

NEW 5-TUBE AUTO RECEIVER

JUNE 17
1933

HUMLESS SHORT-WAVE SET

15¢
Per Copy

RADIO

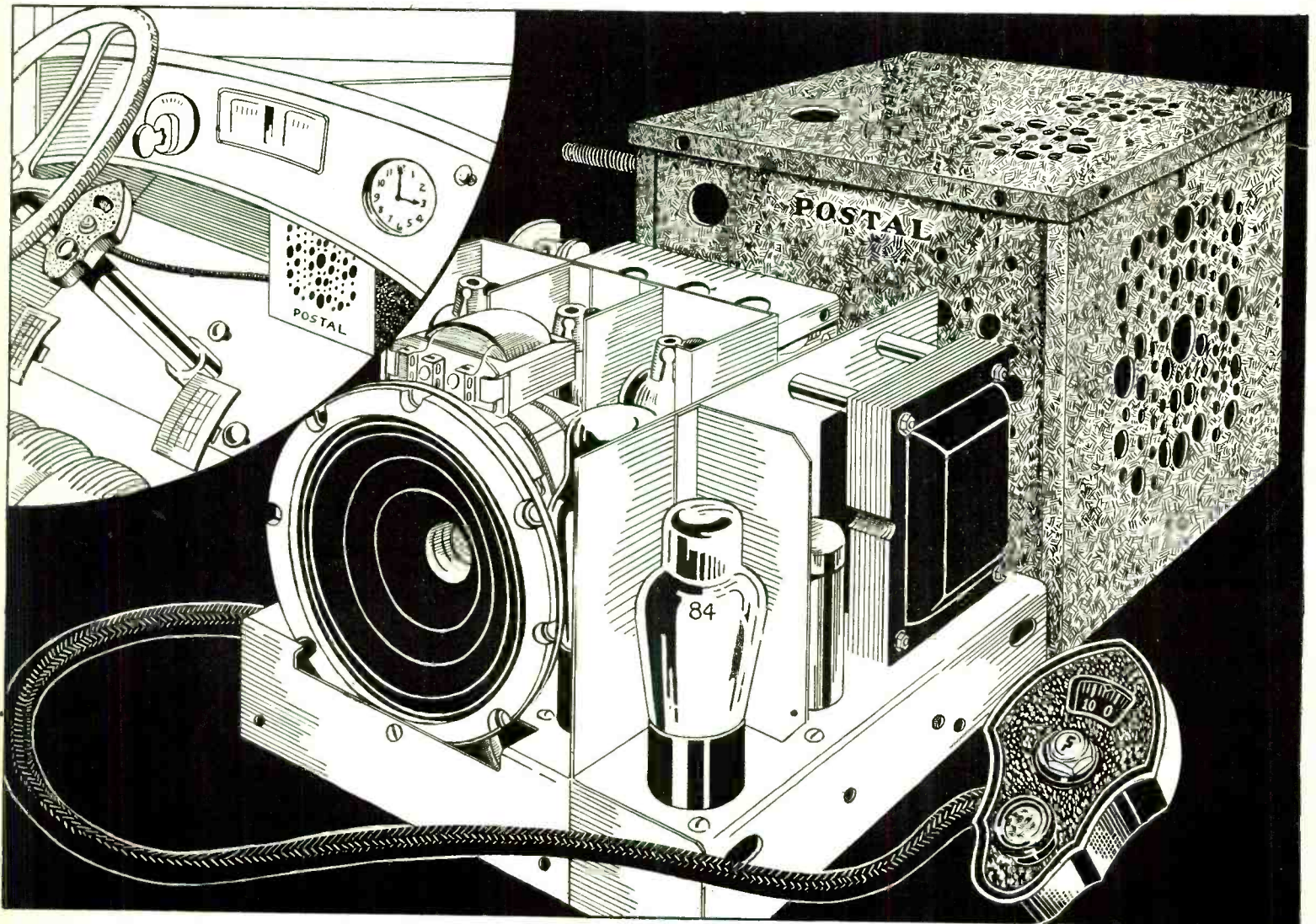
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WORLD

The First and Only National Radio Weekly
Twelfth Year 586th Consecutive Issue

Socket Code Applied to an Analyzer

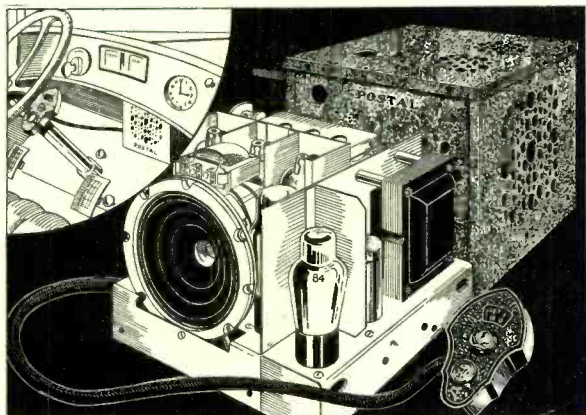
How to Use the 53 in Class B Output



A five-tube auto set for a-c or battery operation. See page 8.

JUST WHAT YOU'VE BEEN WAITING FOR IS HERE IN THE NEW Postal Combination Auto Receiver

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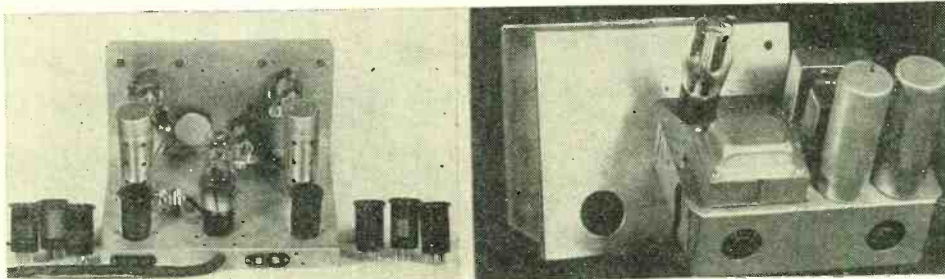
"AMATEUR MOVIE CRAFT," by James R. Cameron. A book dealing with the making and showing of 16 m/m pictures and equipment necessary for same. Paper cover, \$1.00; Cloth, \$1.50. Radio World, 145 W. 45th St., New York, N. Y.

"MATHEMATICS FOR SELF STUDY," by J. E. Thompson, B.S. in E.E., A.M. A complete course in four inexpensive books: Arithmetic, Algebra, Trigonometry, Calculus, for the Practical Man. 1240 pages, cloth, illustrated, \$7.65. Radio World, 145 W. 45th St., New York City.

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

SPAIN OR AFRICA—NO TRACE OF HUM IN SUPERTONE A-C SHORT-WAVE SET

FOR two years we have been determined to bring out an inexpensive short-wave receiver, a-c operated. For two years we experimented with circuits, including the simplest ones and complicated ones. Not until now did we get a circuit that completely suited us, and now it is ready. Parts may be obtained with which to build the receiver alone, or receiver and power pack. Moreover, built-up receivers and power packs are obtainable, all at small cost.



Plug-in coils are used, at conveniently accessible socket positions (near corners of the chassis top). Each tuned circuit is independently controlled. That improves sensitivity. Regeneration control is dual in character—usual feedback condenser and a potentiometer besides. This brings in those elusive stations charmingly. At right is the separate power supply and its shield container.

OUR efforts to get a low-priced short-wave outfit of such supreme excellence as to at least equal in performance the short-wave devices listing at around \$80 finally have been rewarded. Our short-wave combination provides a great wallop and enables consistent tuning in of overseas stations. Spain or Africa mean nothing to this set. In performance we have found it second to none, tube for tube. The receiver and B supply are up to the most exacting standards we could impose.

A DREAM COME TRUE—BIG RESULTS ON SHORT WAVES AT VERY LITTLE COST!

Complete kit of parts for building both the receiver and the separate power supply, contains everything except tubes and set cabinet. The speaker is included.....\$19.25
Five tubes (one 58, one 57, one 56, one 2A5, one 80) at \$3.75 extra.

The wired and tested model consists of the kit built up at our precision laboratory by expert engineers. The price, less tubes, but including speaker.....\$23.50

The receiver proper, less the power supply, less speaker, and less tubes. This outfit can be worked with a filament transformer and a B eliminator, and the price of the wired receiver is.....\$12.00

SUPERTONE PRODUCTS CORP., 35 Hooper St., Brooklyn, N. Y.

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HUM ELIMINATED

IN AN ECONOMICAL SHORT-WAVE A-C RECEIVER;
NEITHER B SUPPLY OR TUNABLE TYPE EXPERIENCED

By Herman Bernard

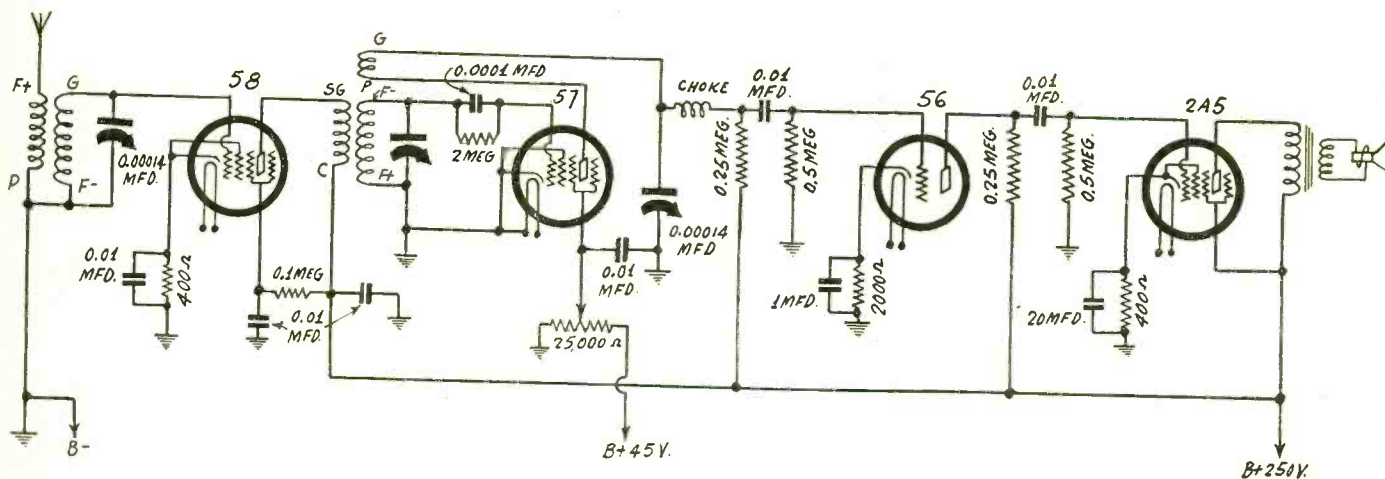


FIG. 1

A standard circuit used for an a-c short-wave receiver that gives exceptionally good results. Separate control of tuning the two circuits, dual regeneration control and tested location of parts contribute toward the success of this outfit. The socket terminal connections of the two coils are coded.

THERE has been some complaint about hum in a-c operated short-wave receivers, where the power supply is in the set, and in general it has been found altogether satisfactory as an easy

solution to put the power pack on the outside, or the B supply, at least. So Edwin Stannard, of Supertone Products Corporation, when assigned the task of designing a completely humless short-

wave set, elected to have a separate B supply, and the result gratified even him, for he is very exacting.

However, the hum problem is not the
(Continued on next page)

LIST OF PARTS For the Receiver

Coils

One set of UX-base short-wave plug-in coils, four coils to a set.

One set of six-pin, three-winding, plug-in coils, four coils to a set.

One Hammarlund radio-frequency choke coil.

Condensers

Three Hammarlund 0.00014 mfd. tuning condensers.

Six 0.01 mfd. condensers.

One 1 mfd. bypass condenser.
One 20 mfd. electrolytic bypass condenser.
One 0.0001 mfd. grid condenser.

Resistors

Two 400-ohm pigtail resistors.
One 0.1 meg. pigtail resistor.
One 2 meg. pigtail resistor.
Two 0.25 meg. pigtail resistors.
Two 0.5 meg. pigtail resistors.
All above resistors are 1-watt.
One 25,000-ohm potentiometer.

Other Requirements

Four six-pin and two UY sockets (extra UY is for voltage cable, extra six-pin per coil; one UX socket, for other coil).

One dynamic speaker for 2A5 output, with output transformer built in; field coil, 1,800 ohms. Cone diameter is 6 inches.

One chassis. Two vernier dials.
Two knobs.

Two tube shields and bases.

One 58, one 57, one 56 and one 2A5 tubes.

One front panel.

SHORT-WAVE POWER SUPPLY

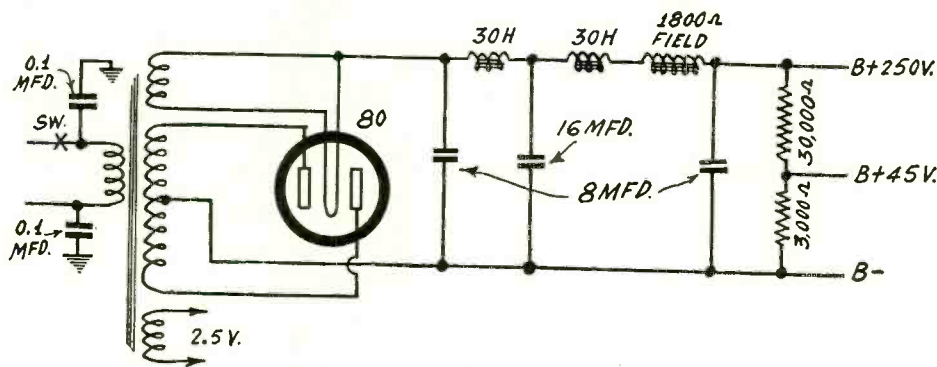


FIG. 2

A separate power supply is used for the short-wave receiver. The diagram shows the connections. The two 0.1 mfd. condensers are tunable-hum removers. Note that there are abundant B choking and husky filter capacity.

(Continued from preceding page)

only one. It has been generally found that small factors become big ones, comparing broadcast practice to short-wave construction, and therefore, following a more or less standard hookup, the parts layout had to be just so. Some dozen or so different layouts were tried and it was surprising what a difference resulted, using the same parts. The layout selected gave the best performance possible, and Mr. Stannard was glad to report the consistent reception of foreign stations.

Got Checks, No Sets

He distributed some sets to friends, just to ascertain their reaction, and with the gracious warning that he would be back for the sets in a few days. There were six such sets, to be exact. And he returned to the factory with the pleasing report that he could not get one of them back. Each friend had preferred to part with a check (a sad performance these days) rather than part with the set.

The reports of foreign stations received by these friends were so numerous and glowing that it was felt unwarranted to cite them literally, because of the known friendship of the reporting persons for the designer of the receiver.

The hookup followed, it has been stated, is more or less standard, which is a strong point in its favor, as it attests to the proven worth, backed up by years of experience, contrasted to some experimental ideas that seem ingenious on paper but do not seem to work out well in prac-

tice. It is hard enough to get good short-wave results even with standard circuits, as evidenced by the strong effect of mere parts placement, much less to offer something more theoretical than sound.

The Circuits Analyzed

Here we have a stage of tuned radio frequency amplification, for the increased selectivity and sensitivity, followed by a regenerative detector, using the shunt feed principle. Then there are two resistance-coupled stages of audio-frequency amplification, the output tube being the highly sensitive 2A5. A 58 is the r-f tube, a 57 is the detector, a 56 is the first audio, a 2A5 the output, and a 280 is the rectifier. So that, all told, there are five tubes, of which four are in the receiver proper and one, the rectifier, in the B supply.

The sensitivity is ample under these conditions, and the usual hum found with "driven" output stages is absent. Of course the B supply has to have adequate filter inductance and capacity, but these are readily provided these days, especially as electrolytic condensers of large capacity are obtainable in compact form, and inexpensively, at that.

Utter Simplicity

Perhaps something of the virtue of a short-wave receiver may be judged from the simplicity of the circuit. Surely one could scarcely ask for a simpler circuit than the one shown in Fig. 1. Just a few parts and you have a real receiver. Moreover, this receiver may be powered

LIST OF PARTS For Power Supply

Coils

One power transformer.
Two 30-henry B chokes.
(Field coil in speaker is listed under receiver parts).

Condensers

Two 0.1 mfd. condensers (not electrolytic).
Two 8 mfd. electrolytic condensers.
One 16 mfd. electrolytic condenser.

Resistors

Two 30,000-ohms (0.03 meg.) pigtail resistors, 1 watt.

Other Requirements

One a-c cable and plug.
One output cable and UY plug. (Grey grid, 45 volts; Brown cathode, B minus; yellow plate, maximum B voltage; H and H, 2.5-volts a. c.)
One chassis.
One shield box for chassis.
Two UY sockets (for speaker and voltage supply) and one UX socket (for rectifier).
One 280 tube.

from a B supply (which by the way also has the heater supply included), or a separate filament transformer and B batteries may be used. The circuit works well either way.

Reverting to the simplicity of the tuner and audio amplifier, we find that for the two tuned circuits we require two coils for each band, and these coils are of the plug-in type. The range is from 15 to 200 meters, and the total number of coils is eight, that is, there are two sets, four for each tuned circuit, representing the four bands of frequencies covered.

