube which is not already in production.

"From the dealer viewpoint, this should give him an opportunity to familiarize himself with all types of tubes now being made and in addition, it presents an opportunity to take stock of his service and test equipment needs for the immediate future."

Eight-prong and nine-prong tubes are said to be in the laboratories, but remote as to introduction into the market.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers should send a request for publication of their name and address. Address Literature Editor, RADIO WORLD, *145 West 45th Street, New York, N. Y.*

Edward Smart, 111 Oswego St., Victoria, British Columbia.
John McNulty, 54 O'Connor St., Wellsville, N. Y.
Lewis Radio Service, 4105 N. Damen Ave., Chicago, Ill.
C. H. Krueger, 2931 N. 4th St., Milwaukee, Wisc.
John González, P. O. Box 22, San German, Porto Rico.
Elbert H. Carroll, West Boylston, Mass.
A. C. Bayly, c/o Nash Nichols Co., 1110 American Ave., Long Beach, Calif.
Chas. K. Hood, 404 Granet Ave., Hazel Park Sta., Royal Oak, Mich.
Jno. D. Young, 2750 5th Ave., So., St. Petersburg, Fla.
Mark J. Swartz, Hershey, Penna.
R. Friedrich, 5026 N. Keeler, Ave., Chicago, Ill.
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Robert Burk, 2110 Vega Ave., Cleveland, Ohio.
Bill S. Wedel, 305 6th St., Huntington Beach, Cal.
C. F. Bell, Jr., P. O. Box 252, Altadena, Calif.
Clifford Talbot, 219 Mellon Place, Elizabeth, N. J.
Kenneth E. Gould, 110 East Third St., Prophetstown, Ill.
Jack H. Nixon, Box 1526, Alexandria, Louisiana.

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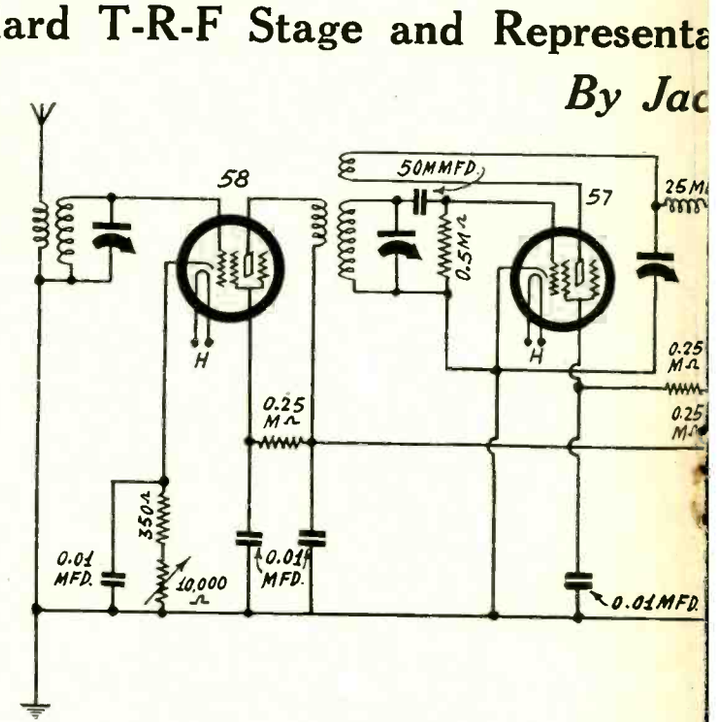
CONSTANTS FOR 5-TU

Standard T-R-F Stage and Representa

By Jac

Excellent reception of short waves is provided by this circuit, which has the standard t-r-f stage and regenerative detector. In this portion of the circuit the constants are selected partly on the basis of commercial short-wave coils, the winding data for which also are given in the text. The regeneration control is quite smooth and the detuning effect of the feedback condenser is slight.



HOW many times the circuit consisting of a tuned radio frequency stage and regenerative detector with shunt feedback control has been described I don't know, any more than I know how many more times it will be described again, but we all know that it works very well. That is the reason it gets such a play.

Whenever new tubes come along that are to be used in such a circuit, new experiments have to be made, so that the constants will be properly selected. This has been done long since for the 58 and 57, but when a total receiver is to be built there may have to be some slight changes, and the set diagramed is one in which the changes have been experimentally determined.

One of the important considerations is the voltage of the B supply after the field, and for a set with a 2A5 or 47 output tube this voltage should be around 365 volts d.c. This means that the voltage at the filament end of the speaker field is around 450 volts to ground, and therefore any condensers used for filtering this voltage should be of the 500-volt rating.

Thus the full B voltage as obtained after filtration is fed to the output tube in two places, to the first audio tube and to the radio-frequency amplifier tube. In the case of the detector, large series resistance cuts down the applied plate voltage to around 50 volts, while the screen voltage is effectively around 30 volts. The two 0.25 meg. resistors in the bleeder and series network account for this, and the plate load resistor is only 0.05 meg. (50,000 ohms), because that is the value that works best.

The radio-frequency part of the circuit is simple and familiar, and while the volume control is a rheostat that alters the bias, which introduces some detuning, it is advantageous because it is a gain control and will correct for any tendency of the r-f tube to oscillate, as it may at some of the higher frequencies. Thus the tube may be worked up to its maximum gain, for the increased sensitivity and selectivity, and in those circumstances when there would be a spillover, the control is retarded a bit.

The operation of the two controls, however, one for volume and the other for regeneration, should be almost completely independent. There is some slight interdependence, but it is too small to be noticeable in mere operation, and shows up only on measurements with highly-sensitive instruments. You can not have one tube coupled to another without the tuning of one tube having some effect on the tuning of the other. But when the effect is of such a low order that we can not measure it handily, as the effect a receiving circuit has on a broadcasting antenna due to the ether coupling, we can forget about it.

The coils used are of the plug-in type, and the data are given for coils as wound on Alden's forms by Sickles, and which are widely distributed. The antenna coil has two windings, primary and secondary, beside each other. The interstage coil has three windings, with the primary wound within part of the winding space occupied by the secondary, while the tickler is below the secondary.

With the circuit built as shown there was activity even on the 10-to-20 meter coils, although in this region some short-wave sets give virtually no response, and possibly even do not regenerate. I know that the going is toughest on the smallest coil, and also that this is a daylight reception coil.

Well, anyway, the present circuit does give considerable response in this region, and it can be said it does regenerate at all dial positions even on this smallest coil, so what reception is brought in depends considerably on the operator.

The 57 is a high-gain tube, so is the 58, while the 2A7 has the highest mu of any receiving tube so far, and yet the volume is not too much. Short-wave signals, at least those most desired, do not deliver anything like the voltage in the antenna as do one's favorite broadcast-band stations. The amplification after the detector ought to be considerable. Here it is about as much as can be obtained from any two tubes (assuming only a single tube in an envelope). Although the 58 is shown as the first audio tube, a 57 may be used at slightly greater gain.

The grid leaks in the audio channel are shown as 0.5 meg., as such a value is safe, but it is always good practice to try higher values of grid leaks, provided that the plate current in the two tubes concerned (the audio amplifiers) does not increase materially. Of course the 58 or 57 first audio plate current will be low, less than 0.5 ma, but even so, an increase to 1 or 2 ma would become dangerous to the life of the 1-watt plate resistor and besides would indicate flow of grid current, which is inimical to quality.

Higher leak values produce more volume and also give the low notes an extra kick, but the low-note accentuation may be so great that motorboating sets in, and then the leaks have to be reduced to such value as is consistent with the absence of this trouble.

The biasing reistor of the power tube, 410 ohms, also furnishes the screen voltage for the first audio amplifier, and particularly due to the common purpose a large condenser should be across this resistance. A value of 50 mfd. is specified, and this is easily obtainable in a 30-volt-rating electrolytic condenser about one-third the physical size of an 8 mfd. 500-volt electrolytic. Use of small condensers to bypass the biasing resistor in the power tube stage always cuts volume, and particularly hurts the low notes.

