OCT. 31
1931

WORLD-WIDE RECEPTION

PRICE
15¢
PER COPY

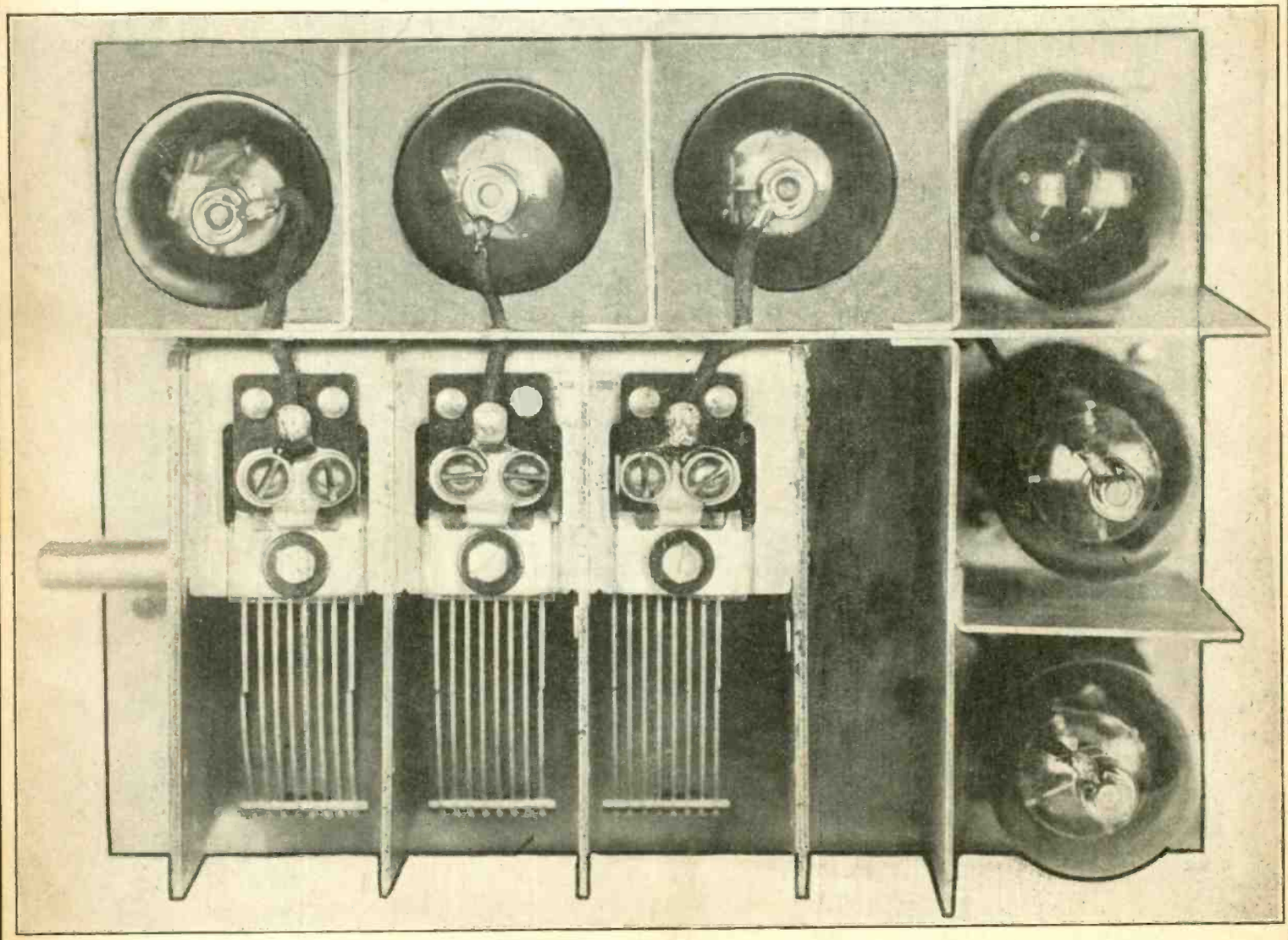
RADIO WORLD
REG. U.S. PAT. OFF.
The First and Only National Radio Weekly
501st Consecutive Issue
TENTH YEAR

Farm Lighting Set

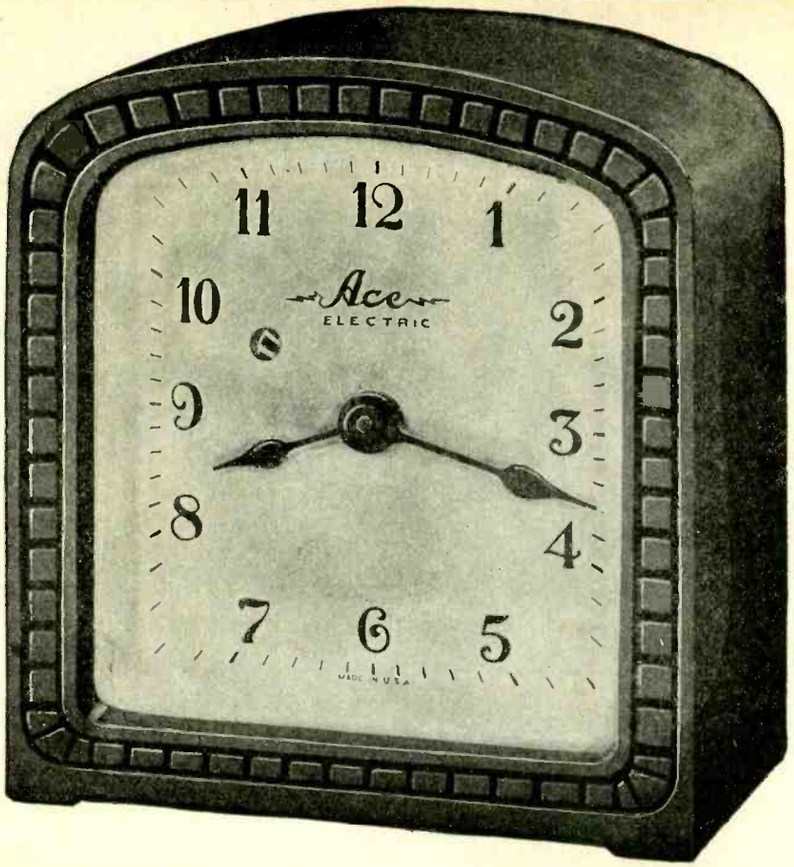
Curves on 236 Tube

Vacuum Tube Voltmeter

AUTOMOBILE RECEIVER



Layout for a dandy auto set. See pages 6 and 7.



ELECTRIC ALARM CLOCKS

110 Volt AC 60 Cycles

BAKELITE CASE, EXACT SIZE AS ILLUSTRATED

An Ideal Xmas GIFT

Give one to a friend for Xmas. Keep one for your own use. TWO of these clocks for $3.00. Or get 4 for $5.75.

TWO FOR $3.00

No Orders Accepted For Less Than 2

25 YEAR GUARANTEED electric ALARM clock, 110 volt, 60 cycle. Bakelite case. Current indicator. Beautiful dial. Heavy lens. Works from your house current. Never needs winding. Nothing to wear out or go wrong. Almost a million in use. Complete with 6 foot cord and plug. Limited quantity. ORDER TODAY. Two of these clocks for $3.00. Or four for $5.75. Money refunded if not satisfied.

Send Cash, Money Order or Check to:

Orders shipped same day received. No delays.

R. A. MATLI CO.

1114 Mission Street San Francisco, Calif.

Tube Prices Lowered!

Eveready-Raytheon 4-Pillar Tubes

(Why waste money and time and endanger your set with phoney tubes?)

227	@$0.70	245	@$0.77	200A	@$2.80	233	@$1.83
224	@ 1.12	247	@ 1.09	240	@ 2.10	236	@ 1.83
235	@ 1.12	250	@ 4.20	112A	@ 1.05	237	@ 1.23
551	@ 2.20	V-190	@ 1.93	222	@ 3.15	238	@ 1.93
226	@ .56	U-199	@ 1.75	230	@ 1.12	280	@ .70
171A	@ .56	120	@ 2.10	231	@ 1.12	281	@ 3.50
210	@ 4.90	201A	@ .53	232	@ 1.61	BH	@ 3.10

Blueprint No. 627, a five-tube midget designed by J. E. Anderson and Herman Bernard, uses two 235, one 224, One 247, one 280. Covers 75-550 meters, or broadcast band only, if preferred. Price 25c.

Send for our free list of leading short-wave stations with hours on the air. Ask for Table W.

Roland Radio Co

The Reliable Immediate-Delivery House

35 HOOPER STREET BROOKLYN, N. Y.

BARGAINS

"A" ELIMINATOR PARTS

Choke coil, to filter out the hum. Wound with No. 16 wire on secondary. Husky choke. Only one needed. Will pass 3 amperes. In shielded case. Cat. AECH @ $5.50

Westinghouse Rectox metal disc rectifier, to pass 2 amperes, or connect rectifiers in parallel to pass 4 amperes; mounting brackets. Cat. WRX @ $1.95

Jefferson transformer, 110 v. 50-60 cycle primary; 12 volts, no load; 9 volts when used full load on Rectox rectifier; DC voltage at full load, 7 volts. Cat. J-12V @ 99c

Dry electrolytic condenser, 1,500 mfd. (two required). Cat. DRL @ $3.25

CABLE AND PLUG

Five-lead cable with 5-prong plug attached that fits into UY socket. Useful as a connector of set voltages or for short-wave adapters. Cat. CPG @ 62c

RESISTORS

Grid leaks 5 meg., 2 meg., ¼ meg., 1 meg., 5,000 ohms (specify which) Cat. CGL @ 11c

Filament ballasts: 4 ohm for one 201A, 112A, 200A, 240A, 171A; 2 ohm for two 201A, 112A, 200A, 240 or 171A, or for one 171 or 112 Mounting supplied. (Specify which.) Cat. FB @.....11c

Wire-wound resistors: 1 ohm, 1-3/10 ohm, 6-5/10 ohms; 30 ohms; 50 ohms. (Specify which.) No mounting supplied or needed. Cat. WWR @ 16c

30-ohm rheostat with battery switch attached. Cat. 30RH @ 65c

75-ohm rheostat with battery switch attached. Cat. 75RH @ 65c

Variable voltage divider; 10,000 ohms; will pass 100 ma; eight sliders and fixed terminal connections; mounting bracket. Cat. VVD @ $1.49

CONDUCTORS

2 ampere fuse, cartridge type, for fusing AC line entering receiver; with fuse holder. Cat. 2AFH @ 25c

GUARANTY RADIO GOODS CO.
143 West 45th Street, New York, N. Y.
(Just East of Broadway)

115 DIAGRAMS FREE!

115 Circuit Diagrams of Commercial Receivers and Power Supplies supplementing the diagrams in John F. Rider's "Trouble Shooter's Manual." These schematic diagrams of factory-made receivers, giving the manufacturer's name and model number on each diagram, include the MOST IMPORTANT SCREEN GRID RECEIVERS.

The 115 diagrams, each in black and white, on sheets 8½ x 11 inches, punched with three standard holes for loose-leaf binding, constitute a supplement that must be obtained by all possessors of "Trouble Shooter's Manual," to make the manual complete. We guarantee no duplication of the diagrams that appear in the "Manual." Circuits include Bosch 54 D. C. screen grid; Balkite Model F, Crosley 20, 21, 22 screen grid; Eveready series 50 screen grid; Erla 224 A. C. screen grid; Peerless Electrostatic series; Philco 76 screen grid.

Subscribe for Radio World for 3 months at the regular subscription rate of $1.50, and have these diagrams delivered to you FREE!

Present subscribers may take advantage of this offer. Please put a cross here ☐ to expedite extending your expiration date.

Radio World, 145 West 45th St., N. Y. C.

RADIO WORLD and "RADIO NEWS"

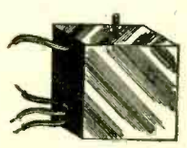
BOTH FOR ONE YEAR @ **$7.00**

You can obtain the two leading radio technical magazines that cater to experimenters, service men and students, the first and only national radio weekly and the leading monthly, for one year each, at a saving of $1.50. The regular mail subscription rate for Radio World for one year, a new and fascinating copy each week for 52 weeks, is $6.00. Send in $1.00 extra, get "Radio News" also for a year—a new issue each month for twelve months. Total, 64 issues for $7.00.

☐ If renewing Radio World subscription, put cross in square.

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

Three 0.1 mfd. in One Case



Three Supertone non-inductive fixed condensers of 0.1 mfd. each, (250 v.) in steel case, provided with a 6/32 mounting screw, built in. The black lead is common to the three condensers, the three red leads are the other sides of the respective capacities. Size, 1½" square by ⅞" wide. Order Cat. SUP-31. list price, $1.00; net price, 57c.

GUARANTY RADIO GOODS CO.
143 West 45th St. New York N Y

"A" BATTERY SWITCH

A push-pull switch for battery-operated sets. Made by Benjamin. Firm, sure contact, extremely long life. Price, 25c.

GUARANTY RADIO GOODS CO.
143 West 45th St., New York, N. Y.

UNINTERRUPTED READER INTEREST
EVERY WEEK — EVERY YEAR

RADIO WORLD

Vol. XX No. 7 Whole No. 501
October 31st, 1931
[Entered as second-class matter, March, 1922, at the Post Office, at New York, N. Y., under act of March, 1879]
15c per Copy. $6 per Year

TENTH YEAR
Technical Accuracy Second to None
Latest Circuits and News

A Weekly Paper Published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y.
(Just East of Broadway)
Telephone, BRyant 9-0558 and 9-0559

RADIO WORLD, owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.; Roland Burke Hennessy, editor; Herman Bernard, managing editor; J. E. Anderson, technical editor.

Reaching Out on All Waves

Separate Dial for Each of Four Tuned Circuits

By Roland Tookle

"BECAUSE of the specialized functions of the (antenna) systems the station is very international in character, there being no trouble in the interception of signals from foreign countries. In fact, radio signals, both telephone and telegraph, from every country in the civilized world are regularly heard."

Now, that is not the raving of some aberrated radioist, but is a verbatim quotation from a booklet printed by the Government Printing Office, at Washington, D. C., distributed at 10c a copy by the Superintendent of Documents, same address, and entitled "Radio Activities of the Department of Commerce." The quotation concerns the central frequency monitoring station six miles west of Grand Island, Nebr., amid a quiet prairie, where interference is as low as the most carefully selected site makes possible.

Surely it is the goal of every radioist to have a receiver that will be as dependable as that—"radio signals, both telephone and telegraph, from every civilized country in the world are regularly received."

How Near Can One Come?

The installation at the Government monitoring station can not be duplicated, except with the aid of the same expertness that backed that project, plus expense prohibitive to an individual. Special antenna systems of great diversity and keen directivity, Diesel engines for generating one's own electricity, and other provisions are quite outside the expectations. But one can inquire as to what kind of set-up is used at the great central monitoring plant.

Extensive quotations from the booklet were published in last week's issue, the quotation regarding the Grand Island plant being in full—the entire discussion of this subject in the book—while data on the secondary monitors in scattered locations, and of the circuits used, were published.

We find that there are two principal receivers, one for low frequencies, the other for high frequencies. The low frequency one tunes from 100 to 1,500 kc., or 2,998 to 199.9 meters, thus covering the so-called long and intermediate waves. The frequency range of the other receiver is from 1,500 to 30,000 kc., or 199.9 to 9.994 meters. Plug in coils are used on both sets, while the long wave set has a three loop antenna, with provision for external antenna, though the high frequency set has no loop provision.

Circuits Described

Here is what is said of the circuits, the first part concerning the low frequency receiver:

"Four individually tuned stages of radio-frequency amplification, an individually tuned, regenerative detector stage and an audio amplifier, consisting of one stage of resistance-coupled amplification and one stage of impedance-coupled amplification, are employed in this receiver. Vacuum tubes of different types, all of 5-watt power rating, are employed, and audible reception is by means of either head phones or dynamic loudspeaker.

"The high-frequency receiver has a tuning range of 1,500 to 30,000 kilocycles, or 200 to 10 meters. This receiver is not supplied with loop antenna, external antennae being employed exclusively.

"Three individually tuned stages of radio-frequency amplification, an individually tuned, regenerative detector stage and an audio amplifier similar to that employed in the low-frequency receiver are employed. Screen-grid vacuum tubes are employed in the radio-frequency stages, while the tubes employed in the detector and audio stages are identical to those employed in same stages in the low-frequency receiver. Audible reception is by means of either head phones or dynamic loudspeaker."

There is, then, a distinction between the two sets, principally the difference in the number of stages of tuned radio frequency amplification. The low frequency set has four such stages, the high frequency set has three.

It should be pointed out, also, that storage batteries are used for filament supply, although it is not stated whether the generated electricity is used for B supply by rectification and filtration, or whether B batteries are used.

Covers the Same Bands

Considering, then, the situation at Grand Island as disclosed, we must at once decide how best to pattern a circuit after the sets used there, while realizing that we shall not attain the pinnacle that much additional expense and special precautions have made possible there. We shall not have screened rooms and automatic temperature control, but we shall have something worth while, nevertheless.

Our first decision is to have a receiver that will cover the entire bands covered by the two receivers used at Grand Island, because we do not feel we can extend ourselves to the luxurious limit of having two separate sets. Therefore we shall select three stages of tuned radio frequency amplification, a tuned input to a regenerative detector, and two stages of audio, using plug-in coils to cover from 150 to 30,000 kc. It can be done, and rather nicely, too.

This means that we shall have four dials on the front panel for tuning purposes, besides two knobs for volume control and regeneration control. The line switch may be built into the volume control, otherwise there would be three knobs or equivalent. Besides, it must be remembered, there will be four plug-in coils for each band to be covered. For the low frequencies this is not serious, as we could go from the end of the broadcast band well beyond the low limit with two sets of such coils, total eight coils, while another set, total twelve coils, would enable us to cover the entire broadcast band.

Vastly Sensitive

To gain that end the smallest maximum capacity condenser to use is 0.000325 mfd., which just enables coverage of the broadcast band without coil changing. To assure complete coverage of the broadcast band with this capacity and one set of coils the set has to be wired so that the distributed capacity is at a minimum. Since no trimming condensers are used, there is no jacking up of minimum capacity to line up the respective condensers, as would be true if a gang were used. In fact, only by using individually tuned stages can the maximum in sensitivity and selectivity be achieved all over the dial for any set of coils, for all ganging and aligning systems benefit convenience at the expense of performance.

Here we are not seeking all the modern conveniences, but a set that will be a world traveller in the true sense, where foreign stations will constitute the performance rather than the mere promise, and where we may disregard to a great extent receiver shortcomings that otherwise are ascribed to ether conditions to explain the collapse of performance on this night or that.

While the penetration of the waves, particularly the short ones, varies greatly with differing conditions, the possession of a receiver

(Continued on next page)

Tentative Design for a Truly All-Wave Set, to Cover from 10 to 2,000 Meters with Plug-ins

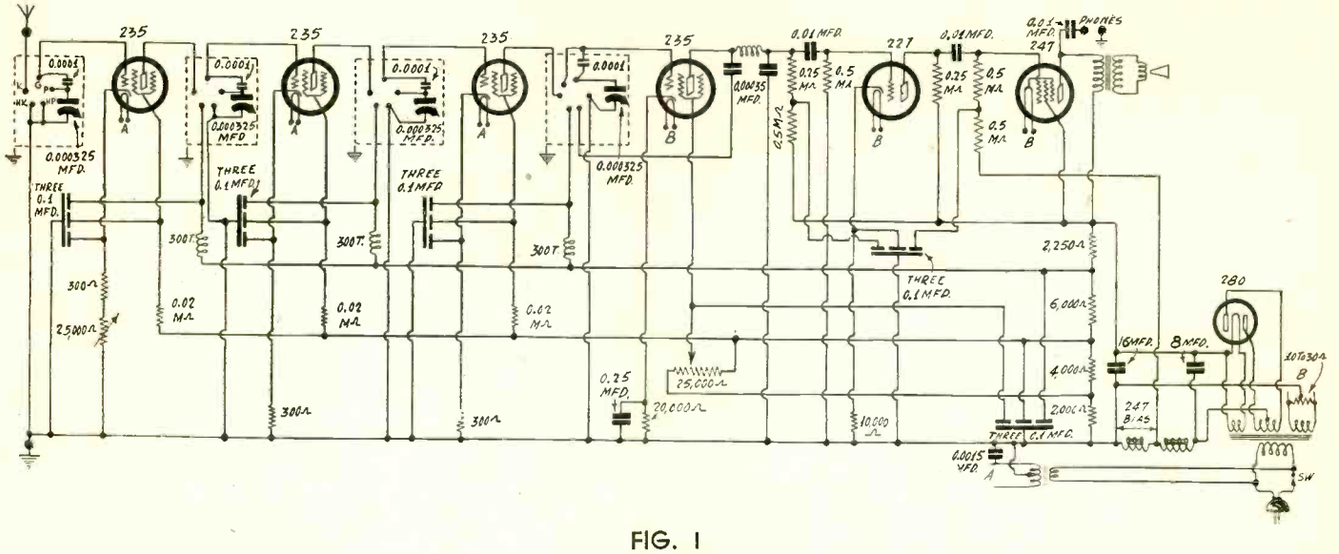


FIG. 1

Three stages of t-r-f, tuned detector input, with regeneration, and separate condenser and dial for each tuned stage, mark this truly all-wave receiver, 10 to 2,000 meters. The coils are plugged into sockets, as explained in the text.