The antenna coil is of the four-pin base type (UX), while the interstage coil is of the six-pin base type. While a standard six-pin coil system was used, with a specially-wound set of antenna coils, the circuit works well on standard coils in the antenna stage, also.

So, besides the coil and tuning condenser, and three bypass condensers, there are only the tube, socket and two resistors in the first stage. The detector has the two variable condensers (one for feedback), an r-f choke, a tuning coil, a grid condenser and leak, a bypass condenser, a plate resistor and an auxiliary regeneration control potentiometer.

Some Parts Discussed

The double control of regeneration proved highly effective. If only regen-

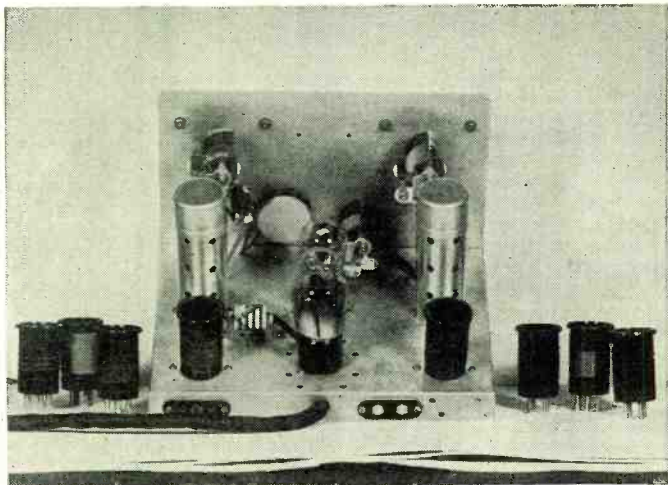


FIG. 3

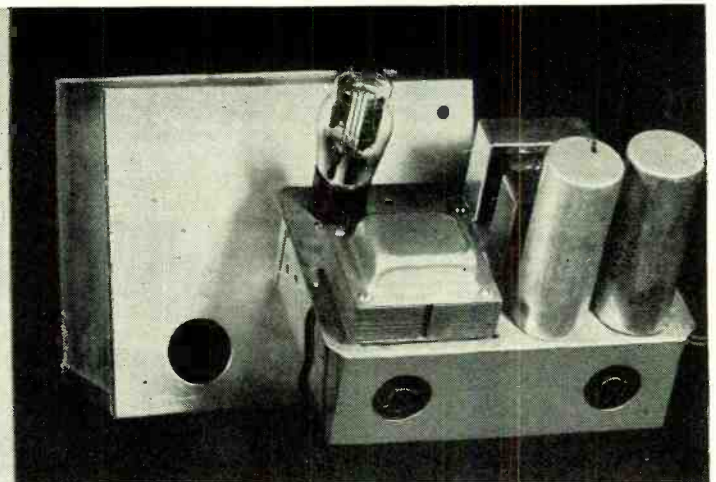


FIG. 4

At left is shown the rear view of the receiver, with the eight plug-in coils. The 58 is at left, the 57 at left, the 56 toward the front panel and the 2A5 at rear (reader's front). At right is the power pack removed from the shield case. The cable from the set plugs into one of the sockets, the other socket being for speaker.

eration is relied on there might be some critical aspects, and besides the control when advanced for greatest selectivity would also be at maximum volume, and some overloading might be present, therefore the potentiometer acts as a check on the regeneration control, and while primarily a part of a dual regeneration device, is also useful as a volume leveller.

The r-f choke is a special one of low distributed capacity, made by Hammarlund on a dowel piece. The plate load resistor is the standard 0.25 meg. (250,000 ohms), 1 watt. While the grid resistors in the audio circuit are shown as being 0.5 meg. apiece, this value should be retained only if there is no resultant motorboating, otherwise a lower value may be selected. It should be high as practical, consistent with stoppage of the trouble. Another remedy is to use a lower value of plate resistor in either or both resistance-loaded plate circuits to get rid of motorboating. By either of these general means the trouble will be stopped, but the designer preferred to reduce the plate resistors. This may be done by paralleling one or the other or both of them with 15,000 to 50,000 ohms.

The 56 is biased by 2,000 ohms, bypassed by 1 mfd., but the power tube, where the amplification is much greater, hence the negative feedback through its biasing resistor would be almost incomparably higher, has across its resistor 20 mfd., also readily obtainable in compact electrolytic form. Some types of electrolytics are 50 or 70 mfd. and may be used. Although the capacity is high, the unit is smaller than the 8 or 16 mfd. cans.

Simple Voltage Divider

With the output transformer, which is built into the small speaker, the receiver circuit is completed, and the only remaining consideration is the power supply.

As only maximum and one intermediate voltage are to be obtained, this may be accomplished by using a simple voltage divider constituted of two resistors. The power supply circuit, A and B, is even simpler than the receiver proper. There is no reason, therefore, why even the novice may not undertake the construction of this inexpensive and well-performing combination, for he is going to get the surprise of his life in the excellence of the foreign-station reception. Not only excellence but also variety and volume, for the receiver has plenty of kick behind it, an essential for short-wave reception, where the antenna voltage is a tiny fraction of that usually fed to a broadcast set even from a station a thousand miles away.

Tunable Hum Eliminator

An examination of the circuit diagram of the power supply will show that both sides of the primary are grounded, each side by one condenser. Normally the a-c line is grounded on one side, and to that extent one condenser is shorted, which is all right, for the other side of the line then is grounded by a condenser to radio frequencies. The object of the two condensers, therefore, is to dispense with the necessity of concern over which side of the plug goes to which side of the convenience outlet.

However, the inclusion of these condensers is more than a mere gesture, as an important cause of tunable hum is a difference in potential between chassis, used as return for r-f circuits, and the ground as it exists on the pole transformer of the lighting company. Hence this difference in voltage is established across a sizeable impedance to radio frequencies, and when a station is tuned in, hum may come along with it, but the 0.1 mfd. condensers render the danger of tunable hum from this source not only improbable but practically impossible.

Location of Capacities

So the fundamental hum, as due to the

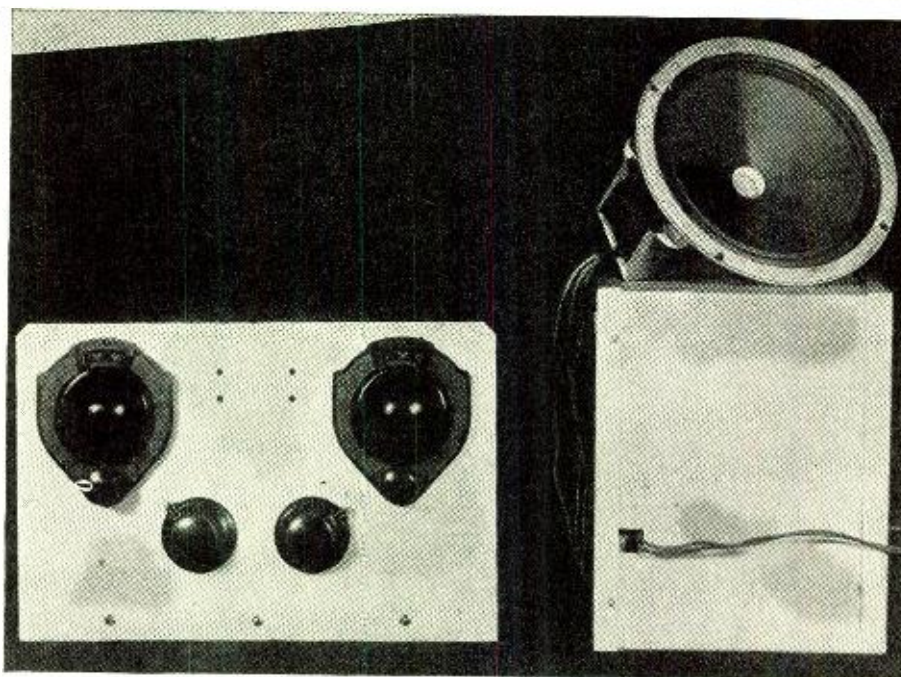


FIG. 5
The front panel has the two vernier dials and the dual knobs for regeneration control. Also shown is the small dynamic speaker used, resting atop the power pack supply shield case.

power supply's proximity to the receiver, and the tunable hum, are eliminated, and we have a device that, though inexpensive, lends itself most admirably to the powering of a short-wave receiver.

Note that next to the rectifier is an 8 mfd. condenser, while there are in reality three choke coils, two of them separate 30-henry units, the other the 1,800-ohm field winding of the dynamic speaker. After the first choke is a 16 mfd. condenser, while the other 8 mfd. is put at the end of the file filter. There is no condenser at the juncture of speaker field and one 30-henry choke.

The voltages obtainable under operating conditions are diagramed, but without load (receiver not connected), will be considerably higher, except perhaps for the 2.5-volt a-c winding.

The magnet wire table herewith is useful for determining axial length of coil windings, or, if the length and wire size are known, the number of turns, and indirectly the inductance.

Another useful purpose is determination of the approximate amount of wire for current shunts across meters. Moving the decimal point three places to the left, under continuous current ohms per 1,000 feet, gives the resistance per foot. For instance, No. 40 wire has a c-c resistance of a little more than 1 ohm per foot. From the known meter resistance and sensitivity, the required shunt may be calculated, the approximate length of wire obtained from the table. For low resistance shunts do not use the finer wires.

It has been said that the total outfit is inexpensive. Although the results are comparable to those obtainable from a \$50 receiver-power supply combination (\$80 or so list), all the parts necessary to build the combination at present discussed may be obtained generally for less than \$20.

Moreover, this is a combination that uses a dynamic speaker, has the latest type tubes, provides for dual control of regeneration, has a shielded and well-filtered power pack, uses the best parts (Hammarlund, Lynch, Acme etc.) and is tuned by two vernier dials.

Much better results were obtained by this independent tuning method than by trying to use a two-gang condenser with a manual trimmer that amounts to the same thing as dual control.

There is virtually no body capacity.

Turns Per Inch

B. & S. Gauge	cc. Ohms per 1,000 Feet	Single Silk	Double Silk	Single Cotton	Double Cotton	Enameled	Enameled SS	Enameled DS	Enameled SC	Enameled DC
14	2.525			15.6	13.6	15.2			14.1	13.3
15	3.184	16.9	16.3	16.1	15.1	17.0			15.6	14.8
16	4.016	18.9	18.2	17.9	16.7	19.1	18.4	17.7	17.4	16.3
17	5.064	21.2	20.3	19.9	18.2	21.5	20.5	19.7	19.3	17.9
18	6.385	23.6	22.6	22.1	20.2	23.9	22.8	21.8	21.4	19.7
19	8.051	26.3	25.1	24.4	22.2	26.8	25.4	24.2	23.6	21.5
20	10.15	29.4	27.8	27.0	24.3	30.1	28.4	26.9	26.1	23.6
21	12.80	32.7	30.8	29.8	26.7	33.7	31.6	29.8	28.9	25.9
22	16.14	36.6	34.2	33.0	29.2	37.7	35.0	32.8	31.7	28.1
23	20.36	40.6	37.7	36.2	31.6	42.3	39.0	36.4	34.9	30.6
24	25.67	45.2	41.6	39.8	34.4	47.1	43.1	39.8	38.1	33.1
25	32.37	50.2	45.8	43.6	37.2	52.9	47.8	43.8	42.8	35.8
26	40.81	55.8	50.5	47.8	40.1	59.1	52.9	48.0	45.7	38.6
27	51.47	61.7	55.5	52.0	43.1	66.2	58.4	52.9	49.7	41.4
28	64.90	68.4	60.9	56.8	46.2	74.1	64.5	57.8	54.0	44.4
29	81.83	75.1	67.1	61.3	49.2	83.3	71.4	64.1	58.8	47.6
30	103.20	83.1	73.2	66.5	52.5	92.2	77.8	69.2	63.0	50.3
31	130.13	91.5	79.3	71.9	55.8	103.4	85.6	75.3	68.1	53.5
32	164.10	100.5	86.5	77.2	58.9	115.6	93.8	81.6	73.2	56.6
33	206.90	110.1	93.6	82.8	62.1	129.3	102.7	88.2	78.5	59.7
34	260.90	120.4	101.0	88.4	65.3	144.9	112.3	95.2	84.0	62.8
35	329.00	131.4	108.5	94.3	68.4	162.3	122.5	102.4	89.6	65.9
36	418.80	142.8	116.2	100.0	71.4	181.8	133.3	109.8	95.2	68.9
37	523.10	155.0	124.2	105.8	74.3	202.4	144.1	117.1	100.6	71.7
38	659.60	167.7	132.2	111.6	77.1	227.7	156.4	125.1	106.4	74.6
39	831.80	180.5	140.2	117.2	79.8	252.5	167.7	132.2	111.6	77.1
40	1,049.00	194.5	148.3	122.8	82.3	280.1	179.5	139.4	116.6	79.5

THE 53 IN CLASS B

Design Features, Including Power Supply and Coupling Transformers—Speaker Field May Be Choke in B Source

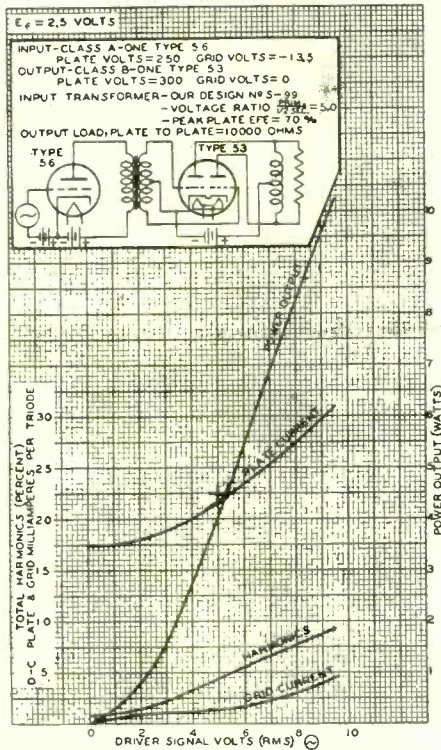


FIG. 1
Operation characteristics of the 53, Class B, using the 56 as driver, at 250 plate volts, negative bias 13.5 volts.

THE type 53 tube is a Class B twin-amplifier designed primarily for use in a-c operated receivers. Combining two high- μ triodes in one bulb, the 53 is capable of approximately 10 watts output with a plate supply of 300 volts, yet requires the chassis space of only a single tube.

The output and tone-quality capabilities of the 53, coupled with its economy of chassis space-requirements, do much to simplify the application of Class B output systems to moderately-priced a-c receivers. The 53 gives greater power output for a given plate-supply voltage than do the pentodes usually employed in a-c receivers of the medium-price group. The total distortion present in the output from the 53 is no higher than that of other output systems of the same power-handling ability.

The high output of the 53 is due to its design and the inherent efficiency of Class B amplifiers. The plate current of the 53 with no signal on the grids is considerably higher than that of other Class B amplifier tubes. The change in plate current from the no-signal value to the value at full output is relatively small compared with earlier types of Class B tubes. This feature of the 53 is largely responsible for its gradual rise of total distortion with output.

The small change in plate-current drain with output obviates the necessity for a power-supply system having excellent regulation. One circuit arrangement made possible by the small change in the 53's

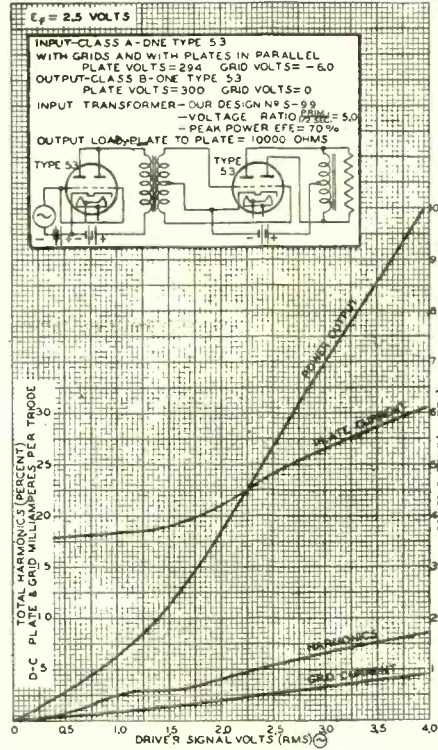


FIG. 2
The 53 Class A as a driver of 53 Class B. Operation characteristics are given. The driver's two triode sections are paralleled.

plate-current drain provides for the operation of the speaker field as a series choke in the power-supply system, say RCA Radiotron Co., Inc., and E. T. Cunningham, Inc.

Driver Stage

Two combinations of driver stage and a 53 are shown in Fig. 1 and Fig. 2. The first combination employs a type 56 tube as a driver. The 56 is operated with a plate-supply voltage of 250 volts and a grid bias of minus 13.5 volts.

Under these conditions the plate current of the 56 is 5.0 milliamperes. Curves of power-output from the 53, current per plate, current per grid, and total percent distortion versus signal input to the driver are shown for this combination in Fig. 1.

Fig. 2 shows a type 53 tube operated as a driver. When used as a driver, the 53 is operated with the two triode sections in parallel. Under these conditions, the plate-supply voltage is 294 volts, the grid bias is minus 6 volts, and the plate current is 7 milliamperes. Curves of power-output (Class B stage) from the 53, current per plate, current per grid, and total harmonic distortion versus the signal input to the driver are shown for this combination in Fig. 2.

