JULY 29th 1933 15c Per Copy

RADIO WORLD

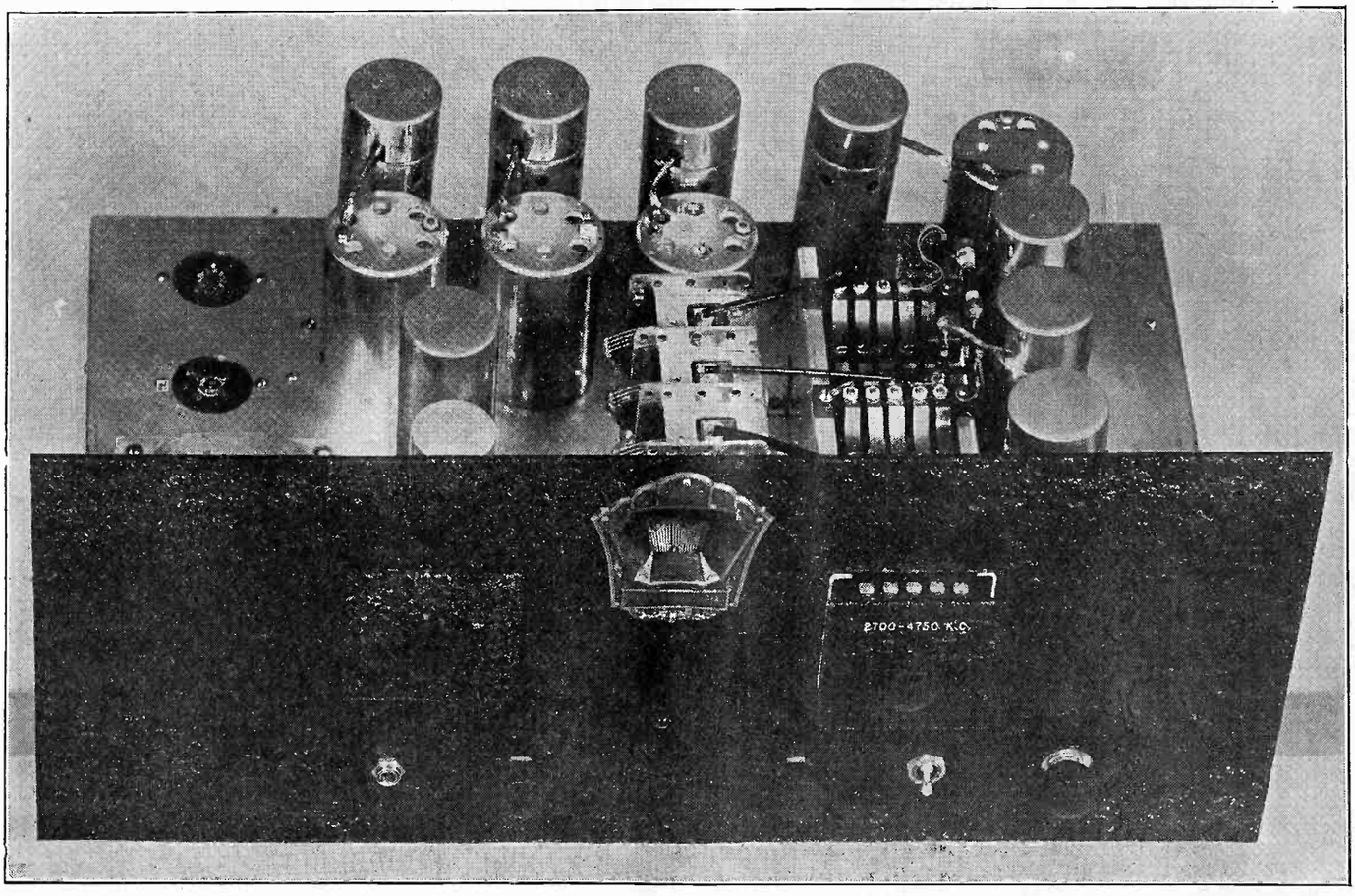
REG. U.S. PAT. OFF.

The First and Only National Radio Weekly

Twelfth Year *592d Consecutive Issue*

NEW TUBE HAS TRIODE AND PENTODE COMPLETELY ISOLATED BUT IN ONE ENVELOPE

A SLICK SHORT-WAVE SET



View of a highly sensitive short-wave superheterodyne, using plug-in coils, with the three coils for each range in one copper shield, operated as a drawer. Band-spreading for amateurs is included. There are nine tubes. See page 3.

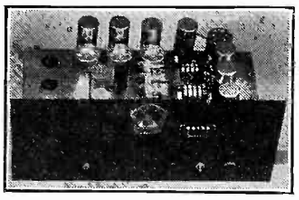
RELIABLE CONSTANTS for REGENERATIVE SHORT-WAVE SET

SINGLE MANUALLY TUNED CIRCUIT FOR SHORT WAVES

VERY SENSITIVE 6-TUBE SUPER FOR BROADCASTS

VARIOUS USES FOR THE NEW 53 TUBE

THE "MULTIFORMER"



A SHORT WAVE laboratory precision unit, now available for the first time through POSTAL, for the experimenter and "Ham" and used in the INTERNATIONAL SHORT WAVE RECEIVER, described in this issue.

In the MULTIFORMER we have three inductors, R.F. Detector and oscillator circuits which are simultaneously changed in a single operation from the front panel, and by a half-inch movement of the MULTIFORMER band spread is instantaneously provided over a 65 degrees spread on all four amateur bands.

You may now build at a nominal price, the finest short wave A.C. superheterodyne receiver, up to now obtainable only for commercial Short Wave communication.

The complete MULTIFORMER consisting of three coils individually shielded in a copper container, adjusted with proper kilocycle engraving on front panel, available in any one of the four bands with diagram of complete receiver. Price each.. **$4.95**

The especially designed socket to accept all range MULTIFORMERS, equipped with positive action phosphor bronze contacts. Price **$2.25**

Three gang 140 M.M.F.D. tuning condenser designed to match MULTIFORMER. Price..... **$2.25**

Complete International Short Wave Receiver

A 9-tube Professional Short Wave A.C. Superheterodyne receiver designed to cover from 15 to 200 meters with bandspread feature included and consisting of a high frequency R.F. amplifier stage, a high sensitivity first detector, electron coupled high frequency oscillator, two stages I.F. amplification tuned to 465 kilocycles, 2nd detector and audio beat oscillator for C.W. reception on a 2A5 output tube and 280 rectifier. GUARANTEED TO OUTPERFORM ANY SUPERHETERODYNE SHORT WAVE RECEIVER, now offered to the public, operating under similar conditions. We invite competitive tests.

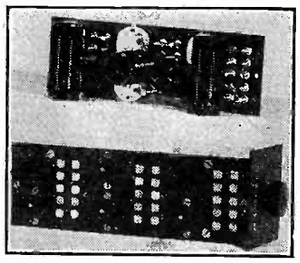
The International Short Wave Receiver as described in this issue, in kit form, consisting of all necessary parts including power supply, front panel and MULTIFORMER for any band with simplified constructional diagram and instructions..... $41.50

The above kit, laboratory wired, tested and adjusted..... 49.50

Complete set of 9 matched Arcturus tubes..... 6.75

One Rola Dynamic Speaker, to match Receiver..... 5.50

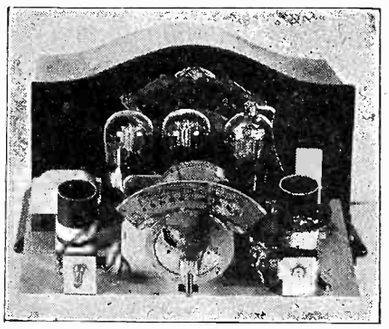
Complete set on demonstration. Carries Postal Guarantee. Individual parts of the International set available separately. Write for prices. Tested and approved by RADIO WORLD.



POSTAL RADIO CORP.

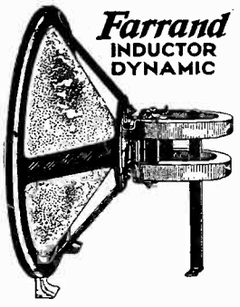
135 Liberty Street New York City

4 STAR SPECIAL



DETROLA Self-Powered Short Wave Converter

Foreign reception guaranteed. Working on all types of sets. As described in June 3rd issue Radio World. Complete with tubes..... **$8.95**



SPEAKER Chassis

12-inch Double Magnet, Works on Battery and Electric Sets

Will equal the tone of any high price Dynamic Speaker. In original Sealed Cartons. Formerly listed at $35.00... **$2.95**

AUDIOLA 2-TUBE SHORT WAVE CONVERTER

Chassis. 15-200 Meters. Can be attached to any AC operated set. Brings in Foreign Stations, Police Calls, Amateur Talks, Ship-to-Ship Conversations, and many other thrills. Employs '27 and '24 tubes (less tubes) **$3.95**

BRONSWICK 5-Tube AC.DC. Midget Set with Dynamic Speaker. Using the latest tubes, 1-'77, 2-'78, 1-'43, 1-25Z5,

EXCELLENT TONE
VERY SELECTIVE

EXTRA SPECIAL

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NEW YORK CITY

NO MORE CALCULATING OF INDUCTAI :E!

Get your answers accurately from curves in the only book of its kind in the world, "The Inductance Authority," by Edward M. Shiepe, B.S., M.E.E. Two charts, one in the book, the other (18x20 inches) as a supplement, relate inductance, capacity and frequency, the large one from ultra to audio frequencies. Thirty-five charts, with 13 curves on each, cover the numbers of turns and inductive results for solenoids, for 35 wire sizes and insulation types. Wire sizes are Nos. 14, 16, 18, 20, 22, 24, 26, 28, 30, 31 and 32. Insulations: single silk, double silk—single cotton, double cotton and enamel. Form diameters: ¾, ⅞, 1, 1⅛, 1⅜, 1½, 1¾, 2, 2¼, 2½, 2¾ and 3 inches. Pages 9x12, printed on one side only. Price, $2.00 postpaid, including supplement.

RADIO WORLD

145 WEST 45TH ST., NEW YORK CITY

ANDERSON'S AUTO SET

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.

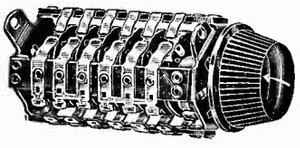
The complete parts, including set chassis and set shield, battery box, remote control, battery cable, all condensers, resistors and coils, speaker with shielded cable; and a kit of RCA tubes (two 239, two 236, two 237, one 89, and one 85) are supplied less aerial. Cat. 898-K @.....$34.60

Wired model, licensed by RCA, with complete equipment, less aerial, but including RCA tubes. Cat. 898-W $37.40

Hennessy Radio Pubs. Corp.

143 West 45th St. N. Y. City

DUAL-RANGE SWITCHES



Wiping contact switches that improve with use and have an exceedingly low contact resistance enhance performance in the police-television-amateur bands without disturbing the line-up of the broadcast band.

The switches are sturdy, compact, smooth and dependable. The frame is insulated from the switch connections, so the switch may be used to slide condenser stator from one extreme of coil to a tap on the coil, or to short out part of the coil without changing condenser stator connection. The mounting hole is to be 5/16 inch diameter, with 8/32 hole ½ inch away, to engage a small flange that prevents slippage. Two extra holes on a fixed bracket permit additional anchorage to front and possibly rear flaps of chassis.

Type A is for governing three tuned circuits (triple pole, double throw) and besides there is a single pole single throw extra section for shorting and padding condenser or antenna series condenser. Entire switch encompassed by 2-inch diameter. Length, 5 inches; shaft, ¼ inch, 1" long. Used in 9-Tube Diamond. Cat. EBS-A at $1.49.

Type B is for governing four tuned circuits and substituting one padding condenser for another (five pole, double throw). The switch is 9 inches long. Used in the 12-Tube Diamond. Cat. EBS-B at $2.49.

We selected these switches because we deem them the best ones made, in the stated price range, and because they make excellent and definite contact and afford long service. The illustration reveals the general type of construction.

Hennessy Radio Pubs. Corp.

143 West 45th Street New York, N. Y.

CHARACTERISTICS CHART

All the receiver tubes, and some others, under the following groups: Detectors and Amplifiers, Power Amplifiers, Rectifiers, Phototubes. Regulators. Two full pages, also page of descriptive text. In Radio World of April 1, 1933. 15c a copy, or send $1.00 for trial subscription of 8 weeks, including April 1. Radio World, 145 W. 45th St., New York City.

LOOK AT YOUR WRAPPER

You will see by the date thereon when your subsription for Radio World expires. If the subscription is about to run out, please send us renewal so that you will not miss any copies. Subscription Department, RADIO WORLD, 145 West 45th St., N. Y. City.

WAFER SOCKETS

6/32 mounting holes, 1-11/16 inches apart; central socket hole recommended, 1⅜ inches, although 1¼ inches may be used.

UX, with insulator.....10c
UY, with insulator.....10c
Six-pin, with insulator.....11c
Seven-pin, with insulator.....12c

HENNESSY RADIO PUBS. CORP.

145 WEST 45th STREET, N. Y. CITY

BOOKS AT A PRICE

"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. Per copy. (Cat. AB-SH), postpaid..50c

"Foothold on Radio," by Anderson and Bernard. A simple and elementary exposition of how broadcasting is conducted, with some receiver circuits and an explanation of their functioning. (Cat. AB-FH), postpaid 25c

HENNESSY RADIO PUBS. CORP.

143 West 45th St. New York City

PUSH-PULL SUPER DIAMOND: Construction and trouble-shooting article and double-page picture diagram. In Radio World of March 18, 1933. 15c a copy. Radio World, 145 W. 45th St., New York City.