(*Continued from preceding page*)

so vastly sensitive as to respond even to very weak signals is in no small measure a compensation for the ether phenomena.

For ICW Reception

Also, we have regeneration in the detector, not that it will be needed always, but because it will enable the increase of the amplification (both sensitivity and selectivity, to be exact) when specially needed, as when encountering adverse conditions, besides being a means of receiving a form of code transmission not otherwise clearly audible (interrupted continuous waves). This form of transmission depends on an independent oscillator setting up a beat with the incoming wave to produce audibility, the frequency of the beat being whatever you make it, according to the frequency difference between the separate oscillator and the incoming wave. The separate tuning of the stage enables the production of any desired audible frequency.

It is well appreciated that there will be more noise in an alternating current operated receiver than in one using batteries, nevertheless we shall present the option of selecting an a-c or a battery model, and describe the theory of the a-c model first. The a-c model is in keeping with the higher noise level that is bound to exist, anyway, for we can not comb the country for the quietest place to be found, from an electrical viewpoint, and particularly not one centrally located so as to make the broadcasting stations dot the circle around us. We admit inevitable limitation of our own receiver as compared to the two nutured nets at Grand Island.

Since we have elected to cover all the prescribed bands with one receiver, naturally we must make some special provision for short wave treatment, as we would not want to tune in the short waves, at least below 75 meters or so, with 0.000325 mfd. condensers, because of the necessarily low ratio of inductance to capacity and the dial crowding.

Reason for High L-C Ratio

If you pluck the string of a tuned violin you will find the string vibrates readily, but if you loosen the string by turning the key, and then try to get some response, you will virtually fail. The tight string is more sensitive. That situation depicts the difference between a high ratio of inductance to capacity (tight string) and a low ratio (loose string). Instead of mechanical vibration, as present in a string, we are dealing with a form of electrical vibration called oscillation. The mechanical analogy fits the electrical one nicely in all other respects.

The effective capacity of the tuning condensers is easily reduced by series condensers. If 0.0001 mfd. is used, then the resultant maximum capacity, instead of being 0.000325 mfd., will be 76.5 mfd., approximately. The minimum capacity will be less than 5 mmfd. (computed value, 3.33 mmfd.).

The shift is a quick and wide one, for at once we leave 0.000325 mfd. to adopt 0.0000765 mfd., but we can not well change the series condenser time and again, as the adjustments and compensations would become too numerous and uncertain, and we are also compromising on other points, to avoid building two receivers, including confinement to three stages of t-r-f.

Therefore some band of frequencies must be selected as the one after which the radical capacity change is to be made. It is suggested that for the first short wave band, known as the continental band, we may properly retain the higher capacity, because we shall end up at about 3,750 kc. (79.95 meters), whereupon we can apportion the next coil, using the smaller capacity, to overlap sufficiently to cover the 80 meter amateur band.

Band Coverage

Designation of a band by a round number of meters hardly discloses what the band is. The so-called 80 meter amateur band is from 3,500 to 4,000 kc. (85.66 to 74.96 meters). The thought will suggest itself to many that a relatively high L-C ration may be maintained by using only part of the total displacement of the 0.000325 mfd. condenser, so winding the coils that tuning starts at 60 or so on the numerical dial reading for 1,400 kc., and 10 represents 3,700 kc. (81.03 meters). Then if the next coil, now with the small condenser, picks up 3,300 kc. at the start, it will bring us to about 6,600 kc. (45.43) meters), and the amateur band will be spread out sufficiently.

The system as outlined, switching from use of less than two-thirds the total displacement of the larger capacity, to use of the smaller capacity for the next band, is of course favored if straight frequency line or midline condensers are used. The junior midline condensers have a curve close to the straight frequency type.

32 Coils, But the World is Yours

It is expected that the coils required will total 32 to cover the specified frequency range, eight sets of coils, four coils to a set. However, we can start with the broacast band, where the design is easiest, and then make coils for the low frequency band (above the broadcast band in wavelength), and will be facilitated greatly by the fact that the stages are individually tuned. So, to wind an adjacent band coil all we need do is tune in a station near one extreme of the dial for all stages save the one used for experimenting, and then wind the next coil so that the frequency will come in near the opposite extreme of the dial. This method holds true no matter in what direction you work.

If we start with the broadcast band, and move to higher wavelengths, we must select a coil with more turns of wire on both the primary and the secondary, so that at some low number on the dial the frequency is tuned in with the test coil. What numerical setting to use will depend on the type of condenser.

The circuit diagram shows how the series condenser is used. The receptacle for the coil is a five prong (UY) tube socket. The K terminal may be used for aerial, heater adjoining cathode (HK) as ground, heater adjoining plate (HP) as ground, plate for stator of the tuning condenser, grid as grid connection for the coil. Therefore from 81.03 meters up (increasing wavelength), a wire connects grid and plate terminals of the coil socket, serving as a strap to short out the series condenser. As this condenser is not built into the coil but onto the chassis, or shield, it is set once and left thus, preferably at some frequency high enough to enable close adjustment. An equalizing condenser of 20-100 mmfd. will serve the purpose, and can be adjusted with a neutralizing rod or other device, but not with a common screwdriver.

(*Continued on next page*)

Television Above 43 MC

Definite Assignment Due in Six Months

THE place of television in the radio spectrum, a problem constantly before scientists since earliest experiments in visual broadcasting, probably will be decided within the next six months, it was stated orally by Gerald C. Gross, engineer of the Federal Radio Commission.

"Although it is not possible to say definitely what position television stations will occupy," he said, "experiments now being conducted indicate that visual broadcasting probably will be established in the high frequency bands between 43,000 and 80,000 kilocycles."

Stations Using Both Bands

Mr. Gross made available the following information, according to "The United States Daily":

At present there are about 20 television experimental stations operating throughout the country. Most of these stations are experimenting on both high frequencies and those just above the present broadcasting band. Results of experiments now being conducted, and of those conducted in the past, indicate a definite trend toward the higher frequencies.

There are four bands, each of 100 kilocycles, just above the frequencies allocated to broadcasting. These are 2,000 to 2,100, 2,100 to 2,200, 2,750 to 2,850, and 2,850 to 2,950 kilocycles. It is obvious that these few narrow bands could not accommodate all television stations should the visual broadcast industry assume anywhere near the proportions of the present broadcasting organization.

Enough Room on High Frequencies

On the other hand, in the higher frequencies there are sufficient channels to accommodate enough stations to serve the public if television should become practical. Three high frequency bands are being used for experimental purposes. They are 43,000 to 46,000, 48,500 to 50,300, and 60,000 to 80,000 kilocycles.

Although experiments have not definitely determined advantages and disadvantages of visual broadcasting in the low and higher bands, results indicate that the double-image effect and fading are less noticeable in the higher than in the low frequencies. If further experiments substantiate this theory, it is almost certain that television will be assigned to the higher channels, especially in view of the already crowded condition of lower bands.

Ultra-Highs "Elementary"

There may be some possibility of using the ultra-high frequencies in the millions of kilocycles, but experiments in this field are so elementary that nothing more may be said about it.

The experiments of about 20 television stations in all parts of the country are doing much to dispel the mystery of the so-called "great unknown field" of radio, above 28,000 kilocycles. Further experiments will increase knowledge of this field, with a possibility, not so far in the future, of having the great unknown field include for the most part frequencies in megacycles.

Ultra-High Bands

In addition to the stations already experimenting with television, the Commission is receiving more and more applications to construct experimental stations for visual broadcasts. Since Sept. 1 the Commission has received 11 such applications. One, just received, requests permission to construct an experimental station for television, operating on a frequency of 43.5 megacycles, or 43,500,000 kilocycles. If the application is granted, the station, which will be operated by the Journal Company, at Milwaukee, Wis., will be one of the few transmitters experimenting on ultra-high frequencies. The other 10 applications request permission to operate television stations on frequencies included in the low or higher bands explained above.

Should experiments definitely determine where visual broadcasting will be placed, a problem long before radio scientists will be solved. It will be an outstanding step in the progress of television.

Band Width Important

Television has been handicapped in its transmission due to interference, one may add to the above quotation. Expectation of special means to overcome relatively narrow band widths have not materialized. More than 100 kc. band width easily could be accommodated at higher frequencies.

List Prices of Tubes

The following table gives the prevailing price lists of the various tubes:

Tube	Price	Tube	Price	Tube	Price
227	@ $1.00	551*	@ $2.20	240	@ $3.00
201A	@ $0.75	224	@ $1.00	WD-11	@ $3.0 0
245	@ $1.10	171A	@ $0.90	WX-12	@ $3.00
280	@ $1.00	112A	@ $1.50	200A	@ $4.00
230	@ $1.60	232	@ 02.30	222	@ $4.50
231	@ $1.60	199	@ $2.50	BH	@ $4.50
226	@ $0.80	100	@ $2.75	281	@ $5.00
237	@ $1.75	233	@ $2.75	250	@ $6.00
247	@ $1.55	236	@ $2.75	210	@ $7.00
223	@ $2.00	238	@ $2.75	BA	@ $7.50
235	@ $1.60	120	@ $3.00	Kino	@ $7.50

*This tube comparable to the 235.

All Wave Set of High Sensitivity

(*Continued from preceding page*)

The detector input requires a six prong plug and six spring socket, which are special, for there are six different connections to take care of, on account of the tickler.

Regeneration is provided by returning the detector plate bypass condenser to ground through a coil inductively related to the secondary. This extra winding is on the plug in coil and it differs with band, the difference not being much on the high frequencies, but being great as compared to the number of turns used for feedback on the low frequencies, below the broadcast band.

While the condensers are shown as enclosed in the same shield as the coils, they need not be, but may be separately shielded, while shielded plug in coils may be used.

The audio channel differs from the one used at Grand Island, in that the second stage also is resistance coupled. It is suspected that the engineers who designed that set had a little trouble with low frequency oscillation, hence used impedance coupling for the second stage, but since it has been disclosed in these columns that any resistance coupled amplifier can be stabilized, we can apportion the feedback correctly and thereby get better quality than we would from the impedance coupled stage.

The Government sets have earphone listening posts, as well as dynamic speaker connections, and the diagram, Fig. 1, shows that earphones may be cut in, being useful even while the speaker is on. This may aid in close tuning when receiving uncivilized countries, as well as for other occasions when the volume is not quite enough to fill a large room with sound. Even on a set such as this there will be stations—far off, of course—coming in with not enough volume to rock the roof.

So there has been given a goal to shoot at, and the plan has been laid before the readers in keeping with the policy of letting them know not only what has been done and is being done, but what is intended to be done. The set has not been built, the discussion herewith is entirely theoretical, but the building is now under way, and any who desire to obtain a quick report on results may do so by addressing the author.

[*Certainly Mr. Tookle has hit upon a fascinating subject, even though prompted by a Government report. The details of the experimental results, it is expected, will be published in an early issue of* RADIO WORLD, *and meanwhile readers who just can't wait may obtain a brief report thereon, a few days prior to publication in these columns, by addressing Mr. Roland Tookle, c/o* RADIO WORLD, 145 *West* 45*th Street, New York, N. Y.*—EDITOR.]

A Six Tube Automobile

Screen Grid Tubes and High

By Burton

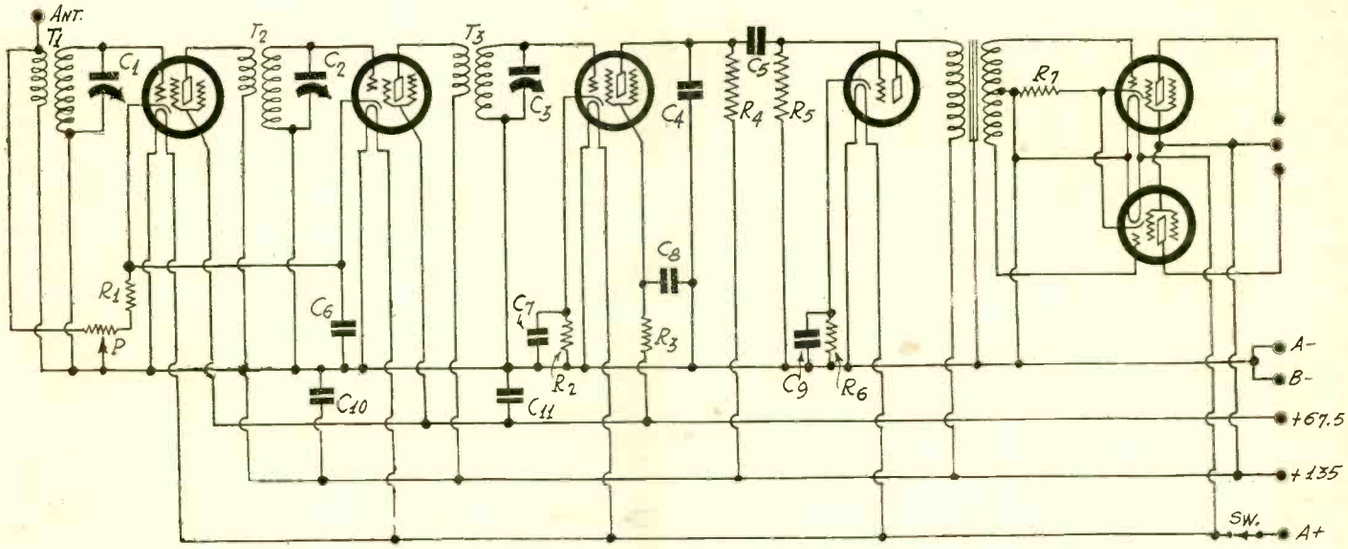


FIG. 1
The circuit diagram of the six tube midget automobile receiver.

THE most important characteristic of an automobile receiver is high sensitivity. It must be much more sensitive than a home receiver because in the auto neither a good ground nor a good antenna can be provided. At best, only a counterpoise of moderate efficiency can be had, and that counterpoise is the metal part of the car itself. As to antenna very little can be provided in a closed car because any wire inside the body is almost completely shielded. In all-metal bodies the shielding is nearly 100 per cent. In open cars the situation is somewhat better because a wire used for antenna is at least partly exposed to the radio wave.

Field for Car Radio

If the set is sensitive it does not require a great deal of pick-up to receive good signals and the little that enters a closed car is sufficient. It will be found that if the antenna wire is put out of a window good signals will be obtained if the wire extends a few feet from the body, but if it is run along the body, outside, within a foot or so, there is virtually no pick-up, as judged by a set of moderate sensitivity.

The proper field for a car radio is not in the car while the car is in motion but outside the care while the motorists are camping or parking. When it is used for entertainment during stops, it is possible to erect an antenna that will have a sufficient pick-up even at remote places from sending stations.

While this is the logical use of the car radio, the fact is that those who have such installations want to receive at all times, and wherever they may happen to be. They must be served. And the only way is to give them a very sensitive set which will overcome all the obstacles.

On the front cover of this issue is the picture of a midget automobile receiver which is quite suitable for use in a car. As will be observed, the circuit contains six tubes. They are two 236 radio frequency amplifiers, a 236 grid bias detector, a 237 audio amplifier, and two 238 power amplifiers in push-pull. Therefore, the circuit contains two radio frequency stages, a detector, and two stages of audio frequency amplification.

In Fig. 2 is a side view of the receiver, showing the three tuning condensers and one of the output tubes on top and the three shielded radio frequency coils and the push-pull input transformer below. Fig. 3, which is a view of the under side of the subpanel, also shows the three shielded coils and the audio transformer together with various resistors and by-pass condensers.

LIST OF PARTS

Coils—

T1—One special antenna coupler as described.
T2, T3—Two interstage shielded tuning coils as described.
T4—One push-pull input transformer.

Condensers—

C1, C2, C3—Three 350 mmfd. tuning condensers in one gang.
C4—One 350 mmfd. fixed condenser.
C5—One 0.1 mfd. fixed condenser.
C6, C8, C9—One triple 0.1 mfd. condenser.
C7—One 0.25 mfd. condenser.
C10, C11—Two 0.1 mfd. condensers or larger.

Resistors—

R1—One 300 ohm resistor.
R2—One 30,000 ohm resistor.
R3—One 2.5 megohm resistor.
R4—One 250,000 ohm resistor.
R5—One 500,000 ohm grid leak.
R6—One 2,000 ohm resistor.
R7—One 1,000 ohm resistor.

Other Parts—

Eight UY type sockets.
Five grid clips.
Special remote tuning control with plug and cable, including P, a 5,000 ohm potentiometer and the condenser dial.
Special loudspeaker with 6 volt dynamic field.
A special chassis.

Remote Control

No controls are shown because they are mounted on the steering gear of the car and the circuit is remote controlled. A special device, which clamps on the steering gear, contains a dial and a knob and these are connected to the tuning condensers by means of a flexible coupler. The device also contains the volume control and the on-off switch. Another cable contains the necessary wires for the volume control.

At each end of the chassis is a terminal socket, each of the five prong type. The front socket, that is, the one at the end where the condenser shaft projects, is for the volume control and the filament circuit connections. Two of the leads in the cable are connected to the storage battery in the car, or to any six volt storage battery which may be carried for operating the circuit. The other terminals of the cable are connected to the volume control.

The socket at the back end is for connection to the loudspeaker. Two of the terminals go to the plates of the power tubes and two go to the field of the speaker. The field, of course, is connected to the filament circuit. The remaining terminal goes to the center of the push-pull output transformer built into the speaker. The two plate terminals of the transformer, of course, makes contact with the prongs to which the plates of the power tubes are con-

Receiver with Push-Pull

Audio Gain Insure Sensitivity

Williams

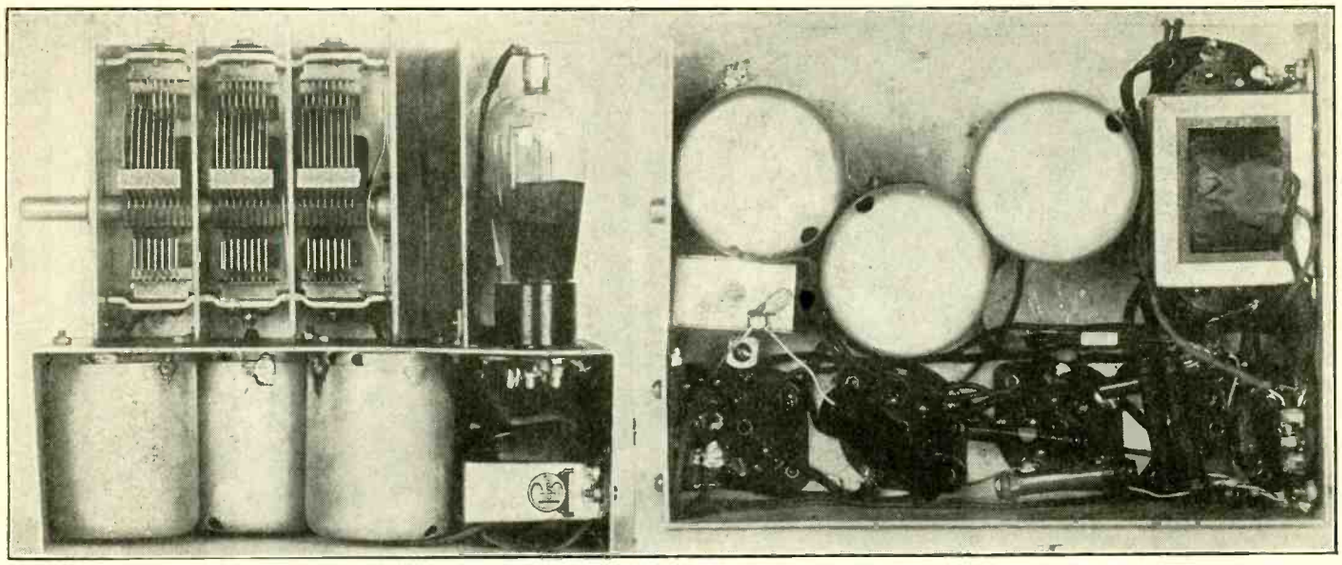


FIG. 2
A side view of the midget automobile receiver, showing the layout of the condensers and the coils.