The circuit lends itself to ready duplication with parts one may have about the home or shop. The plug-in coils are familiar, besides the data to wind your own are given, but if you have other plug-in coils you might try them, as very likely the

Coil

Antenna Stag

Coil No. 1.—Secondary, 51¾ turns No. 22 dou
turns per inch.
Primary at bottom, ⅛" distant from lower
silk covered or enamel wire, close-wound

Coil No. 2.—Secondary, 22¾ turns No. 22
16 turns per inch.
Primary, at bottom, 3/32" distant from lo
silk covered or enamel wire, close-wound

Coil No. 3.—10¾ turns of No. 22 double silk
inch.
Primary, at bottom, 3/16" distant from lo
silk covered or enamel wire, close-wound

Coil No. 4—4¾ turns of No. 22 double silk
inch.
Primary, 3/32" distant from lower end of
silk covered or enamel wire, close-wound

Interstage

Coil No. 1.—Secondary, 50 turns No. 30 singl
Primary, wound in between secondary tu
silk covered wire.
Tickler, distant 5/32" from lower end o
covered wire, close-wound.

Coil No. 2.—Secondary, 23 turns of No. 26
Primary, wound in between secondary tu
silk covered wire.
Tickler, distant 3/32" from lower end of
wire.

Coil No. 3.—Secondary, 11 turns of No. 26
Primary, wound in between secondary tu
covered wire.
Tickler, distant 3/32" from lower end of
wire.

Coil No. 4.—Secondary, 5 turns of No. 26 sin
Primary, wound in between secondary at
wire.
Tickler, distant 3/½" from lower end of s
wire.

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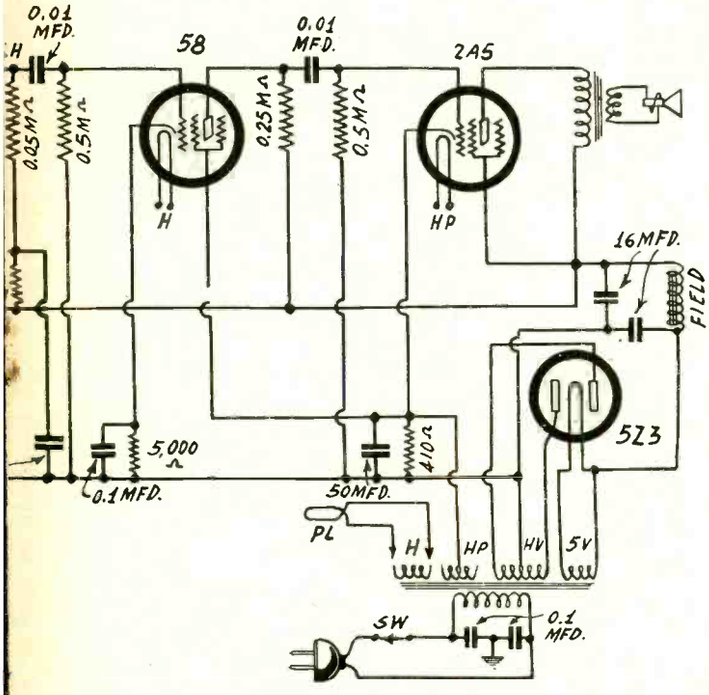
JBE SHORT-WAVE SET

ıtive Detector, with Two Audio Steps

ːk Tully



The r-f tube is a 58, the detector a 57, while the first audio amplifier is a 58 and the output a 2A7. However, a 57 may be used as first audio amplifier without any circuit changes whatever. The screen voltage on the first audio tube is the same as the bias of the output tube, polarities reversed, of course. There is no hum trouble in this set, as 32 mfd. filter capacity and a speaker field-choke are used.

LIST OF PARTS

Coils

One set of four UX-base plug-in coils, as described
One set of four six-pin-base plug-in coils, as described
One power transformer

Condensers

One two-gang 0.00014 mfd. tuning condenser
One 50 mmfd. feedback condenser
Six 0.01 mfd. mica fixed condensers
Three 0.1 mfd. bypass condensers
Four 8 mfd. 500-volt electrolytic condensers, which may be in four separate cans, or two cans, double eights, in each can
One 50 mfd. 30-volt electrolytic condenser
One 50 mmfd. grid condenser

Resistors

One 350-ohm pigtail resistor
One 10,000-ohm rheostat, or potentiometer used as rheostat
Four 0.25 meg. pigtail resistors
One 0.05 meg. pigtail resistor
One 0.5 meg. pigtail resistor
(Do not use wire-wound resistors for the above items).
Two 0.5 meg. pigtail resistors
One 5,000-ohm pigtail resistor
One 410-ohm wire-wound resistor

Other Requirements

Five six-hole sockets, two four-hole sockets and and one five-hole socket (the last-named is for the speaker cable's plug).
One a-c switch and cable
One chassis
One dial
Two knobs
Antenna-ground binding post assembly
Three grid clips
One dynamic speaker with output transformer built in, for pentode tube (around 6,000 ohms impedance); field coil built in.

Data

e (UX Form)

ble silk covered or enamel wire, wound 40

end of secondary, 15 turns of No. 31 double Color ring code, green.

double silk covered or enamel wire, wound

wer end of secondary, 7 turns of No. 31 double Color ring code, yellow.

covered or enamel wire, wound 16 turns per

wer end of secondary, 6 turns of No. 31 double Color ring code, red.

covered or enamel wire, wound 6 turns per

secondary, 4 turns of No. 31 enamel double Color ring code, blue.

(Six-Pin)

silk covered wire, turns 1/32" apart.
ns at the lower end, 31 turns of No. 32 single

the secondary, 16 turns of No. 30 single silk Color ring code, green.

single silk covered wire, turns 5/64" apart.
rns the lower end, 15 turns of No. 32 single

secondary, 8 turns of No. 30 single silk covered Color ring code, yellow.

single silk covered wire, turns 3/32" apart.
rns at lower end, 8 turns of No. 32 single silk

secondary, 7 turns of No. 32 single silk covered Color ring code, red.

gle silk covered wire, turns spaced 3/32" apart.
lower end, 4 turns of No. 32 single silk covered

econdary, 5 turns of No. 32 single silk covered Color ring code, blue.

results will be quite as excellent that way. The biasing resistor for the r-f tube is shown as 350-ohms, but if you have anything from 150 to 350 ohms you may use that, and if you have no 10,000-ohm rheostat use one of a maximum from 2,000 ohms up to 25,000 ohms. Of course there's a difference, and I found 10,000 ohms satisfactory, but as to a mere matter of fineness of this control, as against buying a new part, certainly you can use what you have.

The 0.25 meg. resistors must not be altered, but the 0.05 meg. resistor in the 57 plate circuit may be from 0.025 meg. to 0.05 meg. (25,000 to 50,000 ohms), and the grid leak in the detector, instead of being 0.5 meg., may be somewhat higher or lower, higher values to be preferred if any change is to be made. The grid condenser will work well if 0.0001 mfd., instead of half that value, but if there is any difficulty about regeneration all over the dial, put two 0.0001 mfd. in series to constitute 0.00005 mfd. (50 mmfd.) and increase the leak resistor to the specified 0.5 meg.

The radio-frequency choke, 25 mlh, may be any choke you have, of the honeycomb or similar type, so long as it has at least a few hundred turns. The 25 mlh choke has 1300 turns. The inductance of an 800-turn choke of the same type of construction is around 10 mlh, which is sufficient also, and even 3.2 mlh (400 turns) proved satisfactory, but there was a little more smoothness of regeneration control when the choke was large, i.e., 25 mlh. So if you have 25, 60, 80, 100 etc. mlh chokes, use the one with the highest inductance. The distributed capacity should be very low, however.

Various values of resistors were tried for biasing the first audio tube, but more than 5,000 ohms should not be used, although less than 5,000 ohms would be all right, say, down to 2,000 ohms or so.

The 410-ohm resistor, under the circumstances narrated, afforded a bias voltage of 17 volts, which is close to correct, and yet 500 ohms gave 20 volts, which is all right, too, so if you have a 500-ohm 1-watt resistor you may use that. Though this is a power tube stage, the wattage of the resistance may be that low, because the total current does not exceed 40 ma, and the biasing voltage is only 20 volts at most, so around 0.8 watt is the dissipation.

The speaker field resistance is not so material. Actually 1,800 ohms was used. Fields of 1,200 to 2,500 ohms may be used without any circuit changes whatever, although the output transformer should be one for the pentode class of tubes. The output impedances of the 2A5 and 47, and even the 59, are not so far different that one need to worry as to the speaker. If a speaker is meant for one it will serve for the other, but this hardly holds true of substitution of triodes for pentodes.

There is one possible disadvantage of the 2A5 tube, and that is, since it is of the heater type of construction, it does not draw enough current immediately to cause the regulation of the system to lower the voltage, hence the maximum starting strain is upon the filter condensers, and particularly on the one next to the rectifier, therefore, again, be sure that 500-volt condensers are used, which may be four separate eights in separate cans, or two cans with two eights in each can.