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Drawer Type Plug-in Coils in THE INTERNATIONAL S-W SET

By Samuel Miller

Postal Radio Corporation

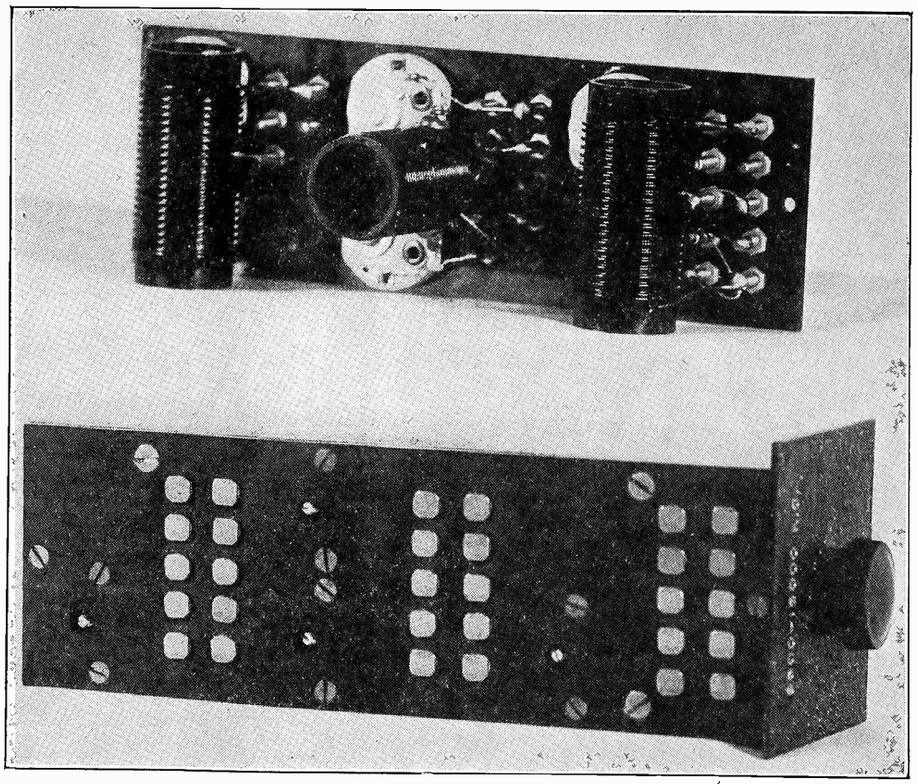
THE drawer type of plug-in coils, three coils plugged in simultaneously, with a small movement of the drawer inward for band-spreading for the amateur bands, provides an effective and handy means of accomplishing an otherwise awkward task. When one has to lift lids and plug coils in from the top, or reach behind a console to attempt to get to a socket near the front panel for plugging in only one coil (much less three coils), the task is fearful. Yet the convenience of a method that lends itself to console installations would be meaningless were not the performance on an exceptionally high level.

The front cover illustration shows the appearance of the front panel with the drawer slid out just enough for amateur band spread. If the drawer is pushed all the way home amateur band spread results.

How the Coils Work

A better idea of how the drawer type coils work may be gleaned from the views of top and bottom. At top are two coils in the same axial position, the third or center coil at right angles to them. Beside the central coil are seen two of the three condensers that are set at the factory for bandspread results. The spreading is accomplished by paralleling the capacity of the tuning condenser by an experimentally-determined amount, to reduce the capacity ratio, maximum to minimum, hence reduce the frequency coverage, or spread the band. The amateur bands are spread out over approximately 65 degrees of the dial.

The bottom view of the coil drawer shows three pairs of rows, each row consisting of five tabs, or ten tabs for a pair of rows. Each grouped ten represents the terminals of a coil-condenser system for a stage, as there are three stages to consider: radio-frequency amplifier, modulator and oscillator. Actually, fewer tabs take care of the coils proper, the extra ones representing the effect of switching in the parallel condensers for bandspread.

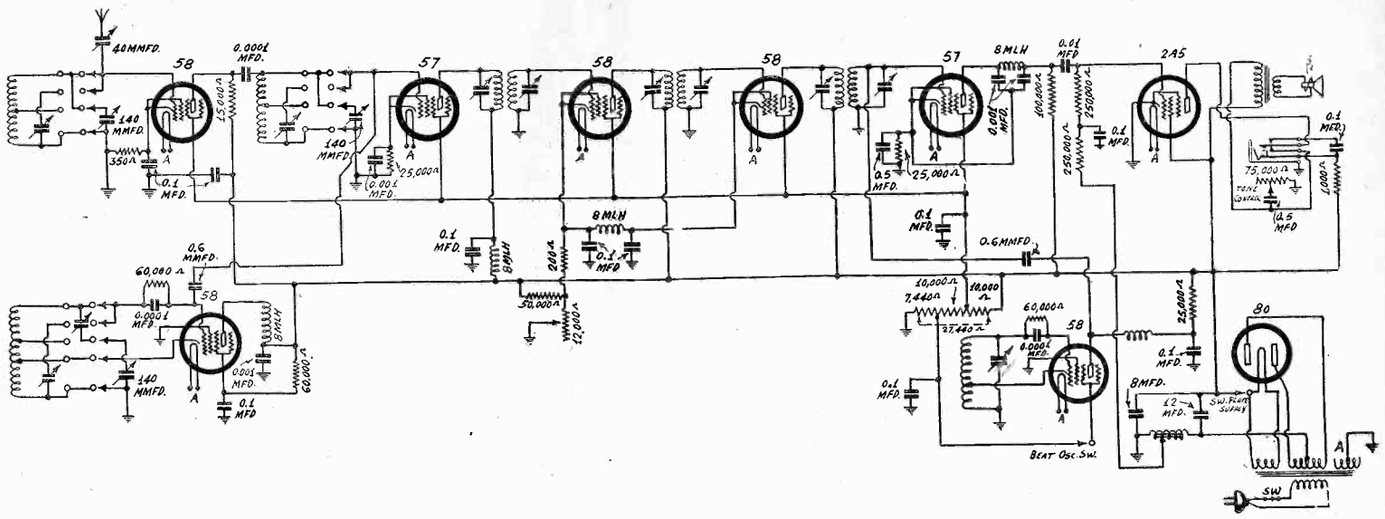


Top and bottom views of the drawer-type copper-shielded plug-in coils. By a half-inch movement outward contacts are made with a bandspread application. Each group of three coils takes care of three tuned circuits: radio-frequency amplifier, modulator and oscillator. There are four groups, or drawers, to cover the short-wave bands.

The knob at front of the drawer is for pushing and pulling, and not for turning. It can be observed that three coils represent one general band of tuning, and

(*Continued on next page*)

Images Rejected by this Short-Wave Set



Completely stabilized, this nine-tube short-wave receiver affords high gain, and at the same time simplifies the use of plug-in coils by adoption of the drawer-type of construction. The coupling between local oscillator and modulator is very loose, as is that between the beat oscillator and the second detector. Care must be exercised to have the beat oscillator couple exclusively to the second detector, and not to a preceding intermediate stage, otherwise this oscillation will be amplified, overload the second detector, and greatly reduce signal strength.

(*Continued from preceding page*)

since from 1,540 kc to 15,000 kc may be covered, there are four such coil combinations available.

Kinks Removed from Circuit

The commercial name for this drawer-coil system is the Multiformer, and it is being used now in an International nine-tube short-wave receiver designed by the author. Although special pains were taken with the coil system, and not only a workmanlike result attained but one that is sturdy and attractive, with copper shielding carefully included, the circuit itself was produced only after the kinks had been fully removed. Short-wave users in particular know what that means.

It was not deemed sufficient merely to have a receiver that was something nearly as good as sets that cost a great deal more, nor was any attempt made to meet the bargain requirements of competitors offering practically unworkable short-wave apparatus, but the goal was set at the needs and exactions of the professional user. In communication work an excellent set must be used, one that is completely dependable, and so this receiver got its first taste of popularity in the hands of the most discriminating and exacting users of short-wave apparatus.

Amateurs Like the Set

Among these, of course, were the amateurs, for they were attracted by the bandspread features, plus the high sensitivity, and full attainment of their desires. One of the factors that led them to like the set was the absence of image frequency interference, accomplished by using a stage of tuned r-f amplification ahead of the modulator. The intermediate frequency is 465 kc, and yet no matter what the intermediate frequency may be, there would be interference due to images and other causes, without this t-r-f stage, well worth including.

The ease of changing coils was another important point, as the work could be done swiftly from the front panel, and it was found that calibrations once accurately recorded could be relied on, because the whole circuit was so arranged that there was relative freedom from frequency shifting and drifting.

Beat Note Oscillator

Still another consideration was the inclusion of a beat note oscillator. This is necessary for clear reception of continuous waves.

The receiver therefore has two oscillators, of which the first is the local oscillator, used in conjunction with the frequency-changing, at the "front ends", and the other is the beat oscillator, loosely coupled to the second detector, and affording a note of a few thousand cycles.

The switch that controls the off and on positions of the beat goes to the plate supply through a voltage divider. Therefore the beat oscillator tube is going all the while, so far as heater is concerned, but the B voltage is off and when the switch is off. The moment the beat oscillator service is desired, a throw of the switch produces the note. One does not have to wait for the tube to heat up. Especially do not amateurs desire to wait, and most especially professional operators simply cannot afford to wait. The tube life is not used up when the B voltage is off, as simply a resistor (the heater) is drawing current.

Tuning Adjunct

Of course the beat oscillator may be used also as a tuning adjunct, since a beat is heard every time the front end comes across a carrier. Thus carrier location is simplified and even the relative intensity of the carrier may be approximately judged. The switch may be thown to off position so soon as the carrier is located, and the final tuning adjustments and volume level attained by the usual means.

Looking at the circuit diagram, we find that there is a variable condenser in series with the aerial. This serves several purposes. First, it limits the antenna capacity as effective on the coil to less than the capacity of the series condenser. This makes tracking simpler, but not perfect, since any aerial introduces tracking problems, due to dissimilarity between the input circuit and some succeeding one. However, by making this condenser adjustable, and manually accessible, it becomes a front-panel control for absolutely correct tracking of the modulator, at least, while the oscillator itself is made to come right up to snuff by a tiny padding system.

The first tube, or r-f amplifier, is a 58, the oscillator is a grid current type, also using a 58, while the modulator, or first detector, is a 57. It is true that a 58 may be used in this position, also, but the sensitivity will not be quite so high as if the 57 were used.

Bias for Volume Control

Bias on the two 58 intermediate amplifier tubes is altered for volume control, and to prevent the intermediate amplifier from oscillating, which it otherwise would do almost uncontrollably, the plate current of the 57 is filtered through an r-f choke and a condenser, and the signal is removed from the cathode circuits of the two i-f tubes, in one case through a pi-filter, consisting of an r-f choke and two condensers, and in the other case the second of these condensers, bypassing the biasing resistor. The first i-f tube therefore does not couple strayly either backward or forward. The filtration of the second i-f tube is in the cathode leg, and this proved very effective, probably because that leg is in the plate circuit, of course, but also is common to the grid circuit.

The second detector tube also is a 57, and this feeds directly into a 2A5, the most sensitive power tube so far. With the 58 beat oscillator and the 80 rectifier, full account is made of the nine tubes included in this dependable short-wave receiver.

High Goal Set

I stress the dependability because there is a flurry in the short-wave set and kit market right now, and so much junk is being put forward that customers must be assumed to have abundant confidence

(*Continued on next page*)

LIST OF PARTS

One—Postal Multiformer (band desired to cover)
One—Special Postal socket, for Multiformer
One—3 gang 140 mmfd Postal condenser
One—40 mmfd. Ant. comp. condenser
Three—465 K.C. I.F. transformers
One—Audio beat oscillator coil 456 K.C.
One—Power transformer, to handle 9 tubes
One—12 mfd. condenser 450 volt working v.
One—8 mfd. condenser 450 v. working v.
One—12,000 ohm. volume control and switch
One—75,000 ohm tone control.
One—Single circuit jack, with single pole double throw switch.
One—Toggle switch for "B" supply
One—Rotor switch for audio beat oscillator.
One—dial and front plate
Five—58 sockets
Two—57 sockets
One—2A5 socket
One—280 socket
One—Speaker 5 prong socket
Five—8 millihenry R.F. chokes
One—Ant. Gnd. binding post.
Eight—.1 mfd. tubular condensers
One—.05 mfd. tubular condenser
One—.01 mfd. tubular condenser
Four—.001 mica fixed condensers
Three—.0001 mica fixed condensers
One—.0000006 mmfd. condenser
One—25 watt wire wound resistor 27,440 ohm, tapped 10,000 ohm. 10,000 ohm. and 7,440 ohm.
One—10 watt wire wound resistor 1,000 ohm
Two—60,000 ohm. 1/3 watt pigtail resistors
One—15,000 ohm. 1 watt pigtail resistor
One—60,000 ohm. 1 watt pigtail resistor
Three—25,000 ohm. 1 watt pigtail resistors
Two—250,000 ohm. 1 watt pigtail resistors
One—350 ohm. 1 watt pigtail resistor
One—200 ohm. 1 watt pigtail resistor
One 1,000,000 ohm. 1 watt pigtail resistor.
One—Cord and plug.
One—Chassis 11" x 19" x 3"
One—Steel front Panel 9¼" x 20½"
Six—Knobs

FORUM

Editor, RADIO WORLD:

I HAVE ALWAYS thought you have not stressed quality amplifiers sufficiently and believe this will be a very interesting field for you to edit. Most any kind of a tuner will pick up a large number of stations nowadays, but the main point is, how do they sound after you get them? Perfection has been by no means obtained yet through the speaker grille and probably never will be, but there certainly is great room for improvement.