FIG. 3
The bottom view of the midget automobile receiver, showing the layout of the coils and other coupling devices as well as the by-pass condensers.

nected. A special cable is connected to the speaker terminating in a Y type plug.

The leads to the B battery are flexible wires or a separate cable.

The Circuit

The circuit used in the midget automobile receiver is given in Fig. 4. This shows three tuned circuits, T1C1, T2C2 and T3C3. All the coils are shielded, as can be seen in the photographs and each tuning condenser is in a separate metal compartment. In the finished receiver a metal cover goes over the chassis and this cover is so arranged that the shielding of the condensers as well as of the tubes is complete. Thus each tube is also in a metal compartment.

The volume is controlled by means of a potentiometer P of 5,000 ohms connected between the common cathode return of the radio frequency amplifiers and the antenna. This control is used because the 236 tubes are not of the variable mu type and it is therefore inadvisable to increase the bias alone but to reduce the signal input simultaneously. R1 is a resistance of 300 ohms to determine the minimum bias on the grids of the two tubes.

Grid bias detection is used in the circuit, and the detector is a 236 screen grid tube. It is biased by means of a 30,000 ohms resistance R2 connected in the cathode lead. This is shunted by a condenser C7 of 0.25 mfd. capacity.

Bias on Audio Tubes

The audio amplifier following the detector is a 237 and this is biased by means of R6, a 2,000 ohm resistance. It is shunted by a condenser C9 of 0.1 mfd. capacity. The two power tubes are biased with R7 a resistance of 1,000 ohm. No by-pass condenser is connected across this since it serves a push-pull stage.

The coupler between the detector and the first audio amplifier is of the resistance capacity type. R4 is a 250,000 ohm resistance, C5 a condenser of 0.1 mfd. capacity, and R5 a grid leak of 0.5 megohm. A resistance R3 of 2.5 megohms is connected in the screen lead of the detector tube, and this resistance is shunted by a condenser C8 of 0.1 mfd. capacity.

Condensers C6, C10, and C11 are also of 0.1 mfd. capacity. They serve mainly to by-pass radio frequency currents and thus to stop oscillation, and for that reason they are only 0.1 mfd. Of course, larger capacities may be used if desired and if there is room for them in the set. Condenser C4 has a 0.00035 mfd. fixed capacity.

Voltages Required

The screen returns of all the 236 tubes are connected to a 67.5 volt tap on the plate battery and therefore this is the screen voltage on the first two tubes. The screen voltage on the detector is considerably less on account of the high resistance R3 in its screen lead.

The plate voltage on all the tubes is 135 volts, and that includes the space charge voltage on the two power tubes.

The heater voltage, of course, is the voltage of the storage battery, which is about 6.3 volts when the battery is fully charged, which it always is if the charger on the car has been adjusted properly.

The total current drawn by the receiver from the storage battery is only 1.8 ampere. The field of the speaker is also connected across the battery and this has a resistance of 4 ohms so that it draws 1.5 amperes. Thus the total current is 3.3 amperes. This is not much and is scarcely noticeable in comparison with the current taken by the ignition system.

The total plate and screen current is normally 33.6 milliamperes but varies somewhat with the adjustment of the volume control. But even the maximum is not great and the plate batteries should last a long time.

The Tuners

Each of the three tuning condensers has a maximum capacity of 350 mmfd. and the three secondaries of the tuning coils are wound to this capacity. The minimum capacity in each circuit, despite the fact that a trimmer is used across each tuning condenser, is low enough to bring in 1,500 kc when the inductance of each tuning coil is large enough to tune in 550 kc.

The trimming of the circuit can be done satisfactorily with the trimmers in most instances so that the tuned circuits are lined up throughout the range. In case there should be a slight detuning at one end of the band it is possible to bend the rotor plates of the condensers to allow for this.

Each coil is wound on a form one inch in diameter with 127 turns of No. 36 enameled wire. The primaries of T2 and T3 are wound outside the secondary windings with No. 40 silk enameled wire, being separated from the primaries by a thick insulator so that the primary diameter is about one sixteenth greater than the secondary diameter. The primary winding on each coil is nearly ¾ inch long. The coils are inclosed in zinc shields measuring 2 and ⅛ inch in diameter and 2.5 inches high.

The primary of the antenna coil is a duolateral wound coil mounted inside the coil form and at one end of it. The primary amounts to a large choke coil and the coupling between the antenna and the secondary is partly inductive and partly capacitive. The winding has been carefully proportioned to give best results from the points of view of sensitivity and selectivity.

(Continued next week)

Something Entirely Diff

Powerful T-R-F Tuner with Converter

By Howard

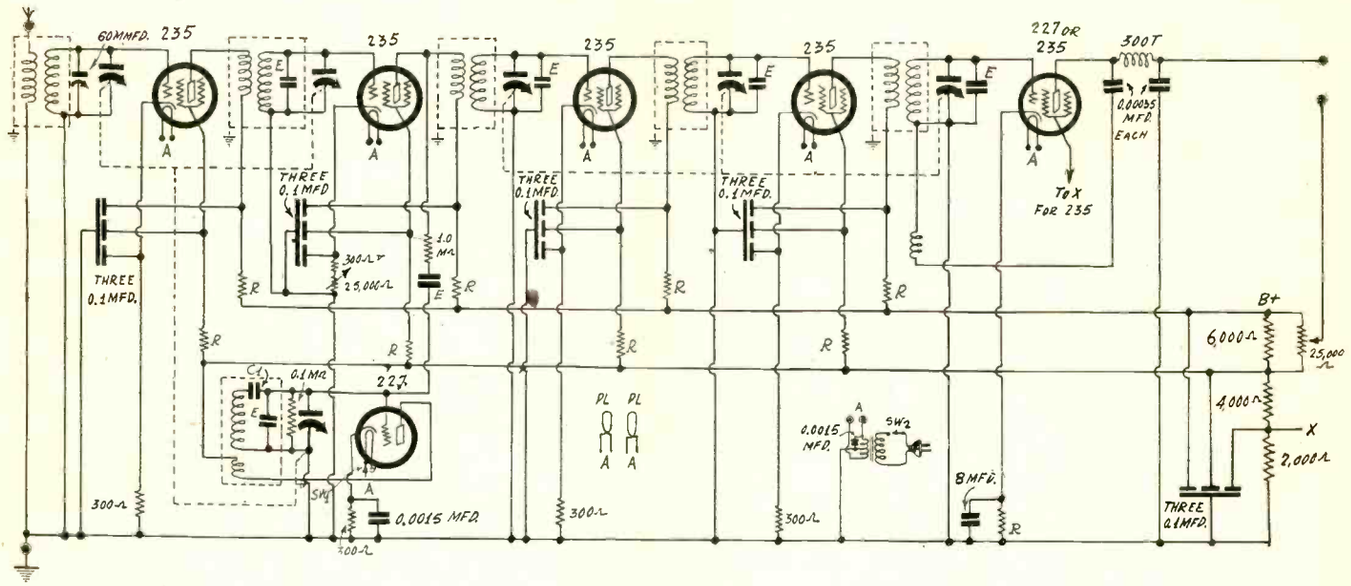


FIG. 1

Four stages of T-R-F and tuned detector—five tuned stages—for broadcast coverage. A sensitive super also for short wave coverage.

AN alternating current tuner, 15 to 550 meters, is diagrammed in Fig. 1. The system used for broadcast waves is tuned radio frequency amplification. For short waves the circuit becomes a superheterodyne. It is therefore a tuner with short wave converter built in, but is different from any model ever shown, in that two three gang condensers are used, with a separate dial for each three gang.

Three circuits for short waves require plug in coils. For tuned radio frequency reception on the broadcast band only two are needed, an antenna coil with a radio frequency choke primary, and an interstage transformer, as only two sections of the gang are used in this case. The circuit then consists of four stages of t-r-f and a detector.

When short waves are to be received the switch SW-1 is turned on, to heat the oscillator tube. The coupling of oscillator and modulator is automatically established. A pigtail resistor of 1 meg. in series with a condenser, E, of up to 100 mmfd., constitutes the coupling device.

Circuit for Short Waves

Now we have a stage of tuned r-f, an oscillator, a tuned modulator, two stages of intermediate frequency amplification, and a second detector.

The filament supply is built in, but the audio amplification and the B power must be supplied externally.

Since there is a dial for each of the three gangs, total two tuning dials, it is possible to select any intermediate frequency within the tuning band, but if the circuit is properly arranged, the lowest frequency that can be tuned in may be used, by setting the right hand dial at the numerical reading of 100. Then the intermediate frequency will be around 520 kc.

It is necessary as part of the coil design for the oscillator to select some specific frequency region, and the reason for picking out a low one is that it is sufficiently high to keep down image interference and permit good reception down to 15 meters.

Operation Analyzed

Since the antenna coil is of the plug in type, for short waves the primary is smaller than for broadcasts, and is wound on the same form, instead of being a choke coil placed inside the secondary. Also, since we desire for broadcast work a circuit that will be highly selective, the primary of the first interstage transformer, in the plate circuit of the 235 tube at upper left in Fig. 1, may have 15 turns, if the diameter is small, say, around 1 inch to 1⅛ inches. However, the next three primaries may have 25 turns each, as this gives a big lift to the low radio frequencies.

So the situation is as follows:

(1—For broadcast reception, no molestation of the coils is necessary, but the a-c switch for the oscillator filament should be turned off. An oscillator coil may be in position, however.

(2)—For short waves three coils are plugged in for each band. Since the three gangs used are of 0.00046 mfd. capacity per section, the short wave band is covered with three sets of coils.

Padded Oscillator

The oscillator is padded for the first short wave band, because the intermediate frequency then is a large percentage of the original carrier frequency, or there is a large percentage of difference between the oscillator and the modulator frequencies. For the next two oscillator coils no padding is necessary.

The padding arrangement is built into the oscillator coil for the first short wave band. Therefore a grid leak is necessary to provide a grid return. If the value of this leak is high it will have practically no effect on selectivity or on oscillation. The use of a plate winding assures oscillation down to the lowest wavelength for which the coils are designed.

Use of Two Filament Transformers

The diagram shows one filament transformer, but since 10.5 amperes will flow in the heater circuits, and 0.5 ampere in the pilot lamps, it is unlikely you can readily obtain a filament transformer that will stand such a drain, and still not heat up unduly and not drop considerably below 2.5 volts. So two separate filament transformers may be used instead, in which case use a bypass condenser from center ground to one side, of 0.0015 to 0.01 mfd.

The resistors marked R have a value of 0.02 meg (20,000 ohms) and are used, with one exception, as part of the capacity-resistor filters. These filters keep the radio frequencies out of the power amplifier, and help confine to each stage the currents intended to be present therein. Thus stability results.

The exceptional use of R is as bias resistor for the detector tube, which may be a 227, a 235, or a 224. The circuit shows that either a screen grid tube or the three element tube may be used as detector. If the 227 is used, then the grid connec-

erent for 15-550 Meters

Built-in; Two Dials Used Adroitly

Farnsworth

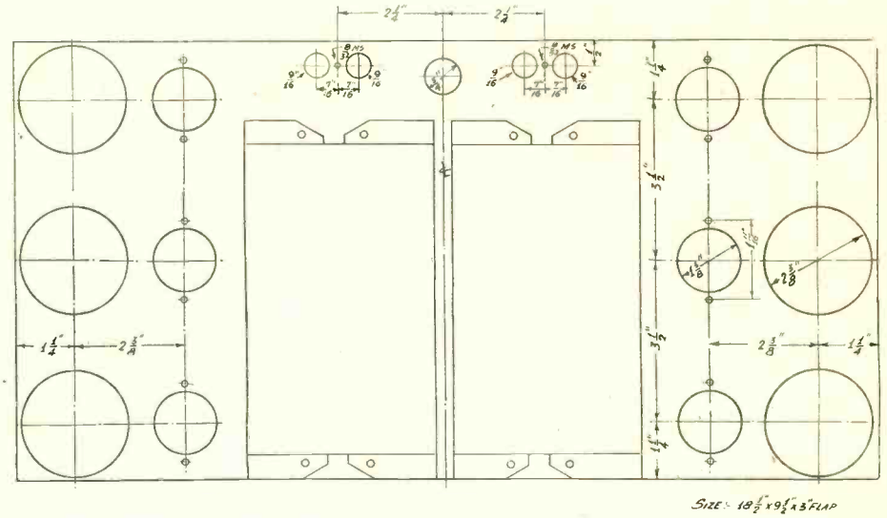


FIG. 2

The layout of the chassis top. The shielded three gang condensers, a separate dial for each gang, are at center. At the left rear is the first r-f coil, next the oscillator, next the second r-f or modulator, depending on use, as told in the text. The antenna-ground and phone jacks are at rear.

tion is to G post of the socket, the heater, cathode and plate being the same for both types. If a screen grid tube is used, the control grid is the cap and connects to one side of the tuning coil, while the G post goes to a positive voltage, marked (X). This voltage will be around 25 volts, if the applied voltage at B plus is 180 volts. The r-f screens will get around 70 volts, under such circumstances.

What About the First Detector?

The 235 tube may be used as detector, if the bias is high enough, as it will be under the circumstances, and is then interchangeable with the 224. Those who doubt this statement should make the trial.

It will be noticed that when short waves are to be received there must be two detectors, and nothing has been said of the first detector, but instead the stage has been discussed only from the viewpoint of radio frequency amplification.

By locating the volume control, a grid bias adjustor, in the cathode circuit of the second radio frequency tube (broadcast reception), is becomes readily practical to turn the control until the bias is high enough to provide the tube with a modulating (detecting) characteristic. Also, by adjustment of this control the volume may be governed on the basis of altered modulation effectiveness. This also has the indirect effect of varying the coupling between oscillator and modulator, so that it may be loosened for higher frequencies, say, when using the set of smallest coils.

There would be some discrepancy in the tuning at the high frequencies (short waves), but as the second tube from upper left is then a modulator, it has a larger input capacity than as an amplifier, and besides has an equalizer, so a manual trimming condenser placed across the first tuned circuit enables ready tracking of the two, while the oscillator's curve is determined by the coil-condenser combination, including padding, as previously stated.

Suggested Layout

The gain obtainable from the third and fourth stages of radio frequency amplification is very large, and when short waves are tuned in these stages comprise the intermediate channel. The selectivity would not be high enough, if one depended on these stages only, but it is high enough indeed when the short wave t-r-f stage and the tuned modulator are considered. The oscillator can not be counted additionally, as when the selectivity of the intermediate channel is allowed for, that is all the selectivity that the oscillator possesses. In point of scientific fact the oscillator alone has no selectivity, but merely generates different frequencies, and what seems to be its selectivity is derived solely from the selectivity of the intermediate channel. This could be proved practically by using resistance coupled intermediate stages.

Fig. 2 shows the suggested layout, with the antenna coupler at left rear, the oscillator next and the modulator at front, on the basis of short wave reception. or, as a broadcast set, the antenna coupler and first and second interstage couplers. respectively. Then at the other side, the tubes and coils are arranged progressively in the opposite direction, front to back, and are not disturbed.

Regenerated Detector

Please note that the second coil from left, feeding the modulator for short waves, otherwise the first interstage coupler, has a fixed condenser, E, across the coil. Since this is a plug in coil, this condenser is built into the coil, but including the coil for broadcast use, the advantage of this system being that there is independent and fixed trimming for each coil, and no disparities otherwise due to unavoidable differences where different coils are used. However, since the trimmer across the input stage (antenna coupler) is of the front panel and manually operated type, it should be across the condenser.

Regeneration in the detector stage is included only so that clear reception of interrupted continuous waves may be enjoyed by followers of code, including the tuning in of the NAA time signals, but those having no use for such reception (i.e., can't read code), may omit the regeneration.

The regeneration control is a potentiometer that alters the plate voltage.

Data on Coils

In all places where E is specified it is an equalizing condenser of the set-screw type, to be adjusted once and left thus, and has a range of capacity from 20 to 100 mmfd. (0.00002 to 0.0001 mfd.)

The three fixed condensers of 0.1 mfd. in one case have four leads emerging. The black one is common and goes to ground. Any of the three red ones, representing the other plate of the condenser, may go interchangeably to the destinations diagrammed.

The coil data for the broadcast band are as follows, diameter 1⅛ inches:

Antenna coil: radio frequency choke coil of 200 to 300 turns, mounted inside the coil form. The choke may be near either end of the form. The secondary consists of 105 turns of No. 31 enamel wire.

The first interstage transformer has a 15 turn primary wound directly over the secondary, near the bottom, with insulating fabric between. Any kind of insulated wire may be used for the primary, while the secondary has 100 turns of No. 31. The difference in secondaries is due to the choke's reduction of the secondary conductance.

The next three interstage coils have the same 100 turn secondaries, with 25 turn primaries wound on top.

The feedback coil for the detector has 30 turns over the secondary.

There is no oscillator coil for the broadcast band.

For the first short wave band to be tuned in, the primary of the antenna coupler may consist of seven turns of No. 28 enamel wire, while the secondary, on the same form, beside the other, not underneath it, and separated by ⅛ inch, may

(Continued on next page)

(*Continued from preceding page*)

consist of 40 turns of No. 28 enamel. The same directions apply to the next coil, or input to the modulator. The oscillator, if C1 is 0.01 mfd., would consist of 35 turns, with a 20 turn plate winding separated by ¼ inch.

The second band is covered by similar secondaries, C1 omitted from the oscillator. The primary for antenna coupler has 8 turns of No. 18 enamel, that for the next coil, 5 turns of No. 28 enamel; secondaries, separated ⅛ inch, have 12 turns of No. 18 enamel, while the oscillator coil has 10 turns for secondary, and No. 18 enamel, and 8 turns of No. 28 enamel for the plate winding, which also is separated therefrom by ⅛ inch, side by side.

The third set of coils all have the same secondaries, 4 turns of No. 18 enamel, with 4 turns No. 18 enamel primary for the antenna input, separated ¼ inch, and six turns No. 28 enamel wire, separated ⅛ inch, for the plate of the first 235. The oscillator plate winding consists of 6 turns of No. 28 enamel, separated ¼ inch.

All the coils are shielded, either copper or aluminum shields to be used, of a diameter no less than 2.25 inches.

Other Details

If desired, the 0.1 meg. resistor in the grid circuit of the oscillator need not be there permanently, but may be built into the first short wave range oscillator coil (largest one), as the omission of C1 from the succeeding oscillator coils establishes the grid return to ground, and eliminates the necessity for this resistor in those instances.

The 8 mfd. condenser to bypass the resistor biasing the detector tube is an electrolytic condenser, with case grounded, and with anode (lug at bottom of the inverted type condenser) to cathode. This large capacity is included, as it is not known with what type of audio amplifier the tuner will be worked, but if regenerated audio is used in the power amplifier, which is unlikely, then this condenser may be as small as 0.1 mfd., serving only radio frequency bypass purposes.

The B plus lead for the detector, if permanently attached to a resistor or inductive impedance, including primary of an audio transformer, must be removed, and connected instead to the slider of the potentiometer governing regeneration, unless regeneration is omitted.

Why the Detector Option

If a coil of any type is used as the coupler from detector to power amplifier, the detector tube should be a *227*, otherwise (if a resistor is the plate load) the 224 or 235 should be used. That is reason for giving the option.