The power transformer may have only one 2.5-volt winding, and if so use that for all four tubes. If the 5-volt winding is center-tapped use the center for take-off of the B supply. Otherwise follow diagram and take off the B from either side of the 5-volt winding.

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Radio University

A QUESTION and Answer Department. Only questions from Radio University members are answered. Such membership is obtained by sending subscription order direct to RADIO WORLD for one year (52 issues) at $6, without any other premium.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK, N. Y.

Set Won't Start Promptly

A MOST PECULIAR thing has happened to my set. Formerly it started playing as soon as I turned it on. Now it does not start that way, but I have to turn the set on (hearing nothing), wait a few moments, turn if off, and then turn it on again.—J. H. W.

Put a 10-watt or higher rating resistor of 15,000 ohms from maximum B plus to ground, or between the feed of the B line to the r-f and similar tubes and ground, if the second-mentioned voltage is lower than the maximum.

* * *

More Kick Desired

IN MY SUPERHETERODYNE I do not get enough kick. The r-f and i-f tubes are 58's and the plate voltage is 100 volts, the screen voltage around 50 volts. The screen voltage is obtained through a 50,000-ohm resistor. I have tried increasing the voltage, but then i-f oscillation sets in.—O. H.

You will get much more volume by increasing the B voltage on these tubes to around 200 to 250 volts. While it is true that oscillation might result, the usual precautions against such oscillation then should be taken. The complete precaution consists of interrupting the B plus return of the plate windings of the i-f transformers with radio-frequency choke coils of 25 millihenry or higher inductance, and bypassing these chokes with 0.1 mfd. or higher capacity. Then each screen lead should have a resistor in it, similarly bypassed, although the effect of increasing the plate voltage is likewise to increase the screen voltage, due to the series resistor. The remedies are suggested for the i-f level, but if needed may be applied to the r-f level as well, in the same way. The individual screen resistors should be around 25,000 ohms, perhaps a little less, so as not to dampen the circuit too much. Experiment will dictate the values.

* * *

Police Band Coverage Poor

IN A SET I built that is supposed to switch to the police band, as well as to the broadcast band, police signals come in only over the higher capacity part of the dial, and the circuit is dead from then on.—K. G.

It is assumed your set is a superheterodyne. The failure on part of the dial for police waves is due to poor tracking or absence of tracking. You will have to determine at what frequency the oscillator coil oscillates when the condenser is at minimum capacity, for police waves, and then you will know if the inductance is too high or too low. Probably it is too high, and the response over part of the dial is due to tuning to the low-frequency setting, which of course causes the set to be dead after the possibility of low-frequency setting is exhausted. After the oscillator inductance is properly selected for the high frequency end, a padding capacity, the value of which also must be determined experimentally, should be included, and this would be selected for some position around 70 on a numerical dial, assuming numbers increase with capacity. A test oscillator is required for this work. One that covers the broadcast band will do, as its second harmonics and in some instances third harmonics may be used.

Push-Pull's Value

IN A PUSH-PULL amplifier, is it a fact that the amplifier will work with one of the push-pull output tubes removed from socket? What is the advantage of push-pull?—J. W. S.

The circuit will "work," after a fashion, with one tube out, but that doesn't prove anything. In a resistance-coupled push-pull amplifier, single-aided operation is obtained with one of the banks of tubes out, with better results than with transformer-coupling, with one bank out. The advantage of push-pull is that it permits greater power output at less distortion. That does not mean more volume of sound, as the sound quantity refers to the sensitivity. The power refers to the ability to stand the gaff.

* * *

Mars Communication

HAS ANY PROGRESS been made lately in communicating with Mars? Did some professor ever try to make an ether ascent in a rocket in connection with this aim?—G. D. C.

No progress has been made lately or otherwise in communicating with Mars. No professor, or anybody else, we hope, ever attempted the rocket ascent for any purpose. Temperature and oxygen would be two deterring considerations, but the crash to earth would probably come before any other troubles would materialize. Communication with Mars requires a common medium of intelligence and presupposes the existence of articulate life on that planet. We have seen grotesque pictures of what Martians are assumed to look like, if such animals exist, of whatever appearance, but closer than that we never got in arriving at verification. It has been found recently from cosmic ray research, that from Mars the carrying power is particularly good on a certain frequency in the short-wave spectrum. This should be the frequency to use, perhaps, but what to say and whom to address, and how long to await the answer are problems that baffle us, too. Nothing herein stated denies the remote possibility that some day (or night) communication with Mars may be established —two-way, we hope.

* * *

Where the 53 Won't Do

REGARDING the 53 tube, which I take it consists of two high-mu (35-mu) tubes in one envelope, may not a suitable short-wave set be made, using one tube for r-f amplifier and regenerative detector, another for first and second audio, a third tube as output, and the usual rectifier?—T. W. D.

No, this method does not work out well. To answer your question we set up the circuit. The tube does not lend itself to this combination of uses on short-waves. The feedback, possibly through the tube capacities, was entirely too much. Control of r-f stage oscillation became a very serious problem even on the second highest band of short-wave frequencies. The audio combination works all right, but not the r-f. The tube's special uses, outside of triode driver for Class B and Class B output, should be verified carefully before the conclusion of satisfactory service is drawn.

* * *

Class B for Battery Sets

DO YOU THINK that Class B audio is satisfactory for battery-operated sets, and if so, would the new 19 tube be satisfactory?—K. D.

Yes, it is a method of getting a respectable amount of power out of battery type tubes at relatively low B voltage, 135 volts. The 19 tube is satisfactory, and special data on its use in Class B output, with either a 30 or 31 tube as driver, will be found in this issue.

* * *

Oscillator Won't Work

THE OSCILLATOR in my sunerheterodyne does not function now, hence reception has stopped. I get an audio

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A THOUGHT FOR THE WEEK

YOU remember when radio was said to be in its swaddling clothes? Well, television has advanced slightly beyond that infantile period, but commercially it is still feeling its way along the slow road to practicality. Anyway, keep your eye on television and some day you'll be surprised to see it jump out of its crib and then—well, then there'll begin a new era in radio and thrills will take the place of vague hope.

RADIO WORLD

The First and Only National Radio Weekly

Twelfth Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, editor; Herman Bernard, managing editor and business manager; J. B. Anderson, technical editor; J. Murray Barron, advertising manager.

HOKUM

THERE is still considerable hokum being broadcast, paricularly regarding healing and prognostication. Dr. Morris Fishbein, addressing a life insurance convention, said some stations permit quacks to offer their "remedies" to the gullible public. "There are still radio stations," he said, "that permit themselves to be parties to fraud by advertising fake remedies and healings."

One station recently cut loose from a chain so far as receiving the program of one sponsor who sells a natural concoction claimed to be curative.

Dr. Fishbein, as editor of "The Journal of the American Medical Association," would be just the one to organize his colleagues to spot offenders, and submit the reports, together with a petition, to the Federal Radio Commission. The layman is not equipped to do this and the Commission itself evidently requires a complaint.

But the necromancers are pretty bad, too, and some official listening by Commission agents ought to produce enough material to warrant action.

The stations that lend themselves to these tactics risk their licenses.

POLICE RADIO SUCCEEDS

FOR the first three months of 1933 there was a 21 per cent. decrease in major crime in New York City, reports Police Commissioner Bolan, saying that police radio had something to do with this. He praises the "increased efficiency of the radio patrol system." Not only does the Commissioner use the system, but he uses it well, and widely advertises advice to city dwellers to 'phone the police if a crime is suspected or is being committed. He uses regular commercial media for such advertising, in other words, makes a business of it. That he should succeed is no more than he deserves.

TOO QUIET

THE North and Central American Regional Radio Conference must be having a hot time of it, judging from the paucity of news concerning what is being done. It has been found that open sessions might prove inimical to the interest and objects of the conference, so the difficult problems are, it is hoped, quietly discussed. A quiet solution would be in order, but at least we'd like to hear about it.

CODE'S PROVISIONS SWEEPING

THE proposed code for the radio industry has been submitted to the National Recovery Administration. It follows the general tenor of the President's code, intended for industries that do not have their own codes, but since the radio business is replete with original and bad practices, naturally special provisions had to be included. These are far-reaching, even radical and, generally speaking, stop at nothing.