For some years I have used a pair of 250's in push-pull and an auditorium speaker. The theorist would say that this is wholly sufficient for a hall seating 5,000 persons and I presume that each one of those 5,000 could understand speech from this kind of out put, nevertheless it is none too much whatever for the good reproduction of band music and some of the lower instruments, such as a bass drum and bass fiddle right in the living room.

No amplifier should be run to capacity if distortion is to be avoided and I find that there is no excess power in the 250's for good reproduction of orchestra and band music for good living room volume.

I would like to see some articles in your magazine on amplifiers and speakers and the acoustics relative to them with the end in view of obtaining more nearly perfect reproduction.

High-mu power tubes do not rate highly with me, as my experience has been that the higher the mu of the power tube, the greater the percentage of distortion which it delivers. The 47 was the first high-mu power tube and I gave it quite exhaustive tests when it first came out, under the best conditions, and have never yet been able to obtain the tone from it that I could from the 45. This fact has since been admitted by a number of our manufacturers.

The only good purpose of any high-mu power tube is to eliminate the expense of building another stage of audio or in case of an automobile receiver it does permit of a greater output with less current drain and where the power supply is limited its use might be justified. However for the parlor console where real tone is desired, and where adequate power supply and space are readily available, let's have the best there is regardless of how many tubes it takes or what kind they may be or how many filters and other devices may be necessary to obtain the desired end.

M. A. CHALKER
1316 Mahoning Bank Building,
Youngstown, O.

Blan Welcomed Back After an Operation

Michael Blan (Blan the Radio Man) of New York City has returned to his store after several weeks in a hospital, where he underwent an operation. Many of his large following were quite anxious about Blan, as he has built up a host of radio friends during the past ten years or so, and his return was greatly welcomed.

MILLER'S NINE-TUBE SET

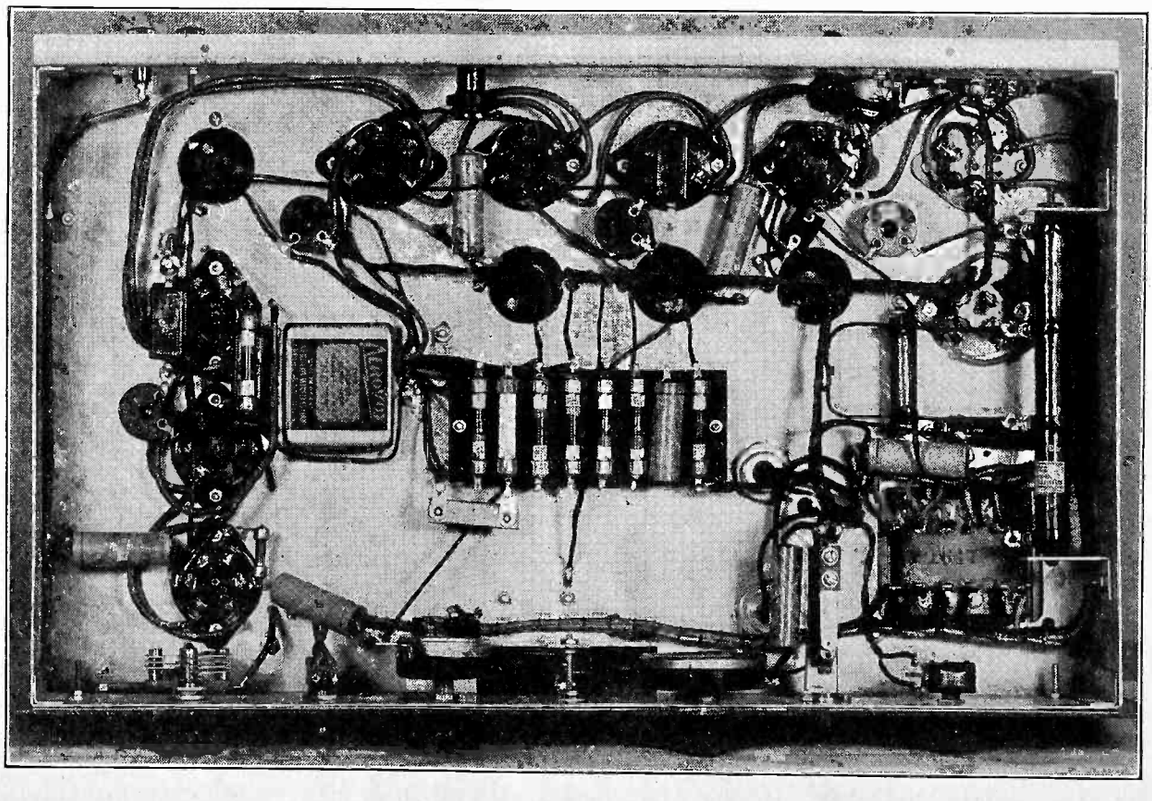
(*Continued from preceding page*)

that unlikely circuits will work wonders simply because they do not cost anything.

However, it is assumed that short-wave set users want dependable reception of foreign stations, that some of them are amateurs and want their bands when and how they want them, and that still others are professional users who must have the highest type of performance.

When the entire situation is canvassed it is found that the set that fulfills the requirements of the professional also meets the demands of the amateur and the fan who seeks European, Asiatic and other such reception and will even get up at 4 in the morning to try for it, or stay up until 4, whichever way you prefer your punishment.

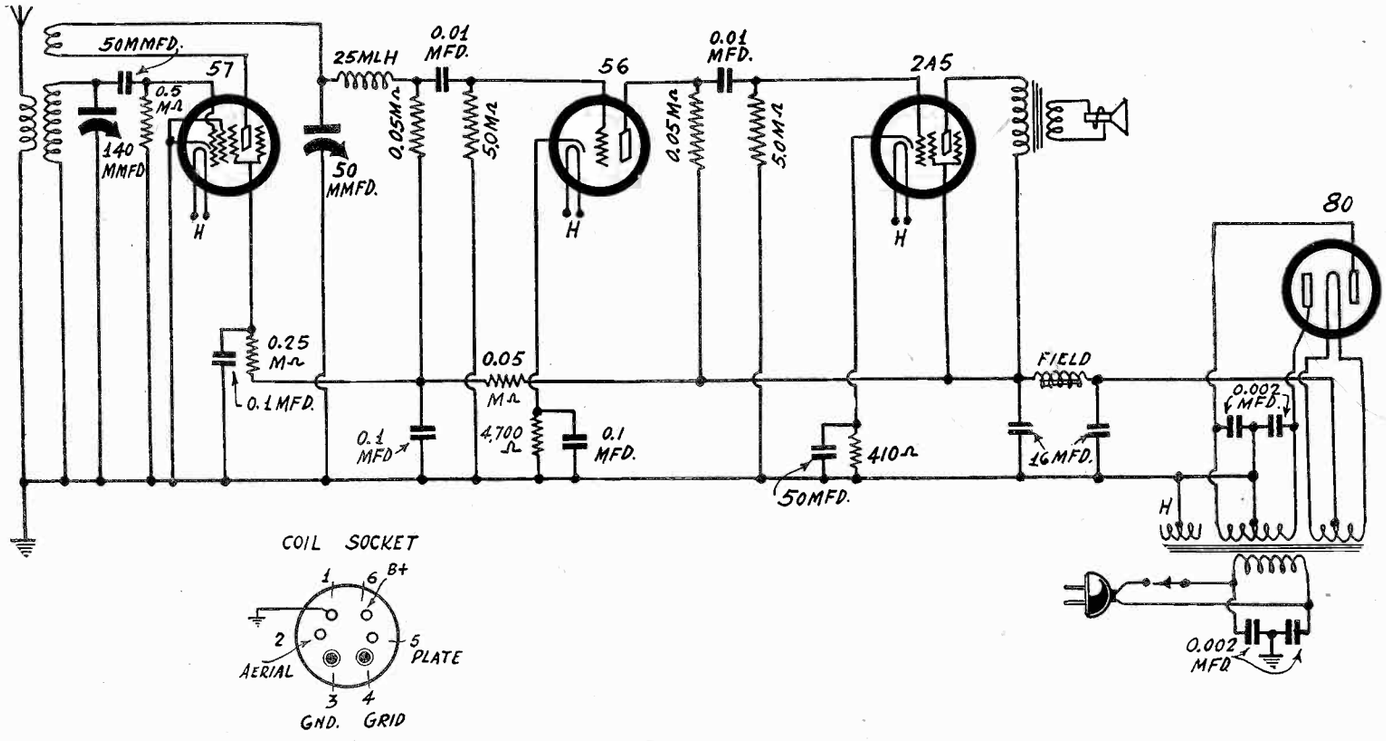
And it can be said truthfully that the present receiver, though it doesn't cost much at that, ranks with the best, and in some respects is superior to sets costing more than four times as much. Now, think of that!



Bottom view of the chassis, showing the neat construction and excellent distribution of parts. Although quite a number of parts is necessarily used, the layout avoids cramping and otherwise objectionable arrangement that would result in back-coupling.

THE TRADITIONAL SHORT-WAVE ONE-TUBE TUNER WITH VERIFIED CONSTANTS and Two Stages of Audio, for Speaker Operation

By Herman Bernard



A four-tube short-wave set, using a single plug-in coil for each band, and covering four bands, from about 1,500 kc to about 30,000 kc. The constants have been determined experimentally to enable ready construction of this approved and long-distance standing circuit. The bottom view of the coil socket or form is shown, with circuit connections designated.

AS a part of the experimental work in developing the short-wave reception system that reduces the carrier at once to an audio frequency, then modulates an oscillation at a lower frequency and amplifies that oscillation and detects it, a standard short-wave set was built as diagrammed. The data are given so that any who desire to build a very simple but still a good short-wave set, using four tubes, to operate a speaker, may do so.

Everything is orthodox, and the only choice of constants for use of the particular tubes in the receiver comprises any additional information to those familiar with short-wave set construction.

It should not be surprising to any that exactly the same hookup, with somewhat different, and, one might say, erroneous constants, produced miserable results. By the cut and try method the stated values were arrived at, and the results were satisfactory, especially as there was reception even on the coil with the smallest inductance. This is the coil that "plays dead" in so many short-wave sets, whether using plug-in coils or switching. The present circuit relates to the plug-in variety.

Audio Howl Eliminated

That nasty audio howl present in short-wave sets unless a corrective is introduced was eliminated entirely by proper proportioning of maximum oscillation. Besides, it was pretty definitely settled that the howl is due to saturation of the tube. Therefore the number of tickler turns was reduced. In the case of the commercial type coils used the number of turns was cut in half. This type has three windings. The obvious one is the secondary. The winding that is put on between the spaced turns of the secondary is the tickler. The winding removed 3/16-inch from the two others, and not interwound, is the primary. It was the interwound, light-colored wire whose number of turns was halved. The same hole in the coil form was used to bring the wire altered terminal of this winding through the inside of the coil form to the base pin for soldering.

To make the removal handy it is advisable to get a sharp pocket knife, and cut the wire where it enters the upper hole. That leaves a large amount of wire for threading, and makes the work a simple task of five minutes, because of the handy leeway with the extra length of wire. Then half the number of tickler turns is unwound for each of three plug-in coils, one coil completed at a time.

Smallest Coil Unmolested

The entire work consists merely of unsoldering the existing wire connection at the base pin, after the cutting has been done as explained, unwinding half, and passing the whole excess length through the old hole in the coil form, inside the form to the pin, scraping off the insulation from the wire, resoldering, and snipping off the excess wire that now protudes from the pin.

The smallest inductance coil is not molested.

Even when the connection is made on the three coils the feedback capacity does not have to be large. The commercial rating of the Hammarlund star condenser used is 50 mmfd. This condenser had seven plates. It is a small one and is mounted on the chassis. Since the chassis is assumed to be metal, and grounded, only the stator side of the condenser need be additionally connected, and goes to return of the feedback coil. Any who desire to eliminate the danger of shorting the B voltage if the opposite plates of the feedback condenser touch may put a large mica fixed condenser between the stator lug of the feedback condenser and the return of the feedback coil or tickler. (0.006 mfd. up.)

The R-F Choke Coil

It was found that on all coils there was "action," and that the proportion of inductance and capacity was thus right. To insure best operation the coil marked 25 mlh., which is a radio-frequency choke, had better be a honeycomb, as then the distributed capacity is low. However, any honeycomb of small physical size, comprising 800 turns or more, may be used. The one put into the set had 1,300 turns, tapped at 500 turns, but the tap was not used, only the extremes, and it made no difference which extreme went to return of the tickler and which to the plate resistor.

The choice of the plate resistor is important, and so in fact is that of the screen resistor. It is necessary to have the plate resistor low enough to insure oscillation, unless the effective B voltage is to be extraordinarily high for such a detector. Then, again, the high B voltage introduces that squawk. As built finally, the set did not spill over with any howl whatsoever, and the passing of the point just below oscilla-

LIST OF PARTS

Coils

One set of four six-pin plug-in coils as described.
One power transformer.
One 25-millihenry radio-frequency choke (honeycomb).

Condensers

One 0.00014 mfd. Hammarlund midline junior condenser (brass plates).
One 0.0005 mfd, grid condenser.
One 50 mmfd. Hammarlund star condenser (aluminum plates).
Three 0.1 mfd. bypass condensers.
Two 0.01 mfd. stopping condensers (mica).
Four 0.002 mfd. fixed condensers (mica).
Four 8 mfd. electrolytic condensers, inverted mounting type.
One 50 mfd. electrolytic condenser, 30 volt rating.