The diagram shows what parts are needed, and nearly all of them have been discussed. The coils may be wound for tube base type of plugging in, hence the coil receptacles would be tube sockets.

[*Readers having any questions regarding this circuit amy address them to the author. Write to Mr. Howard Farnsworth, c/o* RADIO WORLD, 145 *West 45th Street, New York, N. Y.*—EDITOR.]

THE following is a list of some of the new members of the Short Wave Club. Virtually every week new names are published. There are no repetitions.

Gaston Van Hypte, 39 Porter. St., Taunton, Mass.
Cecil Brownlow, W5BMK, Eldorado, Okla.
Chas. E. Kelly, 4217 Comiy St., Wissinoming. Philadelphia, Pa.
Major L. R. Elkins (Rtd.), Star Route, Elkins Park, Jasper, Ark.
Clarence Beachey, P. O. Box 121. Sturgis, Mich.
Wm. Spartivent, 93 Broadway, Newark, N. J.
Henry Zdybalski, 12709 Watterson Ave., Cleveland, Ohio.
Peter A. Ross, 1125 Lytle St., Chicago, Ill.
Rex Shannon, 612 South 9th St., Terre Haute, Ind.
Arthur W. Schmitt, 918 Rudd Ave., Canon City, Colo.
Saul Goodman, 135 Erin St., Pittsburgh, Pa.
Frank C. Coffin, 11 Cobbet Place, Lynn, Mass.
L. A. Dowd, 728 Chestnut St., Oakland, Calif.
President, Radio Club, Senior High School, Reading, Pa.
Lloyd V. Smith, Box 171, Kennard, Ind.
Felix T. Lanier, 867 Harrison St., Memphis, Tenn.
Lion W. Hayes, Appleton, Minn.
R. J. McCutcheon. 2509 Pine St., Pueblo, Colo.
George Roberts, 4521 45th St., Long Island City, N. Y.
T. C. Hughes, 57 Wallebrove Ave., Verdun, P. Q., Canada.
Alfons Bruhn, c/o French Bldg. Barber Shop, 551 Fifth Ave., New York, N. Y.
Levi L. Lachappell, 41 Ashley St., New Bedford. Mass.
R. P. Sickler, 102 N. Marion Ave., Wenonah, N. J.
Joseph C. Thomas, 20 Linden Ave., Montclair, N. J.
Charles D. Souder, 34 E. Emaus Ave., Allentown, Pa.
W. M. Donnelly, Box 175, Watrous, Sask., Canada.
H. W. Shedeker, Brigade Signal Co., 1st Brigade U. S. Marines 3, Port Au Prince, Haiti.
Ten Eyck Ronson, Matawan, N. J.
Mario Lozano (Radio Service Man), 1649 Vine St., Chicago, Ill.
Frank R. Grey, W9TC. 4144 West 25th St., Chicago, Ill.
Otho N. Cozart, Jr., 86 Crawford, Oxford, N. C.
K. G. Silverwood, 502 Jefferson St., Port Clinton, Ohio.
Ernest A. Stolha, 7 Cherry St., Fitchburg, Mass.
Byron Donel, 342 Burton Ave., Washington, Pa.
Ralph Bennett, 700 So. Mariposa St., Burbank, Calif.

Short Wave Club

ARE you interested in short waves? Receivers, transmitters, converters, station lists, trouble shooting, logging, circuits, calibration, coil winding—what not? If so become a member of Radio World's Short Wave Club, which you can do simply by filling in and mailing attached coupon. Or, if you prefer,, send in your enrolment on a separate sheet or postal card. As many names and addresses as practical will be published in this department, so that short wave fans can correspond with one another. Also letters of general interest on short wave work will be published. Besides, manufacturers of short wave apparatus will let you know the latest commercial developments. Included under the scope of this department is television, which is spurting forward nicely.

Short Wave Editor, RADIO WORLD, 145 *West 45th St., New York.*

Please enroll me as a member of Radio World's Short Wave Club. This does not commit me to any obligation whatever.

Name .....

Address .....

City..... **State**.....

Speaker a Limiting Factor in Audio Systems Not Useing the New Regeneration Principle

Taking the orthodox audio amplifier, meaning one not using audio regeneration, large filter and bypass capacities are needed. and by all means should be used. The filter capacities in the rectifier need not be much different for various audio channels, but if there is no regenerated audio the by-pass capacities are from 8 mfd. up. This applies to audio tubes, including grid biasing resistors and screen voltage reducing resistors.

In respect to filter and bypass capacities, they should never be lower than the minimum specified value, and always may be higher than the specification calls for, definitive values being given for guidance only.

With four 8 mfd. the low-note protection is abundant, and there will be no discrimination against them of any kind that the loudspeaker is able to reproduce with intensity.

It is well known it takes more power to drive the low notes through the speaker, and the power is there, but it is also true that speakers have a rising characteristic, too, or a rising and falling characteristic, either of which, in respect to low notes, means that there is a certain minimum frequency below which it is next to useless to provide much amplification, as the speaker will not do justice to it. However, waiving the speaker consideration, a good amplifier will amplify the lowest audio frequencies broadcast by any station, as well as the highest, and will give considerable amplification to all the audio frequencies, since the amplification curve is relatively flat, from 25 cycles to 7,000 cycles. The audio circuit thus attains the fullest and severest requirements for television.

If the chassis is to be in a midget mantel cabinet, then the dynamic speaker will have the output transformer and the B supply choke coil built in. The coil in parallel with the secondary of the output transformer is the voice coil of the dynamic speaker. Even if the installation is to be made in a console, the same method may be used, unless you have a speaker already, and if so, a B supply choke coil might be necessary, as well as an output transformer, unless either or both are in the speaker.

When a 400 ohm choke was used in a set that hummed badly previously, and 8 mfd. added, where two 8 mfd. existed, there was no hum one could hear. The condensers were placed, one next to rectifier, one at beginning of the new choke, one at juncture of the new and old chokes, and the other at the end of the old choke.

Use large capacities across power tube and other under audio and detector biasing resistors when hum is out.

Various schemes have been proposed, and some used commercially, for hum reduction. One is to have a separate secondary, its voltage out of phase with the secondary feeding the rectifier plates, and introducing this dephased voltage into the filter choke, as a bucking agency. To the same effect a separate tube has been used as a phase shifter, with its output fed into the filter choke. If the systems were fully effective they would be self-sufficient. But they need resistance, hence the pi-filter remains. Such a filter is easy to construct, is dependable, and when adequately proportioned gets rid of the hum to the queen's taste.

A DC Potential Meter

Measures Voltages Without Drawing Any Current

By Brunsten Brunn

WHEN designing resistance coupled amplifiers and power detectors working into high resistance loads, ordinary current drawing voltmeters are not accurate enough, not even if they are of a 1,000 ohms per volt sensitivity. The reason is that the voltage drop in the high resistances is often many times higher than the voltage indicated by the meter.

An example is the measurement of the output voltage of a tube, that is, the voltage across the tube itself when there is a high resistance load. Another is the measurement of the screen voltage when there is a high resistance in series with the screen lead. Still another is the measurement of the grid bias when this is obtained from a high resistance in the cathode lead. There are many other cases in which the current drawing voltmeter does not give even approximately correct voltage indications.

In all cases of this kind a true potentiometer should be used for measuring the voltage, or a meter which does not draw any current from the source. If the meter does not draw any current the voltage obtained is the same as the voltage that exists across the two points when the meter is not connected.

Non Current Drawing Voltmeter

The diagram of a non current drawing voltmeter of simple construction is shown in Fig. 1. It employs two tubes, one a 227, which is used as a balance indicator, and a 280, which is used only to supply the voltage.

The voltage to be measured is connected between the two terminals marked "DC volts," with the polarity indicated. In series with this unknown voltage is impressed another voltage, bucking the unknown, and this voltage is measured with the voltmeter V. This known voltage is obtained from the drop in the left portion of potentiometer P, which is connected across the output of the B supply.

The theory of this voltmeter is simple and depends on the fact that the plate current of the 227 tube is the same when the grid bias is the same, no matter how it is obtained, provided that other conditions remain constant, particularly the plate voltage on the 227 tube. We first must establish a balance point. To do this we throw switch Sw1 to point (1) and pick up B minus. The grid of the tube is then negative by an amount depending on the grid bias resistance R. This resistance is used to insure that the grid is negative at the balance point and thus to insure that the tube will draw no current at the balance point. It does not make much difference what the bias of the tube is at the balance point, just so it is a volt or so negative and not so much negative that the plate current is cut off.

When the switch is on point (1) we note the reading of the milliammeter M and keep it in mind. That is the balance point. In order to get an exact point it is well to change the resistance of rheostat Rh until the reading falls exactly on same division line on the scale. Having made this adjustment, the rheostat is left alone but the reading is remembered.

Procedure

Now throw Sw1 to point (2), picking up the unknown voltage. Before this is done, however, make sure that the slider on P is near the ground or B minus end. If this has been attended to and if the unknown voltage has been connected with the polarity indicated, the plate current as indicated on M will reduce when Sw1 is set on (2). Now move the slider on P toward the positive end until the reading on M is the same as it was when the switch was set on (1). Now the unknown voltage is exactly equal to the reading on the voltmeter V. It may be necessary to change the range of this voltmeter in order to get an accurate reading, especially if the unknown voltage is low. It is suggested that a three range meter be used. Sw2 is a switch for picking up the different ranges. This may possibly be built into the instrument, but if it is a single range meter of low voltage range, external multiplier resistances can be connected in the three leads to the switch. The ohms per volt of V is of no importance and a moderately sensitive instrument is just as good as a 1,000 ohms per volt, or better, instrument.

It may be that the balance point has drifted between the time the balance point was established and the time that the unknown voltage was balanced. This drift may be due to a change in the plate voltage or to a change in the filament voltage. In order to make sure that an error does not arise from this source, the balance point should be checked by returning Sw1 to (1). If the reading on M is not the same as it was before, make it the same by a slight adjustment of Rh. Then find the balance with Sw2 on (2). The reading obtained this time on V is more nearly equal to the unknown. In case the accuracy of the adjustment is doubted another check should be made.

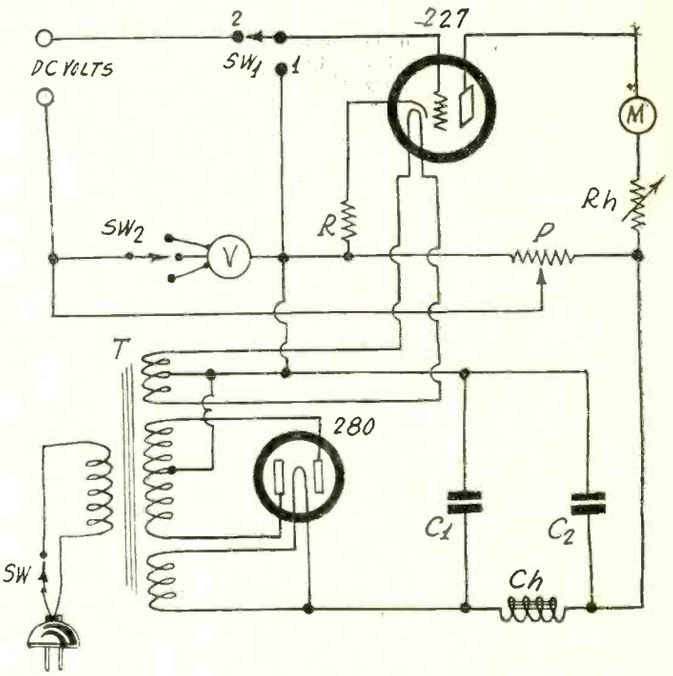


FIG. 1

The circuit of a non current drawing voltmeter in which an unknown voltage is balanced against an auxiliary voltage measured with an ordinary voltmeter.

If the regulation of the B supply is good there will be no appreciable drift so that the first adjustment is correct. Also, if there is only a small drift so that it is necessary to adjust Rh only slightly, the second adjustment will be close enough. The adjustments are made so rapidly that there is very little chance that the line voltage will vary between time the adjustment is made on point (1) and the time it is made on point (2). If the voltage is known approximately, the potentiometer P can be set so that V reads this voltage, while Sw1 is on point (1), in which case there will be no appreciable drift and the first reading will be correct.

There is a danger in doing this, however. If the unknown voltage should happen to be much lower than that expected, the bias on the tube will be highly positive when Sw1 is set on (2). This will cause a high plate current and might damage M. This danger might be avoided by putting a shunt across M, but it is preferable to use good care than extra parts, which will complicate not only the circuit but its operation.

Just as it was not important what kind of voltmeter is used for V, so it is unimportant what kind of current meter is used for M. The only condition is that it gives a good deflection. Comparatively inexpensive instruments may be used for both meters.

Variation in the line voltage, which would cause variations in the plate and filament voltages, is not important at all, for the balance point is checked before each balance of the known against the unknown.

The instrument is particularly useful in taking curves on tubes in resistance coupled amplifiers where the actual plate voltages for different grid voltages are desired. Such curves may be taken quickly and accurately with the instrument and they yield exceptionally useful information.

The B supply is a regular B battery eliminator involving a power transformer T, having one 2.5 volt winding, center tapped, one 5 volt winding, and one high voltage winding, center tapped. The rectified voltage should maintain at least 150 volts across P. It is not absolutely necessary to use the filter C1, Ch, and C2, but it is desirable to use at least some filtering.

Curves of 236 Autom

Low Screen Voltage Best fo

By J. E.

CURVES taken on the 236 screen grid tube in a resistance coupled circuit are typical of curves taken on tubes of this type. They show primarily the importance of not using too high screen voltage.

In Fig. 1 is a set of four curves taken on a 236 with 135 volts in the plate circuit, 6.3 volts on the heater, and 250 ohms in eht plate circuit. The four curves represent screen voltages of 67.5, 45, 22.5, and 6.3 volts.

We note first that there is a limiting of plate current of 0.235 milliamperes. When the plate current has this value the drop in the 250,000 ohm plate resistance is approximately 59 volts. This is the limiting value for all screen voltages. When the screen voltage is 67.5 volts there is practically no change in the plate current until the grid bias is over 4 volts. At 4.5 volts the plate current drops suddenly to a value about half the maximum. Then there is a kink in the curve and for higher bias values the curve assumes the regular shape. It is the region to the left of the kink which is useful.

On the 67.5 volt curve the curvature in the useful region is so great that amplification is not possible, the tube being good only for detection. To obtain detection under these conditions it would b necessary to use a grid bias of about 7.5 vlts. But the detection efficiency is not good.

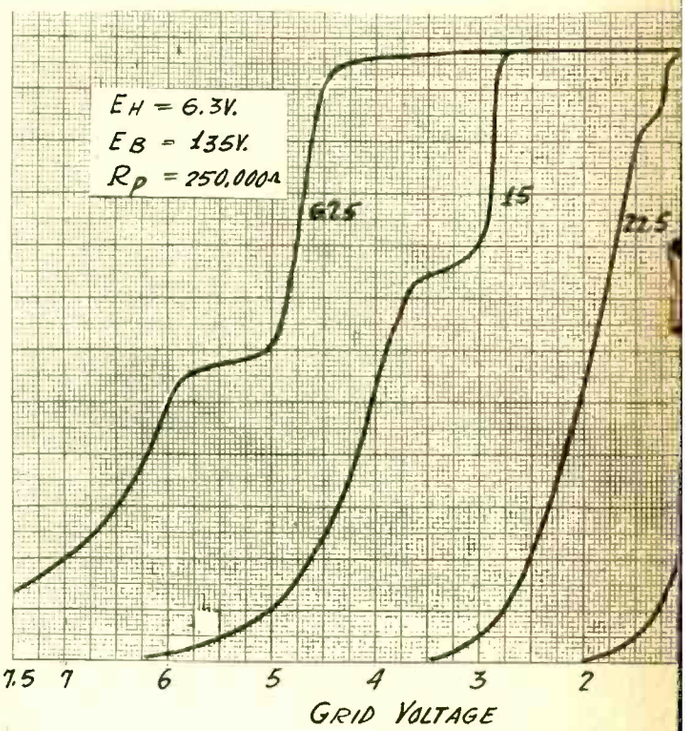
Lowering the Screen Voltage

On the next curve the screen voltage is 45 volts. The sudden drop in the plate current occurs when the grid bias is about 2.8 volts and the kink centers about a bias of 3.25 volts. The useful portion of this curve is to the left of a bias of 3.5 volts. Fair amplification of weak signals could be obtained by adjusting the grid bias to about 4.2 volts and good detection by making it about 4.75 volts. It will be noticed that the kink in the curve was moved toward the right and up toward the higher plate current. The useful range is considerably extended both for amplification and detection.

The 22.5 volt curve shows still further improvement. The useful portion on this curve begins when the bias is 1.5 volts. For most efficient detection the bias should be between 2.5 and 2.75 volts. For amplification the voltage on the grid should be about 2 volts. At this point, with a signal amplitude of 0.5 volt, the amplification is about 40 times. If the tube is operated as an amplified with a bias of 2 volts, a bias resistance of about 18,000 ohms should be used. This must be by-passed with a very large condenser or the amplification will be considerably lower. By large is meant 4 mfd. or more, and even a 4 mfd. condenser is small in respect to the lower audio frequencies.

Low Screen Voltage

For detection with the conditions represented by the 22.5 volt curve the operating point might be put at 2.7 volts where



the plate current is 0.024 milliampere. This would call for a bias resistance of 112,000 ohms. This resistance, too, must be shunted by a very large condenser or the detecting efficiency will not be what it is expected to be.

Th curve at the extreme right is for a screen voltage of 6.3 volts. Apparently, this is the best curve of all. It is not only the steepest in the amplification range but it also has the greatest curvature in the detection range. For detection the bias should be adjusted to about 1.2 volts where the plate current is 0.134 milliampere. Thus if self bias is to be used the bias resistance must be 4,850 ohms. If the amplification indicated by the curve is to be obtained there should be a large capacity across the resistance.

The indicated amplification at 0.65 volt bias, for a signal amplitude of 0.25 volt, is 67.5 times. This with an input voltage of only 0.25 volts, peak value, the output voltage amplitude will be 16.9 volts.

Big Progress Is Recorded in R

"AIR COMMERCE BULLETIN," used by the Aeronautics Branch of the Department of Commerce, sets forth the following in the October 15th issue in regard to radio devices for airplane control:

The last year has seen the development of practicable visual indicating methods for use with radio indicating methods for use with radio direction finders, and extensive work is in progress on methods of aiding an airplane in determining its direction of flight or its position. Research into the matter of landing aids has resulted in development of equipment which can be applied in making blind landings.

Radio apparatus for communication between aircraft and ground on medium frequencies has become commercially available and experience gained in operation on medium-high frequencies has suggested many refinements in apparatus design. Two-way communication has been made available to the itenerant flier, while the design of two-way radiotelephone equipment for military operators has been completed. Considerable investigation is in progress on the use of high frequencies for aircraft service.

Conclusions reached by a liaison committe follow:

1. Radio receiving apparatus for the medium frequencies and two-way redio-communication apparatus for the medium-high frequencies have been brought to high degree of efficiency and have stood the test of extensive use for mor than a yar on airplanes in flight.

2. Information has accumulated on the usefulness of various frequencies for different times and conditions; the data now available give a partial answer to the choice of frequencies in practice, and point the way to a comprehensive investigation of this subject.

otive Screen Grid Tube

· Resistance Coupled Circuits

Anderson

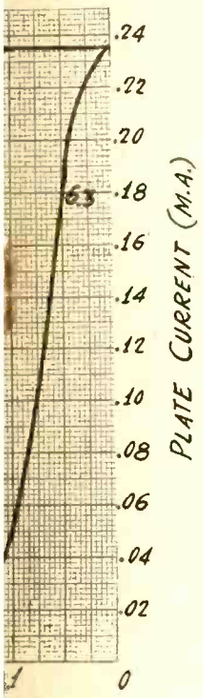


FIG. 1
Four characteristic curves of a 236 screen grid tube with a 250,000 ohms load resistance and 135 volts in the plate circuit, showing the variation in the plate current with changes in the grid bias and the screen voltage.