The combination employing a 53 as a driver requires considerably less signal input for full output than does the combination employing the 56. However, the plate current required for the type 56 driver is slightly less than that for the 53. The use of the 53 as a driver has a

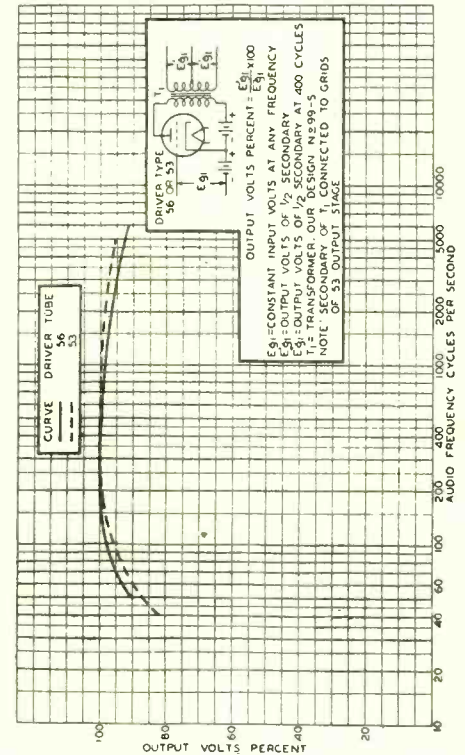


FIG. 3
Fidelity curves for the driver stage and input transformer as measured from grid of driver to 53 output grids.

further advantage in that the number of different tube types in the set may be reduced by one.

Input Transformer

Specifications for an input transformer suitable for use with the 53 are shown later on. The curves of operating characteristics with the 53 and 56 driver were taken with this transformer.

Fidelity curves for the driver stage and the input transformer, as measured from the grid of the driver to the grids of the 53 output tube, are shown in Fig. 3. The curves show less than 10 percent drop in output voltage at 60 cycles per second with either a 53 or 56 driver. The high-frequency response is also good with either type of driver tube.

Output Transformer

Specifications for an output transformer suitable for use with the 53 are shown also.

In this design, the inductance of the primary is made relatively low for full output in order to avoid possible loud-speaker damage caused by the large movement of the voice coil which might otherwise occur at low frequencies at the resonance point.

At medium values of power output, the inductance of the primary is considerably higher than at full output, due to the permeability-characteristic of the core. Consequently, the average efficiency of the

transformer is improved, and the low frequency response at medium volume is enhanced.

The output transformer was designed for a 1.3-ohm voice coil. This reflects an effective plate-to-plate load of 12,400 ohms to the tubes. Due to the input transformer characteristics, a slightly higher load (15,600 ohms) gives approximately 10 per cent more power output. A different output transformer is required however when the 15,600 ohm load is used.

The curves of operating characteristics for the 53 (Fig. 1 and Fig. 2) show that a power output of ten watts is obtained with over 50 percent plate efficiency. The measured distortion is small at low volume levels and increases gradually with increasing power output. A listening test demonstrates that the output quality is good at all volume levels up to the rated 10 watts output.

Power-Supply System

Fig. 5 shows a typical power-supply system for the 53. This system was designed for use with a typical set having a total plate-current drain of 38 milliamperes exclusive of the output tube and driver. The resistances of the power transformer are shown in the diagram. A type 80 rectifier is used and gives sufficiently good regulation for satisfactory operation of the 53 output tube. The speaker field (L_1) is operated as a series choke in the power-supply system, thus eliminating a choke and reducing the total power consumption of the set. Although there is a small change in current through the speaker field, due to the change in plate current of the 53 from no signal to full output, satisfactory operation of the speaker is obtained at all volume levels. The necessary capacity of the filter condenser C_3 will range from two to ten microfarads depending on the amount of filtering required to give satisfactory low hum-levels.

The total plate current (I_b) of the output 53 will vary from 35 milliamperes with no signal to 50 milliamperes at full output. The voltage output of the power-supply system is 300 volts with no signal on the 53 output tube and 272 volts with full output.

R_1 , R_2 , C_1 and C_2 comprise the speaker-correction network, the function of which will be discussed under general comments on Class B designs. A less expensive, but probably less effective, speaker-correction network consists of a 14,500 ohm-resistor and a 0.017 uf. condenser connected in series between the plates of the output 53.

The operating characteristics of the 53, with the transformers S-99 and S-100, and this power-supply system, are shown in Fig. 4. The curves show a power output of 5.6 watts in the speaker-voice coil.

The regulation of the power-supply system corresponds to that of a constant

INPUT TRANSFORMER S-99*.

Core: Material—Grade Audio B, Gauge No. 26, Alleghany Steel Company; or equivalent.

Punching EI-75.
Window $\frac{3}{8}$ " x $1\frac{1}{8}$ ".
Tongue $\frac{3}{4}$ ".
Stack $\frac{3}{4}$ ".
Joint Butt (tight).
Net section 3.2 sq. cm.
Mean length mag. circuit 13.3 cm.
Weight 0.62 lbs.
Winding:

Primary:
Turns 5500 No. 40 enamelled.
Location over insulated secondary.
Turns per layer 240.
Layers 23.
Insulation between layers 0.001" paper.
Insulation over winding 0.015" paper.
Mean length of turn 5.1".
Resistance at 25° C. 2630 ohms.

Secondary:
Turns 2200 No. 36 enamelled, tap at 1100 turns.
Location next to core.
Turns per layer 150.
Layers 15.
Insulation between layer 0.001" paper.
Insulation under winding 0.045" paper.
Insulation over winding 0.015" paper.
Mean length of turn 4".
Resistance at 25° C. 318 ohms total.
Efficiency approximately 74% at full load.

Inductance of primary at 10.0 volts, 60 cycles and 5 ma. d. c. is 50 henries.

*RCA Radiotron Co., Inc., and E. T. Cunningham, Inc., design identification number.

Inductance of primary at full output, 60 cycles, is approximately 35 henries.

In order to avoid possible damage to the speaker at the low-frequency resonance point and to secure a more efficient design, the inductance of the primary is designed to decrease somewhat at full output. At medium values of power output the inductance of the primary, due to the permeability of the core, is considerably higher, giving better low-frequency response.

*RCA Radiotron Co., Inc., and E. T. Cunningham, Inc., design identification number.

poor, although the circuit apparently has been designed properly. In such cases the trouble may be due to radio-frequency oscillation in the output tubes. This oscillation occurs only when an audio-frequency signal is applied to the grids.

The result of these radio-frequency oscillations is an audible rasp in the output which easily can be mistaken for higher harmonics of the input signal. To determine if this rasping is due to oscillations, an a-c signal should be applied to the grids of the Class B output tubes, and the grid leads touched with a finger. If the

(Continued on next page)

OUTPUT TRANSFORMER S-100*

Core: Material—Grade Audio C, Gauge No. 29 Alleghany Steel Co., or equivalent.
Punching EI-75.
Window $\frac{3}{8}$ " x $1\frac{1}{8}$ ".
Tongue $\frac{3}{4}$ ".
Stack $\frac{3}{4}$ ".
Joint 100% lap.
Net section 3.12 sq. cm.
Mean length of mag. circuit 13.3 cm.
Weight 0.62 lbs.
Winding:

Primary:
Turns 3650, tap at 1825, No. 37 enamelled.
Location next to core.
Turns per layer 170.
Layers 22.
Insulation between layers 0.0015" paper.
Insulation over winding 0.015" paper.
Insulation under winding 0.045" paper.
Mean length of turn 4".
Resistance at 25° C. 650 ohms total.

Secondary:
Turns 43 No. 20 enamelled.
Location over insulated primary.
Turns per layer 25.
Layers 2.
Insulation between layers 0.005" paper.
Insulation over winding 0.015" paper.
Mean length of turn 5.1".
Resistance at 25° C. 0.192 ohms.
Efficiency approximately 71.5% at full load.

Inductance of primary at full output, 60 cycles, is approximately 35 henries.

In order to avoid possible damage to the speaker at the low-frequency resonance point and to secure a more efficient design, the inductance of the primary is designed to decrease somewhat at full output. At medium values of power output the inductance of the primary, due to the permeability of the core, is considerably higher, giving better low-frequency response.

*RCA Radiotron Co., Inc., and E. T. Cunningham, Inc., design identification number.

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(Continued on next page)

voltage source supplying power through a 2,000-ohm resistance. If the speaker field in the power-supply system is replaced by a choke, and the speaker field is connected across the power-supply, the regulation can be reduced to the equivalent of a 1,000 ohm resistance. This improvement in regulation increases the power in the voice coil to 6.4 watts. The use of a power-supply system having nearly perfect regulation, such as obtained with a mercury-vapor rectifier tube and a transformer and choke having very low resistance, will increase the power in the voice coil to more than 7.0 watts. Since the efficiency of the output transformer is 70%, the actual power output from the 53 is over 10 watts.

Class B Designs

As a word of caution regarding Class B output systems, listening tests sometimes show the quality of the output to be very

FIG. 4
Performance of the 53 Class B stage with transformers described in the text.

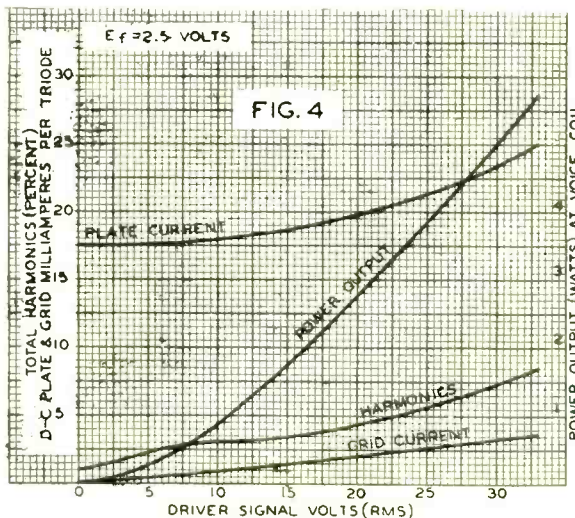
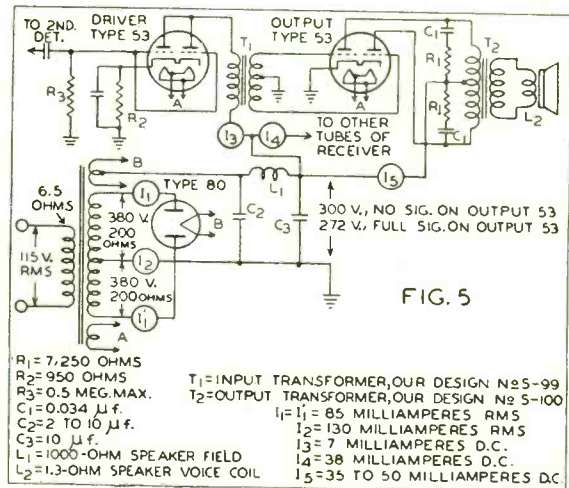


FIG. 5
A typical power supply system for the 53.



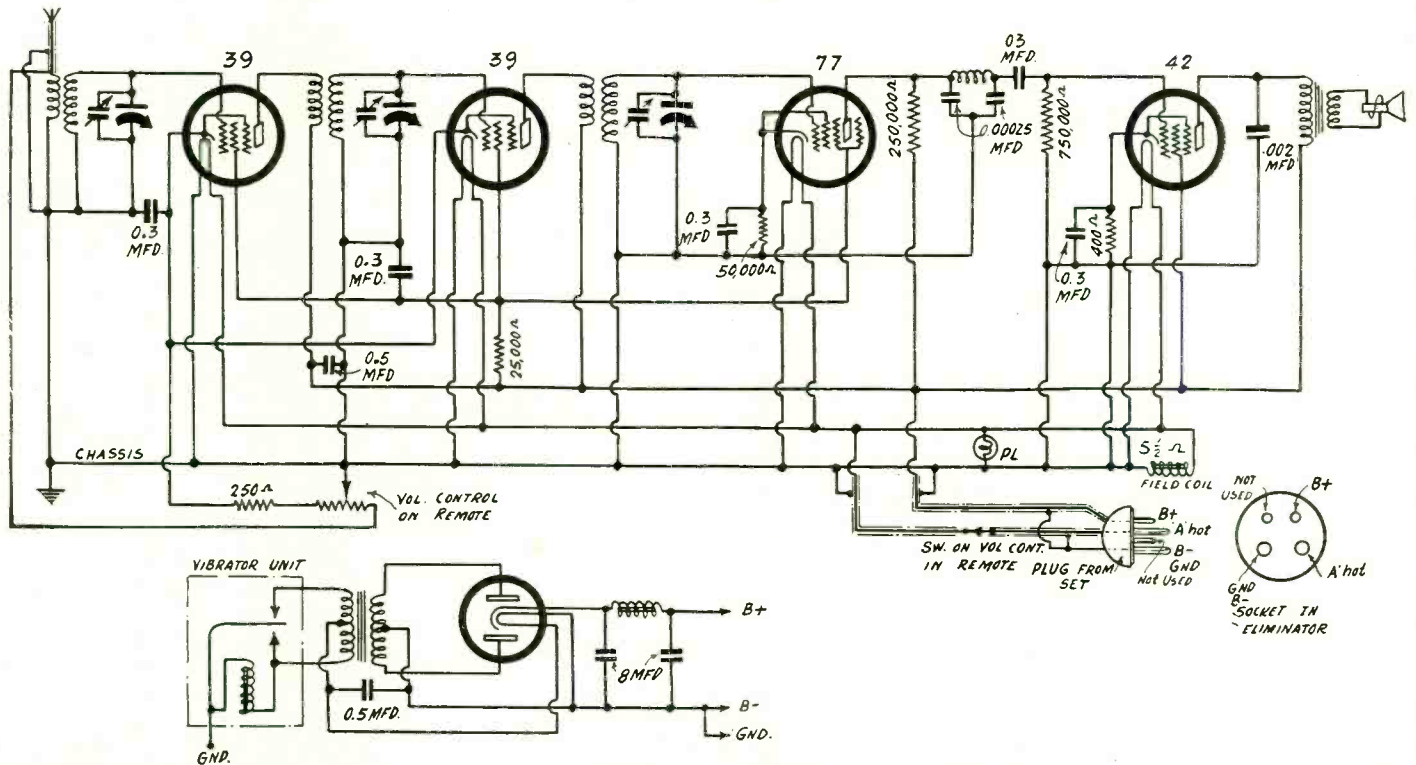
- $R_1 = 7,250$ OHMS
- $R_2 = 950$ OHMS
- $R_3 = 0.5$ MEG. MAX.
- $C_1 = 0.034$ μ f.
- $C_2 = 2$ TO 10 μ f.
- $C_3 = 10$ μ f.
- $L_1 = 1000$ -OHM SPEAKER FIELD
- $L_2 = 1.3$ -OHM SPEAKER VOICE COIL
- $T_1 =$ INPUT TRANSFORMER, OUR DESIGN No S-99
- $T_2 =$ OUTPUT TRANSFORMER, OUR DESIGN No S-100
- $I_1 = I_1 = 85$ MILLIAMPERES RMS
- $I_2 = 130$ MILLIAMPERES RMS
- $I_3 = 7$ MILLIAMPERES D.C.
- $I_4 = 38$ MILLIAMPERES D.C.
- $I_5 = 35$ TO 50 MILLIAMPERES D.C.

A COMBINATION SET

In Use on Autos with Electric B Supply or Batteries

By *Eli Babkes*

Consultant, Postal Radio Corporation



The Postal five-tube auto set, just released, affording the optional use of B eliminator or B batteries. The design is exceedingly simple, though the result of exhaustive experimenting.

THE advent of the new auto tubes has made possible great strides in automotive set design. The advantages are numerous. Every available auto radio improvement is used in the new Postal radio. Increased power output comparable to that of sets used in the home is easily obtained at relatively lower voltages. The sensitivity, selectivity and tone quality are also on a par with the domestic type of radios. For every tube employed in the home set, there is a corresponding one with identical characteristics, of course, except for filament voltage and current drain.

Yet in the automotive type of radio we can easily realize a closer theoretical output per stage than is possible in the home type. Because the antenna circuit of the home set is most always "evaded" (a greater transfer of signal voltage from antenna to tube), the set is not prone to oscillate as easily. The aerial limits in the car leaves no chance for such. It therefore becomes necessary in the design of

an auto set, as is herewith to be explained, that shielding and plate load characteristics be of prime importance.

The Circuit

The circuit of the Postal Auto Radio is of the tuned radio frequency type, self-powered by a specially-constructed and patented vibrator power supply. Five tubes, including 84 rectifier, are employed. Unlike other 5-tube self-powered auto sets, this particular one uses a 3-gang condenser. Two tuned r-f stages use 39's, while the other a 77 is the detector and suited to automatic volume control. The rectified signal voltage is then fed from the detector directly to a 42 output tube. One type 84 is used to supply the 180 volts to the entire unit. The entire set, including speaker and power supply, is housed in a black crystallized case measuring 8 inches wide, 7 inches deep, and 6 inches high. For those who are economically interested in the battery set itself, the exact same speaker and audio system can

be had less the power unit. The set measures 6 by 6 by 7 inches deep. Both units are compact affording practical and simple installation in all cars.