Resistors

Four 0.05-meg. (50,000-ohm) pigtail resistors.
Two 5.0-meg. (5,000,000-ohm) pigtail resistor.
One 0.25-meg. (250,000-ohm) pigtail resistor.
One 4,700-ohm pigtail resistor.
One 410-ohm, 2-watt, wire-wound pigtail resistor.

Other Requirements

One chassis.
One vernier dial.
One a-c shaft-type switch.
Three six-hole sockets, one five-hole socket (UY) and one four-hole socket (UX). The extra six-hole socket is for coil receptacle.
Two tube shields with bases (for 57 and 56).
Antenna-ground binding post assembly.
One dynamic speaker, with d-c field coil, any ohmage, 1,800 to 3,000 ohm.
One a-c cable and plug.
One 57, one 56, one 2A5 and one 80 tubes.

tion was marked by a gentle plop that was very agreeable to experience. It only goes to show that fringe howl can be cured with proper constants, and these constants relate to the necessity of proper operation in the circuit at hand, and require ignoring more formal recommendations for other or different use of the 57 tube.

Regeneration Is Vital

For instance 0.25 meg, is the usual recommendation for the plate load resistor, yet this value is not satisfactory in the present circuit. Where negative fixed bias detection is used, and no regeneration, the 0.25 meg. value produces better results, but here everything, or almost everything, depends on proper regeneration, so 0.05 meg. (50,000 ohms), which supplied this need, was selected.

Another precaution to take is that the effective screen voltage be lower than the effective plate voltage. Since the screen limiting resistor is returned to the same point as is the plate load resistor, and since the currents are proportioned about 3 to 1 while the resistors are proportioned 1 to 5, the screen voltage always will be lower than the plate voltage. This also makes for better quality of detection, besides avoiding the possibility of a chance dynatron oscillator.

Tunable Hum Absent

Suppose the plate current is 1 ma and the voltage fed is 100 volts. Then 50 volts will be dropped through the plate load resistor, an effective plate voltage of 50 volts remaining. Suppose the screen current is 0.33 ma. Then the voltage drop in the 0.25 meg. (250,000-ohm) limiting resistor is 82.5 volts, and the effective screen voltage is 17.5 volts. So the effective plate voltage is about three times as great as the effective screen voltage.

While the circuit will work well without the additional 0.05 meg. resistor that limits the voltage common to the plate load and the screen voltage-reducer to 100 volts, smoother action obtains when it is included. Besides, hum is less, in fact, so low as to be unobjectionable, and there is no tunable hum, either. This is due partly to the filter action of the resistor and the 0.1 mfd. condenser that bypasses the low-voltage side of the 0.05-meg. resistor to ground. The same cause is aided by the 0.002 mfd, condensers in the power transformer primary and power transformer high-voltage secondary circuits.

The 57 detector tube feeds a 56 and this drives a 2A5, so there is enough amplification for loudspeaker signals for most stations received. However, this is only a four-tube set, and while it is sensitive and selective, it does not produce sufficient volume to "fill a room" on foreign reception, though by moving up to only a few feet from the speaker the signals may be heard. At least, that was the writer's experience in a location not particularly good for short-wave reception. Others no doubt will fare better. Besides, there is nothing like telling the truth, even about a short-wave set.

The negative bias on the 56 is maintained high enough to prevent the flow of grid current, but this is not always possible in the succeeding stage, so while the grid leak in the last audio stage is shown also as 5.0 meg., a meter should be put in the plate circuit of this tube as a test, to be sure the plate current does not much exceed 40 milliamperes on strong signals. If it does not, the 5.0 meg, may be left in this stage, as it would be left anyway in the preceding stage. To reduce grid current, or its effect, reduce the leak value, although volume then declines a bit also.

Motorboating

The only disturbing trouble that may be experienced is an audio howl, ever-present, and this would be due to excess of a-f regeneration. Since there will be some such regeneration, the bypass condenser across the biasing resistor of the 56 is shown as only 0.1 mfd., but if the howl is present, either this condenser may be omitted entirely, or a condenser of 0.002 mfd, put from 56 plate to ground.

The 50 mfd, acts the same way, that is, toward increase of audio regeneration, but volume is much higher when this condenser is present, so the other remedies are advised, rather than omission of, or reduction of capacity of, the 50 mfd. condenser. This condenser is of the electrolytic type, by the way, and smaller in physical size than the 8 mfd.

The filtration of the B supply is accomplished with the field of any dynamic speaker. The d-c resistance of the field is of scant importance, so speakers of 1,800 to 3,000 ohms total may be used, and any tap on the field coil ignored. The 16 mfd. condensers really are two 8 mfd., thus accounting for a total of four 8 mfd. These may come two 8 mfd. in one container, or four separate containers.

"Boiling" of Electrolytics

If there is any "boiling" when the set is turned on it is due to the starting B voltage exceeding the voltage at which the electrolytics had been formed, at least the condensers next to the rectifier. To get around this, either a bleeder resistor is introduced, from the fully-filtered B plus lead (say, between 2A5 screen and ground), of around 15,000 ohms, 25 watts, or a series resistor put between the rectifier filament and the field coil, of around 10,000 to 15,000 ohms, 5 watts. Since the 2A5 tube does not draw much plate current at the start, there being little cathode emission at first, this boiling condition might exist when that tube is used, although not present when the filament type tube is used, e.g., 47.

Of course another remedy is to use condensers, next to the rectifier particularly, that have adequate breakdown voltage, say, 500 volts.

The tubes may not well be substituted, except that a 47 may be used instead of the 2A5 with a bit more resultant hum, and the rectifier may be a 5Z3 or an 83. If the rectifier filament winding of the power transformer is not center-tapped, use either leg for take-off of the B supply. If the 2.5-volt winding is not center-tapped, use a center-tapped resistor across it, 10 to 30 ohms, center to B minus (ground).

If the transformer has two 2.5-volt windings, use the one that stands the greater current for the 57 and 56 tubes, and the other for the 2A5, although there is small difference. The sum heater current of the 57 and 56 is 2 amperes and the single current of the 2A5 is 1.75 amperes.

There is a slight advantage in the separate 2.5-volt windings, as the 16.5-volt bias on the power tube is not then introduced as a voltage difference between cathode and heater of the 57 and the 56. The difference is not enough to warrant purchase of a new transformer if you already have one with single 2.5-volt winding.

Frequency Ranges

The receiver is not lacking in selectivity, even when a long aerial is used. For short-wave reception, excluding special antenna treatment, it is advisable in the interest of clear, loud signals to have a high, long aerial and a good ground. Even so, it is easy to pass over even semi-distant American stations. In the 49-meter band, for instance, short-wave program transmitters of or associated with, the Columbia Broadcasting System and the National Broadcasting Company, were easily skipped over, so careful tuning is required, and a dial with high vernier ratio is advisable, not less than 5 to 1 and preferably around 30 to 1, which is especially obtainable.

The tuning ratio with the Hammarlund 0.00014 mfd. condenser across the secondaries is about 2.3-to-1. So the frequency ranges would be approximately as follows:

Coil No. 1 1,500 to 3,450 kc.
Coil No. 2 3,450 to 7,935 kc.
Coil No. 3 7,935 to 23,800 kc.
Coil No 4 23,800 to 42,975 kc.

Make a Calibration

These are computed values, and not actual, but do give a good indication. The coils overlap a bit, and this has not been allowed for in the computation, so the highest frequency will become around 30,000 kc, or 10 meters. With the guidance given, and in conjunction with actual reception of stations of known frequency, the dial can be calibrated it will be found that, due to the fixed but loose antenna coupling, and the loose tickler coupling, the calibration will hold well for repeated reception. That is, the feedback condenser detunes the secondary only the least bit.

The coil data are as follows for 1 1/4-inch diameter:

Coil No. 1: Secondary, 50¾ turns of No. 30 single silk covered wire, space-wound; spacing equal to the diameter of the wire and insulation. Tickler, 11 turns of any fine insulated wire, wound in the space permitted in the secondary. Primary, separated 3/16 inch from secondary, 13 1/4 turns of No. 30 silk enamel wire.

Coil No. 2: Secondary, 22 1/4 turns of No. 22 single silk covered, space-wound; spacing equal to twice the diameter of the wire and insulation. Tickler, 6 3/4 turns of any fine insulated wire, wound in the space permitted in the secondary. Primary, separated 3/16-inch from the secondary, wound below it, near base pins, 8 1/8 turns of No. 30 silk enamel.

Coil No. 3: Secondary, 10 7/8 turns of No. 22 single silk wire, space-wound; spacing equal to three times the diameter of the wire and insulation. Tickler, 3 7/8 turns of any insulated wire, wound in space permitted in secondary. Primary separated 3/16-inch from secondary, 6 1-8 turns of No. 30 single silk wire.

Coil No 4: Secondary, 4 7/8 turns of No. 22 single silk wire, space-wound; spacing equal to 3/16-inch between turns. Tickler, 2 1/2 turns of any suitable insulated wire,

(*Continued on next page*)

CONSTANTS FOR NEW 6

SMOOTH REGENERATION CONTROL ATTAINED

By Herm

A ONE-TUBE regenerative short-wave tuner was built as detailed on the preceding two pages, and the constants in that part of the circuit were as shown, but when an intermediate amplifier was added, some of the constants had to be changed, to achieve smoothness and convenience in tuning, particularly regeneration control.

The circuit, as diagramed herewith, embodies the new idea of reducing the carrier at once to an audio frequency, setting up a local oscillator and modulating that oscillation with the audio, and feeding the oscillation through an intermediate amplifier tuned to the same frequency as the oscillator. Thus no repeat points are possible, no padding required, no tracking and no elaborate tuner system. The theory of such a circuit was published in last week's issue (July 22d).

Relationship of Constants

To get the tuner into smooth working condition it is necessary to have the proper relationship among inductances, voltages, capacities, resistances and aerial-ground. The first result was that regeneration was too ploppy. This was cured in part by reduction of the B voltage, until there were only 70 volts applied through the 50,000-ohm plate load resistor. The screen limiting resistor was 250,000 ohms, and in series with the high B voltage to the common 70-volt point was another 250,000-ohm resistor.

By making the connection to the maximum B feed in this way the voltage in the detector or first tuned circuit is maintained constant enough, no matter what normal differences in drain result in the rest of the circuit due to departure from specified constants, or to use of some differently-voltaged power transformer.

Smoothness of Control

Aside from the B voltage as a control for adjustment to proper regenerative action, the grid leak may be changed, lower values making for reduced regeneration, higher values for stronger regeneration. It must not be assumed that the stronger regeneration and consequent increased sensitivity are desired, for the main considerations are ease of operation and smoothness of control. These produce better results in the long run, because otherwise so many stations are missed for failure to put the feedback at the proper value, an attainment a ploppy circuit scarcely renders practical on weak signals.

The feedback capacity is 50 mmfd. at maximum, consisting of a Hammarlund Star condenser of seven plates. This is a small unit and is controlled from the front panel.

The other consideration is the tickler, but this topic was taken up in the article on the preceding two pages. The coils used are described in that article.

The coil problem consists largely in getting one coil to work properly, and then altering the number of tickler turns, or coupling between tickler and secondary, so that for each of the other plug-in coils the results are just as smooth. The coil data referred to bring about such a situation.

Four-Tube Set Tried First

It can be seen that the circuit is quite simple, as it consists of a regenerative detector, a local oscillator, an intermediate amplifier, a second detector, an audio amplifier and a rectifier.

Assuming that the rectifier, output tube and first detector circuit are constructed, intermediate and local oscillator not, the top of the grid leak at the 2A7 input may be carried over instead to the grid of the 2B7, for operation as a four-tube set. It is helpful then to have a little bias on the 2B7, so temporarily the 2B7 cathode may be connected to biasing resistor of the 2A7, especially as the 2A7 tube would be out of socket.

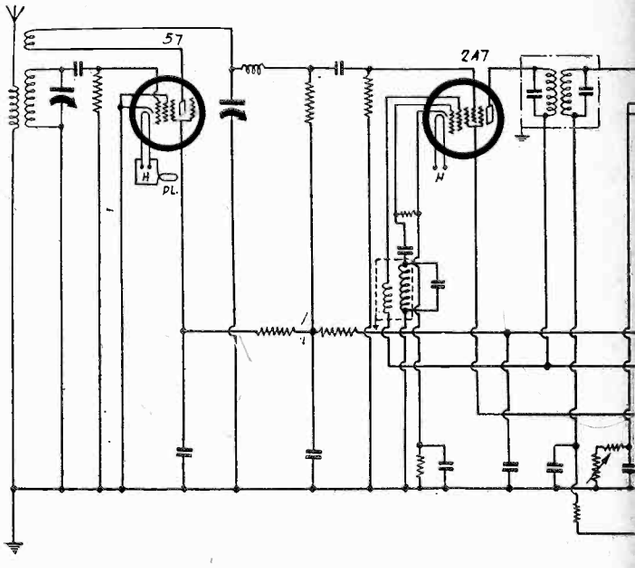
After the circuit is working well that way, and a note made mentally of the performance, the intermediate amplifier and oscillator may be hooked up. The oscillator coil may be a regular intermediate, which, if it has a doubly-tuned system, should have the condenser disconnected from the plate coil. While the circuit will oscillate without this removal, with only the grid circuit tuned it is easier to establish definite resonance.

Modulation Switch

A switch is shown, whereby the grid return may be moved from ground to H, where H represents either side of the heater of the 2A7. This switch may be on top of the chassis, as there is no need having it at the front panel. When thrown to H the switch causes the 60-cycle hum to be introduced into the oscillation, and thus a modulation is provided for audibility. The two intermediate transformers may be peaked on the basis of this built-in test oscillator. When the peaking is finished the switch is thrown to the grounded side and left thus.