Due to the fact that self bias always introduces degenerative feed back and that it is not practical to use condensers large enough to overcome this at the low audio frequencies, it is best to obtain the bias with batteries whenever this may be done. Since batteries can only be changed in steps of 1.5 volts and as the adjustment is extremely critical with respect to bias, it is necessary to use a low resistance potentiometer with a comparatively high current through it. This potentiometer may be connected across the heater circuit when the heater current is steady. In some cases the bias may be taken from the voltage divider ,that is, when a B battery eliminator is used.

Varying the Screen Voltage

The operating point not only depends on the screen voltage, but also on the plate load resistance and the plate voltage applied. There are several ways of achieving correct adjustment for either amplification or detection. Suppose, for example, that we can have a bias of 1.5 volts on the screen we will have fairly good detecting efficiency, but we could increase a little by increasing the screen voltage by a few volts. Likewise if we want amplification and we have a bias of 1.5 volts, we can get good amplification efficiency by increasing the screen voltage still more. We could also effect proper adjustment bv changing the plate load resistance or the applied plate voltage. In a resistance coupled amplifier it is better to increase the plate voltage than to make any other changes.

One good way of effecting the correct adjustment of the grid bias and the screen voltage is to connect the screen to the positive end of the heater battery and the grid return to the negative end. A potentiometer of about 500 ohms could then be connected between the same two points and the cathode so the slider. By moving the slider the entire 6.3 volts can then be thrown either into the grid circuit or the screen circuit. Somewhere between the two extremes a point can be found where the screen and the grid voltages are just right for maximum detection. This also provides a good volume control in case the potentiometer is used to control the detector tube.

The use of ahigh plate voltage in series with the plate coupling resistance is of utmost importance if a high output voltage with little distortion is desired, because this widens the useful range of the characteristic curve. If the voltage available is limited, somewhat the same effect may be obtained by using a lower coupling resistance, but this in turn lowers the amplification. There is really no substitute for a high voltage. It is perfectly safe to use a higher voltage in series with the coupling resistance just so the maximum effective voltage on the plate does not exceed the maximum voltage rating of th tube. That the applied voltage may be increased considerably is obvious from the fact that the drop in the high plate coupling resistance is high so that the effective voltage on the plate is low even if the applied voltage is high.

adio Aid to 'Plane Operation

3. Automatic volume control has been developed, relieving the pilot of much of the attention which he was hitherto required to give to the receiving apparatus

4. A system of simultaneous radio-telephony and visual radio-beacon service has been worked out. In this system a single transmitter will give these two services on a single frequency, so that the pilot does not have to interrupt the reception of voice messages to observe his radio course indicator or vice versa.

5. Direction finders have been developed for use aboard aircraft with devices giving visual indication of direction.

6. Experimentation has been advanced on radio-echo and sonic types of altimeters, which give promise of enabling a pilot at anv time to observe accurately his distance from ground.

7. A distance of radio aids for blind landing has been worked out, by which landings can be made at a suitably equipped landing field when the ground is wholly invisible.

8. Engine ignition shielding equipments have become commercially available and have given good results on many airplanes.

9. Progress has been made in the development and use of engine-driven generators for power supply for radio equipment.

10. An entirely new field of research and use has been opened up by experiments on radio communication at frequencies in the neighborhood of 50,000 kilocycles. These frequencies are satisfactory for short distance communication between airplanes, and have the advantage of very simple and lightweight apparatus and very little interference.

A Set for Farms

Automotive Tubes Operated on a 32 Volt Battery

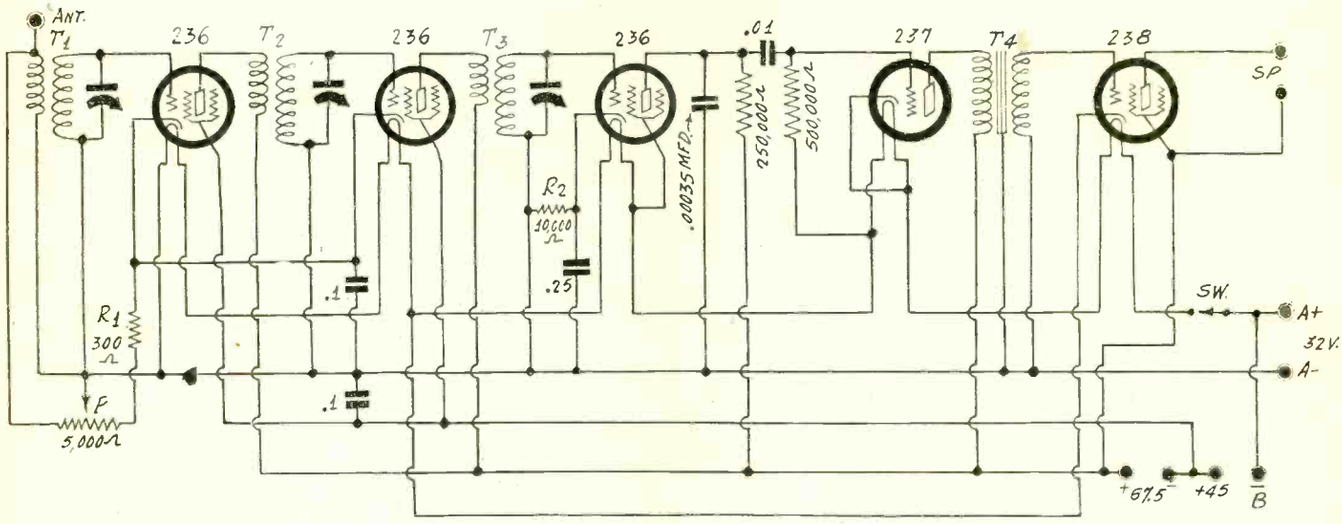


FIG. 1

The circuit of a five tube receiver utilizing the automotive type tubes designed for operation on a 32 volt farm lighting installation. Booster batteries are used to get sufficient plate voltage. The arrangement is such as to use a minimum of parts.

THERE is some demand for receivers to be operated on 32-volt farm lighting installations. Those wishing to build a midget type receiver suitable for this purpose are offered the circuit diagrammed in Fig. 1. This is not a theoretical circuit but is one that has been tried for automobile use, and it is essentially the same as the automobile receiver described in detail elsewhere in this issue. It differs only in details made necessary by the different filament supply.

Since the voltage of a farm lighting system is 32 volts and one tube of the automotive type requires 6.3 volts, only 5 of the automotive tubes can be used in series on the battery. One of the tubes, therefore, must be left out. The question is now which should be left out, one of the radio frequency amplifiers or one of the push-pull power tubes. The farm equipped with a 32-volt system is not likely to be close to broadcast stations and therefore a high sensitivity is necessary. This requirement imposes that all the radio frequency tubes be kept. Hence we have left out one of the power tubes. Naturally, the sound output of this receiver will not be as much as that from a power push-pull stage, but it will be sufficient for moderate requirements. It is enough to operate a sensitive magnetic or inductor type loudspeaker with good volume.

Filament Connections

In the auto set the filaments were connected in parallel. In this they are connected in series. This is the main difference. The volume control and the tuners are exactly the same. The method of obtaining bias for the radio frequency amplifiers is also the same and the same values of resistors and condensers are used.

The first major departure, aside from the filament connection, is the connection of the cathode and the screen of the detector tube. A grid bias resistance of 10,000 ohms is connected in the cathode lead of the tube and this resistance is shunted with a 0.25 mfd. condenser. The grid return is made to the negative side in common with the returns of all the grids except that of the first audio frequency amplifier. The screen of the detector is connected to the positive end of its own heater, which gives the tube a screen voltage equal to the drop in three heaters, less the drop in R2. The screen voltage is therefore very nearly 18 volts. If a lower voltage on the screen is desired it may be had by connecting the screen to the negative end of the heater of the tube, and if a higher voltage is desired it may be had by connecting the screen to the positive end of the heater of the first audio frequency amplifier. These various connections should be tried and that one which gives best results should be retained. The circuit should be judged by sensitivity and the amount of distortion when the volume is maximum, or when it is that at which the circuit is to be operated.

The bias for the first audio frequency amplifier is obtained by connecting the cathode to the positive end of its own heater and the grid return to the negative end. This gives this tube a bias of 6.3 volts, which is just about right for the plate voltage that is applied. This connection eliminates the necessity of using a grid bias resistance and also a condenser across this resistance. Thus degenerative feed back is also eliminated.

Power Tube Bias

The grid return of the power tube is made to ground and the cathode to the negative end of the detector heater, or what amounts to the same thing, to the positive end of the heater of the second radio frequency tube. This gives the power tube a bias of 12.6 volts, which is approximately the rated value when the plate voltage is 135 volts. The effective plate voltage in this case is about 132 volts.

The 32 volt battery is used not only to supply the heater current but also part of the plate voltage and the bias. As much of the heater batter voltage as is practical is applied to the tubes, and the rest of required voltage is obtained from a booster battery of 112.5 volts. It will be noticed that the screens of the two radio frequency amplifiers are returned to a point on the booster battery where the voltage is higher than A plus by 45 volts. Thus the effective screen voltage on the two first tubes is about 77 volts. If this voltage is too high for satisfactory operation the screens may be connected 22.5 volts lower, that is, toward A plus.

During operation the voltage of the storage battery varies from about 33.6 volts to 30.4 volts, depending on the state of charge. Most of the time the voltage will be slightly over 32 volts. This variation does not matter for the tubes can be operated at voltages from 6 to about 8 volts. When the voltage of the battery is 32 volts, each tube will get a voltage of 6.4 volts. This is about right and any variations that will normally be met are entirely negligible.

A More Elaborate Set

If a more elaborate set is desired two parallel branches of heaters may be made up and as many as ten tubes may be connected in the circuit. In such circuit a push-pull amplifier could be used to good advantage. Not only could two tubes of the 238 type be used in the final stage but four of them, two and two in parallel. This would account for three additional tubes. Two more could be connected to the heater circuit without taking any more current from the battery. One might be a radio frequency amplifier to boost the sensitivity. In case it is not desired to use so many tubes, each tube omitted in the second series would have to be replaced by a resistor having the same value as the resistance of the heater, that is, 6.3/0.3, or 21 ohms.

While it is possible to get plenty of volume with enough of these tubes, if it is necessary to use four of them in the last stage a more economical arrangement could be found with other tubes.

Coil Switching Methods

Tap for 75 Meters Popular on T-R-F Sets

By Herbert E. Hayden

PICKING up a tap on a coil to attain higher frequencies works out all right for waves down to about 75 meters, where the tapped coil is originally intended for the broadcast band, but even a stable r-f channel at broadcast waves might prove a little too tricky on regeneration for lower waves, so a three tuned stage channel may be converted to two tuned stage channel, as in Fig. 1. This is the diagram of a midget in very simple form, using six tubes, with some audio feedback introduced by obtaining the bias for the first a-f tube from the drop in a 30 ohm resistor in series with the 400 ohm pentode biasing resistor.

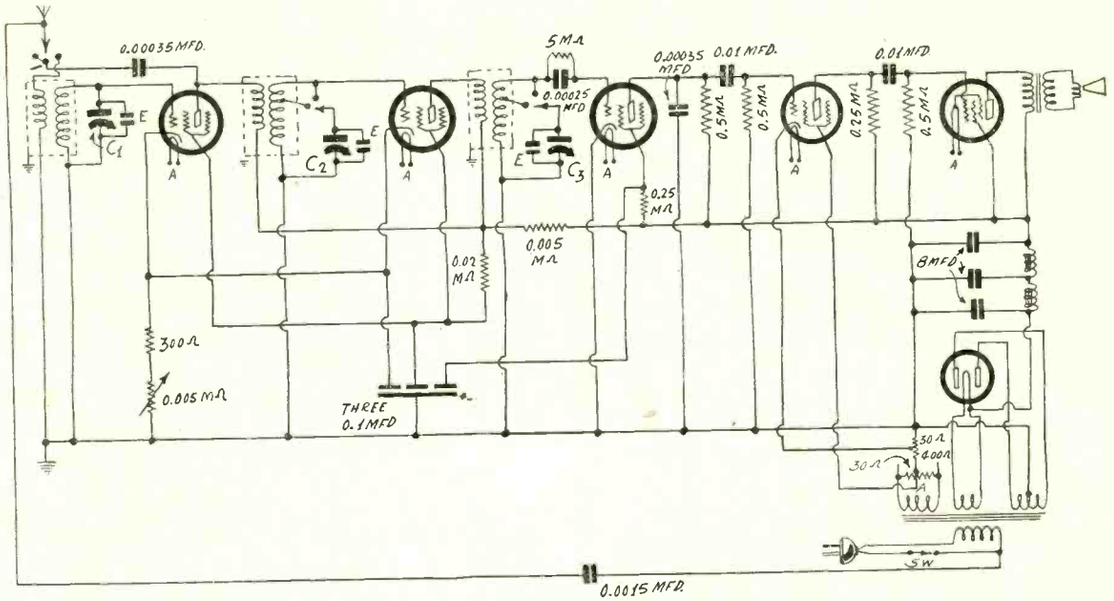


FIG. 1

Good results are obtained down to about 75 meters by using one tap on a coil otherwise serviceable for the broadcast band. This is becoming a popular feature of small receivers, as it enables reception of television, police calls, amateur phone and code, airplane and ship conversations.

The other method is that of using separate coils, and is diagrammed in Fig. 2, showing a short wave superheterodyne.

The intermediate frequency is 450 kc, not 175 kc, because at 450 kc intermediate it is easier to avoid image interference and also to get down to lower wavelengths, on account of the greater difference in frequency between oscillator and modulator tuning.

Condenser Switching

The short waves are covered in four stages. For the highest wave band the difference in frequencies will be relatively greater, and the disparity may be taken up by using a three gang condenser, two sections in parallel for the first and second bands of tuning. Then for the third and fourth bands, where the tuned windings are identical, only two sections of the three gang are used, one section for modulator, the other for oscillator.

In Fig. 2 the wave band switch is a rotary selector switch, three pole, four point. That means the switch has three decks, each deck representing a circuit picked up by the index, while for each circuit there are four possible consecutive selections. and these are simultaneous for the three poles, decks or circuits. In one deck two of the points are left blank because not used.

Speaker Plug Connection

E represents an equalizer of 20-100 mmfd. The rest of the data are given on the diagram. The socket representation at right is for the speaker plug. Connect pentode plate and B plus maximum to the heaters of speaker plug socket, plate spring of this socket to ground, G to tap T on the field coil of the dynamic speaker, and K to B minus. The field coil is used as B supply choke and is in the negative rectifier leg, so the center of the 2.5 volt winding is grounded, which is not ture in more usual rectifier circuits.

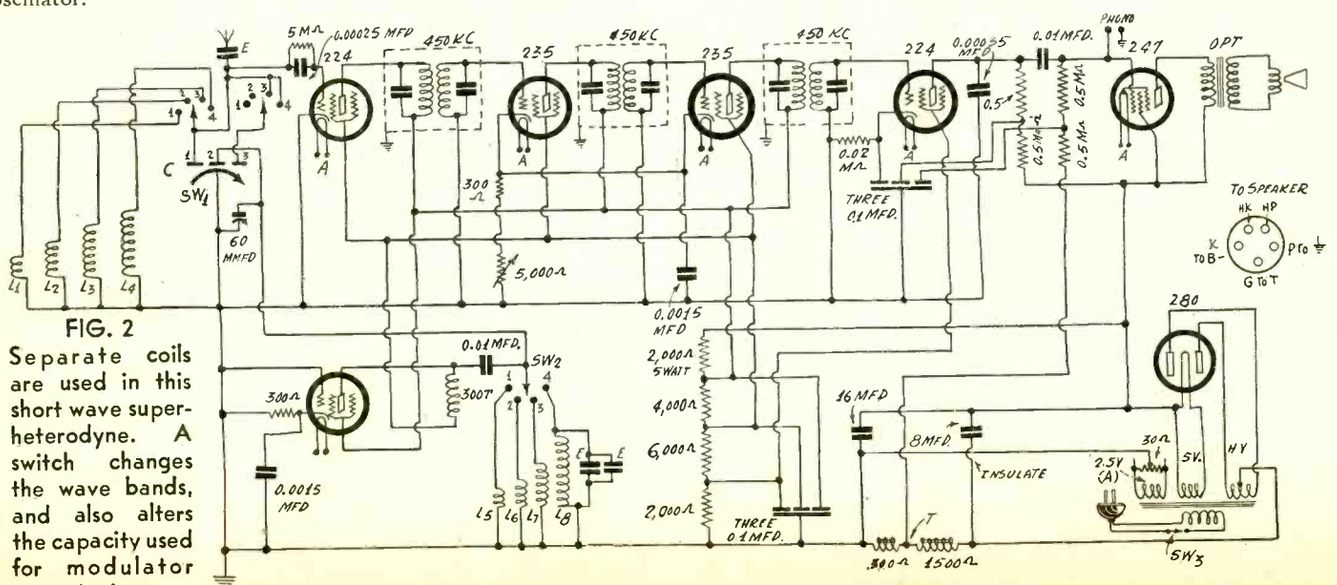


FIG. 2

Separate coils are used in this short wave superheterodyne. A switch changes the wave bands, and also alters the capacity used for modulator tuning.

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

Radio University

To obtain a membership in Radio World's University Club for one year, send $6 for one year's subscription (52 issues of Radio World) and you will get a University number. Put this number at top of letter (not envelope) containing questions. Address, Radio World, 145 West 45th Street, New York, N. Y.

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

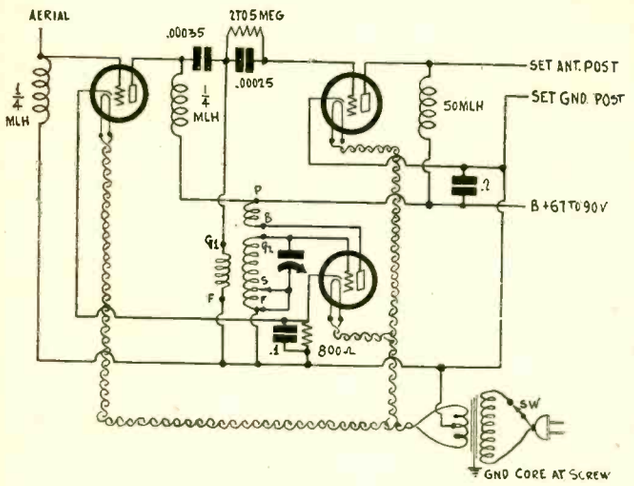


FIG. 962

Such a circuit as this works well as a converter, but if the modulator is tuned the circuit will work still better, although another set of plug-in coils would be required, and precautions against undesirable or excessive coupling.

Open or Shorted Antenna Winding

MY tuned radio frequency set played well until recently, when it tuned in only the lower broadcast waves, and none of the higher ones. Also, the lower ones came in more selectively than formerly. The set now squeals, while formerly it did not, although the volume control may be used to check this oscillation at radio frequencies. What can be the trouble?—J. S.

The primary of the antenna coupler is either open or shorted, more likely open. The coils themselves pick up enough to produce reception on the lower wavelengths, because of the greater amplification at those wavelengths, particularly when attended by regeneration. The external antenna is in fact not connected to the circuit, due to the open or short, and therefore the resistance is lowered and the squealing results. Find the open or short and correct it.

* * *

Pentode Tubes

WHAT is the principal purpose of the pentode output tube? So many manufacturers advertise the pentode as an advantage in their sets that it would seem that this tube is far superior to all other output tubes, and yet engineers say that there is a strong third harmonic, which, if true, is almost insoluble, because push pull takes out only even harmonics.—G. W.

The principal object is economy. The pentode is the most sensitive output tube, by far. So it permits speaker operation at satisfactory volume of sound with only one stage of resistance coupled audio. As for the third harmonic, it is present, and in some of the pentodes it is strong, having attained values close to 15 per cent in an extreme case. The percentage varies with the types of pentodes, and in some pentodes is not high. Curves taken by us of high grade pentodes showed excellent regularity, and we recommend the use of such tubes for circuits like the one mentioned, or for similar purposes. But where there is an abundance of radio frequency amplification, or where the audio channel is of high gain, the other type output tubes may be preferable, e.g., 245, 210 or 250 for a-c operation, and 171-A for battery operation.

* * *

Multiple Modulation

IS it practical to produce multiple modulation on very high frequencies, and if so how does the practicability arise?—U. S. G.