The key switch-volume control combination and pilot light are enclosed in a remote control that mounts directly on your steering column. In the all-electric type there is only one shielded wire leading to the storage battery. The wire proper is connected to the "hot" or ungrounded side of the storage battery, the shield being connected to the car frame automatically. One other lead is the antenna, thus making the actual installation a pleasure.

In the battery model, there is an additional shielded wire, in which case the wire itself is connected to the 135 or 180-volt tap on the batteries, and the shield, together with B-minus of batteries, is grounded to the car frame. The circuit of the power supply has been specially constructed to have a negligible mechanical vibration. In fact, when the unit is

The 53 as a Class B Output for A-C

(Continued from preceding page)
rasping stops when the lead is touched, it is undoubtedly due to radio-frequency oscillations.

A remedy for oscillation is effected by connecting small fixed-condensers between each grid and cathode of the Class B stage. Tests have shown that 0.0005 mfd. condensers are usually satisfactory. These condensers may not be required if a speaker-correction network of resistance and capacitance is employed between the plates and cathodes.

It may be desirable to employ a speak-

er-correction network between the plates of the output tube, in order to maintain a uniform load at all frequencies. For a 10,000-ohm plate-to-plate load on the Class B stage, a resistance of 11,500 ohms and a capacitance of 0.021 mfd. should be connected in series between the two plates. For an 8,000 ohm load, the resistance should be 9,000 ohms and the capacitance 0.026 mfd. A more effective, but also more expensive, way of applying the correction network is obtained by balancing the network to the center tap of the interstage transformer. The value of

resistance between each plate and center tap is one-half that given above, while the value of each capacitance is twice that given above.

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

The tube is in a few sets already.

LIST OF PARTS

- One 3-gang variable condenser, 360 mmfd.
- One set of three r-f transformers.
- One condenser block containing four 0.3 mfd. sections @ 200-volt rating, also one 0.5 mfd. at 400 volt rating.
- One .0002 mfd. @ 400-volt rating.
- Two 0.00025 mfd.
- One dynamic reproducer, 5 inches outside diameter.
- One transformer for 42 type output; field resistance 5.5 ohms.
- One drilled and cut chassis.
- One Case (black crystallized).
- Resistors: One 400-ohm; One 25,000-ohm; One 50,000-ohm; One 250,000-ohm; One 750,000-ohm.
- One r-f choke, 10 millihenries.
- One remote control and necessary cables (electrical and mechanical).
- One Postal Auto B Power Unit.
- Hardware, wire, and solder.

entirely enclosed there is no vibration or mechanical noise present. The B eliminator supply is so designed that when one places ear to the speaker there is no detection of that so-common crackling or extraneous noise as found in most auto sets. The unit is capable of delivering 180 volts with a current drain up to 50 milliamperes. With an output wattage of 9 as compared to the input wattage of 14, it becomes apparent that the unit is about 70% efficient.

Sensitivity

The sensitivity goal for the set is more than realized. As each individual component coil, condenser, and tube is individually shielded, high gain and stability are achieved. Radio-frequency transformers with very high plate resistance characteristics would be impractical were it not for the fact that all grid leads are isolated from one another. The layout of the set so conforms to high gain design that plate leads are only 1/2-inch long. There is not one grid lead exposed.

Another feature to aid of sensitivity is the use of increased values of condensers for by-passing. Instead of 0.1 mfd., 0.3 mfd. is used throughout, and in addition

the high voltage has 0.5 mfd. All cathodes, screens and voltage leads are by-passed, eliminating any feedback. The detector circuit is another boost to sensitivity.

The 77 type tube enables relatively large output with a minimum amount of input. With the plate current adjusted to 0.1 ma at no signal impressed, in addition to maintaining a high screen voltage on the detector, both high output and high gain are obtained simultaneously. In that case, the detector screen obtains its 100 volt potential from the r-f screens with no additional series resistance. The one 25,000-ohm resistance produces the necessary voltage drop to supply 100 volts to the screens of all the r-f and detector tubes.

The 77 type detector has been found by experiment to produce the greatest undistorted output when working into a 250,000 in plate resistance. Then, the r-f component in the detector plate circuit would be audible were it not for the double by-passing about the r-f choke in the plate circuit. The sum reactance of these condensers is sufficient for the lowest frequency note produced.

The 42 as an output tube has been wisely chosen despite the slightly increased filament drain. But the advantages attained more than offset the disadvantages at 135 or 180 volts the plate current is not appreciably more than that of 0- any other sizeable output tube. Yet with the 42 at automotive set voltages, more than 2 watts of power can easily be handled. The mu is of the order of 200.

And, speaking of filament drain, the entire set, including the speaker and tubes, including the 42 and power supply, draws only about 4.5 amperes. At ordinary driving speeds in your car the generator charges the storage battery at approximately 10 amperes. There then remains no fear of discharging the battery.

Selectivity

The problem of selectivity has been met by special design features. The three-gang variable condenser and careful shielding have eliminated overload points and oscillation. Perhaps the greatest cause of crosstalk in previous models of sets has been due to overloading of detector or r-f stages. In that condition, the r-f grids draw current due to the positive

grid swing and function as detectors. Cross modulation then enters. In this particular set there is an initial fixed bias of 3 volts on each of the r-f stages. A higher than normal cathode bias maintained on the detector prevents overloading and distortion.

The r-f coils are of special design, having high primary impedance and correct coupling between primary and secondary. This is easily noticed in the alignment of the receiver. The compensator screws on the variable condenser tune very sharply at any position of the broadcast band. This indicates a uniform gain throughout.

The first impression gained upon tuning the receiver would be that it is a superheterodyne worked at a high intermediate frequency. The gain is surprising. Tube for tube, there is no doubt that a t-r-f set possesses greater amplification qualities than a superheterodyne. A simple fact is that modulator and detector circuits of a superheterodyne do not even approach the amplification of the corresponding stages of the t-r-f circuit. But in most t-r-f sets much of this gain is sacrificed for selectivity. In an automotive receiver, however, that is unnecessary. Due to the scarcity of antenna the selectivity becomes a function of the number of tuned circuits. In all, stations are received over the entire band with space to spare for separation.

Tone Quality

The use of a dynamic reproducer, capable of withstanding power in excess of the output tube, is one important reason for the faithful reproduction. The non-distortion quality of the detector insures a distortion-free signal feed to the audio stages. Had it not been for the incorporation of the doubly bypassed radio-frequency choke, r-f currents would find their way into the detector plate circuit and cause a howl and so-called "tinny" reproduction.

A time constant of 0.02 is obtained in the resistance-coupled audio circuit. This value is sufficient for the lowest note produced.

This receiver when tried under actual operating conditions in the city and far out in the country proved far beyond the author's expectations and to his knowledge it has the gain of most 8-tube receivers.

Ten Years Ago!

(Some of the matters discussed and illustrated in RADIO WORLD dated June 16th, 1923)

D. L. Brown told about "A Portable Radio Set with Roller Skate Attachment," and there were illustrations of the set on the road—but not a sign of roller skates.

The radio equipment of Captain Mac-Millan's arctic vessel, "Bowdoin," was shown in type and story. The article was by Sheldon Fairbanks, a member of the famous expedition.

Robert L. Dougherty discussed a portable single loop receiver that was both cheap and reliable.

Somebody said in a special article that radio is not a summer luxury—it's a necessity. And so the story has come down through the years and millions of people are sure the theory is right.

C. White again showed he had been busying himself on an article entitled "An Extremely Selective Single Circuit Receiver." The caption of an illustration stated that "A single circuit set can be made super-selective by the use of two potentiometers—which nobody can deny."

J. Nazeley, Palisade, N. J., had just been granted a patent on a new collapsible loop antenna, the rights to which were later taken over by the General Electric Co.

Somebody advised the world at large that folks should treat their earphones as carefully as a watch.

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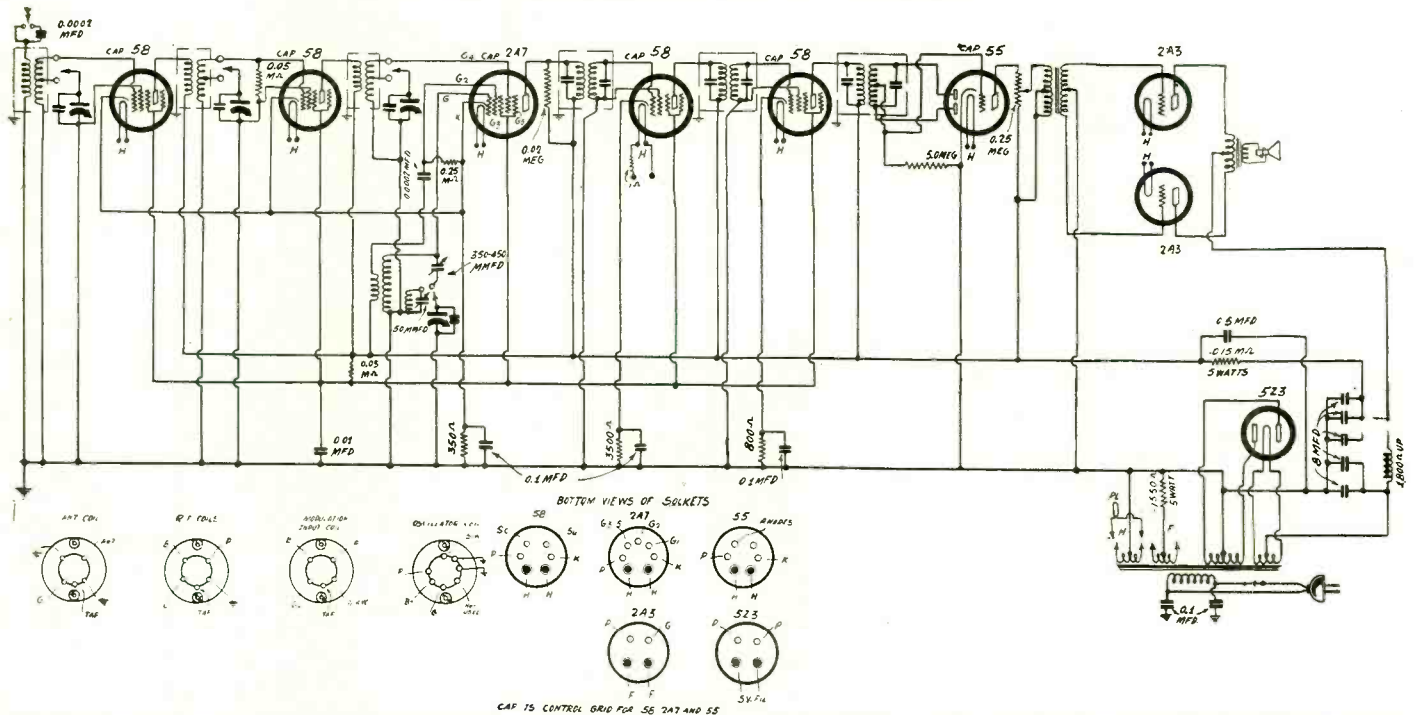
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RADIO WORLD, 145 West 45th Street, New York. (Just East of Broadway)

NOVELTIES IN SUPER Grounded Suppressers, Series Heater Stabilizer, Transformer Primary in 55 Plate Circuit

By Compton P. Edwards



A nine-tube superheterodyne, introducing some actually tried novelties. The suppressers of all the 58 tubes are returned to ground, and thus the plate impedance changes somewhat with signal intensity, making the set less selective when locals are tuned in, to gain better quality, and most selective on weak, distant stations. Higher negative bias than normally recommended is present in the 2A3 push-pull output stage, and the primary of the push-pull input transformer is directly in the 55 triode plate circuit.

A FIRST glance at the circuit herewith would give the impression, true enough, that virtually every point that could be grounded has been grounded. Even the a-c line is grounded through condensers. The suppressers of the 58 tubes, instead of being returned to the more formal cathode point, are grounded. The 55 second detector has load resistor grounded.

The circuit is that of a nine-tube superheterodyne, fashioned considerably after the 11-tube Double Push-Pull Diamond, with the driver audio stage of push-pull omitted, however. The circuit was subjected to many hours of experimentation, and is not offered in any sense as an improvement on what has gone before, but merely as introducing some rather new points, which may be incorporated in existing receivers of various types.

It may as well be said that the circuit lacks nothing in sensitivity, that it is sufficiently selective, only slightly less so than the original Diamond.

Both the broadcast and the police bands are tuned in.

Grounded Suppressers

Let us consider grounding of the suppresser. This is unusual in that there is no automatic volume control associated with the circuits that have the suppressers of tubes grounded. If there were automatic volume control the effect would be that strong signals would reduce the plate impedance of the tubes, because rendering the suppressers more negative in respect to cathode (assuming suppressers tied to a. v. c.). Here however, while the direction of change is also negative, it is a smaller change by far, for only the fact that the signal in each tube

tends to drive the grid positive in respect to the fixed bias renders the suppresser relatively negative. It is thus a modified or lessened effect of changing plate impedance.

To achieve highest selectivity the plate impedance should be as high as practical. As the plate impedance is reduced the selectivity is reduced. The same trend exists under both circumstances just discussed, but we are content to adhere to the smaller effect, because we do not want the powerful locals to reduce the selectivity much.

It is of course quite possible to have an intermediate amplifier with its concomitant front-end tuner so selective that the high audio frequencies are seriously attenuated, due to sideband cutting. The form of the modulation is such that the lower frequencies are nearer the zero axis, and thus the higher frequencies at the fringes of the envelope are first to feel the effect of over-selectivity.

A Long Wait

It is conceded, I think, that for DX-hunting it is desirable to have a little too much selectivity, compared to local reception. Therefore a system that changes the selectivity in the right direction, while it may make it a bit difficult to get a DX station 10 kc removed from a powerful local, nevertheless gives that powerful local full play, and most enjoyment must result from hearing local stations, for the quality then is best.

So every 58 tube has its suppresser grounded, which is also a small contributory to the elimination of oscillation. In a circuit such as this, without stabilization, it must be expected that there will be oscillation at both the i-f and r-f levels. However, correctives are introduced. In the

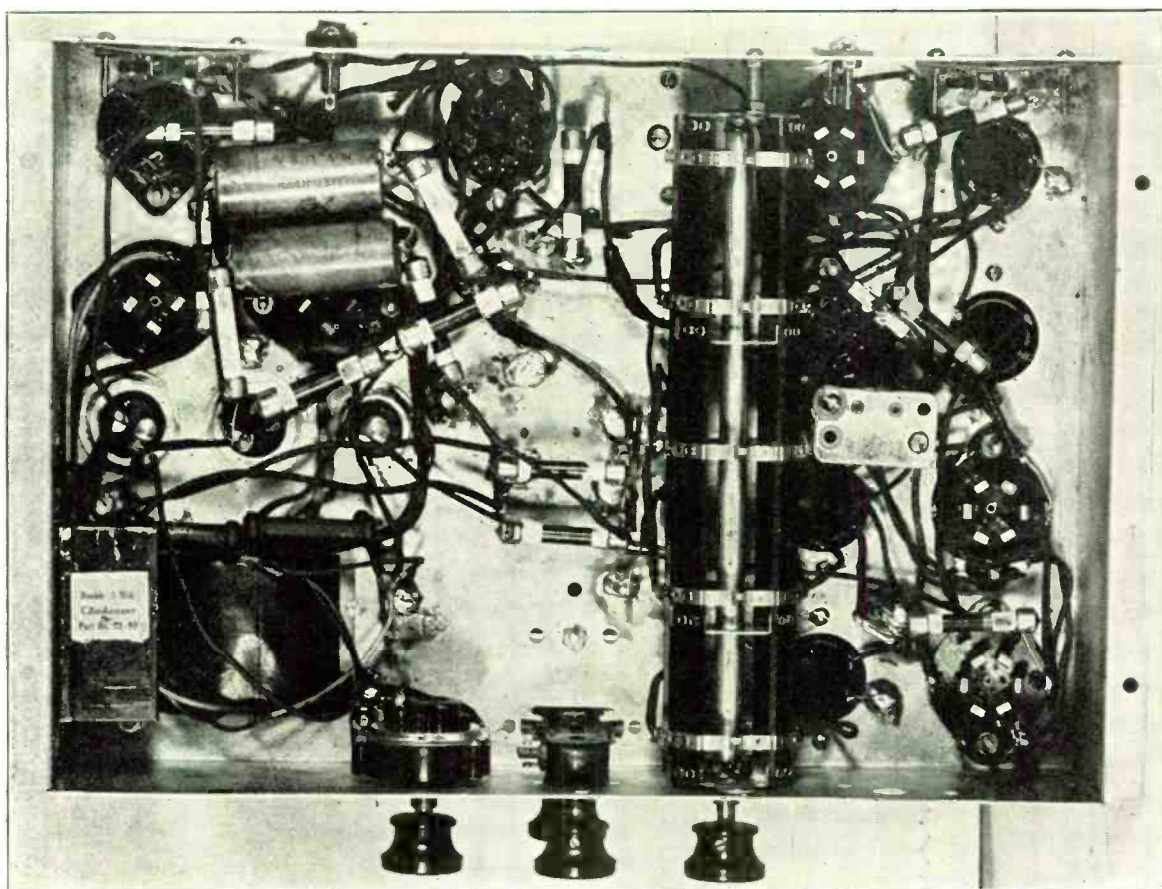
r-f channel a 50,000-ohm resistor in parallel with the second r-f circuit does the trick. In the intermediate amplifier a resistor in series with the heater feed for that tube only, suppresses oscillation found present in that circuit.