The aim is lofty, therefore perhaps the means is tolerable, but one cannot refrain from observing the illegality resorted to in attempting to stamp out unethical practices. It is not a case of quibbling over legal technicalities, either. The code, breathing the same fire as the rest of the codes, impairs the obligation of contract, fixes discounts that must not be exceeded, and looks toward, even promises, the fixing of minimum prices to be charged by manufacturers, the first instance of such obligatory action in the history of the country. More than that, if more were needed, it attempts to prevent the system of manufacturer sales direct to dealers, by imposing a limit to discounts to dealers so served that will not be one whit different than discounts by distributors to dealers, thus seeking perpetration of the distributor method of selling. And violations, while not stated as to penalties attaching but referring merely to the Act of Congress itself, are really the usual ones, fine or imprisonment. This part is dealt with ever so lightly, as the whole object is to achieve a desired end, recovery from the depression, by co-operative effort. However, the compulsion can not well be concealed.

Moreover, for whatever it is, and economically the code is just as unsound as the rest of the codes, the proposed enactment is welcomed by the radio industry at par, since there are no special labor problems as tangle the solution of codes in other industries. If the remedy is unsound, at least the evil it is intended to cure is even more unsound. Whatever its shortcomings, this particular remedy can not be expected to be worse than the ailment.

The economic unsoundness of the attempted recovery through codified practices, minimum wages, limited hours of employment, limited discounts, etc., arises from the impracticality of forced growth of purchasing power. Because purchasing power is based on the amount of goods that a dollar will will buy, the purchasing power is decreased by the code. Prices are raised, a dollar buys less. Also, wages are not necessarily raised in proportion to prices, and a large percentage gets no increased pay. If later the currency is inflated, the dollar buys still less. Since 90 per cent. of buying is done on credit, the credit currency is what counts the most, and the amount of money in circulation need not be any greater than cash purchasing requires, and if made greater than required, is turned into credit currency.

Despite this inherent unsoundness, it is most unlikely that the intended purpose of the code, and the whole attempt to establish recovery by Congressional enactment and legislative power delegated to the President, will fail. The reason is that the people of the country have been seeking "action," are getting it, and the psychological effect is one of hope and confidence. Restoration of these two factors have more to do with recovery than higher prices by fiat, or managed currency, or any of the other economic panacea that never did work.

More persons back at work is splendid, higher prices are desired by industry, but enthusiastic hopes are carrying otherwise sober-minded executives off their feet. The radio industry for a few years has been showing nothing but losses, almost without exception. It should be plain enough that the code requires instantly increased labor and material costs, all extra expenses in the certainty class, and all imposed on manufacturers who have been and are now losing money. The recompense from the operation of the code, not only to atone for these extra costs, but to produce a profit, is not a bit certain. An upswing is virtually certain, but its duration is uncertain, and success depends on duration, not on flurry. Aggressive activity replacing lethargy; emotional driving power; sheer psychological determination to rise out of the morass; confidence in self and country, plus decent respect for the rights of employees, and a heart for the hungry, all of which the code may instill or encourage, will provide the depression cure. The country has been stalemated by the depression, but can't lose in the long run. More mental and physical activity in the right direction will do it. But fifteen-cent lunches and the code will not.

As a rectifier of ills in the industry the code is splendid. If recovery depended on ethics in business the ethics could be enacted alone, and the abrogation of contracts by Presidential order avoided, likewise the fixing of discounts, ultimately of prices, and other forms of standardization that conflict with real competition. But the codes are what they are, there is no stopping them, and even those not convinced of the legality of some of the provisions or the wisdom of other provisions are more than willing to give the endeavor not only a trial but a sincere helping hand.

20,000 Daily See Sanabria Television

Ulysses A. Sanabria, youthful Chicago television experimenter and inventor, has moved his laboratories from that city to New York City. He demonstrated his latest device in a New York department store, where the attendance was about 20,000 a day. Images were sent over a wire from the store window on the ground floor to the receiving system on the tenth floor. A carbon dioxide arc lamp was used in conjunction with a mechanical scanning system, and the pictures were shown on a screen six feet high and four feet wide. There was sound accompaniment. The pictures were clear, in black and white.

Mr. Sanabria believes that television will become a commercial practicality in about two years, and he further believes that the electrical scanning system will be used. This includes cathode ray tubes for pickup and for the receiving end.

Listeners' Tastes to be Canvassed

State groups are being organized by the National Council of Radio Listeners with the intent of making a survey in the fall of what listeners prefer to hear. Sixteen state groups are complete, four more nearly so. Complaints against various types of broadcasts, such as those that excite children with gruesome tales, purvey fortune-telling and offer quack cures, will be investigated.

The nation-wide listener group is particularly interested in child welfare, and the executive secretary of the council is Howard L. White, of the Leisure Time Service of the Heckscher Foundation for Children, 1 East 104th Street, New York City.

The work of the council will be co-operative, and various matters that come up will be referred to the stations and sponsors, for possible adjustment. There is no commercial feature to the enterprise.

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howl that changes in pitch slightly as I turn the tuning dial from one extreme to the other. I had been doing some experimenting with the set and perhaps something I did caused it to go haywire. —J. D. C.

The condition you describe, if you have the grid leak type of oscillator, may be due to open grid return, or other open in the oscillator coil. Remove the oscillator coil from the receiver, examine it closely and test for continuity each winding on the coil. Restore any break encountered. If in your experimenting you made the not uncommon mistake of putting the grid condenser between the grid and the cathode, with secondary grounded to B minus, check up to be sure that the connection makes the parallel leak go from grid to cathode and the grid condenser from grid to coil. Otherwise there would be an open grid, as in the broken coil example, and besides the leak might get hot.

* * *

Pentode Speaker, Triode Tube

I HAVE A SPEAKER that was intended for a pentode type tube, and naturally it has a high impedance, around 6,000 ohms, whereas the output tube I desire to use has an impedance of around 2,500 ohms. I would like to use this speaker for a while, as I can not well get another now, and was wondering if you can suggest a method.—H. C.

You may use self-bias on the output tube, and incorporate a resistor of twice the usually-recommended value. That will establish a compromise. It will reduce the sensitivity a bit, but will increase the plate resistance considerably, and you will get pretty good quality. Doubling the biasing resistance does not by any means double the voltage. For instance, if instead of 775 ohms used for biasing the 2A3 tube, the resistor is 1,550 ohm, the bias voltages will be 60 and 72 volts, respectively.

* * *

56 Drives Two 2A's

A 56 DRIVER is suggested to feed 2A3's in push-pull. Is this sufficient to swing the output stage?—J. E.

Yes. The 56 should have maximum B voltage, as stated on characteristic charts, and the negative bias that goes along with that B voltage. If the current is rather large for the primary of the transformer to be used, put a resistor of 50,000 to 100,000 ohms in the plate circuit, put a condenser of 0.01 mfd. to plate, other side of condenser to P of primary of transformer, and return primary of transformer to 56 cathode. This is known as filtering, or parallel feed. As you realize, it keeps the direct current out of the primary, hence the primary inductance is held up, maintained. Otherwise that inductance would be reduced by the d.c., and there might be a falling off of response at the low audio frequencies.

* * *

Beat Note Oscillator

CAN A SATISFACTORY beat note oscillator be built, using as one oscillator a rather high frequency coil, with fixed condenser, and as other oscillator, a similar coil, and a variable condenser?—R. D.

Yes. The tuning condenser, however, on the variably-tuned oscillator would have to be extremely small. In this sense 50 mmfd. would be very large.

* * *

Transformer Ratios

TWO AUDIO TRANSFORMERS that I have are different as to ratios, but I cannot tell just what the ratios are, hence the difference. Is it all right to measure the d-c desistance of one winding, then that of the other, and divide the smaller into the larger, to get the ratio, and also to determine which is primary and which is secondary?—K. D.

That method would be all right if you could be sure that the same size wire was used on both windings of each transformer, although each transformer might have different size wire, so long as on its primary and secondary the wire size was the same. However, if yours are audio transformers of the interstage type (not output transformer), a better way would be to connect the assumed secondary to the 110-volt a-c line, the voltage of which is measured, and then measure the voltage of the other winding. Then the division you suggest would apply. This method, you see, is independent of the wire size. Or, if you'd rather, you may use the lower voltage of a power transformer for the test.

* * *

Vacuum Tube Voltmeter

WHEN A VACUUM tube voltmeter is built, does it measure the root mean square value of the voltage, or the peak voltage?—G. D. C.