It is entirely practical, because of the enormity of the high frequency as compared to the low radio frequencies modulated thereon. The process consists of having transmitters send out their programs on low radio frequencies, such as broadcast frequencies, which frequencies themselves are of course modulated. Then the modulated broadcast frequency is modulated on the high frequency. This modulation may be in multiple because of the frequency insignificance of the broadcast carrier compared to the high frequency. Thus at 3,000,000 kc (1 meter) for the relay transmission frequency, not only could the 96 channels allotted to broadcasting be superimposed thereon, but if the low radio frequencies begin at 1,500 kc and go down in frequency, several times 20,000 such transmissions could be modulated on the 3,000,000 kc wave.

* * *

Grid Leak Versus Negative Bias

WILL you please let me know which is better, grid leak or negative bias detection? Is there much difference in the performance, and if so, which produces the better quality?—G. R.

There is not much practical difference between the two, provided the circuit is designed for one or the other. The grid leak type is more sensitive and therefore fewer primary turns are useful on interstage transformers, say 10 to 20 turns, before oscillation begins, compared to 20 to 30 turns for the negative bias type of detection. The net result is selectivity and sensitivity of about the same level, as the larger primaries make up for the lower sensitivity of the negative bias type, to produce equal results on those scores. As for quality, the negative bias type more readily lends itself to feeding an output tube through one stage of audio coupling. However, the leak-condenser type requires no biasing resistor, and also, if a three-element type tube is used, as is common, there is no resistor in the screen lead, for there is no screen. Both these resistors, for negative bias of the grid and for screen voltage reduction, are potentially troublesome due to negative feedback effects normally requiring large by pass condensers. For the leak-condenser type it should be said, too, that high leak values, e.g., 5 meg., with the usual grid condenser value of 0.00025 mfd., will produce less hum in a-c sets.

* * *

Shielding a Condenser

IS it necessary to use a shield over a three gang condenser? In former days we never heard of shielding the condenser, but lately I find that it has come to be quite the thing.—A. W.

In some circuits it is imperative to shield the condenser to avoid coupling between stages due to the electric field. This is true when the set is very sensitive, say, of the order of 10 microvolts per meter, or if there is oscillation present, when every means is used to get rid of it. Shielding the condenser never can do any harm, and always will do some good, though it is not vital, as stated, unless circumstances require it. A good rule, therefore, would be to use the shield always. The capacity may be slightly raised by its use, so any calibration made should be on the basis of the inclusion of the shield.

* * *

Tuning of a Converter

FOR a short wave converter is it preferable to have two tuned stages or one tuned stage, and if two stages are preferable, please explain why.—O. Y.

It is preferable to have two tuned stages, rather than one such stage, because the selectivity and the sensitivity are increased. This system encompasses the tuning of both the modulator and the oscillator. The modulator tuning will seem broad on strong signals, but on weak ones it will prove close and very effective. The effect does not show up much on strong signals. The object of higher selectivity is to enable penetration of greater distances, which penetration might be frustrated by a low order of selectivity, or there would be garbled reception of two or more stations, one much farther distant than the other. Greater selectivity alone will cure such conflict. See Fig. 962.

* * *

Television Today

CAN television be said to be on such a plane to-day that a man will get his money's worth if he buys a manufactured television set-up, and can he depend on reliable reception, night in and night out?—H. G. K.

Television is on an experimental basis yet, and utterly dependable results of sufficient importance can not properly be said to exist. The great demonstrations of television have been with laboratory machines that cost many thousands of dollars to build. The art seems to be awaiting a tube that can be used for scanning, thus discarding mechanical scanning and moving parts. While such tubes do exist, there is trouble in them, and the trouble is being eliminated gradually. Then, too, the illumination has to be better, so that projection can be enjoyed, that is, pictures can be seen on a screen large enough for a party of persons in a room to enjoy without straining. Projection of this type also has been demonstrated as a laboratory feat, but the development has not reached the commercial stage. Unless you have the same, or similar, laboratory apparatus, the results will not be the same. The entertainment value at present is exceedingly limited, and it is doubtful whether the kick one gets out of first seeing television in one's home will last even for several evenings. This is not said in discouragement of television or its progress, which recently has been

fairly good, but as an answer to your question whether a man would get what he feels is his money's worth out of the television installations offered for sale to-day. We think not. But we do advise the experimentally inclined to continue their interesting observation of television results, particularly as by the use of their own skill they can produce good apparatus at much less cost than that of the semi-commercial television installations now offered. Such an experimenter may become a party to television development and is therefore different from the mere looker-in.

* * *

Prevention of Coupling

YOU have stated a few times that where separate coils are used for covering different wave bands by a switching arrangement that there should be no coupling between the coils, as such coupling may result in dead spots, due to the natural period, or the harmonic of the natural period, of such coupled coil or coils working as a wave trap to prevent reception. Will you please state to what extent shielding would satisfy the requirement?—K. G.

Total shielding would prevent the coupling. As the band shifting is usually for high frequencies, say, above 1,500 kc, for the system you mention, it is not necessary to resort to total shielding for reception, say, to 20 meters, but a copper or aluminum sheet may be placed at the end or ends of the respective coils, at right angles to the axis. This will be sufficient to stop intercoupling. However, total shielding may be used in any instance, and all sets that use tuned radio frequency in any manner at lower waves than 20 meters should be totally shielded, not only as to coils but as to tuning condensers and other parts.

* * *

When Values Differ

PLEASE accept my compliments for the very fine issue you published as your 500th consecutive issue, dated October 24th. In this issue there was an article by J. E. Anderson on midget receivers, and I was intensely interested in the development work that he outlined so clearly. Certain values were given, and specified in the diagram (Fig. 2, page 6, five tube receiver for a-c). Other values have been given in other publications, as well as in previous issues of your own paper, and also in the very issue under discussion.—T. F.

Difference in values often is due to difference in results desired to be attained, and sometimes to the non-effect of the difference. Perhaps you refer to the voltage divider, with values of 2,000, 6,000, 4,000 and 2,000 ohms respectively, in the diagram you cite. Naturally, different values than these will give different voltages, and these different voltages might be necessitated by difference in the number of primary turns on r-f transformers, values of load resistances, etc. Capacity-resistor filter circuits in the audio channel frequency have different values than those cited, but the values are not critical. Such latitude is well within the province of the designer, and the differences need excite no worry. We are glad you enjoyed reading the October 24th issue and thank you for your compliment.

* * *

Audio Regeneration

IN the audio regeneration circuits Mr. Bernard has been describing in your weekly, is it your contention that such regeneration dispenses with the need for the large bypass capacities that you formerly recommended so highly?—H. F. S.

The audio regeneration circuits never were published before by any agency, so far as we know, and constitute Mr. Bernard's invention, therefore we never recommended large bypass capacities for these circuits, but did recommend them for the orthodox circuits we had been printing previously. Therefore it is true indeed, and we reaffirm, that the use of regeneration in the audio channel dispenses with the need of large bypass condensers for grid and screen biasing, since regeneration does all that the large capacities would or could do, that is, removes the negative feedback up to the optimum point of removal. The standard test is that of low frequency motorboating, for if that is present the circuit is giving more low note amplification than it should, and more than the system can support. Regeneration is used to reduce the negative feedback but not to the point of creating or sustaining positive feedback to an oscillating degree. It is much like the use of r-f regeneration to the point of greatest sensitivity, which is just under the point of oscillation. When oscillation is reached the operating possibilities become hopeless in either a tuner or an audio amplifier.

* * *

Why L-C Ratio Should Be High

WHAT is the significance of the L-C ratio and why should it be high? In band spanning devices it is usually low, because of a large minimum capacity, represented sometimes by a fixed condenser in parallel with the tuning condenser.—I. R. E.

The L-C ratio is the ratio of the inductance to the capacity, and it should be high because of the resultant high impedance. In the broadcast band and at lower frequencies it does not make such a great difference, but at higher frequencies it does, particularly at frequencies above 5,000 kc, and most particularly in oscillator circuits, for the oscillation may stop somewhere around that frequency due to the very fact of low L-C ratio. This is notably true with dynatron oscillators, which are notorious for stopping when the ratio is low. Oscillators with the plate coupled to the grid are not so sluggish on this score, hence will not stop oscillating so soon, but the intensity of the oscillation declines nevertheless. Also

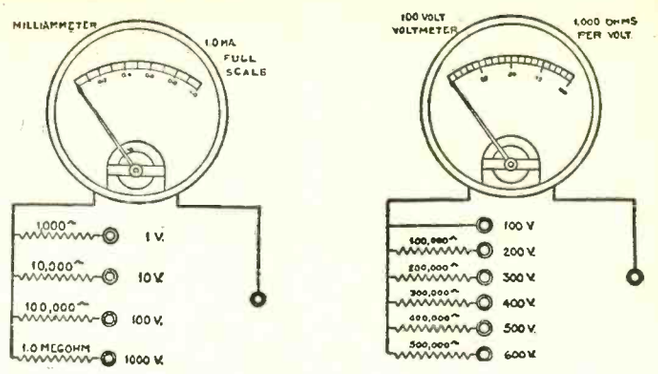


FIG. 963

How to use a 0-1 milliammeter as a voltmeter and how to increase the reading of an existing 0-100 volt voltmeter that has a sensitivity of 1,000 ohms per volt.

tuning systems with low L-C ratio for short waves have sharply declining sensitivity as the frequencies increase. The decline is true even of band spanding devices, but is compensated for by special circuit arrangement, including regeneration.

* * *

Meter Resistors

USING a 0-1 milliammeter, please show what resistance should be used, and what the connections are, to constitute the device a voltmeter to read the following maxima: 1, 10, 100, 1,000 volts, and also how to increase the reading of a 100 volt voltmeter (1,000 ohms per volt) to 200, 300, 400, 500 and 600 volts.—D. M.

Fig. 963 illustrates these points. At left the milliammeter is converted into a voltmeter of the ranges requested. The resistance of the meter itself is too low to require allowance. For instance, one such popular meter has a resistance of 27 ohms. Compared to 1,000 ohms for the 1 volt scale, this may be neglected, and of course the privilege is greater the higher the range. Since the meter is a 0-1 milliammeter, the meter resistance being neglected, there will be 1,000 ohms in series for each volt of the full scale deflection. At right is shown how to increase the reading of the 0-100 volt voltmeter, as requested. Wire wound resistors, accurate to at least 1 per cent, should be used for all nine purposes illustrated.

* * *

Large Output from Small Tubes

IN audio amplifiers at plate current cut-off until the signal swings positive to restore flow, may self bias be used? If the circuit is in push-pull style is it really push-pull?—T. V.

Self bias may be used, but not for the push-pull type of circuit, to which the system applies for obtaining large output from small tubes. The circuit looks like but isn't push-pull.

RADIO WORLD

The First and Only National Radio Weekly
Tenth Year

Owned and published by Hennessy Radio Publications Corporation, 145 West 45th Street, New York, N. Y. Roland Burke Hennessy, president and treasurer, 145 West 45th Street, New York, N. Y.; M. B. Hennessy, vice-president, 145 West 45th Street, New York, N. Y.; Herman Bernard, secretary, 145 West 45th Street, New York, N. Y.

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

Edison's Monuments

NO single individual ever benefited mankind more than did the late Thomas A. Edison. His genius, phenomenal inventive faculty, and untiring work produced devices which are the foundations of gigantic industries and services, all of which contribute to make life throughout the civilized world more pleasant and comfortable.

His work covered a wide range of interest, but was concerned chiefly with applied physics. In this work he inevitably touched upon radio and associated branches of physics. Early in his career he invented a successful microphone. He also discovered the "Edison effect," which is the basis of the modern radio tube.

This phenomenon is that current will flow from a second element to the filament if the second element is positive in respect to negative filament, but no current will flow if the second element is tied to the negative filament.

A THOUGHT FOR THE WEEK

NOW that a Los Angeles judge has consented to the broadcasting of a criminal trial at which he is presiding, perhaps in the near future it will be possible for the public to listen in on something as judicial as the following:

Prosecuting Attorney (to the accused murderer, but facing the mike): Did you or did you not hit Spike Maginnis over the head with a hook, causing his death? (No immediate reply forthcoming, he addresses the judge): Your Honor, I ask that you compel the defendant to reply. I insist that no prisoner shall flout a prosecuting attorney who has a record of seventy-four convictims out of seventy-five trials.

The Prisoner: Yer Honor, I don't mind answerin' this guy, but I want to be sure me friends down on the river front hear me (adjusting the microphone and speaking directly into it) Naw, I didn't. I used a hammer. . . . Hey, youse boys at Bill the Mug's —Kin yez hear me? How's t'ings?

The August Judge (straight into the mike and not looking at the prisoner): The accused will be more respectful; also he must not address his cronies from the stand. As I am up for re-election this Fall, I shall not permit the public to believe that I, one of the most conscientious members of the judiciary and always a protector of the public, would permit such indecorum in my courtroom.

The Prisoner (again into the mike): Hey, youse guys, de hard-boiled gent on de stand says I mustn't talk to yez—but, say, listen and you'll hear a lot of hot stuff. . . . See yez when I beats de rap!

(Ad lib, ad nauseum!)

Newspapers Use Radio To Augment Printed Sheet

By Thad H. Brown

General Counsel, Federal Radio Commission

THIS is the age of speed and more speed. A few months ago a record of 240 miles an hour was made by an automobile at Ormond, Fla. Within the past few weeks a record of 388 miles an hour by plane was established by a British aviator. But in the field of radio we get real speed, radio waves traveling with the rapidity of light, 186,000 miles per second. To the press, therefore, where speed is of the first importance, radio comes as a revelation.

Modern civilization through air travel and radio has been given a glimpse of far-off pastures and has rapidly become "world-minded." It is eager to know "how the other half lives," and this knowledge is daily being supplied by the press through radio.

91 Newspapers Own Stations

In speaking of radio, the general public thinks, of course, of broadcasting. There are 614 broadcasting stations in the United States at the present time, of which 91 are owned by newspapers. In all of the countries outside of the United States, there are only 620 broadcasting stations. In other words, with a population of 122,000,000, the United States has almost as many broadcasting stations as the rest of the world with a population of approximately 1,906,000,000.

In June, 1930, there occurred an event of outstanding interest to the newspaper profession. The New York "Evening World" successfully achieved a photo-radio feat which will probably have a tremendous effect upon newspaper publishing. After reproducing its pages by photoradio from New York City to Atlantic City for four successive days the "Evening World" then reproduced its first page by the same process on the Steamship America, 2,700 miles at sea from New York City.

Services Classified

The "Evening World's" achievement opens the door to possibilities of incalculably profound effect upon humanity. In the future it may be entirely possible to publish a newspaper simultaneously in Mexico City, Buenos Aires, Manila, Paris and New York City.

How the press is daily supplying the world with news through radio may be seen from a consideration of the following classes of services which are recognized by the Federal Radio Commission: Public point-to-point radiotelegraph, multiple address using automatic printers and mobile service with ships.

The first is by far the most extensive since it constitutes a regular communication service maintained by radio telegraph stations located in various cities throughout the United States and the entire world for the collection and dissemination of news. In the United States, these stations are operated by Press Wireless, Inc., in Needham, Massachusetts, near Boston; Hicksville, Long Island, New York; Chicago, Illinois; San Francisco, Calif.; and Los Angeles, Calif.

Press Wireless, Inc., also have under construction stations at Honolulu, T. H.; Dallas, Tex.; Kansas City, Mo.; Denver, Colo.; Minneapolis, Minn.; Seattle, Wash.; Salt Lake City, Utah; Washington, D. C.; New Orleans, La.; Philadelphia, Pa.; Atlanta, Ga.; Cleveland, Ohio; Memphis, Tenn.; Detroit, Mich.; Miami, Fla., and Upper Newton Falls, Mass.

Automatic Transmission

Communication is carried on by the use of 20 frequencies in the continental band between 4,000 and 6,000 kilocycles, and 20 frequencies in the transoceanic band above 6,000 kilocycles. Contents of messages are limited to material intended for publication to the general public. These stations are licensed by the Commission for this service on condition that they must serve all comers equally, regardless of who the she sender may be. The usual power rating at each station is 5 killowatts, but in some cases is as small as 500 watts. The continental Morse code is used in this type of service and this is transmitted manually or by automatic machines.

Multiple address service consists in the dissemination of press information by automatic printer instruments in coordination with radio transmitters operating on both low and high frequencies.

Scope of Work Widened

The receiving stations located at strategic points throughout the United States employ automatic printers which reproduce the matter transmitted. In this service, the American Radio News Corporation is licensed to use two low frequencies, 95 and 99 kilocycles, for unlimited time, and five high frequencies above 6,000 kilocycles during daylight only. Two such stations are in operation by this company at Carlstadt, N. J., and Chicago, Ill., while others are in the process of construction at San Francisco, Denver and Atlanta.

The life of a newspaper man has never been the proverbial "bed of roses," and if the last 10 years in the life of radio is any indication of what may be expected in the next 10 years, he will have to add to his already much burdened brain a wealth of knowledge and information constantly being brought to light by this important science, as well as the facts concerning its rapid development and advancement.

Already applications are being received by the Commission from companies equipped to experiment on a frequency between 1,000,000 and 3,000,000 kilocycles heretofore unknown. At present, the highest frequency used in commercial communication is 28,000 kilocycles and the band from 28,000 to 75,000 kilocycles is considered the "great unknown field of radio." Think what 10 years of experimentation in this field will bring!

Station Sparks

By Alice Remsen

Ann Leaf is so Tiny that when she sits at the enormous organ in her studio at the Paramount Theatre, New York, she looks like a stray wisp of fragile moon gossamer. Her sweet elfin face lights up with an ecstatic smile, as her tiny hands and feet manipulate the many keys, stops and pedals of her giant music box, giving pleasure and solace to thousands of listeners all over the country. I shall have the pleasure of running her biography in a future issue.

* * *

Station WAAT, of Jersey City, is known as the "Sunrise to Sunset" station, because it comes on the air as soon as the sun rises, and goes off at sunset. The time varies as the days grow shorter or longer. Though a small station, it has a very good reputation for the excellence of its programs, being fortunately possessed of an intelligent and capable manager, Dale Kennedy, assisted by E. R. Hampton as program director. This young station bears watching; its studio dance orchestra, under the direction of Tommy Gordon, and its classic trio, directed by Ina Grange, rank with the best music heard on the air, for their size and combination. Among the staff artists are such well-known entertainers as Tommy Weir, Mitzi Rich, the Ritz Quartette and many others.

* * *

Westell Gordon, tenor, cellist and composer, celebrated his fifth anniversary with the Major Bowes Family broadcasts on Friday, October 23, over WEAF. He sang "One Little Dream of Love" and "Faraway Bells," two of his own compositions which he sang on his initial program with Major Bowes.

* * *

Phil Cook, "the man of many voices," is making a vaudeville tour of the Middle West. He will appear in the RKO theatres through arrangement with the NBC Artists Service. His broadcasts will continue as usual through the facilities of associated NBC stations from each town where he will appear before the footlights.

* * *

Long Before Art Jarrett, the popular Chicago broadcaster, was a singer, he was an actor. Both of his parents were for many years stars of the legitimate stage, and Arthur made his first public appearance at the age of five as the little Indian in "The Squaw Man." He still has his Indian regalia tucked away somewhere.

* * *

Nellie Revell, who broadcasts over an NBC-WEAF network as "The Voice of the Radio Digest," now has a fan in Palmerston, North New Zealand. A letter from that South Pacific island, almost 10,000 miles away, reported that her program had been picked up there clearly. It was broadcast over the regular WEAF transmitter, and not by shortwave, usually used for distance. The letter, addressed to the NBC, follows:

"Just after 4:00 p.m., on a very cold day (it's Winter down here now) I was surprised to pick up your carrier on 660 KC. A lady, Nellie Revell, talking about different artists, either in pictures or radio, seemed to be giving their pedigrees and whom they were with, etc. I don't know whether you will consider this report enough for verification. I sincerely hope so."

The NBC engineering department stated that conditions in New Zealand were conducive to long-distance reception, and that a number of reports had been received of WEAF programs having been picked up down there.

* * *

When WLW went on the air with 50,000 watts, WOR's effective distance range was sharply shortened because of the inability of the average receiver to tune out the Cincinnati station. Wonder what's going to happen when WOR's new "willupuss-wallapus" smites the ozone! And also when we may expect it to go into effect!