However, there is a slight contradiction in the utilization of the series heater resistor, in that it lowers the heater voltage so much that in that circuit the plate impedance goes up considerably. Another fact is that any who get impatient waiting for heater type tubes to function will find that their impatience will be more ruthlessly taxed by the series heater resistor method, as it may take two or three minutes for the tube to heat up sufficiently to bring in signals. The first impression of the uninitiated would be that the set isn't working. But it is.

Transformer Primary Load

Therefore that stabilization method need not be employed necessarily but instead a resistor of several ohms, and of no particular wattage rating, may be put in series with the grid return (between low potential end of the secondary coil in this stage and ground), or a parallel plate resistor of 20,000 ohms or so may be included in the second stage as in the first.

Skipping the prior tubes, except for so much discussion as has taken place, we come to the 55, which is used in familiar full-wave fashion, with diode-biased triode amplifier. This circuit is unusual as it counters the recommendations of some tube manufacturers that the diode-biased method be not used with transformer primary directly in the plate circuit. Examination reveal that at maximum volume the d-c resistance in the plate circuit is least, and



Bottom view of the receiver. The r-f channel is at right.

the plate current is most for signal reasons as well. However, when it is remembered that resistors of 20,000 and 30,000 ohms are commonly used in such circuits, all one need do to protect the tube life is to have a transformer with primary of about that resistance. The transformer used had a d-c resistance of 27,500 ohms in the primary, and the plate current never exceeded the limitations of the tube.

There Is A. V. C.

Now, as to automatic volume control. It has not been omitted. Moreover, noise suppression control is included. The a.v.c feature arises from the fact that the signal alone controls the bias on the triode of the 55. Thus the greater the signal intensity the greater the negative bias, and the greater the negative bias the less the amplification from the triode of the 55. While this is not 100 per cent. effective (and no a.v.c. is, otherwise what would be heard?), it is in the right direction, and fading is checked about as well as it is in the more formal a.v.c. circuits.

It may be assumed that the circuit was built with the idea of not using any more parts than actually necessary, and such is the fact. R-f filters of various types are omitted, as sometimes their very presence introduces so much mutual capacity and other forms of coupling that the remedy is worse than the ailment, although it is admitted that proper filtration serves its excellent purposes.

There is no filtration in the triode output (55), simply to avoid use of a shopping condenser, for the tone quality is better with the condenser out. The tone is good at medium volume, excellent at high volume, the usual Class B condition.

Assuming that everything else is in order (and it is), what about the 55 coming anywhere near driving the output tubes? These are 2A3's, the best output tubes for broadcast receivers to date. And is the bias logical?

Aerial 2 Feet Long

Well, the amount of input to the detector will be such as afforded by the amplification ahead of it and the antenna feed.

It is recognized as important that no long aerial be used, as selectivity is better that way, and the circuit is sensitive enough to pick up all locals and the stronger mid-distant stations from New York City on 2 feet of wire as aerial, hanging from antenna post but not quite reaching the floor.

If instead of the 5.0 meg. load resistor in the triode circuit a meter voltmeter is inserted (1,000 ohms per volt or better, at highest voltage scale, say, 500 volts) the reading obtained will be the actual voltage at that load. The 5.0 meg. resistor of course is then out of circuit. The meter actually used was one of 0.5 ma sensitivity, 300 volt multiplier, or 6,000 ohms, and the strongest local station delivered 20 volts, on that short aerial pickup. If the aerial was lengthened the voltage at the detector exceeded the 30-volt optimum negative bias on this tube for good quality reception.

At 20 volts input to the triode, at a working gain of 3, which is somewhat less than the actual gain, the output tubes would be loaded up, if their bias was 62 volts, as is standard for push-pull 2A3's. If the tube is used at same plate voltage, single-sided, the negative bias may be around 42 volts.

The Extra Bias

However, just as the single sided bias may be increased about fifty per cent., according to data on the 2A3 as released when the tube was announced (though this detail is omitted from some tube charts since published), so may more than 62 volts be applied as negative bias for push-pull. Moreover, if one has any doubts concerning his power transformer standing the 100 ma drain or a set of this general type, the increased bias will cut down that drain to under 90 ma, and the voltages well be upheld.

At 62 volts negative bias, 300 plate volts, for normal push-pull, the power output rating is 15 watts. Here the power output rating is greater, because the bias is increased, and the reduced current increases the B voltage on the tubes compared to what it would be otherwise. But the quality at low volume isn't quite so good. At maximum volume it is better.

From the foregoing it is clear that the 55

will load up the push-pull stage whether the bias on the power tubes is the normal rated amount or considerably higher, as here, for the resistor instead of being 750 ohms is just twice that, 1,550 ohms. This does not mean that the bias is 124 volts, for the current is reduced. The bias may be around 70 volts or more, depending on power transformer regulation and other considerations.

This point about using more than 62 volts negative bias, either with more than 300 volts on the plate, or with 300 volts, has not been brought up before, but the results are so pleasing that it is recommended that the system be tried. Excellent results can be reported on account of tests of the circuit diagrammed, but experimenters should try this for themselves, as it is a very simple matter. Just use twice as much biasing resistance.

Pushing the negative bias thus far over, of course, makes the operation still nearer Class B than it is under the 62-volt condition, which is itself a cross between Class A and Class B. However, this is the non-grid-current type of Class B that is introduced in a measure, and no special precautions about transformer or about regulation of the B supply need be taken.

2A3's and Motorboating

Another point is that, although 2A3's are the output tubes, there is no bypass condenser across the biasing resistor (1,550 ohms). There have been statements printed elsewhere that these tubes are the only ones that actually require such a condenser, and it is a fact that sets have been built by others where motorboating has been reported, curable by including the condenser. However, the strong peaks of the signal are better sustained with the condenser out, and motorboating, present in other circuits, will be found removable by better means, as by putting a resistor across the primary of the input transformer of low enough value to stop the trouble. The present circuit did not motorboat.

The 2A3's as output tubes are excellent on low-note reproduction, and to this extent it is true that motorboating may be experienced in other circuits using the tubes, but is correctible.

IN the construction of a set analyzer the problem always arises as to the designations to apply to the switch points in relationship to the elements of the tubes in the tested circuit. Ordinarily, the practice has been to refer whenever possible to grid numbers, for in the beginning the grids had a rather uniform numerology. Grid No. 1 was the control grid. Grid No. 2 was the screen grid. When Grid No. 3 came along it was the suppresser, but in later tubes became something else, and then came a tube with five grids, and the attempt at uniformity was further upset.

Because of this condition Radio Manufacturers Association, Inc., adopted a standard code which, instead of regarding the identities of grids, plates, etc., referred to the base pins of the tubes. This code has been followed by some of the tube manufacturers in their characteristic charts, the number being given and the element designation as well.

Code for Pins

An examination of the diagrams from the tube charts of RCA Radiotron Co., Inc., and E. T. Cunningham, Inc., from which for the most part those included in the accompanying table were taken, shows that, following this code, the heater or filament numbers are always 3 and 4. As the diagrams show the bottom view of the sockets the positive filament is at left (3) and the negative filament (4) at right.

It is almost, but not quite, true that the plate is always Pin No. 2. The other pins, while always following the coded sequence, may be some elements at one time, other elements at other times.

Taking, then, the left-hand or, let us say, positive filament as the datum, and calling that Pin No. 3, since the plate is almost uniformly next to the positive filament, or equivalent heater leg, and as the direction of numerical decrease from 3 is to the left (remembering it is a bottom view you have), plate in nearly all tubes is Pin No. 2, as stated, and the pin next to plate would be No. 1. With the simplest formation, a UX tube, for instance, the control grid would be Pin No. 1.

Switch Positions

With this code we are free to build a tester that will take care of all types of tubes, as there is only one more possible connection, and that is an overhead grid, as in the '24, 35, 57, 58, etc. To date there are no tubes that have more than seven pins and overhead grid, therefore eight positions on a switch would take care of measuring current in all of these circuits, and the ninth position could be for voltage readings. The final position is fixed at the ninth because there are switches generally obtainable that are limited to nine throws.

There has been some talk about a tube being in line for announcement that has an eight-pin base, with no hint as to whether it would have an overhead grid, but assumptively it would have, otherwise the seven-pin formation would be suitable. However, any analyzer now built along the suggested lines could be accommodated to such a new tube, if any, by an adapter.

Numbers Correspond

Normally switches are supplied with number plates, so that a nine-position switch would have a plate bearing the numbers from 1 to 9 inclusive. Ordinarily these numbers have only arbitrary significance. As far as possible, No. 1 position may be assigned to the control grid, No. 2 to the screen grid, No. 3 to the suppresser. But attempts to reconcile this system with the multiplicity of tube types

TABLE RELATING TUBES WITH FIGURE NUMBERS OF SOCKET DIAGRAMS.

200-A	FIG. 1	36	FIG. 9	59	FIG. 18
WD-11	FIG. 12	37	FIG. 8	71-A	FIG. 1
WX-19	FIG. 1	38	FIG. 9A	75	FIG. 13
40	FIG. 1	39	FIG. 9A	77	FIG. 11
874	FIG. 17	31	FIG. 1	78	FIG. 11
2A7	FIG. 20	35	FIG. 6	79	FIG. 19
2B7	FIG. 21	41	FIG. 15A	80	FIG. 2
6A7	FIG. 20	42	FIG. 15A	81	FIG. 5
6B7	FIG. 21	43	FIG. 15A	82	FIG. 2
UX-9A	FIG. 1	44	FIG. 9A	83	FIG. 2
UX-17A	FIG. 1	45	FIG. 1	84	FIG. 25
22	FIG. 4	46	FIG. 7	85	FIG. 13
24-A	FIG. 9	47	FIG. 6	89	FIG. 14
26	FIG. 1	48	FIG. 15	V-99	FIG. 10
27	FIG. 8	49	FIG. 7	X-99	FIG. 1
30	FIG. 1	50	FIG. 1	864	FIG. 1
32	FIG. 4	55	FIG. 21A	866	FIG. 16
34	FIG. 4A	55	FIG. 13	823	FIG. 2
35	FIG. 9	56	FIG. 8	825	FIG. 5
246	FIG. 13	57	FIG. 11	1	FIG. 22
6A4-A	FIG. 6	58	FIG. 11	2A5	FIG. 15A
10	FIG. 1	20	FIG. 1		

THE TALL

Of Significant Switch

By Herma

BOTTOM VIEWS OF

A highly valuable reference chart relating the tube

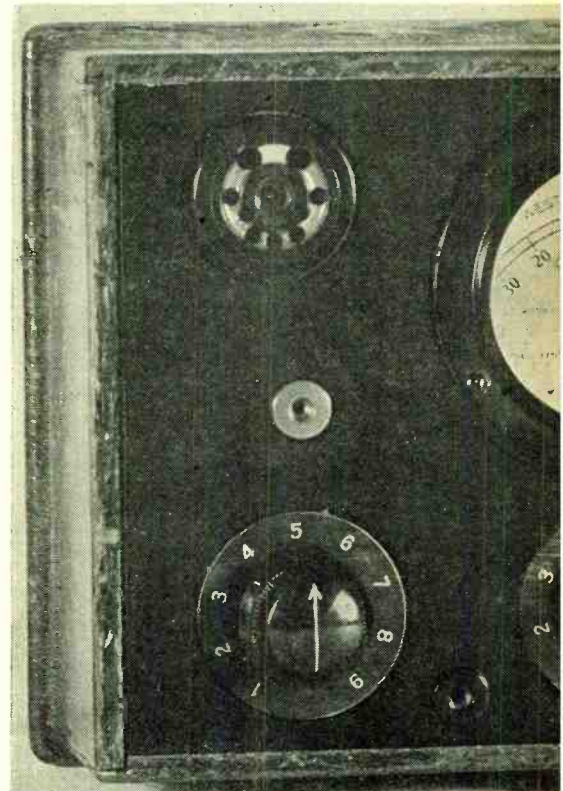
and elements, and the contradictory positions of the grids, etc., in respect to such numbers, finally prove too much. The pin-numbering method, however, is enduring.

So that the numbers on the switch will correspond to the code numbers for the pins of the tube, or springs of the socket, all that one need do is to arrange the circuit so that the pins are picked up in the order corresponding to the numbers on the switch plate, that is, equivalent to the stated switch positions.

Reversing Consideration

We know that positive filament is 3, negative filament is 4, and therefore we connect these leads through the switch so that they contact with the lugs representing, respectively, positions 3 and 4 on the switch plate.

We observe at once that we have doubled up on our tracks, in that for positions 3 and 4 we shall read the same current (filament or heater). This is necessary if we are to preserve the system in respect to existing switch plates, for both the numbers, 3 and 4, are on them, although any who are to engrave their own panels may alter the present method to the extent of omitting, say, point 4, and having the numbers read, instead, 1, 2, 3, 5, 6, 7, 8, 9 and 10 for a nine-throw switch. This would preserve the general polarity, whereby tube elements are negative in respect to voltage sources, and no reversing switch would be needed. However, if the full unchanged sequence of numbers is used, the two positions, 3 and 4, serve the purpose of reversing the direction of current flow, so that no matter in which direction the meter is



The analyzer as illustrated was built with a 100 ohms per volt as voltmeter). The four-decade center and the voltage pickup switch at right. Two light jacks are for lead 8 (overhead)

Y METHOD

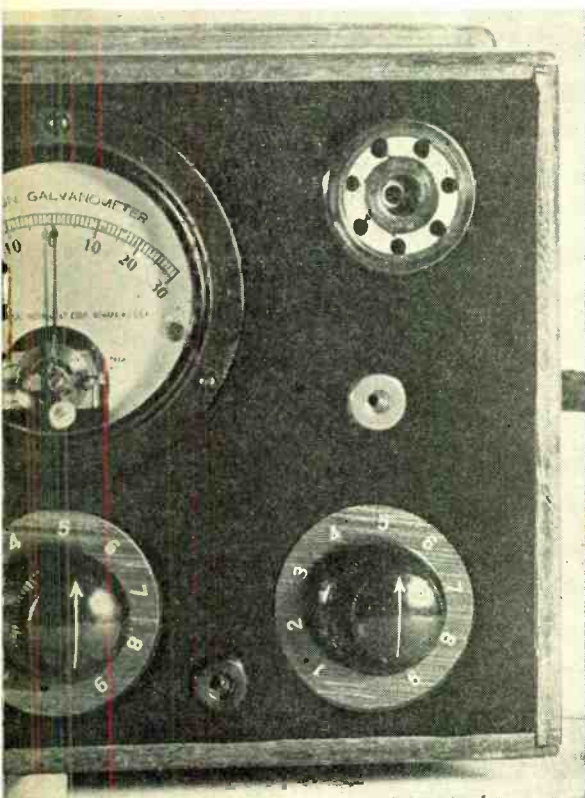
ing in an Analyzer

an Bernard

SOCKETS

34	25Z5	33 47 6A4(LA)	46 49	27 37 56	
58 78 WD-11	55 75 85 2A6	89	48	2A5 41 42 43	
2A7 6A7	2B7 6B7	53	1	84	

types to the coded base pins and tube element identities.



l-c galvanometer of 0.5 ma sensitivity (2,000 switch is at left, the shunt-multiplier switch at right). The sockets are 456 at left, 437 at right. The ad grid), to be used with nearer socket.

wired, the reversal may be accomplished at one of the two positions.

Now let us take a few examples of familiar tubes.

Examples Cited

The four-pin type filamentary tube may be represented by the 201A, 112A, 45, 2A3, 50, etc. We know that the positive filament is 3, the negative filament is 4, and writing in the numbers for the two other elements, in the only possible sequence, the plate is 2 and the control grid is 1. In this group fall the a-c types, e.g., 2A3, 45, 50, 26, etc., concerning which "negative" and "positive" filament have no significance, other than that of identifying the location of the pin.

A rectifier tube, such as the 80, 82, 83 or 5Z3, would have 3 and 4 for the filament, but as there is no grid, the two other elements would be plates, hence 1 and 2 are plates. This is one exception to the rule that the plate is always registered No. 2. It is, in this example, but also it is not.

Take the 27, 37 and 56. These are a five-pin tubes. Positive side of the heater is No. 3, negative side is No. 4, plate is No. 2, cathode is No. 5 and screen is No. 1.

The 8-Connection Tubes

Take the most numerous-element tube so far, the 2A7 or 6A7. So-called positive side of the heater is No. 3 (left in diagram), negative side is No. 4 (right in diagram), plate is No. 2 again, to the left of No. 3; therefore the combined grids Nos. 3 and 5 (so united inside the tube), are No. 1, cathode is No. 5, Grid No. 1 is No. 6 pin and Grid No. 2 is No. 7 pin. Grid

No. 1 is the oscillator grid, Grid No. 2 is the oscillator plate as to its function, and the Grids Nos. 3 and 5 are the screen, and the remaining grid, No. 4, or control grid of the pentode, is the overhead cap, represented by position 8. This tube is really two tubes in one, of which the oscillator is a triode and the modulator is a pentode.

Sufficient examples have been given to prove that the system works out, but of course it is necessary to know which elements of the tubes, other than well-recognized filament or heater, and plate, are represented by the other numbers.

If one knows the pin identities in respect to the elements, that is, a certain pin is cathode, another is screen, etc., then as one knows the code he can ascribe the correct pin numbers.