The usual type of vacuum tube voltmeter measures the peak voltage. However, the device may be calibrated for rms values, and then, while it would measure peak values, it would "read" rms values.

* * *

Pilot Lamp as Resistor

IS IT ALL RIGHT to use a pilot lamp as a series resistor in an a-c and d-c set? Is the resistance constant?—H. X.

No, the pilot lamp should be used principally for illumination, and a parallel resistor of lower value than the operating resistance of the lamp put in the circuit. In commercial practice a 10-ohm resistor is used generally. Relying on a pilot lamp alone is decidedly bad practice.

* * *

Relay Protects Meter

IS THERE a fuse for protecting a 0-1 milliammeter?—C. L. F.

No. The fuses are not reliable on such small current. But there is a vacuum relay which guards against overloads. Suppose that, in testing with the scale connected from 0 to 30 volts, you accidentally touch the test lead across the 150 volt section. Instead of a costly burn-out as in ordinary meters, the vacuum relay will throw open and remain open as long as there is an overload. When the extra voltage is removed, the relay automatically closes and the meter is again ready for use.

Audio Twice in New System

WILL YOU please explain in terms of modulation the system of no-image superheterodyne you have been featuring?—E. L. S.

The carrier is modulated when transmitted from the station. The receiver's functions are: (1) remove the carrier, leaving only the modulation, or audio frequencies; (2) provide a local oscillation at the intended intermediate level and impress the aforesaid audio frequencies thereon; (3) amplify the new carrier; (4) remove the new carrier, resolving into modulation fundamental again; (5) amplify the audio frequencies as such.

* * *

Worth of the Ultra Frequencies

WILL YOU PLEASE tell me what is the reason for all the experimenting being done on the ultra frequencies, and why Guglielmo Marconi is spending so much time on this, as the results of sound broadcasting in the present band are good, the medium short waves have enough troubles to keep most persons off, except amateurs, and there does not seem to be a single commercial utilization of the ultra frequencies, and yet we hear so much about them and so many scientists seem to be spending most of their lives with them. Besides, they travel only a short distance and real value is obtained only from large distance.—H. C.

The object of the experiments is to endow the higher frequencies of transmission with greater commercial applications. It is known that static is virtually absent from these frequencies, and as static is one of the impediments to regular service on nearly all other frequencies, if the range of the ultras can be extended, and by directed effort can be made to give service over distances of hundreds of miles, the usefulness will become really important.

One of the incidental uses would be the enlarged sending areas of television transmitters, when these transmitters are generally in the ultra frequency spectrum, as it is expected they will be.

Nearly all the important television experimenters the world over are given to the idea that the ultra frequencies of radiation will have to be used.

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Station Sparks

By Alice Remsen

Enchantment

FOR WILLARD ROBISON AND HIS DEEP RIVER ORCHESTRA

Sundays at 5:00 p. m.

Thursday at 10:00 p. m., WABC

The forest glade is cool and green
Inviting tired ones to rest.
Within its shade a pool is seen,
With lilies resting on its breast.
A weeping willow slowly bends,
To touch the water, crystal clear—
While mirror-like its surface lends
The image of an antlered deer.

The margin of the pool is lined
With tiny blossoms, sweet and quaint;
Upon a mossy bank we find
Arbutus trailing, while a faint
Elusive perfume lingers there;
Soft silver chimes hang soft and clear
Upon the quiet evening air,
And nature rests as night draws near.
—A. R.

* * *

And the enchantment of Willard Robison's music will carry you to just such a quiet glade, and make you dream of softly flowing water, a magic pool, and the sorcery of moonlight. Listen to him! You'll like his marvelous orchestra, his soft voice and pleasant personality.

The Radio Rialto

BBC POKES FUN AT US

One of the most humorous things heard over the air in a long time was the British broadcast from the BBC in London, via WABC, recently, burlesquing American methods of broadcasting. A full hour program, with British radio stars doing impersonations of their fellow artists of this country; Kate Smith, Arthur Tracy, Bing Crosby, the Boswell Sisters, Amos 'n' Andy and Walter Winchell were all done very well; Stuart Erwin, the movie star, was a lifelike piece of work; I'd like to know who did that impersonation. Our British cousins poked fun at our commercial blah—and who can blame them, for some of it is pretty sad, even to us! . . . Fred Allen, the new Best Foods comedian, was born with the name of John F. Sullivan. He is a New Englander, one of the Sullivans of Somerville, Mass. He started to juggle when he was a kid and eventually landed in vaudeville, when he was known as Paul Huckle, European entertainer; where he dug up that name I have not yet ascertained; neither do I know where and how he graduated to the name of Fred Allen, but I do know, and so does everybody else, that he made a tremendous hit in his first Broadway musical show, "Polly"; from then on, the first "Little Show" claimed him; he was starred with Libby Holman and Clifton Webb, since which time he has never looked back. . . .

SINGIN' SAM AGAIN

Singin' Sam returns to New York from Indiana this month and will resume the Barbasol program at WABC, but this season he will be on only twice a week; Edwin C. Hill will share honors with him, being on three times weekly. . . . For the person who enquired after George Frame Brown: you can hear him on NBC now, via WEAF, every Saturday, on a program titled "The Optimistic Mrs. Jones," in which he plays the character of the said Mrs. Jones. . . .

THOSE COMMERCIALS

"Roses and Drums" is returning to the air on September 3rd, Sundays at 6:30, EDST, sponsored by the Union Central Life Insurance; other WABC openings in September are: September 11th, The Voice of Experience, Mondays, Tuesdays, Wednesdays, Thursdays and Fridays, 11:00 a. m., and Wednesdays at 8:00 p. m., EDST, sponsored by Wasey Products; September 22nd, Fridays, 9:30 p. m., EDST, "The All-America Football Show," sponsored by Postum; September 25th, "Just Plain Bill," each week-day, except Saturday, 7:15 p. m., EDST, Kolynos Sales Corporation; September 26th, Tuesdays, Wednesdays and Thursdays, 6:45 p. m., EDST, The Wyeth Chemical Company will present a new Jad Salts program; The Spool Cotton Company renews "Threads of Happiness," Fridays, 9:15 p. m.; Acme Paint also renews Smilin' Ed McConnell, Sundays, 6:00 p. m., EDST. . . . Hope Jack Foster, of the New York "World-Telegram," is better by the time this reaches print; at this writing he is ill at his parents' home in New Rochelle, N. Y. . . . Peter Dixon, another newspaper man, on the New York "Sun," made a sensation recently on one of the Rudy Vallee Fleischman programs, with a scene from his famous radio skit, "Raising Junior." . . . Taylor Holmes is being recognized by his giggle these days; by-the-way, you knew, of course, that Taylor is the father of Philip Holmes, the movie star, but did you know that Philip calls his dad from the Coast after each one of the elder Holmes' Texaco broadcasts, and criticises his parent's performance and that Taylor rushes out to see Phil's latest picture and phones him, too? Nice gesture! . . .

SO MANY A MINUTE

And now it appears that air-gabbers talk much too fast; the ideal speed, according to F. H. Lumley, of Ohio State University, is one hundred words a minute; President Roosevelt limits himself to that number; the average radio speaker uses a hundred and sixty-two, but the peppy boys do as many as two hundred and seven words per minute! . . . Marion Talley, the pride of Kansas, will return to the air as a regular performer with Frank Black's orchestra some time this week. Watch your local papers for schedule. . . . John Seagle, NBC baritone, is the proud father of a first child; it's a boy, weighed seven pounds at birth, and already gives much promise of possessing as fine a pair of lungs as his dad. . . . Most of the thirteen musicians in Mills Blue Rhythm Band have either attained or are working for college degrees. . . . Hamtree Harrington, comedian at the Cotton Club, is also a portrait painter; at present he is working on a life size study of O'Neil Spencer, percussionist in the Blue Rhythm Band. . . . Duke Ellington and his manager, Irving Mills, are now on the high seas, on their way home from the Duke's successful European tour, via S.S. Majestic. . . .

GLADYS RICE WITH CBS

Gladys Rice, long one of the faithful of the NBC old guard, has gone Columbia. She made her debut on August 7th, with Andre Kostelanetz and his orchestra, and will be heard henceforth each Monday at 10:00 p. m., EDST, with Mr. Kostelanetz, and will do solo and ensemble numbers with the Columbia mixed chorus; Miss Rice will also be heard each Thursday evening with Howard Barlow, at 10:45, at which time she will devote herself primarily to musical comedy, light opera and popular songs. . . . Vera Van, Columbia's newest contralto, is blonde, pretty and youthful; was born in Marion, Ohio, where her family have lived for generations; she was a toe dancer when a child; so was I! . . . WLS, the Prairie Farmer station in Chicago, now presents its popular national barn dance program over a three-station network, which includes WJR, Detroit, and KDKA, Pittsburgh. . . . Wonder what will result from our radio code; let us hope the artists will be given an even break, and that no one will be allowed to work for nothing; then perhaps programs will improve on the smaller stations. . . .