* * *

President Hibben of Princeton University was recently invited to speak over WOR. He said there were two types of speeches—one when the speaker said something, and one when he had something to say! The Professor went on to explain that he would speak when he had something to say. If that rule were only universally applied what a pleasant place the radio universe would be!

* * *

SIDELIGHTS

EUGENE ORMANDY was the first solo violinist on the air . . . JACK MILLER was born in Dorchester, Mass. . . . EDDIE DUCHIN used to be the pianist of Leo Reisman's orchestra . . . ARTHUR PRYOR has written more than 300 popular compositions, including a light opera . . . HARRIET LEE, 1931's "Miss Radio," is a connoisseur of cheeses . . . JULIA MAHONEY and IRENE BEASLEY used to be school teachers before they were bitten by the radio bug . . . ANDRE BARUCH'S hobby is interior decorating . . . JIMMY MELTON is a good cook, his specialty being baked beans . . . ROY SMECK on his ukelele does a marvelous imitation of the tap dancing of Bill Robinson . . . EDDIE CANTOR takes off his tie when broadcasting . . . UNCLE DON CARNEY has given his wife that wonderful chauffeur-driven Packard and has purchased a new Lincoln for his own use . . . H. V. KALTENBORN was born in Milwaukee . . . PHIL MAHER used to be in vaudeville . . . OWEN D. YOUNG was born on a farm near Van Hornersville, N. Y. . . . MILDRED BAILEY has signed as an exclusive NBC artist . . . HELEN BOARD was born in Louisville, Ky. . . . TOMMY WEIR used to be a pugilist; his wife, Jessie, used to be known in vaudeville as "Venus on Wheels" . . . ERNIE GOLDEN has written a new novelty number, called "March of the Goops"; Uncle Don wrote the lyrics.

* * *

Answers to Correspondents

M. D., Brooklyn, N. Y.—Write to WOR, 1440 Broadway, N. Y., stating which particular broadcast you would like to attend and passes will be sent to you.

Mrs. Dale, New York.—Vaughn de Leath has a country home in Connecticut, but also maintains a studio apartment in New York. She will send you an autographed photograph if you write to her in care of NBC, 711 Fifth Ave., New York.

* * *

NOCTURNE

(For Ann Leaf and Her Organ, WABC, 12:30 a.m. daily)

Resounding through the purple halls of night,
Perfect as tides that softly rise and fall,
Sweet melody, and harmony in flight,
Speaking a language understood by all.
Bringing to each of us a different dream,
Of days long past or hours yet to come.
To some it brings the thrill of love supreme,
To others, dreaded rumble of a drum.
It brings sweet surcease to an aching heart,
Or homeward turns the wayward mind of youth;
It calms the brain upset by troubled mart,
And teaches that the path of life is truth!

For music is the heavenly aureole
Encompassing the essence of our soul.

Biographical Brevities

About Abe Lyman

Abe Lyman, whose Californians are heard thrice weekly over the WABC-Columbia network, used to be a taxi-driver in his home town. He drove the first Yellow cab to appear on the streets of the Windy City. Played drums from childhood. Worked in a Chicago movie house for from nothing a week up to as much as five dollars. Always got fired. Even his brother Mike fired him, but that proved to be Abe's biggest break. Mike discharged Abe from his position as orchestra leader at Sunset Inn, Santa Monica, Cal., because Abe directed the band from the drums. Abe took his band to the Ship Cafe, Venice, Cal., where he played for all the film stars. He then added four men to his five-piece band and moved into Cocoanut Grove, at the Ambassador Hotel, Los Angeles, where he was a reigning favorite for five years. After that he was featured with his band for seventy-two weeks in the Chicago company of "Good News."

Has written several song hits, among them, "Mary Lou," "I Cried For You," "You Told Me To Go," etc. Has made more than 250 best-selling phonograph records. Took his band to London in 1929 to play a four weeks engagement at the Kit-Kat Club; remained seven months, playing a double engagement at the Club and the Palladium Theatre, London, and the Moulin Rouge and the Perroquet Club in Paris. He and his band have been heard in more than a score of talkie-single motion pictures.

Abe sometimes goes for a couple of days at a time with nothing to eat but pears. Smokes and chews cigars when working hard; says this helps him to concentrate. Believes that whatever success he has attained is due to giving the public what it wants and not trying to educate the people to some new type of music.

Looking back over the last five years Abe Lyman recalls most vividly the following incidents:

Helping Paul Whiteman hire the men for his first dance orchestra job in the Alexandria Hotel, Los Angeles. Whiteman was playing with a five-piece string ensemble at the time.

Cashing the $75 pay check for a young actress on the M.G.M. lot who used to go to the Ambassador Hotel every Saturday (Joan Crawford).

Watching Ricardo Cortez, Norma Shearer and Billie Dove take their first screen tests.

Sending $20 to a good-looking young

(*Continued on next page*)

Forum

Wider University Club

I for one agree with one R. L. Stanley as regards the University Club, which should be open to all, with a charge per question to non-university members. Probably this is one reason which could account for the lack of really high interest in receiver circuit construction.

We do, however, admire the regular consideration shown those with yearly subscriptions, yet we hope for the betterment of conditions. We have never doubted the ability and endeavors of your technical staff to furnish up-to-date news, circuits and other technical information from the early days of your publication. These readers' belief makes it possible for your publication to boast of ten years of uninterrupted service "with technical accuracy second to none."

FRANK DE MARCO,
63 Oak Street, Yonkers, N. Y.

* * *

Fine, Slush and All

I see in the magazine that there are quite a few who criticize. No magazine ever off the press that wasn't criticized. It merely shows a lot of people are hard to satisfy; and I can say to them, if they know of a better magazine than RADIO WORLD, why in the world don't they let out the secret. I want to subscribe.

You run a lot of stuff, of course, that I don't like, mainly the low wave slush, but I know full well that thousands of others are eating it up.

JIM SWISHER,
Box 1297, Bartlesville, Okla.

* * *

Wants Fuller Exposition

YOUR caption on the letter from E. W. Bayard of Texas, "Good Advice from Texas, was not misplaced. I think most of your subscribers will agree that everyone is not a college professor or mathematician.

I am one of your readers who delights in technical articles, but more examples as to how you arrive at the figures would be appreciated.

After reading an article on S. W. coil winding several times some of the figures are still a puzzle to me.

NOEL S. GEYER.
112 So. 8th St., Reading, Pa.

* * *

STATION SPARKS

(*Continued from preceding page*)

foreigner, who had been unsuccessful in his attempt to get into pictures, so that he might take out a girl. . . the late Rudolph Valentino.

Giving saxophone lessons to a fifteen-year-old boy who asked to be allowed to sit on the platform with the band each night. Howard Hughes, producer of "Hell's Angels."

Allowing another young boy to sit up with the band several nights each week. Carl Laemmle, Jr., of Universal Pictures.

* * *

SUNDRY SUGGESTIONS FOR WEEK COMMENCING NOVEMBER 1ST

Sun., Nov. 1;—N. Y. Philharmonic ..... WABC—3:00 p.m.
Sun., Nov. 1:—Footlight Echoes..WOR—10:30 p.m.
Mon., Nov. 2:—Elizabeth Lenox..WEAF—9:30 p.m.
Tues., Nov. 3:—Dream Pictures..WIZ—11:45 p.m.
Wed., Nov. 4:—Street Singer..WABC—11:00 p.m.
Thurs., Nov. 5:—Weaver of Dreams—Basil Ruysdael ..... WOR—10:00 p m
Fri., Nov. 6:—Bob Ripley.....WIZ—7:45 p.m.
Sat., Nov. 7:—New World Salon Orchestra ..... WABC—10:30 a. m.
Sat., Nov. 7:—The Goldbergs....WEAF—7:45 p. m.
Sat., Nov. 7:—Little Symphony..WOR—8:00 p. m.

TRADIOGRAMS

With 1931 receiving set sales estimated generally at between 2,500,000 to 3,000,000, most radio factories are now in their busiest period of the year. Production and also sales have had the usual seasonal increase. Parts manufacturers also are especially active. Wages of factory workers in the radio industry are being generally sustained. Public demand for radio sets and also tubes has increased measurably during September and October.

* * *

The number of television companies in the Radio Manufacturers' Association membership is increasing rapidly. That television will be developed within the radio industry seems assured. Laboratories of an increasing number of radio manufacturers are busy on television. The rapid growth of television is also evidenced in the increasing number of broadcast station applications for television permits from the Federal Radio Commission. The RMA Television Committee, of which Mr. D. E. Replogle of Passaic, N. J., is chairman, held a meeting September 24th at the Hotel Astor in New York, discussing the television progress and new manufacturing standards deemed desirable. Attending the committee meeting as an observer was Dr. C. B. Jolliffe, Chief Engineer of the Federal Radio Commission, which has charge of television broadcasting allocations.

* * *

The LCODE, a telegraph code compiled specially for the electrical industry and adaptable for many radio uses, has been completed by the National Electrical Manufacturers Association in cooperation with the RMA, NELA, the Radio Wholesalers Association, the National Electrical Wholesalers Association and other associated organizations. It is designed to effect economies and promote clear and concise telegrams by means of code words. In the preparation of the new LCODE the compilation was studied and developed ,so far as its radio terms are concerned, by the RMA Committee headed by R. T. Pierson of Ft. Wayne, Indiana. The LCODE goes into effect November 15th. It contains many thousands of coded phrases in general use in the electrical industry. The list price is $6.00. It is published by The Business Code, 2 Rector Street, New York.

Literature Wanted

W. C. Marshall, P. O. Box 20, Oneco. Conn.
Julius Saewitz, 1743 E. 19th St., Brooklyn, N. Y.
S. Schoen, 1144 St. John's Place, Brooklyn, N. Y.
R. L. Williams, 8162 E. Jefferson Ave., Detroit, Mich.

Wray E. Wyckoff, Mgr., Potter, Nebr.
Clarence Beachey, P. O. Box 121, Sturgis, Mich.
Joe Knezich, 1027 South Str., Niles, Ohio.
Paul Moran, 1400 Juneway Terr., Chicago, Ill.
C. N. Ivlow, 522 Hefferson St., Gary, Ind.
K. R. Zumhagen, 3609A No. 17th St., Milwaukee, Wis.

Arthur E. Moorhead, U. S. S. Black Hawk, Asiatic Station, Via Seattle, Wash.
A. B. Willis, 233 S. 9th St., Philadelphia, Pa.
T. P. Cook, 1011 Welch, Houston, Texas.
Frederick W. Spencer, 545 O'Farrell St., San Francisco, Calif.

R. G. Gregory, 913 So. Alma, Los Angeles, Calif.
Byron Donel, 342 Burton Ave., Washington, Pa.
R. Delevante, 1265 East 24th St., Brooklyn, N. Y.
K. Williamson, care of W & G Radio Shop, 1155 Tangerine Ave., St. Petersburg, Fla.
Verne F. Leibforth, 6232 W. Roosevelt Rd., Berwyn, Ill.
Tom Pollard, 360 N. Main St., Harrodsburg, Ky.
C. Zinnerman, 1457 W. 46th St., East St. Louis, Ill
R. F. Sirinek, 5244 66th St., Maspeth, L. I .
Ernest Rudolph, Hugoton, Kans.
Schwab & Bronersky, 708 Bridge St., Charlevoix, Mich.
Edward McKeefney, 44 Cumberland St., Crafton Hgts.. Pittsburgh, Pa.

Arthur V. Steinberg, New Ulm, Minn.
R. J. Munsey, 520 Cambridge St., Allston, Mass.
Joseph M. Steele, 627 51st St., Apt. J, Oakland, Calif.
Carroll J. Close, 1602 Classen, Norman, Okla.
P. H. Heard, 1218 Exposition Blvd., Los Angeles, Calif.
W. E. Thomas, 30 Invale Ave., Upper Montclair, N. J.
Malcolm P. Chase, 11 Lewis Bay Rd., Hyannis, Mass.
H. B. Cox, 1416 Clark St., Racine, Wis.
Geo. I. Williams, 802 S. Millwood, Wichita, Kans.
J. C. Bankston, Route 3, Marietta, Ga.
August Zorski, 2699 Bedford Ave., Brooklyn, N. Y.
Raymond Wheeler, Electric Shop Instructor, Dept. of Industrial Education, Jamestown, N. Y.

Saul Goodman, 135 Erin St., Pittsburgh, Pa.
W. Ellett, 436½ Main St., Winnipeg, Man., Canada.
A. G. Murphy, Hilltop Radio Service, 233 N. Burgess Ave., Columbus, Ohio.
Robert Nichols, 4251 Cedar St., New Boston, Ohio.
Devoy Snyder, 752 W. Center St., Warsaw, Ind.
Dwaine Brownell, 5427 Lafayette Ave., Omaha, Nebr.
Harry DeVaney, 2417 Burnett Ave., Waco, Texas.
M. Weathersby, Box 216, Stanton, Iowa.
E. I. Bryant, Versailles, Ind.

Prices Reduced on Ten Types of Popular Tubes

Reduction in the list price of ten tubes was announced by the RCA Radiotron Company and other large manufacturers of tubes. This is the fourth price reduction within two years.

The reductions are for very popular tubes, including the 280, 247, 224, 235 and 227.

Type	Old Price	New Price	Reduction	Per cent. Reduction
171-A	$1.40	$.90	$.50	36.7
201-A	1.10	.75	.35	31.8
224	1.50	1.00	.50	33.4
224-A	2.00	1.60	.40	20.0
226	1.25	.80	.45	36.0
227	1.25	1.00	.25	20.0
235	2.20	1.60	.60	27.3
245	1.40	1.10	.30	21.4
247	1.90	1.55	.35	18.4
280	1.40	1.00	.40	28.6

FROM A LOVER OF RADIO

RADIO WORLD:

TO one who loves radio as much as I, my best wishes, my congratulations, and my hopes for continued success for RADIO WORLD come from the bottom of my heart.

RUDY VALLÉE.

[*The above salutation from Mr. Vallée was in connection with our 500th consecutive issue, published last week.*—EDITOR.]

EXPORTS GO UP $3,000,000 IN FACE OF SLUMP

Washington.

While exports of most United States commodities showed a marked decrease during 1931, shipments of radio apparatus showed a bigger jump in value during the first eight months of this year than at any other time since 1928, it was stated orally at the Electrical Division of the Department of Commerce.

Total exports of all types of radio apparatus for the first eight months of 1931 amounted to $13,606,000, an increase of nearly $3,000,000 over the corresponding period last year. The export in 1930 was also greater than that in 1929.

Tapping European Market

The following additional information was made available by the department:

The Division has no way to determine accurately the cause of the increase. It is believed that it may be laid to two factors: First, the radio-buying public is still purchasing at a normal or above normal rate; second, American manufacturers are this year for the first time building sets and other apparatus especially adapted to European reception. Regardless of cause, it is apparent from export figures that the radio industry "doesn't even know there's been a depression."

The American-manufactured set, while it had certain advantages in Europe over ones made there, was not adapted to European reception. Wave channels for broadcast purposes in Europe cover a much wider band than in the United States. The United States' band extends from 550 to 1,500 kilocycles, while in Europe the channels are assigned over a band from 300 to 30,000 kilocycles.

Table Sets in Europe

Thus it is obvious that sets made for American reception are not particularly adaptable to European reception. In an effort to remedy this situation several large American manufacturers this year for the first time made sets designed for reception within this broad band. As a result, their foreign sales have shown a marked increase.

In Europe the old table type set is still widely manufactured. American-made cabinet sets appeal much more to European buyers than do unsightly receivers made abroad. This, too, may have influenced American sales there.

Europeans, like Americans, are naturally attracted by any commodity imported from another country; the farther the importation, the greater the attraction. It is possible that this factor has played a large part in booming sales of American radio apparatus in foreign countries.

New Corporations

Simolite Products, television, broadcasting—Atty. S. Spring, 521 Fifth Ave., New York, N. Y.

Paul's Supply Stores, garage and radio business—Atty. H. L. Berkson, 150 Broadway, New York, N. Y.

Clayton & Feldman, sound producing apparatus—Atty. F. Sonnek, 30 Church St., New York, N. Y.

Standard Television and Electric Corp., Wilmington, Del., transmit, communicate and broadcast sounds and images—Colonial Charter Co.

American Broadcasting and Amusement Corp., Wilmington, Del., broadcasting stations—Corporation Service Co.

Shumaker Resigns as RCA-Victor President

David Sarnoff, president of the Radio Corporation of America, announced the resignation of Edward E. Shumaker as president of its subsidiary, the RCA Victor Company. The resignation was accepted by the RCA Victor Company Board to become effective as of January 1st, 1932.

Mr. Shumaker's resignation brings to an end twenty-eight years of service in the home entertainment industry, he having joined the Victor Talking Machine Company in February, 1904.

U. S. FIRMS USE FOREIGN AIR

Washington.

The Department of Commerce has issued a bulletin setting forth the following:

In no other country of the world is radio advertising used, directly or indirectly, as extensively as in the United States. Its success as a medium here has led to widespread interest as to its possible success in foreign countries. The increasing trend, especially among smaller stations, toward "electrical transcriptions" has stimulated that interest, so that today several American firms already are sponsoring broadcasting records, with advertising, on foreign radio stations.

The language factor is a prime consideration in foreign broadcasting. In Latin America, except in Portuguese-speaking Brazil, the Spanish language is almost universally used.

In certain countries there are restrictions, both in broadcasting and reception, through governmental control of radio stations and through the license method of receiver-set ownership. The countries treated in this publication are those which are known to accept commercial advertising.

Another radio characteristic of Latin America is that ownership of receivers is largely confined to a relatively small portion of the total population. Only the well-to-do people have sets, yet these are the ones most likely to purchase goods advertised over the air, since many of the poorer classes lack the necessary buying power. However, there are accentuations and exceptions to this generality, which are discussed under the head of each country in this publication.

In former years climatic conditions were great hindrances to suitable reception in the warm, humid countries, but with the installation of improved transmission equipment in recent years, this difficulty has been partially overcome. However, reception in Summer is nowhere as good as it is in Winter, and North American concerns using the radio in Central and South America should not forget the difference in seasons on either side of the equator.

Moore Has New Tuner to Bring in Distance

E. Bunting Moore, of the Moore Radio Company, of 74 Cortlandt Street, New York City, has further developed his "Da-Lite-R" tuner described in the May 2nd, 9th and 16th issues of RADIO WORLD, constituting it really a new tuner, known as the "Super-Da-Lite-R."

By a unique combination of high and low frequency r-f amplification a response curve with a flat top of 10 kc is obtained. The new "Super Da-Lite-R," says Mr. Moore, has no peer in getting DX through the most powerful locals.

COMMUNICATION PERMIT SOUGHT UNDER 1 METER

Washington.

The International Communications Laboratories, Inc., at Hillsborough, N. J., has requested permission to construct two transmitters to operate on a frequency between 1,000,000 and 3,000,000 kilocycles (0.3 to 0.1 meters) in point-to-point communication to conduct experiments to determine the feasibility of using the ultra high radio frequencies for public communications.

Stations $3,000 Each

The transmitters, which are to have a maximum power of 5 watts, are to be located 17 miles apart, if the construction permit is granted by the Federal Radio Commission. The construction work will be financed by the International Telephone & Telegraph Corporation, of New York and Maryland, of which the International Communications Laboratories is a subsidiary.

Should the application be granted, the stations will use concentrated beams in wavelengths of 10 and 30 centimeters and will operate on unlimited time. The stations will be operated within a frequency of 3 per cent of their assigned frequency. They will cost about $3,000 each.

Little Done Here

Comparatively little work has been done in this country on the ultra high frequencies, and little of what has been done has been published. In Europe considerable work has been done and the International Telephone & Telegraph Corporation, through its European associates, successfully conducted experiments between Dover, England, and Calais, France, across the English Channel on a wave of about 18 centimeters.

If the experiments prove successful they will open up a vast field now unknown which may be available for commercial communication.

The Radio Census

The whole number of families in the State of Texas on April 1, 1930, was 1,383,280, as compared with 1,017,413 in 1920. The population per family in 1930 was 4.2, as compared with 4.6 in 1920. The number of families reporting radio sets in 1930 was 257,686, or 18.6 per cent of the total.