Chart Is Helpful

However, the tubes are now so numerous, new ones require additional information, often call for novel arrangements, therefore it is well to have at hand a chart that relates the tube types to the figure numbers of socket diagrams, while these diagrams give the pin numbers, as well as the element identities. Then when one desires to test a circuit in which there is a specified tube, he simply consults the list of tubes, finds the tube in which he is interested, notes the figure number of the socket, and then studies the socket diagram. He can then turn his analyzer switch to the correct number to read the current in the desired circuit.

As stated, the switch discussed reads current at eight positions, the ninth being reserved for general voltage pickup. Another switch will tap the voltages, and this may be of the nine-position, single-pole type, and again the numbers may correspond to the pin numerology. Thus we have taken care of both current and voltage by adopting in the analyzer the standard pin code.

Visualizing the Switch

In line with the foregoing suggestions an analyzer is diagramed. This uses a nine-pole, double-throw closing switch for moving the current meter into any one of the eight circuits opened by a nine-pole, double-throw opening switch. Both of these functions, opening and closing, are performed by the same operation in the same unit, which has the closing device as the front pair of lugs, nearer the knob, and the opening device as the rear pair of lugs, considering lugs in the same front-and-back line.

The diagram may be read literally in this respect, considering the lower oblong, representing the closing switch, and the upper oblong the opening switch. The lower oblong has eighteen lugs shown, nine for each slider of the closing switch, and therefore the switch may be visualized as being represented by this oblong when the knob or shaft is considered at extreme bottom. The upper tier, representing the other lugs for the second slider of the closing switch, is joined to the nearer lug of the other or opening switch. The points of the closing switch are two for each position, represented by a cross, of which the inverted V may be read as one lug and the upper V as the other lug.

7-Pin Tubes

The cathode is 5, and on the lower oblong the connection is reversed in respect to the others. This is because the circuit has to be built on the basis of a given polarity, of which the upper meter terminal is positive, as this is correct for virtually all readings except cathode and

(Continued on next page)

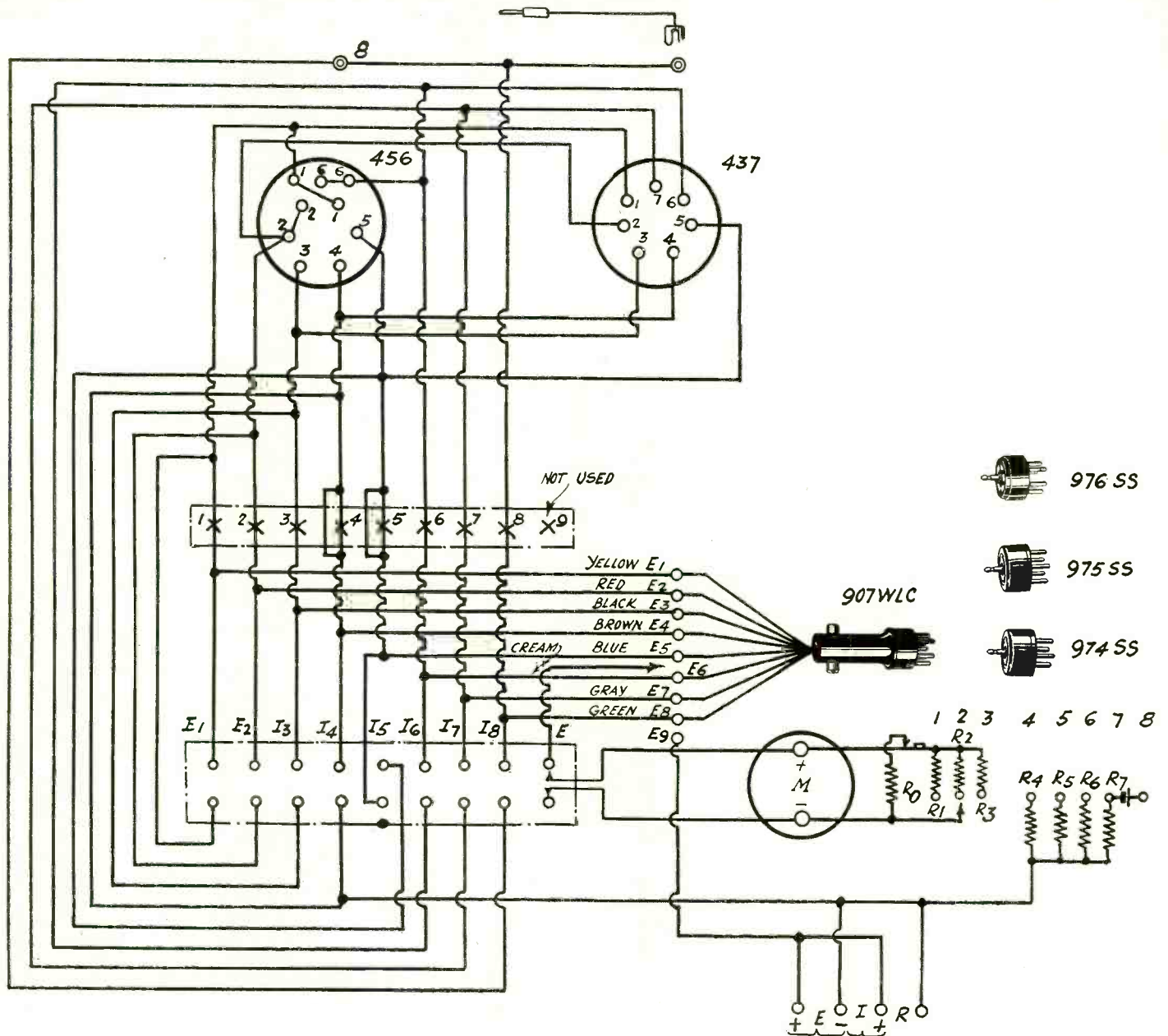


Diagram of the analyzer that uses the tube base pin code.

(Continued from preceding page)
 suppresser current, with suppresser as in the 57 and 58. As to the 57 and 58, this condition may be disregarded, as the suppresser is usually tied to cathode and besides carries so little current (around 8 microamperes), so that your meter would not read it. Otherwise, the equivalent socket position would be negative in respect to supply source for other tubes. However, the cathode is always positive, hence the reversal.

The sockets at top, bottom views shown, are of two types. One is the universal that, without possibility of error, accommodates UX, UY, or six-pin tubes. Adapters are necessary for special or infrequently used tubes, such as those with overhead heaters, or the WX-12 and V-199 tubes. The other socket is for the medium-sized seven-pin base, represented by the 59 and 53. The 2A7 and 6A7 will not fit into this socket, though also seven-pin, but an adapter takes care of this.

Ranges

The filament or heater current leads are shorted, to short out the meter, in the upper oblong, because normally the current is too large for the meter, but any equipped with the proper shunt for the high current readings, and particularly high a-c in heaters, may insert in each of the shorted leads a switch that remains closed unless the button is depressed.

The meter may be a 0-1 milliammeter,

and the voltage multipliers would be selected according to the ranges desired and possibly in consideration of the calibration of the meter scale. That is, if the numbers are 0 to 1 the voltages selected may be 0-10, 0-100, 0-1,000, and at 1,000 ohms per volt these resistors would be 10,000, 100,000 and 1,000,000 ohms, respectively. The parallel meter resistors would depend on the internal resistance of the meter and the desired ranges, considering also the calibration scale, therefore, 0-1, 0-10 and 0-100 milliamperes could be the ranges.

Resistance Tests

The multipliers are R4, R5, R6 and R7, four ranges being shown, because some like to subdivide the jump from 100 to 1,000 volts, with, say, 500 volts. The shunts are R1, R2 and R3, with R0 being protective, and may therefore be a shorting wire. The meter is shorted out unless and until the key of the switch is depressed. This key or button may be of the locking type, which reduces somewhat the safety offered by the switch, because the switch may be left open (locked) and the meter therefore unprotected.

The cold method of testing may be utilized, also, as the meter may be used as an ohmmeter, either the low-voltage multiplier as limiting resistor, or, for 1.5-volt dry cell, 1,500 ohms, for 3-volt battery, 3,000 ohms for 4.5-volt battery, 4,500 ohms for 7.5-volt battery, 7,500 ohms.

Transcribers Want Ruling Liberalized

Washington.

The World Broadcasting Company, a leader among the transcription concerns, has requested the Federal Radio Commission to change its ruling on the use of announcements of electrically recorded programs. Its claim is that transcriptions have been so much improved over the old records that they are immeasurably better as to program value and technical quality. The suggestion made by WBS, in which other companies in the field concur, is that the cheapening announcement now made at the beginning of each such program shall be held for the finish only, to eliminate any prejudice on the part of listeners. Further suggestion is made that the announcement cut out entirely would lead to the use of more electrically-recorded programs. The matter is now under advisement, but it is not expected that it will be settled much before the Summer is over.

TELEVISION SCHEDULE OF W9XG.

Experimental television station W9XG, Purdue University, Indiana, is now transmitting motion pictures and news reels from 8 to 9 on Tuesday and Thursday evenings, CST. Sixty lines are used on 2,800 kc.

SHORT WAVES FROM ABOVE

Stratosphere Broadcast Plans Discussed

By O. B. Hanson

Manager of Technical Operations and Engineering, National Broadcasting Company

THE proposed flight of the Piccard balloon to the stratosphere above Chicago about July 1st will carry the microphone to an altitude never before achieved and will offer an opportunity to the NBC engineering staff to demonstrate again their ability to bring the unusual into the home of the listener. It would seem but a simple problem to install a radio transmitter in the gondola and transmit back to the ground, but it is not so simple.

First, to obtain such altitudes the balloon must have a high gas capacity and the gondola must be extremely light.

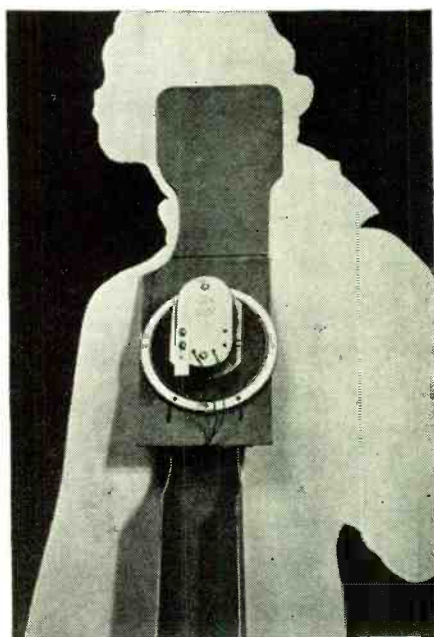
Many other things beside radio must be carried. It is planned to carry two persons, a pilot and an observer, and also to take a quantity of scientific apparatus and make the usual observations required at high altitudes and particularly study the behavior of the cosmic rays. Special apparatus will be used to count these rays and an attempt to rebroadcast the effect will be made.

Hundred-Pound Limit

Due to the rarity of air at such altitudes as ten miles, the gondola must be air tight and capable of retaining normal atmospheric pressure within. Food and water as well as the all important oxygen tanks to sustain life in the stratosphere, must be carried. A maximum of 100 pounds, therefore, is all that can be permitted for the radio transmitter and receiving apparatus and their power supply.

These limitations force us to use the high frequencies of the short wave band. In this case a frequency on the order of 17,300 kilocycles has been selected to carry the voices from the gondola. This will permit us to obtain the maximum transmission with a minimum of weight. In fact, the transmitter designed for this purpose weighs, with its complete power supply and antenna, but sixty pounds and will have an output of three watts.

A receiver must be provided in the gondola to enable the observers to keep in touch with the ground-crew, and this



(Havden)
When a soft drink manufacturer's program is on the air, a druggist in Brooklyn, N. Y., puts a speaker behind the manufacturer's cardboard display lady. That's co-operation.

radio link from the earth to the gondola will be conducted on a frequency of approximately 6,100 kilocycles or a wavelength of 49 meters. The weight of the receiving equipment will be approximately 40 pounds.

Inasmuch as the flight may have a duration of as long as twenty-four hours, arrangements must be made in advance

to clear the networks for spot broadcasting from the balloon during the flight. The three most important periods during the flight will be the take-off, the point of maximum altitude, and the return to earth. The exact time of these occurrences is problematical, which will keep the engineering staff constantly under tension awaiting these high spots.

It must be understood that little is known about the stratosphere or about the direction or strength of the winds at such altitudes, and it is quite possible that as the balloon enters the stratosphere it may be borne away from Chicago in any direction by winds of high velocity.

Selection Problem

It is thought that this radius will not exceed a maximum of 300 miles within the contemplated 24 hours from the start. Herein lies a problem in the selection of suitable receiving locations so that one or more short wave pickups will always be within range of the balloon's minute transmitter and in turn each of these points must be connected by wire to the NBC main control room in Chicago.

There is a possibility that the balloon, upon its return, may alight in an isolated spot or possibly in one of the Great Lakes and although that in itself may not necessarily be fatal to the balloonists, it may put the radio equipment out of commission.

Will Use Dirigible

In order to be prepared for emergencies such as the above, and to facilitate following the course of the balloon, the NBC plans to make use of a Goodyear dirigible also equipped with a radio of higher power, which can relay its messages and offer it assistance upon return to earth.

These are a few of the problems which will face the engineers of the NBC in attempting to bring the voices of the "stratospherians" into American homes from the highest altitude yet obtained by man.

Roosevelt Will Open Amalgamated Chain

President Roosevelt officially will open the new radio chain of the Amalgamated Broadcasting System this month, announced President Ed Wynn, head of the third national network. Officials of WOL, the national capital outlet of Amalgamated, sent word that the President is displaying personal interest in the enterprise, which has been hailed by those familiar with its policies as initiating "the new deal" on the air.

Work on the seven-studio program headquarters on two floors of the new Amalgamated building at 501 Madison Avenue, New York City, has so far progressed that auditions of the hundred and more artists on the first week's features are being conducted from the studio chambers direct rather than from temporary headquarters in the building.

Among those who will be heard regularly on the new chain are McIntyre & Heath and William T. Tilden 2d.

Meanwhile Amalgamated officials an-

nounced that their plans were progressing for extension of the network through Pennsylvania and Ohio into Michigan where Amalgamated's chain of seven stations will go on a non-transcription program thenceforth.

Visitors were shown through the studios by Mr. Wynn.

Reports widely circulated in the Bronx that the studio formerly used by WBNX there would be discontinued permanently brought quick refutation from Amalgamated's directors.

Howard Frazier, chief engineer of WPEN, Philadelphia, and WTNJ, Trenton, two of Amalgamated's parent network outlets, has been named consulting engineer for a long-term period. It was Mr. Frazier who designed and constructed Amalgamated's unique long line and repeater equipment which has made it possible, using Western Union wires, to effect such drastic savings in broadcast overhead that more than a score of national advertisers have contracted for time on the new network before its beginning.

The Amalgamated will have sponsored programs tied in with simultaneous newspaper advertising by the sponsors.

Five Stations Ask 50,000-Watt Permits

Washington.

Five important stations have asked the Federal Radio Commission for licenses to use power up to 50,000 watts. These stations are WGN, Chicago; WBX, Boston; WBAL, Baltimore; WHAM, Rochester, N. Y. Each of these five stations operates on a clear channel, but as present regulations prescribe that only twenty of the forty clear channels available shall be empowered to use the maximum, the twenty authorizations have already been issued. The new requests are in the nature of a plea to amend the rule.

The Commission indicated the applications will not be passed upon before the first of the coming year.

BILL HAY CONDUCTED CHOIR

Bill Hay, Amos 'n' Andy's announcer, once conducted one of the largest church choirs in Nebraska. At the same time he gave voice lessons and had under his guidance the civic male chorus.

Radio University

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

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

Oscillator Stability Test

PLEASE GIVE me some guidance as to testing the stability of an oscillator I built. I have made some preliminary tests, but they are not regarded as particularly good, in the absence of a standard of sufficient accuracy, e. g., a crystal. I have an assortment of meters, so thought perhaps you could suggest something.—E. M. S.

You can rig up a detector circuit, preferably a diode, and filter the a.c. and the d.c. Put a high resistance in the output circuit, to limit the current, and then you may use a 0-1 milliammeter of the a-c type, such as exists in the Weston universal meter. When you couple the output of your oscillator to the input of the extra detector circuit, and also put into that detector the tuned wave of a highly reliable broadcasting station, say, one on 50,000 watts, you may tune the oscillator to zero beat, whereupon the needle of the a-c milliammeter will stand still. The test for frequency stability concerns the steadiness of the needle, for if there is any shift during a short period it will most likely be caused by your oscillator. The needle fluctuations constitute the meter a sort of clock. Therefore you can time the fluctuations, which would be due to oscillator wobble, and determine the frequency stability of the oscillator. The timing may be done with the aid of the minute hand of any watch, or of an electric clock. The limit to the frequency at the upper end is the number of complete cycles or excursions of the meter needle that can be read over a minute, say. Divide by 60 to obtain the frequency. While it is true that the broadcasting station's frequency may shift slightly, this would be gradual, whereas an unstable oscillator changes quickly. Therefore the check is truly upon the frequency stability of the oscillator. Of course, to establish zero beat, or no difference in frequency between the oscillator and the crystal-controlled station-wave, requires very accurate tuning, and for this purpose the ordinary dials used on radio receivers may not suffice.