WORTH THINKING OVER

THERE'S to be still another new network —so the birdies of the ether tell us. This time the network is to be controlled by a banking syndicate which is holding off its activities and official announcement until the new Amalgamated gets under way and proves that there is room for vast expenditures in the broadcasting field. (No; Mr. J. P. Morgan is NOT in the group of bankers mentioned).

A DOUBLE BIRTHDAY

Radio City will have its official opening on November 15th, which is the same date the National Broadcasting Company was organized in 1926. . . . Rosaline Green has been added to the Potash & Perlmutter cast. . . . The Jack Frost Sugar program will celebrate its fifth consecutive year on the air September 4th; there will be a special program arranged for the occasion. . . . Peggy Healy, the cute little redheaded songstress, has been with Paul Whiteman for a year, but says it seems only like a month. . . . Eva Le Gallienne may now be heard in a series of readings for children on WJZ each Wednesday at 7:15 p. m., EDST. . . . A series of exchange programs has been arranged by Columbia with the Canadian Radio Commission. Two programs a week will be broadcast to a nation-wide Canadian network from the CBS studios at WABC, and the Canadians will send one program a week to the Columbia network. Mondays at 10:00 p. m., Tuesdays at 10:00 p. m., EDST, will be the time for the programs emanating from New York; each Saturday night at 10:30 p. m. will be the time for reciprocal program from Canada. . . . The Happy Bakers have had their contracts renewed for another thirteen weeks, which reminds me that I'd better renew my acquaintance with the teapot or slowly pass out of the picture, so here I go for a nice strong cup of tea. Wish you might join me!

Prohibition Sermons Classed as "Political"

Washington.

Stations should be exceedingly careful in classifying talks on prohibition and repeal, and not class as a "political talk" a plea for repeal, and as a "sermon" a plea for the retention of prohibition, said a statement issued by the Federal Radio Cimmission.

"This is rank discrimination and should not be countenanced," said the statement.

Hubert La Due, a Californian, complained in a letter to Commissioner Hanley that stations have gotten into the habit of giving preferred treatment to "all reformers, ministers or otherwise."

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ONE APPROACH TO TELEVISION FOUND IN SKY

Boston.

Ten years ago, while radio engineers were delving into the mysteries of radio receiver research, a young astonomer, Dr. Francois Henroteau, now head of the Astrophysical Department of the Dominion of Canada, scanning the heavens at night, was originating an idea that was eventually to prove the evident solution of television.

Dr. Henroteau's ambition was to eliminate the use of cumbersome telescopic lenses and apply in their stead light-sensitive devices, such as photo-electric cells, to bring the stars close to the human eye. Photocells are sensitive to a wider band of colors than the eye, hence their value in astronomy.

Finally an idea came to him which would provide an ultra-flexible means of star-gazing, in fact, a real "eye", as facile as the human eye, but as sensitive to the colors of the spectrum as a photocell—a Super Eye.

Needed Cathode Ray Pickup

With the development of a Super Eye, which would be electrical in nature, its application to the coming art of television was an obvious step, and the device suited the idea perfectly.

Patents were taken out in many countries and have been in existence for more than three years. The natural question that arises is why hasn't the Henroteau Super Eye been used in television long before this? The answer is that this eye needs the cathode ray type of receiver or reproducer to be fully effective and since the receiver itself had not been perfected, little thought was given to a television "camera."

Like all good inventions, the Henroteau Super Eye is simple, as simple as the cathode ray tube itself. The image to be televised is picked up by a high grade photographic lense and focused on a plate inside a glass tube, much like a television cathode ray tube. This plate is made up of millions of tiny globules which are miniature photocells. A sweeping beam of light or electrons rapidly scans this plate in the familiar cathde ray manner.

Fine Detail Set Forth

With the image playing constantly on the plate each cell has the opportunity to fully register the amount of light or shade the lense directs upon it. As the scanning beam sweeps each minute cell it releases the electricity charged up in that cell, the amount varying according to the amount of light or shade playing upon it from the lense. The discharge places the voltage upon the grid of an amplifying tube.

The outstanding advantages of this method of television pickup, besides the simplicity, is the fact that pictures of tremendously fine detail, up to 500 lines a frame, are possible; pictures with such good light pickup that the long dreamed of out-of-door scenes of baseball and football games become near realities.

It is this powerful light pickup and consequent impulse which makes this Super Eye the connecting link in bringing cathode ray television to a point of practical utility.

The cathode ray receiver had been foreseen by early workers, but a method of picking up the picture which could work up to the 500 line possibilities of the cathode ray picture reproducer seemed remote. Mechanical methods completely failed.

Even though the speed could be obtained by high speed and unwieldy apparatus, the breaking up of the picture into so many fine dots made each one so small and in turn its impression upon the photocell so small that amplification to any useful point was impossible to all intents and purposes.

With the Henroteau device, the scanning beam sweeps with the speed required for the 500 line television, but instead of being limited to the microscopic amount of light impulse which would result in the ordinary method of pickup, the beam arrives at each dot to find it holding a relatively large electrical charge which the beam releases instantly. On a basis of 24 pictures a second, it means that each minute particle will give an electrical impulse based on an exposure of 1/24 of a second, instead of 1/1,000,000 of a second under ordinary scanning conditions.

It is seldom that the literary figure of speech, "star-gazing," has such a literal parallel as in this case of the Canadian astronomer, who, scanning the remote stars, found the answer to television.

TRADIOGRAMS

By J. Murray Barron

Morris Lager, of the Try-Mo Radio Corp., New York City, which corporation operates a chain of radio stores catering to the amateur, experimenter and the general public, has returned from a trip through the mid-west. "Indications point to a favorable uptrend and the general business opinion is good," he reports.

* * *

Postal Radio Corp., 135 Liberty Street, New York City, is now offering a televisor. It is quite simplified, requires only two connections and comes in either kit form or wired. To the many experimenters in television there is lots of leeway in the development of television to the point that broadcast reception has reached. There are thousands of radio experimenters who have not as yet attempted to receive television broadcasts and yet others have found the study very interesting.

* * *

That radio experimenters are consistent mail-order buyers is well known to these houses, while organizations outside of the field are beginning to learn this. A nationally known typewriter firm has found it a good business proposition to sell its products through retail radio stores of the proper type, as so very often the families buying radio receivers have children who attend school or college and are in the market for a machine and as the retailer can offer the company guarantee and is backed up by them the customer is fully protected. This system of selling typewriters through radio outlets should be of a great advantage to the mail order customer in the small community who may be miles from the nearest agency.

ARCTURUS OPERATING UNDER BLANKET CODE

Newark, N. J.

The Arcturus Radio Tube Company has signed President Roosevelt's NRA code and has begun operation under this code.

In accordance with the provisions of the code, the earnings of Arcturus employees were increased approximately 5 per cent irrespective of the shorter working hours. The working force was increased 17 per cent. In taking on new help, Arcturs officials announced that preference was given to former employees.

WYNN'S CHAIN COMPLETES ITS SEVEN STUDIOS

The studios of the Amalgamated Broadcasting System, 501 Madison Avenue, New York City, have been completed.

Each of the seven studios is of a distinct color scheme, using the most modern of lighting equipment. In order that the truest sounds reach the ears of the radio listener, the studios have the newest acoustical equipment, which has been especially designed by Amalgamated engineers.

An unusual technical achievement in all of these studios is the complete isolation by a chamber of surrounding air. This affords sound-proofing to such a degree that the volume of a large symphony orchestra could not be heard even if the listener's ears were propped up against the walls.

Wynn Heads System

All the studios are located on the fourteenth floor of the building. The largest studio has been built to accommodate especially large ensembles, while two others can house orchestras up to 40 pieces. The remaining four are "intimate" studios. A special air-cooling system, noiseless in operation, is also one of the features of Amalgamated's new studios.

Ed Wynn is president of the system.

A massive organ built especially for broadcasting has been installed in one of the studios.