Now the circuit may be tried out as a whole, and if ploppiness is present, whereas it was absent before from the regeneration control, the leak value may be reduced a little, which may be done by putting 5 meg. or so in parallel with it, or the screen limiting resistor may be increased a little, or a larger aerial used. If there is no regeneration, the aerial is too long.

The coils have been wound for a certain value of feedback, so once the regeneration is correctly set for one w it will be so for the other coils. Howev the values specified worked out well, a the remedies are reiterated only on assumption that some additional feedb will show up.



Constants are given for a short-wave set embody oscillator results when the switch in the 2A7 o

Instability Problems Elsewher

The problems concerning the set h to do principally with instability in intermediate and audio amplifiers.

It was found advisable to shield the millihenry r-f choke coil that enables 50 mmfd. condenser to act as a regene tion control, and also shield the sim

Small-Tickler Plug-

fo

(*Continued from preceding page*)

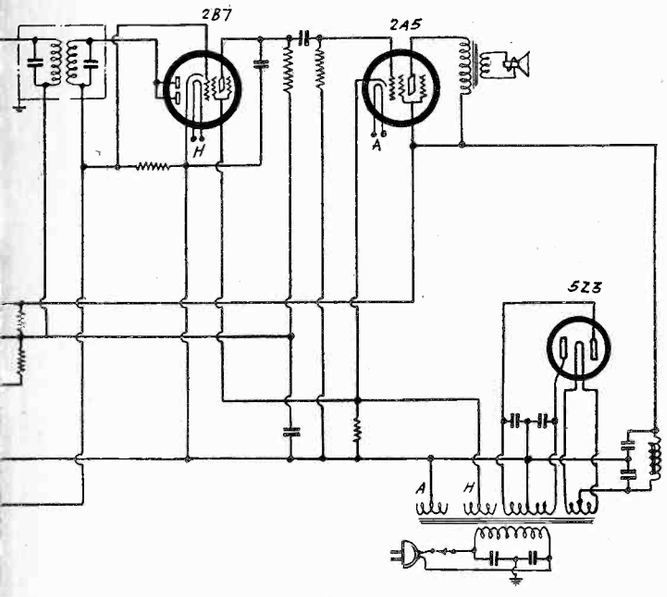
wound in space permitted by secondary. mary, 4 1/8 turns of No. 22 single wire.

Note: Coil No. 4 in commercial coils not have tickler reduced. The tick throughout are wound in the space perm by the secondaries, and the form is to drilled for passing the wire inside the f right at the wire terminals, if you your own forms and wind your own c In no instance, therefore, does the tic occupy as much winding space as the ondary. The separation between prim and secondary is 3/16-inch through The commercial coils have the follow termination, considering the bottom vie the coil pins, heaters toward you, the merical designations equalling those of standard pin code (RMA): top of secon

TUBE SHORT-WAVE SET

A SIMPLE DESIGN—TROUBLE-SHOOTING DATA

Bernard



new use of the superheterodyne principle. A test r grid return is connected to either side of heater.

hoke coil that is included in the lead to he control grid (cap) of the 2A7, which s intended to keep the tuner's radio requencies out of the audio circuit of the nixer. It can be seen that audio frequen-ies alone are put into the control grid, or that such is the intention, and experi-nce has taught that a little radio fre-quency will get by unless the extra choke s included in the 2A7 lead.

The first intermediate transformer hould be well removed from the oscilla-ion transformer, say, 6 inches, as all neans should be sought to prevent stray coupling

Electron coupling between the oscillation transformer and the first intermediate transformer, through the space stream of the 2A7, is indeed strong enough, and any augmentation would be dangerous.

The rectifier tube is shown as a 5Z3 only because the starting drain, due to the large filter capacity next to the left rectifier, may be high, but a 280 tube may be used, if you have it already, though its life may be shortened a little.

No statement has been made as to what the intermediate frequency is, because it may be almost anything, without affecting the operation, therefore handy frequencies are suggested, such as 175 kc 450 kc, 465 kc., etc., for which transformers are readily obtainable. In general, the intermediate frequency should be lower than the lowest broadcast frequency, but not too low (not 100 kc, for instance), because of possible trouble from harmonics of the local oscillator. For that reason, too, the local oscillator should be removed from the detector about as far as the first intermediate coil is from the oscillator.

However, if you can run into instability trouble, a resistor in the plate lead of the 2A7, about 2,000 ohms, and another in the plate lead of the 58, about 10,000 ohms, both bypassed by 0.1 mfd. or higher capacity, will help cure this.

The 2A7 Output is R.F.

The output of the 2A7 is exclusively radio frequency, but it is modulated by the audio put in from the 57. The coil in the 2A7 plate circuit is a short circuit to audio frequencies, but of course since modulation has been accomplished, the 2A7 output is a radio frequency carrier with an audio frequency envelope, that is, the carrier subjected to variation at an audio frequency, but it is still a radio frequency that is so varied. This point is stressed in answer to questions as to whether the audio wasn't short-circuited and performance rendered impossible.

The audio instability has to do with oscillation at a low frequency (motorboating) and oscillation at a high frequency (shrieking). Both these are audio frequencies. It was found necessary to use a low value of grid leak in the power tube circuit, so 250,000 ohms are specified, though less may be used if the trouble endures. This gets rid of motorboating. There was no shrieking if the usual bypass condenser was omitted from the biasing resistor of the 2A5, even though the cathode voltage of the 2A5 is used as the screen voltage of the 2B7. However, a fairly large bypass condenser would have to be included either across the

(*Continued on next page*)

oils

e with 0.00014 Mfd.

winding, near gripping flange, to grid con-denser, right-hand heater pin (4); other end of secondary, to ground, left-hand heater pin (3); beginning of primary, to aerial, nearer top of form, to what would be plate pin if the form were a tube, this being the pin next to left-hand heater (2); end of primary to ground, connecting to pin adjoining the one previously discussed (1); beginning of tickler, terminal nearer top of form, to B plus, connecting to what would be suppressor pin if form were a tube (6); remaining terminal to plate of the 57, being pin adjoining cathode. The direction has been clockwise, viewing the bottom of the form with the pins in sight, beginning with right-hand heater, which would be negative filament of a battery tube. All windings are in the same direc-tion.

LIST OF PARTS

Coils

One set of four plug-in coils as described
Two shielded 25-millihenry r-f choke coils
One oscillation transformer, to oscillate at intermediate frequency
Two intermediate frequency transformers
One dynamic speaker, for 2A5 output; field coil, 1,800 ohms or so; output transformer built in. (A speaker intended for the 47 tube may be used.)
One power transformer

Condensers

One 0.00014 mfd. tuning condenser
One 50 mmfd. feedback condenser
One 50 mmfd. fixed mica condenser for grid circuit of the 57
Four 0.01 mfd. mica fixed condensers
Three 0.002 mfd. mica fixed condensers
One 0.00025 mfd. fixed mica condenser for oscillator grid of the 2A7
Four 0.1 mfd. bypass condensers
One 0.5 mfd. bypass condenser
One 8 mfd. electrolytic condenser, 500 volts
Two 16 mfd. electrolytic condensers, 500 volts (may consist of four separate eights, or of two containers, two 8 mfd. in each)

Resistors

One 1.5-meg. pigtail resistor
Three 0.25-meg. pigtail resistors
One 0.12 meg. pigtail resistor (may use 0.1 and 0.02 meg. in series)
One 5 meg. pigtail resistor
One 0.5 meg. pigtail resistor
One 15,000-ohm, 2-watt wire-wound resistor
One 0.1 meg. pigtail resistor
One 410-ohm wire-wound resistor
One 2-meg. pigtail resistor
One 0.02 meg. pigtail resistor (grid leak of oscillator)
Two 1,200-ohm pigtail resistors
One 250,000-ohm potentiometer, insulated type, with a-c switch attached

Other Requirements

One chassis
One front panel
One vernier dial, with pilot lamp and escutcheon
One a-c cable and cord
Four grid clips
One antenna-ground binding post assembly
One phonograph twin post assembly
One switch for phonograph
Tubes: One 57, one 2A7, one 58, one 2B7, one 2A5 and one 5Z3

VARIOUS USES OF 53'S

CLASS B OUTPUT, COMBINATION DETECTION AND AMPLIFICATION, AND PHASE-INVERTER FOR RESISTANCE-COUPLED PUSH-PULL

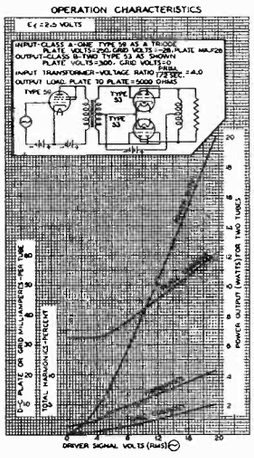


FIG. 1

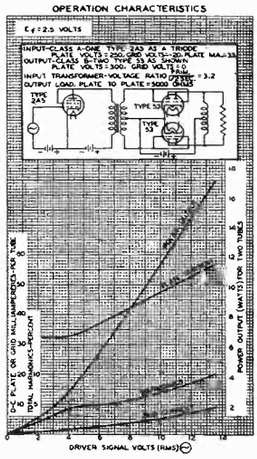


FIG. 2

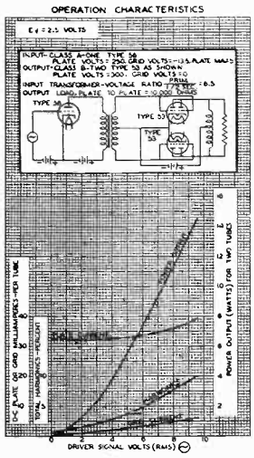


FIG. 3

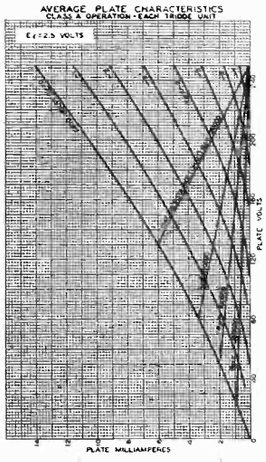


FIG. 4

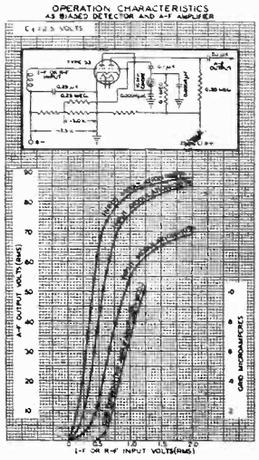


FIG. 5

COMBINING two high-mu triodes in a single bulb, the 53 is designed primarily for operation as a Class B Twin Amplifier. Ordinarily, only a single 53 is used in the output stage of a receiver. However, two 53's can be operated in a Class B output stage with the two triode units of each 53 in parallel. Approximately twice the output from a single 53 is obtainable with such an arrangement when a driver of sufficient power-handling ability is used.

Among other and less conventional applications of the 53 are: Biased-detector and one-stage a-f amplifier, two-stage a-f amplifier, and an amplifier and phase-inverter stage to supply resistance-coupled, push-pull output tubes.

Class B Output Stage

The rated output for the 53 with 300 plate volts is 10 watts. Since the two triodes of the 53 may be operated in parallel, and since two 53's so connected may be used in a Class B output stage, approximately 20 watts output can be obtained from two 53's.

The use of two 53's, with the triodes of each 53 in parallel, in a Class B output stage offers certain advantages over the use of other Class B types, since two 53's are capable of 20 watts output with 300 volts on the plates. No two tubes of other popular Class B types are capable of this output at the same plate voltage. The relatively small change in plate current of the 53 from no signal to full output permits the use of the speaker field as a series choke in the power supply, and also, the utilization of a power-supply system having somewhat poorer regulation than otherwise would be required for a Class B stage. Furthermore, the 53 offers economy in chassis space as compared with other Class B types.

The cost of the two 53's compares favorably with the cost of any two other Class B tube types on a power output basis.

Fig. 1 shows the operation characteristics of two 53's, with the triodes of each in parallel, in a Class B output stage driven by a type 59 operated as a triode. Good quality and high-power output are obtainable under these conditions. Full output from the 53's is obtained with an input signal to the driver of approximately 19.5 volts.

Fig. 2 shows the operation characteristics of two 53's driven by a type 2A5 connected as a triode. The power output with the 2A5 driver is slightly less than that obtainable with the 59 driver, but a smaller input signal to the driver is required.

A Biased-Detector, A-F Amplifier

Fig. 3 shows the operation characteristics of two 53's with a type 56 driver. The maximum power output with the 56 driver is less than that obtainable with the first two combinations, but the power sensitivity of the system with the 56 driver is considerably better.

In Fig. 4, the plate characteristics of a single triode unit of the 53 are shown. From this family of curves it will be seen that the characteristics of a single triode of the 53 are such that the tube is suitable for operation as either a biased-detector or an a-f amplifier.

Fig. 5 shows a suitable circuit arrangement for the 53 in which one triode unit is employed as a biased-detector and the other as a resistance-coupled a-f amplifier. The values of circuit constant are noted on the circuit diagram. The bias voltages for the two units are obtained from a bleeder resistor across the B sup-

(*Continued on next page*)

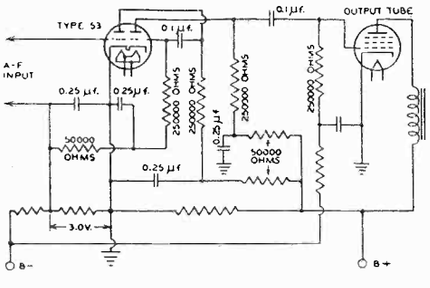


FIG. 6

Two-stage audio amplifier circuit. The plate supply is 250 volts, grid bias minus 3 volts, plate current per unit, 0.5 ma; voltage gain, 26.8; overall voltage amplification, 720; maximum a-f input, 0.08 volt (rms); output, 57.5 volts.