NEW DEFOREST PRESIDENT

The DeForest Radio Company and the Jenkins Television Corporation of Passaic, N. J., announce the resignation of Charles G. Munn as president of both companies, and his election as chairman of the executive committee of both companies. Leslie S. Gordon, who has been identified with banking and manufacturing activities in Chicago, succeeds Mr. Munn as president of the DeForest and Jenkins companies.

"Two Stage Regenerated Resistance Audio"

"Two Stage Regenerated Resistance Audio." How to use this with leak type detector. See next week's Radio World, dated November 7th.

SOLDERING IRON
F R E E !

Works on 110-120 volts, AC or DC; power, 50 watts. A serviceable iron, with copper tip, 5 ft. cable and male plug. Send $1.50 for 13 weeks' subscription for Radio World and get these free! Please state if you are renewing existing subscription.

RADIO WORLD
145 West 45th St. N. Y. City

RESISTORS
and Mountings

Plate Circuit

0.25 meg. (250,000 ohms) Brach resistor, for all screen grid tubes. Order Cat. BRA-25, at....12c
0.1 meg. (100,000 ohms) Brach resistor for all except screen grid tubes. Order Cat. BRA-10, at 12c

Grid Circuit

1.0 meg. Brach resistor for grid leak. Order Cat. BRA-100 at.....12c
2.0 meg. Brach resistor for grid leak. Order Cat. BRA-100, at.....12c
Carborundum grid leak for highest detector sensitivity. The leaks are marked "5 to 7 meg," because values in this range are present. Order Cat. CAR-57, at.....12c

Biasing Resistors

.005 meg. (5,000 ohms) Brach resistor. Order Cat. BRA-005, at.....13c
.015 meg. (15,000 ohms) Amsco resistor. Order Cat. AMS-15, at.....14c
.025 meg. (25,000 ohms) Amsco resistor. Order Cat. AMS-25, at.....14c
[The above resistors are of the tubular type and require a mounting. Lynch moulded bakelite mountings, Cat. LYM, at.....15c]

Filament Circuits

1-ohm Brach resistor, to afford 5 volts for four ¼ amp. tube when source is 6 volts. Supplied with mounting capacity 2 amps. Order Cat. BRA-1, at 22c
2-ohm Brach resistor, to afford 5 volts when two ¼ amp. tubes are supplied from a 6-volt source. Furnished with mounting; capacity 1 amp. Order Cat. BRA-2, at.....20c
4-ohm Brach resistor, to drop 6 volts to 5 for one ¼ amp. tube. Mounting supplied at this price. Order Cat. BRA-4, at.....18c
30-onm Brach resistor. To drop 3 volts to 2 volts on 232 and 230 tubes; use two of these resistors in parallel. Order Cat. BRA-30 (mounting supplied); price is for TWO sets at.....22c

DIRECT RADIO CO.
143 West 45th Street,
New York, N. Y.

LYNCH Resistors

Precision Wire Wound — Metallized

1% Tolerance — ½, 1 1½, 2 and 3 Watts

Write for details of new RMA Color Code Chart
LYNCH MFG. CO., Inc., Dept. W, 1775 B way, N Y

Tubes at 30¢ Each

Four for $1.00

171 245

Sold on basis of remittance with order. We will pay the postage.

RELIABLE RADIO CO.
143 West 45th Street New York, N. Y.

—SPECIALS—

Five-lead cable, 2 ft. long, with plug to fit a five-prong (UY) socket. The cable is connected at the factory so that following wires represent the respective prongs of the socket: Blue with white marker—G post of socket; Red—plate of socket; Green—cathode of socket; Yellow—heater adjoining cathode; Black with yellow marker—heater adjoining plate. .....Net 65c

MARCO black bakelite vernier dials. Read 0-100 with a supplementary scale reading 0-10 between figures on large scale. Takes a ¼" shaft...Net 50c

Parts for "A" battery eliminator: Dry rectifier, $2.10; 0-10 ammeter, 75c; 20-volt filament transformer, $2.50. Will handle up to 2 amperes filament current.

GUARANTY RADIO GOODS CO.
143 West 45th St. New York, N. Y.

853 PAGES, 1,800 DIAGRAMS IN RIDER'S NEW 6-LB. MANUAL

THE most complete service man's manual is "The Perpetual Trouble Shooter's Manual," by John F Rider, published April, 1931, and full of real information. Wiring diagrams of ALL popular commercial receivers and kit sets from 1922 to 1931, inclusive. Also contains a course in trouble shooting. Loose leaf pages, 8½ x 11", bound. 853 pages; index and advertisements on additional pages. Order Cat. RM-31, and remit $4.50. We will then pay postage. (Shipping weight, 6 lbs.) Ten-day money-back guarantee

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

TO INTRODUCE

3 months' supply E-DENT-2 wonder FALSE TEETH CLEANER and 3 months' supply GLEAM-O-SHEEN—the sensational new kind of Silver Polish—25c for both POSTPAID. Send today.
Nelson Lab., Dept. PK, Pasadena, Calif.

MANY PARTS AT BARGAIN PRICES

UNSHIELDED BROADCAST COILS ON 3" DIAMETER BAKELITE

(Cat. SGT-5)—Three circuit tuned for .0005 mfd. condenser, for use where the untuned high impedance primary is in the plate circuit of a screen grid tube. The tuned secondary may be connected to any type tube..... $ .90
(Cat. SGT-3)—Same as above, only for .00035 mfd. condenser ..... .90
(Cat. 5-HT)—Special three-circuit tuner for .0005 mfd. tuned primary in plate circuit of a screen grid tube; untuned secondary..... .95
(Cat. 3-HT)—Same as Cat. 5-HT, except that it is for .00035 mfd. tuning..... .95
(Cat. T-5)—Standard 3-circuit tuner for .0005 mfd., where primary is for any type of tube other than plate circuit of screen grid tube..... .80
(Cat. T-3)—Same as T-5, except for .00035 mfd., condenser instead of for .0005..... .80
(Cat. 2-R5)—Radio frequency transformer for .0005 mfd. condenser where high impedance untuned primary is in plate circuit of a screen grid tube, and secondary is tuned by .0005 mfd..... .60
(Cat. 2-R3)—Same as 2-R5, except that it is for .00035 mfd. tuning..... .60
(Cat. 5-TP)—Radio frequency transformer for use where primary is tuned and placed in plate circuit of screen grid tube, while secondary is not tuned. For .0005 mfd..... .55
(Cat. 3-TP)—Same as Cat. 5-TP, except that it is for .00035 mfd. tuning..... .55
(Cat. RF-5)—Radio frequency transformer for .0005 mfd. tuning, where untuned primary is in plate circuit of any type tube except screen grid. Useful also as antenna coupler..... .55
(Cat. RF-3)—Same as Cat. RF-5, except that it is for .00035 mfd. tuning..... .55

FILTER AND BY-PASS CONDENSERS

(Cat. HV-1)—Compact 1 mfd. filter condenser, for use in filter section of any B supply intended to work 245 tubes, single or push-pull, and rest of tubes in receiver $1.50
(Cat. HV-2)—Compact 2 mfd. condenser for 245 B supply 2.50
(Cat. AVX-8)—Compact 8 mfd. Aerovox dry electrolytic condenser with mounting bracket, for 245 B supply 1.47
(Cat. LV-1)—1 mfd. low-voltage condenser for by-passing, 200 v. DC rating..... .50
(Cat. LV-2)—2 mfd. low-voltage condenser for by-passing, 200 v. DC rating..... 1.00
(Cat. LV-4)—4 mfd. low-voltage condenser for by-passing, 200 v. DC rating..... 2.00
(Cat. SUP-31)—Three 0.1 mfd. bypass condensers in one compact case. 200 v. DC rating..... .57

KNOBS AND DIALS

(Cat. KNB-2)—2-inch diameter moulded bakelite black knob, no pointer; ¼" shaft..... .18
(Cat. MCD)—Marco vernier dial; moulded bakelite; black; pilot light window..... .60
(Cat. NAT-H)—National velvet vernier drum dial, type H, with modernistic escutcheon, color wheel (rainbow feature) 3.13
(Cat. NAT-VBD)—National velvet vernier black moulded bakelite circular dial, variable ratio lever, 6-1 to 20-1; reads 0-100-0; with dial light and bracket 1.70

BLUEPRINTS

(Cat. BP-3A)—Blueprint of three-tube Supertone short-wave converter, using 227 tubes; filament transformer external; coil winding data, list of parts, schematic diagram included..... .25
(Cat. BP-33)—Blueprint of the HB-33, seven-tube screen-grid battery set, using 222a for RF, push-pull 171A output..... .25
(Cat. BP-SGD-4)—Blueprint of 4-tube battery Diamond of the Air, one stage RF 222, regenerative detector, two transformer audio..... .25
(Cat. BP-PPBD)—Blueprint of 5-tube battery Diamond. Extra tube due to push-pull output, either 112A or 171A..... .25
(Cat. BP-DBX)—Blueprnit of 4-tube Diamond, for AC operation, screen-grid RF; no B supply, as 180-volt B eliminator is to be used..... .25
(Cat. BP-UNB)—Blueprint of 4-tube Universal, with 222 RF; battery operation..... .25
(Cat. BP-LIB)—Blueprint library of AC hookups.. .25

Two for the price of One

Get a FREE one-year subscription for any ONE of these magazines:

- ☐ RADIO CALL BOOK MAGAZINE AND TECHNICAL REVIEW (monthly, 12 issues)
- ☐ POPULAR MECHANICS AND SCIENCE AND INVENTION (combined) (monthly, 12 issues).
- ☐ POPULAR SCIENCE MONTHLY
- ☐ RADIO INDEX (monthly, 12 issues), stations, programs, etc.
- ☐ RADIO (monthly, 12 issues; exclusively trade magazine).
- ☐ MODERN RADIO (monthly).
- ☐ RADIO LOG AND LORE. Monthly. Full station lists, cross indexed, etc.
- ☐ AMERICAN BOY—YOUTH'S COMPANION (monthly, 12 issues; popular magazine).
- ☐ BOYS' LIFE (monthly, 12 issues; popular magazine).

Select any one of these magazines and get it FREE for an entire year by sending in a year's subscription for RADIO WORLD at the regular price, $6.00. Cash in now on this opportunity to get RADIO WORLD WEEKLY, 52 weeks at the standard price for such subscription, plus a full year's subscription for any ONE of the other enumerated magazines FREE! Put a cross in the square next to the magazine of your choice, in the above list, fill out the coupon below, and mail $6 check, money order or stamps to RADIO WORLD, 145 West 45th Street, New York, N. Y. (Add $2.00, making $8.00 in all, for extra postage to Canada for both publications.

Your Name.....

Your Street Address .....

City.....State.....

DOUBLE VALUE!

- ☐ If renewing an existing or expiring subscription for RADIO WORLD, please put a cross in square at beginning of this sentence.
- ☐ If renewing an existing or expiring subscription for other magazine, please put a cross in square at the beginning of this sentence.

RADIO WORLD, 145 West 45th Street, New York. (Just East of Broadway)

GUARANTY RADIO GOODS CO.
143 West 45th Street, New York, N. Y.
Enclosed please find $..... for which please ship at once the following:

☐	SGT-5	@	90c	☐	LV-2	@	1.00
☐	SGT-3	@	90c	☐	LV-4	@	2.00
☐	5-HT	@	95c	☐	SUP-31	@	57c
☐	3-HT	@	95c	☐	KNB-2	@	18c
☐	T-5	@	80c	☐	MCD	@	60c
☐	T-3	@	80c	☐	NAT-H	@	3.13
☐	2-R5	@	60c	☐	NAT-VBD	@	1.70
☐	2-R3	@	60c	☐	BP-3A	@	25c
☐	5-TP	@	55c	☐	BP-33	@	25c
☐	3-TP	@	55c	☐	BP-SDGA	@	25c
☐	RF-5	@	55c	☐	BP-PPBD	@	25c
☐	RF-3	@	55c	☐	BP-DBX	@	25c
☐	HV-1	@	1.50	☐	BP-UNB	@	25c
☐	HV-2	@	2.50	☐	BP-LIB	@	25c
☐	AVX-8	@	1.50	☐	Mail items C. O. D.		
☐	LV-1	@	50c				

Name .....

Address .....

City ..... State.....

BOOKS

A Great Volume by Prof. Morecroft

An Event in Radio Literature

PROF. JOHN H. MORECROFT, of the department of electrical engineering, Columbia University, is the outstanding writer of radio text books in the United States. Two of his volumes, "Principles of Radio Communication," a large volume for advanced students, and "Elements of Radio Communication," a smaller volume, for those not yet in the advanced stages of radio studies, have won him the reputation of being foremost in this line.

Now Prof. Morecroft has just brought out a new book, "Experimental Radio Engineering," just the volume for the radio experimenter, a valuable adjunct to the actual work performed by radio enthusiasts in their laboratories, whether at home or in shops or factories.

Also, the new volume marks the Professor's recognition of the great amount of experimental work and receiver and amplifier construction going on throughout the world. He has handled the experimental subject with the same deft skill and authority that marked his two previous volumes.

It behooves every radioist to possess all three books by Prof. Morecroft, but if he can choose only one at a time the experimenter of course wants to start with "Experimental Radio Engineering."

Prof. Morecroft's style is clear and definite and besides he writes with the authority of a scientist. Problems that have vexed you will be found solved and explained in as simple a manner as is consistent with accuracy.

The volume contains fifty-one experiments on the more important phenomena of radio. It is intended to be companion book to the author's "Principles of Radio Communication" but is in itself a text on practical radio measurements. Contains a vast fund of useful information for the beginner as well as for the advanced student of the principles of radio.

Measurements of resistance, self-inductance, mutual inductance, capacity, radio frequency voltages and currents, frequency, amplification; characteristics of antennas, tubes, loud-speakers, vacuum tube voltmeters, rectifiers, detectors; study of selectivity, sensitivity, fidelity, filters, modulation, and many other phases of radio are fully discussed.

The book has 345 pages, 250 illustrations, and is cloth-bound.

Order Cat. M-EXRE @..... $3.50

"ELEMENTS OF RADIO COMMUNICATION"

"ELEMENTS OF RADIO COMMUNICATION," written in plain language, requiring little foundation knowledge of radio, is a complete course on the elements of radio, and gives one an insight into radio phenomena in such a way as to clear them up. For instance, take tuning. A variable condenser commonly is connected across the secondary of a tuning coil. Just what processes take place to accomplish tuning? Obtaining full knowledge of the causes of resonance, and learning how to compute the resonant frequency of a circuit, contribute toward the enjoyment of radio construction. Resistance, impedance, reactance, inductance and capacity are explained with fitting analogies, and the whole theoretical story of radio laid bare in such a fascinating and compelling manner as to make the volume of inestimable value.

The book contains much material never before published, is up-to-date and contains 226 pages, 170 illustrations and a complete index. Cloth bound.

Order Cat. M-ELEM @..... $3.00

(Remit with order and we pay transportation. Five-day money-back guarantee attaches to the purchase of all books.)

"PRINCIPLES OF RADIO COMMUNICATION"

"PRINCIPLES OF RADIO COMMUNICATION," the larger and deeper volume by this outstanding authority and former president of the Institute of Radio Engineers, covers essentially the same ground as "Elements of Radio Communication," but does so more extensively and with a mathematical treatment that commends this book to radio engineers and college and university students in radio engineering.

"Principles of Radio Communication," which is in its second edition, contains 1,001 pages, 831 illustrations and is cloth-bound.

Order Cat. M-PRN @..... $7.50

[Remit with order and we pay transportation. Five-day money-back guarantee attaches to the purchase of all books.]

BOOKS BY MOYER AND WOSTREL

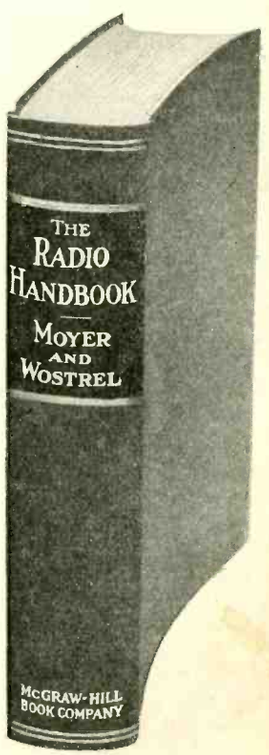
ANOTHER new volume is "The Radio Handbook," by James A. Moyer and John F. Wostrel, both of the Massachusetts Department of Education. This handbook meets the need for a complete digest of authoritative radio data, both theoretical and practical.

From the fundamentals of electricity, magnetism and the electron theory, right down to the latest commercial and industrial applications of radio, this book covers the field, with descriptions, definitions, design data, practical methods, tables and illustrations in profusion. It is a complete modern manual of practical and technical radio information.

Some of the subjects covered are: modern transmitters, piezo crystal control, percentage modulation, commercial and amateur short-wave receivers and transmitters, Kennelly-Heaviside layer effects and measurements, marine radio equipment, auto alarm, automobile receivers, latest tubes including photo-electric cells, television, sound motion pictures, etc.

If you want a book that quickly refers you to the correct information contained within its covers on any subject pertaining to radio, this is the volume. It has 886 pages. 650 illustrations. Flexible binding.

Order Cat. MW-RH @..... $5.00



The need for an up-to-date book on radio tubes that answers all the important questions has been filled by Moyer and Wostrel. This book is a complete discussion of tube principles, functions and uses. The essential principles underlying the operation of vacuum tubes are explained in as non-technical a manner as is consistent with accuracy. The book covers the construction, action, reactivation testing and use of vacuum tubes as well as specifications for vacuum tubes and applications for distant control of industrial processes and precision measurements. 297 pages, cloth bound. Order Cat. MWT. ..... @ $2.50

"Practical Radio," including the testing of radio receiving sets. 378 pages, 223 illustrations. Cloth bound. Order Cat. MWP. ..... @ $2.50

"Practical Radio Construction and Repairing," 319 pages, a companion volume to the above. New edition, new price. Order Cat. MWC. ..... @ $2.50

(Remit with order and we pay transportation. Five-day money-back guarantee attaches to the purchase of all books.)

THREE BOOKS BY ANDERSON AND BERNARD

AUDIO POWER AMPLIFIERS

The book begins with an elementary exposition of the historical development and circuit constitution of audio amplifiers and sources of powering them. From this simple start it quickly proceeds to a well-considered exposition of circuit laws, including Ohm's laws and Kirchhoff's laws. The determination of resistance values to produce required voltages is carefully expounded. All types of power amplifiers are used as examples: AC, DC, battery operated and composite. But the book treats of AC power amplifiers most generously, due to the superior importance of such power amplifiers commercially. Tube characteristic tables and curves profusely included. Cloth cover, 193 pages. Order Cat. APA @ $1.50

THE SUPERHETERODYNE

This volume by Anderson and Bernard deals with the principles and practice of the Superheterodyne method of receiving and is particularly important now, because this is a superheterodyne year. It explains the function of the oscillator, the modulator, the pre-modulator selector, and the intermediate frequency amplifier. It explains the cause of repeat points and gives methods for avoiding them or minimizing their effect. It illustrates various forms of oscillators and tells of the advantages of each. Different types of modulators and pick-up systems are explained and their advantages stated. Different methods of coupling in the intermediate frequency amplifier are shown

Order Cat. SH @ 95

FOOTHOLD ON RADIO

In simple English that any one can understand, the technical side of radio is presented by Anderson and Bernard in their book, "Foothold on Radio." Any one who can read English can understand this book. It is intended for the sheer novice. The treatment is non-mathematical.

Order Cat. FOR @ 60c

(Remit with order and we pay transportation. Five-day money-back guarantee attaches to the purchase of all books.)

RADIO WORLD, 145 West 45th St., New York, N. Y.
Enclosed please find $..... for which mail postpaid the following books, with 5-day money-back absolute guarantee.
Cat. M-EXRE @ $3.50
Cat. M-ELEM @ $3.00
Cat. M-PRN @ $7.50
Cat. MWT @ $2.50
Cat. MWC @ $2.50
Cat. SH @ 95c.
Cat. APA @ $1.50
Cat. MWP @ $2.50
Cat. MW-RH @ $5.00
Cat. FOR @ 60c.
Name .....
Address .....
City .....
State .....