Regeneration Compared

IS IT PRACTICAL to test the effectiveness of regeneration? I am studying its effects but do not find at hand any ready means of judging the increase in the sensitivity.—O. K. D.

It is difficult to make this measurement with great accuracy, particularly as actuation of the regeneration control introduces some detuning. However, if the circuit under test is provided with a small parallel variable condenser, and frequency established with this condenser at, say, half capacity, the rest of the capacity obtained from the main tuning condenser, the regeneration control may be more closely worked, and detuning effect in gang tuning compensated by the small manual trimmer. Then, using no regeneration, measure the output with an output meter at the power tube. This is best done by having a paper dielectric condenser of 10 mfd. or more and an inductance of 100 henries or more, as the filter. The output meter measures the a.c. The input should be some wave steadily modulated, preferably at 30 per cent., as this is standard. Then regeneration may be introduced, and set at its critical value, the detuning corrected, and the output measurement noted now. The effect of regeneration may be expressed by the ratio

of the first output measurement to the second output measurement. Use a low frequency of modulation, say, 400 cycles.

Meter Protection

IN THE CONSTRUCTION of a set analyzer, will you please help me by offering some suggestions for the complete protection of the meter? As the instrument I intend to use is an expensive one, I desire 100 per cent. protection.—K. L.

Particularly as you intend to use an expensive meter, which is therefore a sensitive one, hence draws small current at full-scale deflection, it is hard to find any suitable way to protect the meter fully. So far as we are aware, the manufacturers of analyzers do not fully protect the meter, nor do we know of any method of so doing. Of course a fuse would be fine, but there are no fuses that are useful at the small current values under consideration. In general, the meter fuses are effective down to 10 milliamperes or so, and some special ones are recommended by fuse manufacturers for smaller currents, but are not so reliable, for it is assumptively quite possible that the meter would be ruined before the fuse was opened. One method that helps is to have a closed circuit across the meter all the time, hence unless and until a button is pressed to open the meter to the circuit. This at least requires a conscious act on the user's part, and serves as a warning, precaution and protection. In general, the circuit of the analyzer should be such as to minimize the danger to the meter.

Volume Control and Tone

IS THERE a frequency-discriminating effect in the type of volume control which consists of a slider moving over the total resistance load in a diode rectifier? You have shown several receiver circuits with this type of control.—V. E.

Yes, the effect is to reduce the high audio-frequency response at lower volume levels. This is much better, in our viewpoint, than reducing the lows, for then the reception sounds tinny. Moreover, reducing the highs enables one to use less than maximum volume when listening in on occasions of abundant static, as the relative response of the static is cut down a great deal, and the program may be heard with enjoyment, though this would not be true at full volume. Even when there is compensation, to avoid tone control in the volume control, there is nearly always a result in the speaker nevertheless that is equivalent to frequency control, since the speaker is sluggish to low frequencies, and requires considerable power for active response in this realm. This is another reason for rating as tolerable the type of volume control concerning which you inquire.

Squeals in a Super

IT HAS BEEN my experience that some squeals are unavoidable in a superheterodyne. You have discussed this subject in relation to a recent question, and seem to think they are avoidable, but this does not conform to my experience.—P. O'R.

Yes, squeals due to the superheterodyne action and all forms of amplification encompassed may be eliminated, or rather avoided. However, air conditions may develop squeals, for instance, foreign stations 5 kc removed from domestic stations develop an audible sound at 5 kc, which may be regarded as a

squeal. But sticking strictly to the receiver, if there is no oscillation in the r-f and intermediate channels, the i-f is accurately tuned, and there is sufficient selectivity ahead of the modulator, the oscillator coil is of proper inductance, and its circuit rightly padded, and r-f lineup just so, not only should there be no squeals, but by this method in sets built in our laboratories there are no squeals. We answered this query in substance only last week, but it is a subject that well bears repetition.

One Heater Side Grounded

IN AN A-C OPERATED SET, I use a heater type output tube, in fact, heater tubes throughout. The circuit I am following is from another magazine. One side of the heater is shown connected to ground. I always thought the center must be connected to ground. Must I put in a center-tapped resistor of low resistance, and ground that center, or is the method now in use all right?—I. D. W.

It is easy for you to determine the answer for yourself, as all you need do is try the other way. However, several circuits use the method you follow, and the results, viewed from the hum angle, are entirely satisfactory. It is just possible you will be unable to discern any difference between the one way and the other.

Prefers Battery Set

BEING PARTIAL to battery-operated sets, although I live in an a-c district, I would like to know if I can get satisfactory power output from battery type tubes, compared to a-c models, and also if the amplification ahead of the output will be satisfactory.—P. W. D.

Yes, you will get entirely sufficient and satisfactory results by the use of battery tubes throughout. For battery use the 2-volt series tubes is usually recommended, because of the low filament drain and the high standard of performance. When the tubes came out they were not as satisfactory as they are today. In fact, virtually all tubes are made better to-day than they ever were before.

Son Feels the Urge

MY YOUNG SON has become interested in radio reception and has inquired if I would purchase the parts so he can build a crystal set. We live almost a hundred miles from the nearest station. Do you think he will hear that station on such an insensitive set?—H. W. S.

It is extremely doubtful. However, the cost of parts is insignificant, and the boy's desires should be respected to the extent that he asks. If the station can't be heard it would be a simple matter to add a socket, tube, a small B battery and a couple of dry cells, and let him try his hand at a one-tube receiver. With this he should fare much better. The sensitivity, with regeneration, will be increased more than a thousand times. He will get a great kick out of hearing anything whatsoever from the first set he has built with his own hands. If he tries the crystal set, be sure to have him use a long, high outdoor aerial and good ground, and with crystal sets the antenna-ground system is the entire power supply, so to speak.

Public Address Output

FOR PORTABLE public address do you regard two 43 tubes in push-pull as adequate for aggregations never exceeding 300 or 400, indoors?—R. W. S.

Yes, this is completely satisfactory.

Aerial and Ground

SO MUCH has been written about aerials and grounds that I should like your comment on the receiver I built, a nine-tube superheterodyne. Not only do I not use a ground but also I do not use any aerial, and yet I pick up stations from all over the country, and most of them with fine volume. I thought a set needed an aerial. And what about the ground? Moreover, if I do use aerial and ground, I find that the ground lead (from

MEN OF THE MOMENT

radiator) is a better aerial than is the aerial itself, which I then use as ground. Another thing, when I attach ground wire to the chassis there is a small spark. I put an a-c meter between ground lead and chassis and got a reading of 3.2 volts. Also, I notice that on some stations when I tune them in a hum comes along. Some nights it is not so bad. On other nights it is present on all stations. My set works best without any aerial, because then selectivity is high. Then what is the use of an aerial? I must report that high wavelength stations do not come in with quite as much volume as desired. By the way, I live in an apartment house in New York City, nine flights up. But there's an elevator.—T. H. H.

You do not operate your set without an aerial. Every wire in the set that isn't grounded picks up something. If the set is sensitive enough, and not shielded with a completeness consistent with the sensitivity, you will get enough pickup from the wiring to produce the reception you report. An aerial is not a wire strung indoors or outdoors, necessarily, but may be any wire, however short. You say that most stations come in with fine volume, but that this is not quite true of the higher-wavelength stations. If you use an extra stretch of wire, if only a few feet, you will gain considerably on the higher wavelengths (lower frequencies) because of the added pickup where needed. The t-r-f portion of your set, which no doubt is a super, is more sensitive at the higher than at the lower radio frequencies. Whether a lead is an aerial or a ground has to do with the relative radio-frequency potentials. The higher potential is the aerial, the lower is the ground. Obviously your ground as a ground is no ground at all. Since you live high up in an apartment house, the entire radiator system constitutes a generous pick-up device, and intercepts waves better than does your so-called aerial, i.e., is at a higher r-f potential at the point of pickup. That is not uncommon. The spark you report is also familiar, and is due to the difference in potential between the "grounded" side of the a-c line and the source of what you use as ground, be it outdoor wire or radiator. The "voltage" you read is the drop in the meter when it is interposed between these different potentials, and in the absence of the meter there might be nothing but the ether between these two potentials. Tunable hum may arise from insufficient filtration in the B supply, from coupling between audio and power transformers, by a-c wires near an oscillator, or, more frequently, by the very potential difference between chassis and the grounded side of the line, which exists in your instance. The difference is even greater between chassis and the ungrounded side of the line. Therefore, put a condenser of 0.1 mfd. between each side of the a-c input and chassis. * * *

Regenerative Short-wave Set

DO YOU RECOMMEND that I build a regenerative short-wave set, or had I better try my hand at a superheterodyne, although I am not familiar with supers and haven't much money to spare?—P. C.

You will do very well with a t-r-f set of the regenerative type, but it is preferable to use a stage of t-r-f ahead of the regenerative detector. Then with suitable audio you will get signals of considerable volume even from foreign stations. Supers are excellent on short waves, but much more difficult to build. First try the regenerative set. Follow a design something like the one outlined in this issue. * * *

Police Tap on Oscillator

IN DEVELOPING A SYSTEM of tuning in the broadcast band and also the police bands on a super, what method would you suggest for tapping the oscillator coil? I have the correct tap at the r-f level, as I tune that part from 1,450 kc up, but the oscillator tap has me puzzled.—R. S. W.

A good system is to trim the oscillator for the broadcast band as usual, and then on the basis of the minimum capacity required

The Playboys—Felix Bernard, Walter Samuels and Leonard Whitcup—piano virtuosi popular on a sponsored series, started a new series of WABC-Columbia programs. Their vocal and instrumental harmonies will be heard at 11:30 a.m. on Monday and at 11:45 a.m. on Friday, EDST. All are prolific composers of popular songs and are known also for their stage and screen work. * * *

Walter Blafuss, Chicago orchestra director, was considered a piano prodigy as a youngster. Besides appearing all over the country as a boy wonder piano soloist, he composed and had published two popular members—"Frolics" and "Chicago Rag," before he was 15. * * *

According to Tom Curtin, NBC script writer who specializes in police dramas, it happened at the Welfare Island penitentiary. "What are you in for?" asked a visitor of a prisoner. "Learnin' to be warden," answered the inmate without batting an eye, "I'm startin' at the bottom." * * *

One of Jack Benny's letter-writing fans is an inmate of a Pennsylvania prison. Each letter is full of praise and admiration for Jack's humor and jokes and yet Jack is a bit uncertain. At the close of each letter is the phrase, "Wish you were here." * * *

Your radio drummer these days is a sound effects man as well as a musician. Consider the sound effects repertoire of Dave Grupp, percussionist, who officiates over the bird, dog and cat calls of an afternoon musical program, intended for children.

In a fifteen-minute broadcast Grupp was called upon to mew like a cat, bark like a dog, squeal and grunt like a pig, play the cymbals for a dance number, sound bells, whistle and tweet like a bird and play his drums. * * *

In the recent reproduction of the Seder service during the Goldbergs program, Alan Devitt, who played the Rabbi, was the only member of the cast who was not Jewish. However, his performance was so convincing that a telephone call came to the studios from a young Jewish couple who wanted to engage him to perform their marriage ceremony. * * *

Phil Baker, the Armour Jester on NBC, can remember 'way back when the movies were the "fillums." He was secretary to Carl Laemmle when Mr. Laemmle was directing the IMP Film Company. Mary Pickford and her sister Lottie, and King Baggott were IMP stars in those days, but the biggest imp of all, according to Mr. Laemmle, was his secretary, whose fingers played an accordion better than a typewriter.

A THOUGHT FOR THE WEEK

ED WYNN is all set with his Amalgamated Broadcasting System and ready to show the other big chains just how it should be done. Now, if the public will only accept Mr. So-o-o Wynn in a serious role and forget his comedy manner long enough, there's a good chance for A. B. S. to get across. Can there be any truth in the rumor that Edsel Ford is interested in seeing Amalgamated succeed?

in the circuit for that purpose, select an oscillator inductance to render best reception at the highest signal frequency of the second band, which would be around 4,500 kc. If the intermediate frequency is 450 kc, then adjust the inductance between tap and ground for 4,950 kc. The low frequency end may be padded with a condenser, say, at 1,800 kc or thereabouts. For the intermediate frequency cited, assuming inductance

selected as stated, that the second padding condenser would have to be around 0.002 mfd. If tap difficulties arise, wind a coil and bring out separate leads from various taps around the circumference, one turn apart, from one-fourth to one-eighth the total turns. The work has to be done experimentally, as no computation can apply where only the frequency is known, but neither the inductance or the capacity.

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QUARTER-WAVE AERIAL AT KYW IS A SUCCESS

Six months ago KYW made first use of a new type of antenna that in effect consists of two vertical radiators, so spaced and properly adjusted as to concentrate the larger portion of the radiated energy in one direction. The unique feature of this installation was the utilization of wooden masts for the support of the conductors which radiate the 10 kilowatts on KYW'S 1,020 kc. frequency. (The station is owned by Westinghouse and is located in Chicago.)

The beneficial results, due to increased coverage, obtained from this installation have more than exceeded the highest expectations. Signal strength of KYW was nearly doubled in the heavily populated centers in and around Chicago.

The main antenna at KYW, generally referred to as the exciter antenna, consists of a wooden mast which supports a section of copper tubing 204 feet in length. When first installed, an attempt was made to work the antenna as a half-wave radiator. A tuning coil was placed midway between the top and bottom of the pole at a height of about 100 feet, and current fed by means of a two-wire transmission system to the transmitter.

Quarter-Wave Aerial

This particular system presented some difficulty in the matter of tuning and adjustments, and after some experiments were made it was decided that a quarter-wave, under the circumstances would be more feasible. Since January 5th the exciter antenna has been worked as a quarter-wave, its advantages over the half-wave being that it is little affected by weather conditions and can be tuned and adjusted at the base of the mast. Also as the present method of operating the quarter-wave antenna makes use of a ground consisting of copper sheets and radial wire, the wood pole is very nearly at the same potential as the antenna itself, thus doing away with the possibility of loading considerable portion of the radiated energy into the supporting mast.

When the antenna was first installed, three sets of guys, consisting of four guy wires each, were used for holding the mast erect. The topmost set of guys was approximately 140 feet above the ground. There remained, unsupported, a 60 foot section of the mast at the top. It was decided that this presented a hazard in the case of high winds or ice collecting, and an additional set of guys was installed and attached to the mast, approximately 175 feet from the ground.

Absorption Trouble Remedied

All guy wires had been insulated from the ground and the pole by means of insulators and were broken up into 40 foot sections. The installation of the latter set of guys dropped the signal strength approximately 5 per cent. More insulators were then installed in this set of guy wires, breaking the sections up into 20-foot lengths. Later additional insulators were installed on the portion of the guy wires that were in proximity to the antenna. The signal strength then returned to its normal value. Since then, a few extra insulators have been installed in the guy wires on the second set, with a slight improvement in field strength resulting.

KYW's new antenna since its installation has weather a fifty-mile gale without damage

Short Dramas on NBC During Summer

Two one-act plays, considered among the best in stage literature, will be presented over a National Broadcasting Company network on consecutive Wednesday evenings, June 14th and 21st.

The first, which will be broadcast on June 14th at 10 p.m., E. D. S. T., over an NBC-WJZ network, is "A Game of Chess," a play by Kenneth Sawyer Goodman which enjoyed great popularity on the stage. It tells the story of a Russian nobleman who is interrupted at his game of chess by a radical who threatens to kill him. There is a dramatic and surprising denouement in which George Gaul and Milton Herman, well-known stage and radio players, will enact a gripping scene.

"The Monkey's Paw," the second notable play in this short series, will be presented on June 21 at the same hour and over the same network. It is a macabre tale of the supernatural by W. W. Jacobs, one of England's best known authors, and it has been acted repeatedly in almost every country on the globe. It concerns the dried paw of a monkey, endowed with magical powers, which causes the downfall of a family and the death of their son. The play moves swiftly to a breath-taking climax. It will be acted by a star cast, including Effie Shannon, George Gaul, Alfred Shirley, Eustace Wyatt and Lionel Adams.

Recognizing the interest of listeners in radio drama, the National Broadcasting Company plans frequent presentations during the summer of outstanding plays by well known authors. "A Game of Chess" and "The Monkey's Paw" are examples of the type of drama which will be offered over NBC networks.

and the effect of ice. On March 18th, a heavy coating of ice formed on the antenna. Signal strength dropped approximately 10 per cent. The reason for this was not ascertainable until one of the top guy wires burned off, due to an arc caused by radio frequency leaking across the ice from the copper tubing to the guy wire. It was noticed that even though the guy wire had dropped, an arc still held between the short section still attached to the pole and the copper tubing.

They Shake Out of It

By vigorously shaking one of the guy wires on the top section, the ice at this point was dislodged and the signal strength immediately returned to normal, although the remainder of the pole and copper tubing was still entirely covered with ice. Since then, additional insulators have been installed as close to the pole as possible, thus eliminating a considerable amount of coupling to the wires that are attached to the pole itself. Previously the first or top insulator was placed 24 inches from the pole. It is believed no more trouble from this source will be encountered.

The lead-in on KYW's former antenna was located in such a manner as to be inductively coupled to the 500-ohm transmission line termination in the tuning house. Upon erection of the new antenna, which was located 120 feet from the tuning house, it became necessary to install another transmission line from this tuning house to the new antenna. At the present time the new antenna is being fed by a single-wire feeder, connected at a point about 50 feet above the ground and inductively coupled to the transmission line termination in the tuning house.