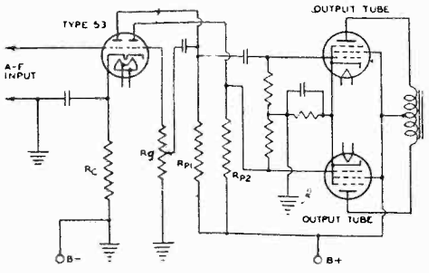


FIG. 7

Phase-inverter and driver circuit for push-pull resistance-coupled output tubes. This is one of the most interesting, although still experimental, uses of the tube, as push-pull resistance coupling has not yet been "tamed."

NEW S-W SET

(*Continued from preceding page*)

diode load resistor (500,000 ohms) or from plate of the 2B7 to ground, as diagramed. This condenser was 0.002 mfd., but it is not to be supposed that frequency discrimination resulted from its inclusion for, as stated, the vice consisted of over-accentuation of high audio frequencies, particularly one such frequency, and the removal of the vice must be considered, as it is, a virtue.

Bypass of Power Transformer

The two bypass condensers from either side of the primary of the power transformer to ground are not necessary in all instances, but they do keep radio frequencies out of the power transformer, and prevent modulation of the rectifier tube, especially if the power transformer hasn't its primary statically shielded from other windings.

The B supply system is such that no objectionable hum should be experienced. Certainly the filter capacities, 16 mfd. each, at the extremes of the field coil, are large enough. Then there is another electrolytic condenser, 8 mfd., across the 110-volt B line. The condensers in the primary circuit of the power transformer remove hum that arises from causes already stated, so that the usual objection to an inexpensive short-wave set, that it hums, should not arise. There was less than 5 per cent total hum in the output of the circuit as built (following the diagram), and this low value was due in part to the cathode emitter of the power tube, that is, isolation of the cathode from the heater.

ply, since a different bias is required for each triode unit, and better filtering is possible with this arrangement. The cathodes of all the tubes in the circuit are at ground potential. The bias voltage for the detector unit is minus 7.5 volts; the bias voltage for the amplifier unit is minus 3.0 volts. The detector bias voltage is not extremely critical, although maximum sensitivity occurs at the value specified. The detector plate current under these conditions is approximately 0.1 milliampere; the amplifier plate current is approximately 1.2 milliamperes.

The high sensitivity of this detector and amplifier system offers the possibility of a reduction in the overall r-f, or i-f, gain in the circuits of a receiver ahead of the detector. For example, it is assumed that the output tube is a type 2A5. The 2A5 requires approximately a 16-volt signal for full output. The modulated 30%, r-f, or i-f, signal required at the grid of the detector unit for full output from the 2A5 is then of the order of 0.3 volts. Even with signals of very low percentage modulation, sufficient output from the amplifier unit will be obtained to give satisfactory operation of almost any output tube.

Two-Stage A-F Amplifier

Another circuit arrangement for the 53 is shown in Fig. 6. Each triode unit is used as a high-gain, resistance-coupled, a-f amplifier. Suitable values for the circuit constants are noted on the diagram. The maximum input to the first amplifier unit is limited to approximately 0.08 volts, since larger inputs cause the second amplifier stage to draw grid current. This input gives an a-f voltage output of 57.5 volts from the second amplifier unit. The overall gain of the two stages of amplification under these conditions is 720.

The distortion of the 53 when used in this circuit was checked by viewing the output voltage wave-form on the screen of a cathode-ray oscillograph. No distortion was observed at inputs up to the point where the grid of the second stage began to draw current.

In resistance-coupled amplifiers, the frequency response at high frequencies is improved by the use of low plate-load resistances, but the gain is reduced. In order to secure good frequency response and the high gains obtainable with large values of plate-load resistance, the impedance of the input source should be low. The two-stage amplifier shown in Fig. 6 when the first stage is fed from a low impedance source gives, at 10,000 cycles, approximately 70% of the maximum voltage amplification.

Another application for the 53 tube is that shown in Fig. 7. Here the 53 is used as a combination amplifier stage and phase inverter, so that output tubes in a resistance-coupled push-pull circuit can be used. The a-f voltage developed across the plate-load of the second triode (R_{P2} in Fig. 7) is 180 degrees out of phase with the voltage developed across R_{P1}. Consequently, the grids of the two output tubes can be resistance-coupled to R_{P1} and R_{P2} respectively. The voltage taken from R_{P2} must equal the voltage developed across R_{P1}. The voltage developed across R_{P2} is adjusted by varying the position of the tap on R_g.

Other Applications

In addition to the application discussed, the 53 offers the possibility of a two-tube oscillator in a single bulb, say RCA Radiotron Co. Inc., and E. T. Cunningham, Inc. Good stability is attainable with such an arrangement. Another possibility is the use of one triode unit as an oscillator and the other as an amplifier.

The 53 can readily be used as a push-pull driver for an output stage. The application of the 53 as a two stage d-c amplifier also presents interesting possibilities.

Two Non-Coupled Tubes in One Envelope Are 6F7

RCA Radiotron Company, Inc. and E. T. Cunningham, Inc., have announced to equipment manufacturers a triode-pentode tube designated as 6F7.

Combining in one bulb a triode and an r-f pentode of the remote cut-off type, the 6F7 may be used in circuits in several ways, since the two units are independent of each other except for the common cathode sleeve. For instance, in superheterodyne receivers, the triode unit may serve as oscillator while the pentode unit functions as mixer tube (first detector).

6F7

GENERAL

Heater Voltage	6.3	Volts
Heater Current	0.3	Ampere
Direct Interelectrode Capacitances:		
Triode Unit—Grid to Plate	2.0	uuf.
Grid to Cathode	2.5	uuf.
Plate to Cathode	3.0	uuf.
Pentode Unit—Grid to Plate (with shield can)	0.008 max.	uuf.
Input	3.2	uuf.
Output	12.5	uuf.
Overall Length	4-9/32" to 4-17/32"	
Maximum Diameter	1-9/16"	
Bulb	ST-12	
Cap	Small Metal	
Base (For connections, see Note 1)	Small 7-Pin	

CHARACTERISTICS

	TRIODE UNIT	PENTODE UNIT	
Plate Voltage	100 max.	250 max.	Volts
Screen Voltage	.....	100 max.	Volts
Grid Voltage	—3	—3 min.	Volts
Amplification Factor	8	900	
Plate Resistance	17800	850000	Ohms
Mutual Conductance	450	1100	Micromhos
Mutual Conductance at —35 volts bias	.....	10	Micromhos
Plate Current	3.5	6.5	Milliamperes
Screen Current	.....	1.5	Milliamperes

CONVERTER SERVICE

	TRIODE UNIT	PENTODE UNIT	
Plate Voltage	100 max.	250 max.	Volts
Screen Voltage	.....	100 max.	Volts
Grid Voltage	‡	—3 min.**	Volts
Oscillator Plate Current (average)	4 max.	.....	Milliamperes
Typical Operation:			
Plate Voltage	100°	250	Volts
Screen Voltage	.....	100	Volts
Grid Bias Voltage	†	—10*	Volts
Oscillator Peak Voltage Input	.....	7	Volts
D-C Grid Current	0.15	0	Milliamperes
D-C Plate Current	2.4	2.8	Milliamperes
Screen Current	.....	0.6	Milliamperes
Plate Resistance	.....	2.0	Megohms
Conversion Transconductance	.....	300	Micromhos

‡Usually obtained by means of a grid-leak resistor.

**Grid bias should be at least 3 volts greater than the peak oscillator voltage applied to the pentode grid.

°May be obtained from 250-volt source through 60,000-ohm dropping resistor.

*Obtained by means of 1,700-ohm self-biasing (cathode) resistor.

†Obtained by 100,000-ohm grid-leak resistor returned directly to cathode.

Note 1:
Pin 1—Pentode Screen
Pin 2—Pentode Plate
Pin 3—Heater
Pin 4—Heater
Pin 5—Cathode
Pin 6—Triode Grid
Pin 7—Triode Plate
Cap—Pentode Grid
Pin numbers are according to RMA Standards Sheet 801-A (M8-116).

New Type Tubes Improve Sets

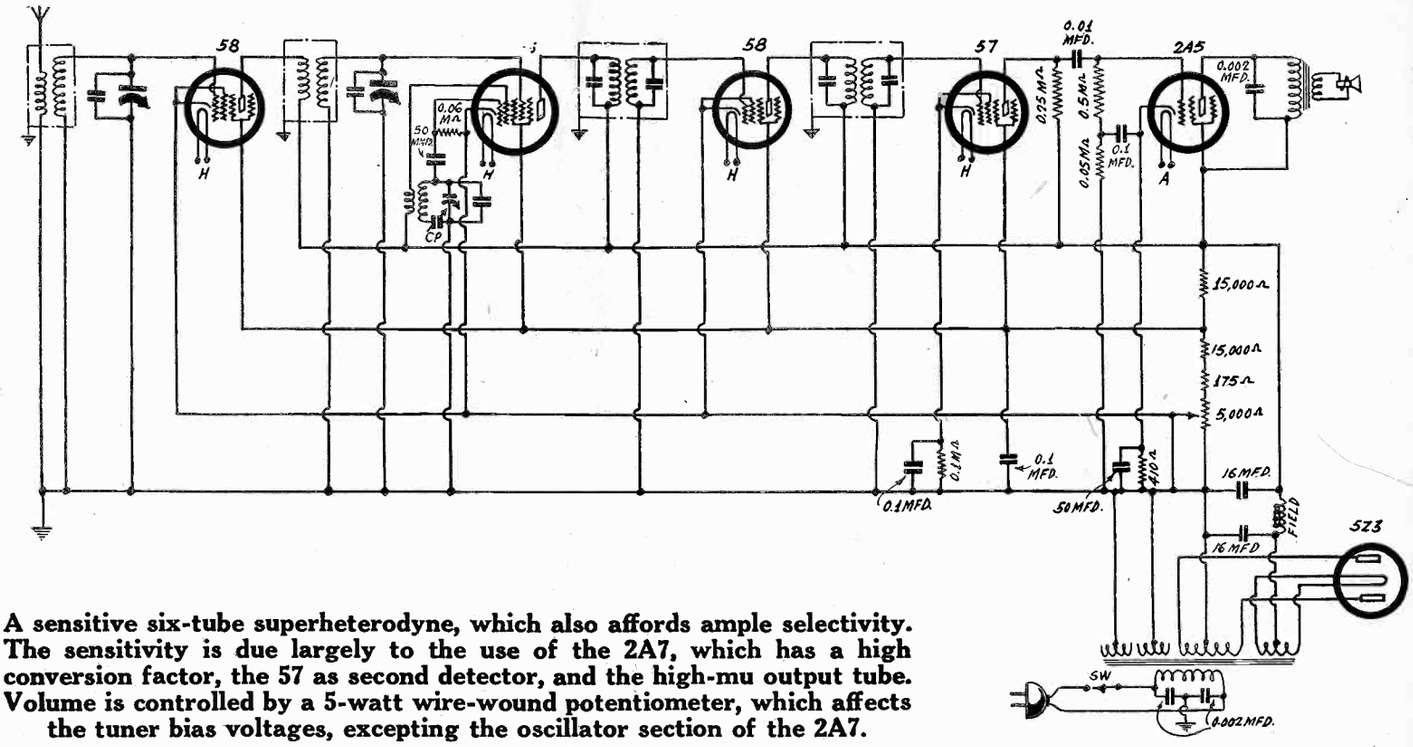
The opportunity to-day to improve one's radio receiver is very great, especially with the advent of new tubes. Some servicemen report exceptionally fine business from this angle. So the experimenter should study carefully his circuit or his neighbor's and see where the old type tubes can be replaced with newer models. With the proper combinations the change in many cases will be so startling and the cost so small by comparison that only then can the real value of the progress made in tube manufacture be more fully appreciated. There are many set owners who while not in the market for a new receiver would not hesitate to spend a few dollars for a worth-while improvement. One way to start this ball arolling is to try to make the change for someone who has a large circle of friends. In this way the first revamping job will act as an advertisement for you and lead to additional sales through its performance.

GRIMES AT 178 GREENWICH ST.

The transmitting department conducted by Frank Grimes for Try-Mo Radio Corp. is at 178 Greenwich Street, New York City, and not 179, as reported in July 15th issue.

HIGH SENSITIVITY
In a Six-Tube A-C Superheterodyne

By William J. Woodstock



A sensitive six-tube superheterodyne, which also affords ample selectivity. The sensitivity is due largely to the use of the 2A7, which has a high conversion factor, the 57 as second detector, and the high-mu output tube. Volume is controlled by a 5-watt wire-wound potentiometer, which affects the tuner bias voltages, excepting the oscillator section of the 2A7.

MANY times even an experienced radioist is surprised at the sensitivity and selectivity of a small receiver. It is certainly true that when the balance is nicely struck between gain and stability the results are extraordinary. The circuit diagram represents a receiver of high sensitivity and excellent selectivity, although only six tubes are used.

The circuit is a superheterodyne with one stage of tuned radio-frequency amplification, a combination oscillator and modulator (or mixer) in the same envelope, one intermediate stage, a very sensitive second detector and a high-mu output tube. The rectifier is the sixth tube.