This organ, designed by R. P. Mathews, of the Marr and Colton Organ Co., is a three-manual instrument, equipped with every type of sound effect used in modern broadcasting.

"Only One with Organ"

According to James Rich, chief organist and director of Amalgamated's Musical Bureau, "the use of the organ together with unique combinations of the string sections of orchestras and other musical devices, is in a very embryonic state, compared to the amazing growth of other types of radio features.

"We are the only network having an organ in our main studios. This one instrument, combined with a twenty-five piece orchestra, gives the radio audience the same rich tonal quality as that of a fifty piece orchestral unit."

Enormous Business Ahead, Says Peters

H. R. Peters, president of National Union Radio Corporation, returned to New York after an extended tour of inspection of the World's Fair in Chicago.

"It is a glorious spectacle," said Mr. Peters, "well worth the expenditure of energy necessary to see it in its entirety.

"The Fair gives one a keen appreciation of the miracles which have been wrought through man's ability to harness the power of electricity. It gives me a keen sense of pride to realize that I am connected with an industry so vitally important to the progress of mankind. While the panorama of development during the last century seems to have moved at a terrific pace, I am confident that in so far as radio is concerned, we are merely on the threshold of an era in the radio business, which will dwarf the past."

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RECOVERY CODE SEEKS TO INSTIL ETHICS IN RADIO

Washington.

After many weeks of work by the Radio Manufacturers Association Board of Directors and Code Committee, a national code for the radio manufacturing industry was filed with the National Recovery Administration.

Immediate application of the code's labor provisions, which it is estimated would give work to 10,000 more radio factory employees and increase industry's annual payroll by $3,000,000 was asked.

Members and the industry were urged by the RMA Board to make the wage increases and reduced working hours of the industry code operative at once.

The RMA also applied to the Government for immediate acceptance and operation of the industry code labor provisions. These are substantially those in President Roosevelt's voluntary code and of that submitted recently by the electrical industry.

The RMA code for the industry was approved by the Association's Board of Directors at a special emergency meeting at the Mayflower Hotel. The code was filed with the Government within forty-eight hours because of serious new problems facing employers and labor following the National Recovery Administration's voluntary code plan. The RMA had planned originally to submit the code to members and the industry before filing, but there will be ample future opportunity for its consideration.

36-Hour Maximum in Factory

The labor features of the RMA code, which would apply to all radio manufacturers including non-members of the Association and will be administered and enforced by the RMA, provide a 36-hour maximum week for factory workers. For all other employees except executive, administrative, research and engineering and supervisory employees and traveling and commission salespeople, a maximum working week of 40 hours is provided.

On the wages the RMA code provides a minimum wage for factory employees of 40c per hour unless this rate per hour for the same class of labor on July 15th, 1929, was less than 40c in which case the rate per hour shall be not less than the rate per hour paid on July 15th, 1929, and provided also that in no event shall the rate per hour be less than 30c. For all other employees, except commission salespeople, the RMA code provides minimum wages at the rate of $15 per week except that office boys and girls, learners and casual employees up to 5 per cent of the payroll may be paid 80 per cent. of these minimum wages.

Provision is made for adjustment of wages of employees above the minimum scale and also for extra-hour employment during seasonal peak periods.

Radical Changes

The minimum wage and maximum working hour provisions of the RMA code appear, to the RMA Board of Directors and the Code Committee, of which W. Roy McCanne of Rochester, New York, is chairman, to be the best probably obtainable in order to obtain prompt acceptance by the Government. The labor provisions were adopted by the Code Committee and approved by the RMA Board of Directors after weeks of labor and consideration of literally bales of statistical and other data.

W. L. Allen, prominent among the deputies on the staff of General Hugh S. Johnson, Administrator for the Government, has been designated to handle the RMA code. He recently had charge of the electrical industry code. The RMA Code Committee and officers will welcome suggestions from Association members or non-members, the latter having been advised of the industry code provisions.

The RMA code is replete with many provisions widely changing merchandising practices in the interests of jobbers and dealers as well as manufacturers and designed to stabilize the industry and its employment. Among major features of the code are two outstanding provisions. One is for a special trade agreement under Section 4 of the National Industrial Recovery Act providing uniform contracts between manufacturers, distributors and dealers, definitely establishing standard discounts, relations and trade practices in the marketing of receiving sets. The provision does not yet extend to but may be applied to other radio products.

Another most important plan in the industry code, also initially applying to receiving sets, would establish a scale of minimum but not maximum prices for various classes of receiver chassis based on a weighted average of production costs.

No set manufacturer would be permitted to sell below this weighted average "cost of production," that is, there would be price-fixing.

The code is described as being eminently fair both to small and large legitimate manufacturers of receiving sets. The code also provides against sales below "cost of production" by makers of other radio products.

The RMA code consists of general provisions affecting all radio manufacturers and also anticipates commercial use and, therefore, includes application to television. Various industry groups have additional chapters in the code containing provisions relating to their special interests. There are separate chapters for manufacturers of receiving sets; tubes; parts, cabinets and accessories; loud speakers, sound distribution equipment and fixed condensers. These group codes may be expanded later.

The code creates a Radio Emergency National Committee, composed of chairmen of the RMA Divisions, with broad powers to administer the national code, both for Association members and non-members—any one engaged in radio or television manufacture. It specifically provides that the code shall, with the approval of the President, be administered by the Radio Manufacturers Association through its Radio Emergency National Committee and be applicable to all manufacturers of radio and television products.

The Committee is given extensive powers to enforce all provisions of the code, including sales below cost of production, and all receiving sets below the proposed weighted average price. Provision is made for improving merchandising.

Summary of Code

Following is a summary of the provisions of the proposed code for the radio industry:

Title: Code of Fair Competition for the Radio Manufacturing Industry as Submitted for Revision.

Whom Affected: Radio manufacturing industry, its employees and contractees. The industry includes manufacturers of receiving and television sets, tubes, parts, cabinets, speakers, condensers and sound equipment.

Effective Date: Tenth day after approval by President Roosevelt.

Monopolies and Oppression: The provisions are not to be used for sanctioning or promoting monopolies or to oppress small enterprises.

Collective Bargaining: Safeguarded to employees, as is right to organize.

Company Union: No employee obliged to join one.

Child labor: No employee under 16 years of age to be hired.

Minimum Pay: For factory employees, 40c per hour, unless the rate on July 15th, 1929, was less, but in no event less than 30c per hour. Casual and incidental labor excepted, minimum 80% of the foregoing two, but limited to 5% of a month's total payroll to "process labor." Other employees (office help, etc.) on weekly salary, minimum $15, with same exception of 80% ($12) for casuals.

Hours of Labor: For process labor, not to exceed 36 hours per week. For others, not to exceed 40 hours per week. Exceptions for seasonal peaks or emergencies.

Sale Prohibited: No sale or offer to sell any product made contrary to the age, time and pay provisions is permitted.

Prices: One list price for entire country made mandatory. No secret rebates, gifts, bonuses to customers, etc., permitted, except extra discounts for quantity sales, and usual sales promotional aids, manufacturers to dealers, the promotion cost is limited to 3% of net selling price, quantity discounts 5% per $25,000, 10% per $100,000 up. Ways existing in the industry for hiding price concessions are listed and condemned, such as billing without enforcing collection, discriminating allowance for "repairs," etc. Manufacturer to fix own prices, but discounts, which must not be exceeded, are enumerated. Provision made for a standard cost accounting system later, and reports thereunder by manufacturers, so minimum prices for particular classes of sets, etc., by number of tubes and uses, may be fixed, on basis of these as yet unascertained data. Meanwhile nothing may be sold for less than the cost of the production, except close-outs, and such would be legal only if approved in advance by the National Recovery Administration.

Warranty: A standard warranty is enacted, guaranteeing freedom from defective material and workmanship for 90 days after consumer sale.

Penalties: Violations of the code constitute unfair competition and punishable under the Industrial Recovery Act by $500 fine, jail and loss of license to do business.

Contracts: Manufacturer agreements with distributors and retailers, and agreements by manufacturers with retailers, are standardized and prior agreements voided. "Distributors" are defined as those who "maintain adequate warehouse stocks and a proper selling organization for selling direct to dealers and who actually sell broadly to dealers." Contrary agreements, even if prior, are abrogated.