For tuning a three-gang condenser is used, and may be 0.00035 mfd. The oscillator section is padded, but the padding condenser is grounded, so that body capacity effects are absent, and also the amplitude of the oscillation limited. Depending considerably on the tickler coupling, this amplitude should be held to 1 volt less than the steady bias condition of the modulator section. As this bias, on grid No. 4 (cap) of the mixer tube is around 3 or 4 volts, the oscillation amplitude should be 2 volts in one instance and 3 volts in the other. This is best measured simply with a vacuum tube voltmeter, with receiver's volume control at "full-on" position.

The primary of the antenna coupler should be small, otherwise a series antenna condenser used, say, 0.0001 mfd. or 0.00005 mfd. However, assuming a small primary is preferable, because easy enough, it would consist of 12 turns of No. 22 single silk wire, or any size wire approximately in that region, wound over a secondary that consists of 127 turns of No. 32 enamel wire, the form diameter 1 inch. The interstage coupler is the same, except that the primary is larger, consisting of 30 turns of any fine insulated wire, wound over a 127-turn secondary. The oscillator coil also has two windings.

For an intermediate frequency of 465 kc the oscillator secondary would consist of 98 turns of No. 32 enamel wire, while the tickler, wound over it, would consist of 27 turns of any fine insulated wire, say, No. 30 single silk. For an intermediate frequency of 175 kc the oscillator secondary would consist of 118 turns of No. 32 enamel wire, with same tickler. The padding condenser, Cp, for 465 kc, should be adjustable from 350 to 450 mmfd., for which purpose the commercial "type 500" may be used, while for 175 kc a larger capacity, adjustable from 800 to 1,350 mmfd., should be used.

The radio-frequency and intermediate frequency amplifying tubes are 58's, the mixer is a 2A7, the second detector is a 57, the output tube a 2A5 and the rectifier a 5Z3 or a 280.

The speaker field value is not critical, and may be around 1,800 ohms.

SHORT-WAVE REGENERATIVE SETS
USEFUL ALSO AS TEST OSCILLATORS

By Conrad Force

There are a great many short-wave sets in use that employ regeneration, and as these may be calibrated as oscillators, three typical circuits are shown. In Fig. 1 the tickler is switched to avoid the regeneration control and thus provides steady oscillation. In Fig. 2 the effect of the feedback condenser is nullified by a high capacity switched across it. In Fig. 3 screen control of regeneration is used, and the maximum voltage setting of the potentiometer arm is used. For adjustable tickler coils, set the adjustment at maximum feedback. Then, too, one has an oscillator.

The circuit should be calibrated for oscillation, and it will be found that there is a difference in some instances between the regeneration calibration and the oscillation calibration.

Of course the single tube is used. In Figs. 1 and 2 there is a third winding, assumed to be the antenna winding, and this may be used for taking the output. In Fig. 3 there are only two windings, and the output may be taken through a small condenser at the high side (right upper).

If there is a t-r-f stage ahead, the third winding, if present, would be in the plate circuit. Then either this may be switched, or the tested frequency fed to the antenna-ground posts, care being exercised to have the first stage precisely at resonance, as the calibration of the oscillator originally should be made that way.

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.

Short-Wave Sets Compared

IN A RECENT ISSUE you printed a letter in which the writer said that he had better luck with regenerative short-wave sets than with supers, but I desire to point out that all of the better-grade short-wave sets are supers, and that their performance is superior. In fact, everybody knows this. Is it your own opinion that regenerative sets are better?—K. F.

The letter was printed in line with our policy of permitting readers a full expression of opinion. Often such opinion runs contrary to our own and the letter you mention is an example. It is a fact that supers are both more selective and more sensitive, and also an incidental advantage is tuning ease, due to the absence of the awkwardness of adjusting regeneration, which often becomes a trying task. This is not to deny the worth of regenerative short-wave sets.

* * *

Output Power and Sensitivity

RECENTLY, following advice I saw printed in your publication, I substituted a pair of 2A3 tubes for 2A5 push-pull, and I am surprised that the signals are not nearly as loud as before. I should say they are only one-third as loud. I do not notice any particular difference in the quality, in fact, there is not enough heard under the present set-up to permit a sensible comparison. I shall put back the high-mu output tubes directly.—H. W. D.

We did not print any advice to replace 2A5 push-pull output tubes with the newer 2A3 tubes, but did point out that the quality is better when the 2A3 tubes are properly used, and the undistorted maximum power output increased considerably. By proper voltaging and constanting, the output may be 15 watts without as much distortion as is obtained from 2A5 push-pull at least less than half that power output. To be able to use 2A3 tubes instead of 2A5 tubes it is necessary to have sufficient driving voltage ahead of the output stage, which your receiver evidently hasn't, for the working mu of the newer tubes is only a small fraction of that of the pentodes. You might try a 56 driver stage. Then, of course, the output impedance is quite different, being about half as great for the 2A3's as for the 2A5's. Either you should get a proper speaker or install a proper matching transformer in your present speaker. When these precautions are taken you should be in a position to side with those who realize the superior quality attained from the low-mu output tubes, and moreover you should not confuse sensitivity with power-handling capability. Sensitivity relates to the amount of voltage input required for adequate quantity of sound output. Power-handling capability relates to the amount of voltage that can be put in without distorting the output.

* * *

Push-Pull Resistance Audio

WHAT IS THE TROUBLE with what seems to be the likely audio circuit, push-pull resistance coupling? You have printed articles about this, but nothing ever seems to be properly reduced to practice on this subject anywhere in the field. There are no commercial receivers using it, and none of your kit circuits shows its inclusion.—U. T. W.

As yet push-pull resistance coupling is in the experimental stage, so designers of kits and sets do not want to include a circuit that is not more or less foolproof. Tests of such circuits made in our laboratories showed varying results, but even the best results did not produce enough sensitivity. The method, so far, seems to concern simply coupling from one stage to the output without much distortion, but that could be done with less adjustment trouble by the single-sided coupling from detector to output. New possibilities are offered by the 53 tube, and no doubt experiments will be carried on, but the adjustment must be expected to be beyond the capabilities of the general run of constructors, who have not the dynamic instruments for effectuating proper balance. An unbalanced attempted push-pull audio circuit is a sorry thing indeed.

* * *

2A7 Coupling

HAVE YOU MEASURED the quantity of coupling in the 2A7 tube, and can it be said to be large or small?—H. J. D.

We have not measured it, but it may be said to be fairly loose coupling at the frequencies for which it is intended (broadcast band). This can be verified by the results of equivalent capacity coupling between grids of two separate tubes in separate envelopes. However, as the frequencies increase the effect is that of much too tight coupling. For instance, a beat oscillator was constructed, for the 5 mgc region, and it was found that one circuit (triode) in the 2A7 invariably "pulled" the other (pentode). Because of the necessity for having a choice and control of the degree of coupling, new tubes are to be announced, which consist of a triode and a pentode in one envelope, entirely separate electrically, no common coupling in other words, hence requiring an external coupling medium. The first of these tubes is the 6F7, but it is assumed that the 2F7 for 2.5 volt a-c operation will follow, and also a battery type tube that permits the same advantages.

* * *

Coil Capacities

IN A SOLENOID what is the reason for spacing the turns? How does that affect the factor? Is it better to use a honeycomb coil of greater or fewer turns? How is Litz wire for broadcasts?—F. D. S.

The turns are spaced in a solenoid to reduce the distributed capacity. This alters the shape factor in the wrong direction, as the theoretically correct coil would have a diameter 2.4 times the axial length of the winding. In commercial practice this is not even approximated, as the coil diameter is always less than the axial length of the winding. However, the difference in results is small, that is, little added resistance or little reduced selectivity, within a wide margin. When spacing is used, of course, the axial length of the winding is increased, normally doubled, and that must be taken into account. Therefore for broadcast use, spaced winding is not common, since the wire would have to be fine indeed and the spacing likewise, and besides the distributed capacity resulting from regular solenoids of the tight-wound type is low enough. We do not know what you mean when you ask if a honeycomb coil of greater or fewer turns is "better," but in terms of r-f resistance, the greater the number of turns, the greater that resistance, and as for distributed capacity, the greater the number of turns the less the distributed capacity. Each turn is capacitatively effectively in series with the next, etc. Litz wire is all right for broadcasts, though better for still lower frequencies. The effect is to produce higher gain at the low broadcast frequencies, with reduced gain and reduced selectivity at the high frequency end. Thus Litz acts as a sort of leveller in the broadcast band, to attone for the rising characteristic of tuned radio frequency amplification. Still the selectivity reduction at the higher broadcast frequencies may be serious.

* * *

Accessor Circuit

AS I HAVE a meter I would like a diagram of some sort of device that serves as an analyzer or tester, to measure currents and voltages, also resistances, depending on the setting of switches and the connection of external meter, external multipliers, external shunts and external battery for resistance results.—H. G.

Such a device is called an accessor, and we expect to print in next week's issue an article detailing the construction. The Radio Manufacturers Association code for socket terminals will be used, and since seven base pins and an overhead grid are accommodated, numbers 1 to 8, the device will apply to all tubes that will fit into the sockets, which includes all standard tubes up to the moment of writing these lines. The socket terminals, being identified by numbers, are independent of the nature of the element affected, although naturally in some instances the same elements are represented by the same numbers on all equivalent tubes. This method keeps the tester from becoming out of date.

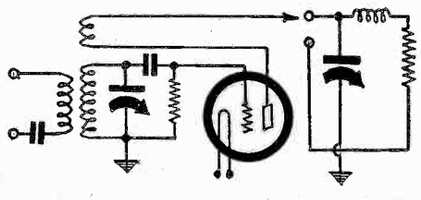


FIG. 1

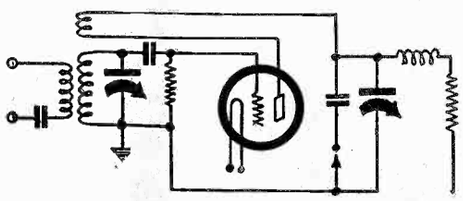


FIG. 2

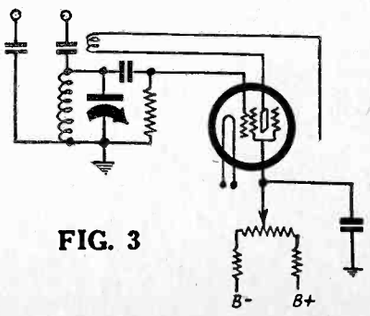


FIG. 3

These diagrams refer to article on opposite page.

Station Sparks

By Alice Remsen

A Man!

FOR "CHEERIO"

WEAF—Mondays, Tuesdays, Wednesdays, Thursdays and Fridays, 9:30 a. m. EDST

The guy who can go through the world with a smile,
When life has sort o' kicked him in the back;
The guy who can plod along mile after mile,
And always keep his feet upon the track;
The guy who can fight off temptation and sin
When he's starving hungry—his feet are all in—
That guy's a MAN!

The guy who can keep his head up in the crowd,
When everybody wants to pull it down;
The guy with a spirit which cannot be cowed
By poverty or fickle fortune's frown;
The guy who can grin when Fate hands him a pain,
Who squares up his shoulders and tries it again—
That guy's a MAN!

—A. R.

* * *

And if your head is bowed a bit lower than usual, just tune in on "Cheerio" and his inspirational talks. I'll guarantee that you'll feel like a new man, stick up your head and give the darned old world a fighting grin. Give "Cheerio" a listen; you'll like him, the singing, the music and the canaries.

* * *

The Radio Rialto

JUST PLAIN BUSINESS

Contract renewals are in order now and both NBC and CBS have a share in them. Richfield Oil has renewed for another thirteen weeks, with the same program set-up; the Jergen Company has another thirty-nine weeks signed up, bringing Walter Winchell back, September 3rd. So much for NBC. Over at Columbia the renewals include a thirteen-week extension for Jad Salts by the Wyeth Chemican Company, for their three-time-weekly program; and the Kolynos Company, which renews its "Just Plain Bill" serial, five-times-weekly. CBS also has a new account, a newcomer to the air—the American Home Products Company, which will start a half-hour program over WABC on September 24th. Maltex will also start a new series on WEAF, August 19th; half-hour once a week; my old friend, George Shackley, will conduct the orchestra. . . .

All Over the Place

Morris Hamilton, genial lad of the NBC program department, has his hands full these days, listening to auditions of promising talent and putting them on his pet program—The Morning Parade, Week-End Revue and the Revolving Stage. He manages to get some interesting items at times, and his bills are always well-balanced. . . . Goodness gracious! Word has just come in that Old Gold has renewed for twenty-six weeks; Fred Waring, Mandy Lou and David Ross will still be heard with them; jolly good program, too. . . . Aren't you glad that the Columbia Dramatic Company has returned to the air? This company of players will be a regular feature each Thursday night from 8:30 to 9:00 p. m. . . . Doris Hardy has been very active on the air recently; she is in full charge of all the radio programs, both dramatic and musical, for the Actors' Dinner Club, and is using five stations—WOR, WHN, WMCA, WHOM and WEVD. She selects all material, directs all programs and appears on each one either as actress or mistress of ceremonies. Quite a busy lady. . . . WLS, the Prairie Farmer station in Chicago, sends word that its deep-voiced folk-song singer will devote her vacation period to the making of phonograph records for the Brunswick Recording Company. Local representatives of the recording firm have been flirting with the titian-tressed mountain girl for several weeks in an effort to obtain a favorable contract and terms have finally been reached. The recordings will be made in New York and "My Renfroe Valley Home" and other songs which made Linda famous to WLS air and stage audiences will be included in the disc repertoire. . . .

Ellington's Stay Prolonged

Although the original booking for Duke Ellington and his orchestra in Europe was only four weeks, he has created so much enthusiasm in England and on the Continent that Irving Mills, his manager, was swamped with offers for additional engagements. So he accepted bookings for an extra month, which included the week of July 10th at the Palladium Theatre in London, four days of concerts in Holland, and two weeks at the Rex Theatre, Paris, which will carry along Ellington and his boys until August 5th, when they leave France to sail for home on the S. S. Majestic. . . . The Mills Brothers are back in New York; last week they played an engagement at the Metropolitan Theatre in Brooklyn and will, it is presumed, do the whole Loew tour. . . . Paul Whiteman's Victor recording of "Whispering" has sold just short of 2,000,000; this was his first record and he was scared to death to make it. . . . Have you heard Herman Hupfeld's new number—"I've Got to Get Up and Go to Work"? It's a corker. . . . WHOM is fast becoming a worth-while station; they're on the air from 8:00 a. m. until midnight; have sold quite a bit of time, under the sale leadership of Atwood Klinger. Some of their accounts are of national importance—Tydol, for instance; on such big propositions, spot announcements are used with a New Jersey billboard tie-up, which is a very unique arrangement; among the local accounts to take advantage of the WHOM wires are: Penn Clothing Exchange, Krakauer Brothers, piano manufacturers; Doctor Haines, D.D.S.; Bercesi Radio Shop, and the Bells of Warsaw, a sponsored Polish program; are broadcasting on 1450 kilocycles, 206.8 meters. . . . Have just received a half-dozen English press notices on Duke Ellington's debut in London; each one praises the dusky rhythm-slinger to the skies, one reviewer going so far as to call the performance a "scientific application of measured and dangerous stimula"; you know they treat their reviewing very seriously over in dear old London; another gentleman of the English press stated that the Duke possessed "an irresistible appeal for this neurotically puzzled and paradoxically repressed world in which we live"; another man expressed himself emotionally; confessed to weeping when the orchestra played Mood Indigo, and described the Ellington debut as "an orgy of masochism, a ruthless exercise in sensuality"; now what do you think of that! . . . I really believe that the Duke must have been a "wow"! . . .

Ukrainian Choir on CBS

The Koshetz Ukrainian Choir began a series of recitals over WABC and the Columbia network on Saturday, July 15th, from 8:15 to 8:30 p. m., EDST. They will be heard at this hour each week under the direction of Alexander Koshetz, former Ukrainian Minister of Education and Kappelmeister of the Kiev Opera House. Koshetz; the Choir has toured seventeen countries in recitals during the past few years, and has appeared before numerous royal gatherings in Europe, and played to extensive audiences throughout the United States. The repertoire includes Ukrainian primitive music of the early Middle Ages, religious chants of the 10th, 11th and 12th centuries, peasant and gypsy melodies, and contemporary Ukrainian operatic works. The Choir's American debut was made at Carnegie Hall in 1923, and they have appeared there regularly to increasingly enthusiastic audiences. . . . Lovers of Puccini will be glad to know that they may have an opportunity to hear the long restricted Puccini operas broadcast by radio station WMCA, New York. Donald Flamm, president of the Knickerbocker Broadcasting Company, has obtained blanket permission to broadcast these works at regularly stated intervals. . . . Johanna Grosse, radio and stage organist, has rejoined the staff of WLW, in Cincinnati, after an absence from that station of nearly four years. . . . And now the kettle is singing and I really must make a cup of tea. You'll pardon me, won't you?

New Small Short-Wave Tubes in Trial Stage

B. J. Thompson, of RCA Radiotron Co., Inc., points out that new tubes of small size for high frequencies are in an experimental stage and not being produced commercially. Mr. Thompson and G. M. Rose, Jr., recently read a paper on the tubes before the convention of the Institute of Radio Engineers in Chicago. Tube types were demonstrated.

Mr. Thompson since then has supplied the following additional information:

"The type of tubes which were demonstrated represented only triodes and screen grid tubes, no pentodes having been made. The longest wavelength at which we have carried out experimental work with these tubes is one meter. At six meters tuned radio frequency amplification is possible with conventional type tubes.

"These small tubes are in a very early experimental stage, and at the present time no attempt is being made to manufacture them on a commercial basis.

"There is no reason to believe that more than one stage of tuned radio frequency amplification would not be practical at a wavelength of 100 centimeters. In the apparatus demonstrated, the screen grid tubes were used only for radio frequency amplification, the triodes serving as detectors and oscillators."

$1.75 LIST ON NEW 1A6

The 2-volt pentagrid converter tube, 1A6, will list at $1.75.

DeForest Co. Buys All Jenkins Television Assets

The receivers for the DeForest Radio Company bought at auction for $200,000 all the property and other assets of the Jenkins Television Corporation of Wilmington, Del.

These assets include all patents of the Jenkins Corporation and shares of stock in the Jenkins Laboratories, Inc.; the Canadian Television Company, Ltd., and the Jenkins Television Company of New Jersey.

The sale was made by the receivers of the Jenkins concern to the DeForest Company, which was the only bidder. It is subject to confirmation by the United States District Court in New Jersey.

World Ham Convention To Be Held Next Month

The World-Wide Radio Amateur Convention will be held in Chicago, August 3rd, 4th and 5th, in co-operation with the Century of Progress Exposition.

There is a "ham" exhibit in the Travel and Transport Building at the Fair, occupying 2,000 square feet.

BUDLONG'S PATENT

Editor Radio World:

MY ATTENTION has been called to your issue of July 22nd, 1933 (No. 591), wherein is featured as the lead article a description of a receiving system based on the principle of detecting an incoming signal and using the audio output of the detector circuit to modulate a fixed local "intermediate frequency" oscillator, the resulting modulated oscillations being amplified and eventually detected again.

This system of reception has been patented by me and is described in U. S. Patent No. 1,909,805, filed March 16th, 1928, and issued May 16th, 1933. Of the seven allowed claims, the fourth more or less completely sums up the system: "4. The method of receiving radio signals which comprises converting the received radio frequency currents into audio frequency currents varying by and in accordance with the transmitted signal, generating sustained high frequency currents, employing said audio frequency currents to modulate the sustained high frequency currents, amplifying the sustained high frequency currents, and finally detecting the modulated sustained high frequency currents."

A. L. BUDLONG,
38 La Salle Rd., West Hartford, Conn.

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.*

Thomas Swatman (Radio Repair Man), 186 Hunterdon Street, Newark, N. J.
B. M. Windom, Ste 7A, Belmont Apt., Winnipeg, Man., Canada.
Frank F. Kucera, No. 3459 E. Boulevard, Cleveland, Ohio.
Everett Vincent, Pullman, Wash.
Lester Porter, Mt. Washington, Ky.
Scot Richardson, 1614 Coy Ave., Saskatoon, Sask., Canada.
Wm. L. Reed, 701 South Park St., Shawnee, Okla.
Jos. J. Black, 1773 Marks Ave., Akron, Ohio.
T. W. Draper, 299 Victoria Road, Walkerville, Ont., Canada.
William Jordan, Schodack Landing, N. Y.
O. W. Wendelburgh, c/o The Union Trust Co., Cleveland, Ohio.
Charles T. Collett, 817 Jefferson St., Fulton, Mo.
Ernest Jaschke, 171 Ludlow St., Long Branch, N. J.
Gilbert R. LaPoint, 8 State St., Westboro, Mass.
M. J. Vaillancourt, 63 Myrtle Ave., Albany, N. Y.
J. Dean Styers, c/o The Gazette, Gastonia, N. C.

TRADIOGRAMS

By J. Murray Barron

That there is a real interest in television by the public can not be denied. It is no fault of theirs that television has not advanced to a point where it is practical for general use. In fact, with a little more co-operation between the laboratory and the broadcasting studio thousands of fans would be ready to buy kits and etc. Even now, with less publicity than a year ago, the interest is great and the public in general flocks to demonstrations. It is a pity that some real active scheme is not worked out to give the experimenter more to work on and in perhaps this way something new, possibly different than now worked out, would be developed that might be the means of advancing television.

* * *

The Postal Multiformer unit for short-wave receivers gives to the experimenter and the ham something unique for radio construction. Here in one unit is a coil assembly of three inductors which fits into a specially designed socket that accepts the whole assembly and which permits of a complete change in a single operation of the entire three inductors—r.f., detector and oscillator, for any of the four amateur bands. With a unit of this kind the experimenter should find the construction of a short-wave receiver greatly simplified and greatly more efficient. For those interested in short-wave kits and sets there is free literature. Address the Postal Radio Corp., 135 Liberty Street, N. Y. City, direct.

* * *

The Powertone Wallace short-wave kit now merchandised by Try-Mo Radio Co., 85 Cortlandt Street, N. Y. City, is showing added activity and judging from the inquiries on this circuit from all quarters of the country the evidence is there will be a very great pick-up in kits early this fall. Naturally on account of the tests taking place from the first of August on, many are anxious to equip themselves with a good short-wave receiver. There is free literature on this particular circuit, which may be had by addressing the Try-Mo organization direct.

* * *

With all the so-called bargains offered it must be rather confusing to the shopper. In dealing with such sellers one has to be extremely careful and take nothing for granted. Only consider guarantees plainly stated on sales slips and be sure it's on the slip before the money is passed over. If this type of seller goes after mail order business it might not be amiss to get the definite understanding before sending money. Better still, one can play safe by doing business with reliable establishments. Naturally one can not mistrust everybody; still, as radio kits and sets are sold in various combinations it is well to understand perfectly just what is offered for the price.

Constants for Resistance A.F.

CONSIDERABLE emphasis used to be placed on the time constant of a resistor-capacity coupler in an audio circuit, and the value chosen so that low frequencies would not be attenuated. I remember 4 mfd. condensers being not unusual, and rather high value grid leaks. Now I seldom see a condenser recommended at more that 0.05 mfd., and the grid leak values are sometimes low. What is the reason?—T. R. D.

The time constant in the condenser-resistor circuit may be disregarded in modern circuits, as there is such a quantity of feedback through the common impedance of the B supply, plus an ever-present risk of grid emission in the power tube, as to offset the frequency considerations as viewed from the resistor and condenser. That is, regeneration is present, and its effect is that of an enormous stopping condenser and leak. Thus the circuit may motorboat and if it does of course lowering the grid leak values is quite all right, because of reduction of the over-accentuation, that is, the procedure is in the direction of elimination of distortion, the very aim. Grid current in the power tube requires that the leak be low so that the tube should not lose much bias. With self-bias the resistor may be higher than with fixed bias (e.g., battery bias or bias through bleeder or negative-leg tapped choke is fixed.)

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NEW RADIO AMATEUR'S HANDBOOK, 180,000 words, 207 illustrations, 218 pages (10th edition, issued 1933). Price, $1.00 per copy. Radio World, 145 West 45th Street, New York, N. Y.

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CIRCUITS AND SERVICE DETAILS OF COMMERCIAL RECEIVERS in issues of Radio World as follows: The Philco Model 15 Superheterodyne, Oct. 29, 1932; Philco's 4-tube Superheterodyne, Dec. 10, 1932; The Philco 37, Dec. 31, 1932; Philco Service Bulletin—No. 146, Models 89 and 19, Jan. 21, 1933; The Model 28, Newest Sparton Set, Nov. 5, 1932; Sparton 14, 14A, and 18, Jan. 7, 1933; The Majestic 324, Nov. 12, 1932; Stromberg-Carlson's Latest Circuits, Nos. 37, 38, 39, 40, and 41 Receivers, Nov. 19, 1932; The Pilot Dragon, Nov. 19, 1932; National Co. Short-Wave Receivers, Dec. 3, 1932; The New Fada Chassis, Dec. 24, 1932; Howard Model M, Jan. 7, 1933; The Comet "Pro," Jan. 14, 1933; Gulbransen Series 322, Jan. 14, 1933; United American Bosch Service Corp. Instructions, Jan. 21, 1933; Crosley Models 132-1 and 141, Jan. 28, 1933; The Colonial C-995, Feb. 11, 1933; Kennedy Model 563, Feb. 11, 1933, U. S. Radio No. 700, Feb. 18, 1933; Bosch 250 and 251, also Clarion Model 300, and Zenith 430 and 440, Feb. 25, 1933. 15c a copy, any 8 issues, $1.00. Radio World, 145 W. 45th St., New York City.

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Vol. III of RIDER'S MANUAL (A New Book)

Just out, John F. Rider's Vol. III Manual weighs nearly 11 lbs. and has 1,100 pages, all diagrams of commercial receivers, etc. (no text). Sets announced up to May 1st, 1933, are included—and complete information on every one, including resistance values. The volume is original and necessary and does not repeat data that are in Vols. I and II.

A Chronological Catalog and Index of all nationally-advertised radio receivers manufactured and sold in the United States between January, 1921 and January, 1933 are contained in Volume III. This list will be of tremendous aid in the identification of receivers for which the model number is not known.

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.

A complete table of I-F. peak frequencies as used in radio receivers. This list augments the information of this type shown upon the diagram pages. Intermediate-frequency amplifier peak information is very important because quite a few of the manufacturers employ more than one figure in their year's production. A wrong guess on your part means trouble.

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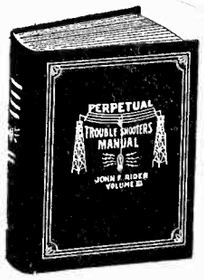

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The a-c model not only is shielded but has the line blocked, that is, radio frequencies generated by the oscillator cannot be communicated to the tested set by way of the a-c line. This is a necessary counterpart to shielding, and a special circuit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

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

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).

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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.