Discounts: Not to exceed following: from manufacturer to distributor, sets listing at $30 or less, 40 and 15%; $31 to $50, inclusive, 50 and 5%; $51 to $100, 50 and 10%; $101 up, $50, 10 and 5%; parts, 50 and 5%. Distributor to dealer, 36%, 40%, 40 and 5%, 40 and 10%, and 40%, for same price groupings as above. Provisions for advertising and sales promotion allowances to be inserted in agreement. Manufacturer-dealer agreements same as distributor-dealer agreements, discounts and all.

Payment: All payments 2% 10 days, 30 days net; or 2% on bills dated from 1st to 15th of month if paid on or before the 25th; or 2% if dated 16th to 26th and paid by the 10th of following month. Invoice date is date of shipment.

Administration: The executive committee of R. M. A. to constitute Radio Emergency National Committee and be responsible for the administration of the code. Six divisions are to be set up: sets; tubes; parts, cabinets, accessories; speakers; sound distribution equipment; fixed condensers.

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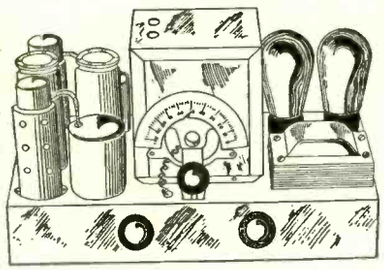
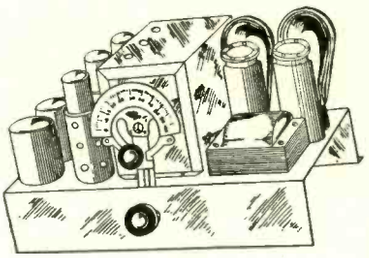


BLUEPRINTS, COILS and CHASSIS

FOR THE TUNED R-F

DIAMOND OF THE AIR



FOUR-TUBE DIAMOND

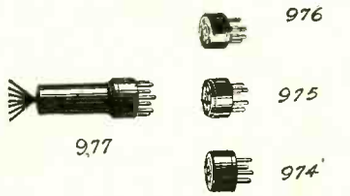
Extremely fine performance, including fetching tone quality, marks the Four-Tube A-C 1933 Diamond of the Air, blueprint of which is now available (half-scale). Many have been surprised that so much can be accomplished on a t-r-f set that costs so little to build. The circuit uses a two-gang 0.00035 mfd. condenser. Special coils are required. The chassis is metal, 13.75 x 6.75 x 2.5 inches.

Send $3.00 for six months subscription (26 issues) and get the blueprint, two official shielded coils and the drilled metal chassis free. Order PRE-D-4-COMB.

FIVE-TUBE DIAMOND

The Five-Tube A-C 1933 Diamond of the Air provides greater sensitivity than the four-tube model, also somewhat more selectivity, as a three-gang condenser is used. An infallible method of permanently suppressing oscillation is introduced, so that besides having a sensitive and selective set one will have a stable receiver. The tone is most excellent. Send $4.00 for 34 weeks subscription (34 issues) and get the blueprint, three shielded coils and drilled metal chassis free. Chassis is 13.75 x 9 x 3 inches. Order Cat. PRE-D-5-COMB.

Analyzer Plug and Adapters



For constructing a set analyzer, an analyzer plug, to go into a receiver socket, is necessary. We offer the exclusive seven-pin analyzer plug, plain long handle as illustrated, and three adapters that enable putting the plug connections into UX, UY and six-pin receiver sockets. The plug has 5-foot 7-lead cable. All four parts sent free on receipt of $6.00 for one-year's subscription (52 issues). Order Cat. PRE-ANPLAD.

0-10,000-Ohm Resistance Meter

A 0-10,000-ohm ohmmeter and continuity tester. A rheostat is built in for correct zero resistance adjustment. The unit contains a three-cell flashlight battery. Supplied with two 5-foot-long wire leads with tip plugs. Case is 4-inch diameter baked enamel. Sent you for an order for one year's subscription for RADIO WORLD (52 weeks) at the regular rate of $6. Order Cat. PRE-500.

We do not pay postage on resistance meter. Average postage 17c.

RADIO WORLD and RADIO NEWS } $7.00

Get both of these mazagines for one year for $7.00, although the regular subscription price of RADIO WORLD alone is $6.00 a year and that of "Radio News" alone is $2.50 a year. Instead of paying $8.50 you pay $7 and you get 52 issues of RADIO WORLD (one a week) and 12 issues of "Radio News" (one a month). "Radio News" recently bought "Citizens Radio Call Book," and "Technical Review" and consolidated them with "Radio News." This offer at this combination price applies only to United States and possessions. Send $7.00 and order Cat. PRE-RWRN.

To Canadian and other Foreign subscribers the combination price offer is at $8.50 for these two magazines. Order Cat. PRE-FOR-RWRN.

RIDER'S MANUAL

The standby of the service man is John F. Rider's "Perpetual Trouble Shooter's Manual," of which Vols. 1 and 2 have been published.

Vol. 1 consists of 2,000 diagrams of commercial receivers, power amplifiers, converters, etc. Total pages, 1200.

Vol. 2 contains additional diagrams on the same basis as above, but in Vol. 2 there is no duplication of any of the diagrams printed in Vol. 1.

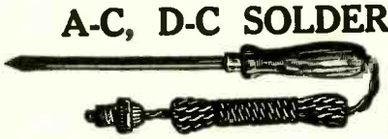
To get Vol. 1 free, send $9.00 for 1½-year subscription (78 weeks) and order Cat. PRE-RM-1.

To get Vol. 2 free, send $9.00 for 1½-year subscription (78 weeks) and order Cat. PRE-RM-2.

PHONOGRAPH MOTOR

Allen-Hough synchronous phonograph motor, 78 revolutions per minute; takes up to 12-inch records. Works from a-c line, 50-60 cycles, 105-120 volts. Equipped with felt-covered turntable. To start the motor give it a slight impetus. Fits into 3-inch depth, hence handy for compact installations. Given free with 34-weeks subscription at $4.00. Order Cat. PRE-PHOMO.

A-C, D-C SOLDERING IRON



A serviceable iron that works on a-c (any frequency) and d-c, 105-120 volts. Sent free on receipt of $1.50 for three-months subscription (13 issues). Order Cat. PRE-SOLIN.

DOLLAR SPECIALS

R-F CHOKE COILS

These coils have 50, 100, 200, 400 and 800 turns, diameter 1 inch, and are suitable for detector plate filtering, screen filtering, grid and plate loads, etc. The 50 is for short waves, 100 for television band, 200 for broadcast band. 400 for high intermediate frequencies (450 to 300) and 800 for lower intermediate frequencies. Any four, or four of a kind, or combinations not exceeding total of four, sent free on receipt of $1.00 for 8 weeks trial subscription. Order Cat. PRE-4-CH and state chokes desired, by quantity and number of turns.

TWO BOOKS BY ANDERSON AND BERNARD

"The Superheterodyne," by J. E. Anderson and Herman Bernard. A treatise on the theory and practice of the outstanding circuit of the day. Special problems of superheterodynes treated authoritatively.

"Foothold on Radio." A simple and elementary exposition of how broadcasting is conducted, with some receiver circuits and an explanation of their functioning. Both books sent free on receipt of $1.00 for 8 weeks trial subscription. Order Cats. PRE-SH-FH.

CHOICE OF PANEL TYPE METERS

One meter sent free with each $1.00 trial subscription (8 weeks). Order Cat. PRE-MTR and add the number of the meter to the catalogue number. Any number of meters may be ordered on the equivalent extended subscription basis.

0-6 Voltmeter D.C.	No. 326
0-50 Voltmeter D.C.	No. 337
6-Volt Charge Tester D.C.	No. 23
0-10 Amperes D.C.	No. 338
0-25 Milliamperes D.C.	No. 325
0-50 Milliamperes D.C.	No. 350
0-100 Milliamperes D.C.	No. 390
0-300 Milliamperes D.C.	No. 399
0-400 Milliamperes D.C.	No. 394

HANDY PACKAGE OF PARTS

One grid condenser of 0.00025 mfd., with clips; one 5-to-7 meg. fixed grid leak; one knob with ¼-inch shaft; one a-c cable and plug. All sent on receipt of $1.00 for 8-weeks trial subscription. Order Cat. PRE-HANPKG.

SHIELDS FOR 57, 58 TUBES

Aluminium shields of the type specified by the tube manufacturers for sensitive circuits, so that the shield top fits snugly about the tube dome, are obtainable, six free on receipt of $1.00 for 8 weeks trial subscription. Order Cat. PRE-TUBSH.

RADIO WORLD, 145 West 45th Street, New York, N. Y.

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