The reflector portion of the new antenna system differs somewhat in construction from the exciter antenna for reasons of economy rather than necessity. It consists of one single wooden mast, extending 90 feet above ground and on top of which is attached a fabricated 60-foot duraluminum tower.

OWN SECRETARY ON AIR REVEALS ROOSEVELT AIM

Colonel Louis McHenry Howe, secretary to President Roosevelt, has started a series of weekly broadcasts. He will be interviewed by Walter Trumbull, nationally famous newspaper correspondent, each Sunday evening at 10 p.m., over WEA-F and a nationwide NBC network. These interviews, based upon the developments of the previous week in Congress, in the White House and in the departments of the government, will have Trumbull representing the citizenry of the country and Colonel Howe frankly discussing the problems.

Congress in giving the President and the heads of several of the departments extraordinary powers to be used at their own discretion, has focused new interest on Washington and its personalities.

Audience Is Solicited

The entire nation is vitally interested in the use that is being made of these powers, the reasons for their use, their accomplishments and the intimate behind-the-news studies of the men and women exercising them.

The radio audience is asked to use Trumbull as their spokesman and to write him questions as interest them, or concerning moves made in Washington, the purpose and probable result of which they do not clearly apprehend.

Since it will not be possible to answer every question, those received will be sorted and classified and the interview will be designed to cover subjects which appear to have the greatest general interest or importance. At present, the White House is receiving an average of 4,200 letters a day—more than ten times as many as were averaged during the previous administration. It is expected that these broadcasts will greatly clarify the situation about which the writers inquire.

Sponsored by Radio Firms

The huge network which is to carry the program to the people each Sunday evening, has been arranged jointly by the RCA Victor Company, Inc., and RCA Radiotron and Cunningham Radio Tube Companies.

These programs will mark the return to the air of these companies after an absence of two years, according to E. T. Cunningham, president of the above companies.

Col. Howe has been secretary to Roosevelt for 21 years.

New "Remote Control" Definition Promulgated

Radio Manufacturers Association, Inc., through its engineering division, has promulgated a new definition of "remote control" in radio manufacture, as follows:

"Remote control is that means and mechanism at a distance from the reproducer for effecting tuning and other operations necessary for normal use."

In this definition the word "reproducer" is substituted for the original word "receiver," to meet new conditions of manufacture and operation.

3 WATTS OUTPUT

An output power of 3 watts is sufficient for general home use, though reserve power is useful.

Station Sparks

By Alice Remsen

Prelude to Dreams

FOR RUDY VALLEE,
"FLEISCHMAN HOUR"
WEAF, THURSDAY,
8:00 P.M.

Into my pulse there comes a stronger
beat,
When e'er I hear your voice, so soft, so
sweet!
It brings back dreams of love's dear
sacred pain,
To one who never thought to dream again.

Gently it soothes the torment of a soul
Wearied at useless striving for a goal.
Voicing a prelude which may break the
seal,
Binding my heart as if with chains of
steel.

O gracious singer, thanks to you for this—
You bring me memory of two things—a
kiss—
A voice—a voice as yours—so sweet, so
low—
Returning from the mists of long ago.
—A. R.

* * *

One of the reasons for Rudy Vallee's continued popularity on the air is the fact that his voice has such sentimental value. To the young folk his voice spells romance; to the older folk—their dreams of what might have been. His gracious simplicity reaches all hearts. I never get tired of listening to him.

A RECORD?

Goldy and Dusty have done over 700 songs since the first of December on the Silver Dust programs; no repeats unless to reply to requests. Is this some sort of a record?

* * *

The Radio Rialto

LET'S START!

Just found out that Phil Ducey spells his name that way, instead of "Dewey"; sounds Hollandish; shall have to inquire, as several readers have asked for the ancestral background of this very likeable young baritone. . . . Will Osborne opened at the Post Lodge, Larchmont, N. Y., with his orchestra, last week. Will is very popular among the younger set of Westchester County. Columbia carries the program. . . . Sorry to announce the fact that Merle Johnston lost that brewery program on WOR, but his loss is another's gain; Art Coogan and his orchestra take over the program; with Art is a young lady, quite new to radio, whom they call "The Buffalo Bluebird." . . .

NINO MARTINI MARCHES AHEAD

It was arranged that Nino Martini, the brilliant young Italian tenor, who has opened the doors of opera to broadcasting talent, should be presented with the Columbia medal for distinguished contribution to the radio art, during a special broadcast over WABC and a coast-to-coast Columbia network, Tuesday, June 13th, from 9:30 to 10:00 p. m., EDST, the program to be transmitted direct from the Colonna Hall of the Italian liner, S.S. Conte di Savoia. A gala party was given in Martini's honor. Columbia is very proud of Martini and his advance to

operatic stardom, because his achievement is at the same time one for radio itself. When the handsome young tenor steps upon the stage of the Metropolitan Opera House to star in leading lyric roles, he will be the first operatic artist whose fame was built primarily by broadcasting. His meteoric rise from a promising, but little known singer, to the most coveted goal in his profession, is at the same time a tribute to his own abilities, and to the influence of radio broadcasting. Martini's name has become a familiar one in thousands of homes throughout the country in the brief space of less than six months, and his fan mail has included countless letters of appreciation from people in all walks of life. . . .

FEMME ACTS AND OTHERS

John Loesche, one of the most efficient production men in radio, is getting his name in the papers quite a lot these days; the same old story of the nutmeg grater. . . . A new harmony sister act made its debut recently on WOR; this new femme trio is dubbed "The Sirens." . . . Another trio of "wimmen," called Major, Sharp and Minor, take the Friday spot of the Three X Sisters while the latter combination is on tour. . . . Bert Lown is writing again; this time the song is called "Let's Settle Down." . . . Fred Waring's Band, sponsored by Old Gold, is now on a network of 80 stations; Peter Dixon thinks they deserve it; so do I. . . . The Boswell Sisters are ready to sail for Europe June 15th. . . . Bert Lown and his orchestra is now on the air every evening from the Park Central Hotel. Whenever you hear the strains of "Bye-Bye Blues" you'll know that's Bert; by the way, if you happen to be dining at the Park Central while Bert Lown is on the air and catch him making funny signs with his hands, don't get nervous; he is merely signaling to his boys; this is what he means: clenched fist—ease from one song to another without pause; first finger and thumb forming circle—violin for the next eight bars; three fingers up—heavy on the piano; four fingers up—change of key for vocal; elbow raised—soften brass; left thumb up—skip to last chorus; quivering hand—add piano chorus; fists shaken—play whole song through; finger tip on lips—play one chorus only. These antics of Bert's seem to fascinate the dancing couples who stop to watch in amazement. . . . Announcers are usually culled from the musical profession; for instance: Graham McNamee used to be a concert singer; Milton Cross was also a singer; Kelvin Keech was a ukulele player; Ford Bond was a pianist; Jimmy Wallington was a singer; Don Ball was another ukulele tickler; Andre Baruch was a pianist; Paul Douglas, a vaudeville artist; Harry Von Zell played ukulele; William Lundell, Alois Havrilla, Neel Ensen, Howard Petrie and Alwyn Bach were singers, while John Holbrook, Ben Grauer, Charles O'Connor and Pat Kelly had dramatic backgrounds.

WAY UP IN THE AIR

Did you hear the spectacular "bird's ear" program of the tour of Manhattan, broadcast last week by Amelia Earhart and Ted Husing, from a plane three thousand feet above the city? It was a great stunt, and its sponsors, the manufacturers of Silver Dust, deserve a great deal of credit for putting it over. Columbia engineers set something of a record on that program when they made forty-two in-

stantaneous "switch-overs" (new hook-ups) connecting the plane, the CBS key studios, and New York's bright spots, including the Empire State Building and the Newark airport, during the hour's broadcast. . . . Classic music lovers all over the country are responding to Leopold Stokowski's announcement of a country-wide request program to be broadcast this Fall. Though the leader of the Philadelphia orchestra is considered one of America's leading exponents of modern music, 90 per cent of the requests so far received are for the accepted classics. . . . Edwin C. Hill may put in a claim for the title of the "world's busiest radio performer." His present activities include four broadcasts a week, six newspaper dispatches a week, making a movie short, and he is also preparing to appear on the stage of the Metropolitan Theatre in Brooklyn. . . . Tom Neeley is a busy man these days; in addition to his duties in the program department at NBC, he has full charge of two broadcasts, the Morning Parade, Mondays 10:15 a. m., and The Week-End Revue, Saturdays, 4:00 p. m.; both are network programs; Tom does a great job on them. . . . Lillian Ashton, the English comedienne, may now be heard on Eddie O'Connor's program over WCDA, every Monday evening at 11:00 p. m. Lillian has a fund of funny English and Scotch stories and songs, should be a very good radio bet. . . . Have to start packing now, getting ready to leave again for Cincinnati, only a short stay this time, so cheerio until I return.

* * *

Biographical Brevities

ABOUT BERT LOWN

Bert Lown, the young and successful band leader, was born and educated in White Plains, New York. He began his musical career as a high school boy, when he played with the school orchestra as pianist; quite early in the game he realized that his great forte lay in salesmanship and managership, and so he took over the management of the school band, and made it pay. After leaving school he procured a position selling cash registers, and he still wears, with great pride, the gold watch which the concern gave him for being its best salesman for two consecutive years.

But the musical ring of the cash register did not appeal to him as much as the musical profession itself, and so he went back to his first love and organized several orchestras, managing them and occasionally waving the baton. During this time he supplied the Munson Line with its orchestras, which took him to South America, where he made many friends, and learned a great deal about South American music. Soon he acquired a regular office in New York, and a fine reputation in the music field—and then a young saxophone player came to the office and asked Bert for a job. Bert gave him one, and started that lad on the road to fame—for Bert realized the lad had something in him; his name was Rudy Vallee; just at that time, as luck would have it, Bert had a chance to put an orchestra in the Heigh-Ho Club, so Vallee went there for Bert, who got the club and its music on the air. Rudy and Bert formed a partnership and organized the Lown-Vallee Orchestras; then Rudy broke away from Bert, and the latter organized another orchestra and went on by himself. Bert stayed for two and a half years at the Biltmore, broadcasting over the Columbia chain six or eight times a week. In the meantime he acquired a recording contract with Victor, which is still in force. At the same time, by permission of the hotel management, Bert was able to leave the hotel on certain occasions, and play for proms and house

(Continued on next page)

PERSONALITIES

Station Sparks

(Continued from preceding page)

Ben Grauer, National Broadcasting Company announcer, is only five feet six, but he doesn't seem to mind whom he tackles when he's ready to go on the air. Even wrestlers or all-American halfbacks don't faze Mr. Grauer.

At the Park Central, a New York hotel, where Grauer was about to announce a dance program by Bert Lown's orchestra, Bert stepped up to Grauer and said:

"Say, Ben we've got Joe Savoldi and Red Cagle here tonight. How about putting them on the air?"

When Grauer had chatted with the athletes he said he'd be glad to introduce them to the public, if they would write their remarks out on paper. Joe didn't see why that was necessary.

"All right!" said Grauer firmly and a bit curtly. "If you won't write it out, you don't go on the air."

Thereupon he flung the writing pad upon the table, turned on his heel and stalked off.

Just as Grauer was ready to announce other celebrities he saw two brawny fellows pushing their way through the throng.

"Oh, oh!" said Ben to himself. "I'm in for it."

Then to his amazement he heard Savoldi say: "Here you are mister. If you don't mind we'd like to speak and we've got it written down. Do you think it will be all right?"

* * *

James R. Waters, veteran actor who plays the role of Jake in *The Goldbergs*, arrived at the studio for rehearsal recently and was told that he could have the evening off, as the script did not call for his appearance.

Waters put on his hat and coat, bade everyone good night and departed. Five minutes later he reappeared, removed hat and coat and took his customary studio seat.

"I can't think of anything else to do," he explained. "I'd rather watch the show."

* * *

Josef Bonime, musical director of *Death Valley Days*, is getting his first vacation in two years of broadcasting. Bonime is driving to Canada for a few days respite from Summer programs.

* * *

To Ralph Kirbery goes the honor of being the first artist to observe holidays, anniversaries and birthdays over National Broadcasting Company networks. As that Dream Singer, the baritone broadcasts a five-minute song recital each midnight and thus welcomes the advent of each new day. Then he goes home to bed.

* * *

"Rosita," a number written by Gustave Haenschen for Mary Pickford's screen success of that name, was played by Haenschen and his orchestra and sung by Frank Munn on the American Album of Familiar Music on Sunday night's program, the first time that Haenschen has offered the number over NBC networks.

* * *

Because Pic Malone and Pat Padgett—*Molasses 'n' January*—of the *Show Boat* cast were appearing at a theatre in Brooklyn the comedians appeared in black-face at the NBC mike.

* * *

While Walter Winchell, New York correspondent, was broadcasting a member of the orchestra that plays the theme song was absorbed in a newspaper. The musician was reading Walter Winchell's newspaper column, neglecting the chance to hear the keyhole reporter in person.

* * *

Jessica Dragonette, a veteran of six years radio experience and several years on the stage before that, suffered from

stage fright when she arose to read one of her own poems at a meeting of poets and poetry lovers at the Hotel Barbizon, New York City, during National Poetry Week.

* * *

Polly Moran, motion picture comedienne, was guest of Belle Baker at the New York studio. Miss Baker sang on the Fleischmann varieties program. Miss Moran sat "backstage" and watched the broadcast.

* * *

Al Goodman, the musical director of Will Rogers's program has struck upon a new method of rehearsing his orchestra.

To get the effect of what musicians will sound like on the air he directs them from behind the glass window of the control room. He then shouts his comments through the studio's public address system.

* * *

Doctor Watson is again having his troubles and it's his old ailment, tonsillitis.

Edith Meiser took Doctor Watson to the hospital this week and the doctors became so concerned over the good Doctor's breathing that they put him in the inhalator. What's more, they used a fluoroscope upon him!

But now he's doing nicely according to Miss Meiser, and she ought to know—because Dr. Watson is her pet Scottie.

Miss Meiser, the author of the *Sherlock Holmes* dramas over NBC, named her dog after one of the best-known characters of the Conan Doyle stories.

Ed East and Ralph Dumke, *Sisters of the Skillet*, can't resist the lure of any sound effects paraphernalia they find around the studios. Just a few days ago, while Ed was telling the radio audience, what a glorious day it was outside, Ralph wandered over into a corner where he began playing with the thunder and wind machines and stirred up a rip-roaring storm in the studio, much to Ed's embarrassment.

* * *

Don Thompson, an announcer in San Francisco, goes off and hides himself in a desert whenever he wants to rest. He left for his 1933 vacation June 1, when he set off with an old prospector friend for Death Valley, where he intends to do some exploration and gather some more material for the articles and radio talks he does on deserts.

* * *

Police Chief William J. Quinn of San Francisco, looks on radio work as recreation and classes his radio talks over NBC as his "favorite hobby" when questioned by interviewers.

* * *

Lanny Ross, the tenor, while at Yale was a champion runner but tells a story about a classmate even speedier. The graduate went to work on a Western sheep ranch. The first day he was directed to return the sheep to the fold. "I've got them all in sir," he reported to the owner, "but I had to hustle to get in those lambs." . . . "What lambs?" asked the ranchman, "I've got no lambs."

When the owner looked into the shed he was dumbfounded to see a pair of panting jack-rabbits!

* * *

Arthur Daly, NBC production man, was asked his opinion of a very pretty girl giving a singing audition in the New York headquarters. "She's a peach," answered Daly, "but no Melba."

* * *

Personal glimpses of radio stars: Donna Olga Albani, soprano, writes stories with a Spanish background. Phil Duey, baritone, golfs and takes pictures with his movie camera, mostly of his

parties at such colleges as Yale, Princeton, Dartmouth, Brown, Cornell and others. After he left the Biltmore Bert played a limited touring engagement at the Lowry in St. Paul, where he broadcast over WCCO; the Bellerive in Kansas City, broadcasting from KMBC; the Netherland-Plaza in Cincinnati, broadcasting over WLW, and the Aragan in Chicago, broadcasting over WGN.

In addition to being a jolly good business man and band leader, Bert is a writer of excellent songs; the delightfully philosophic song, "Bye-Bye Blues," which has served as his theme song for the past two years, is one of Bert's compositions. "Tired," "You're The One I Care For," "By My Side" and many others have been composed by this gifted young man. Last season Bert Lown and his orchestra were heard on WABC for the Premier Salad Dressing Company; he also had the *Tower Magazine* and the Sarnoff-Irving programs on WOR. He is now playing at the Coconut Grove of the Park Central Hotel and will be there until October 1st. He is broadcasting through WJZ, WEAJ and WOR ten times each week, and is still recording for Victor.

young son. . . . Madge Tucker, director of the *Children's Hour*, spends her vacations swimming, emerging from the water only to sleep and eat. . . . William Merrigan Daly, maestro, goes out of his way to be nice to animals and babies. . . . Dave Rubinoff's hobby is photography. Irma Glen, organist, loves canaries. . . . Jane Froman, blues singer, is a movie fan.

* * *

"How are things on your farm this summer?" Lowell Thomas, NBC news commentator, inquired of a Dutchess County (N. Y.) neighbor. "Toler'bal," replied the native. "I'm makin' a little on hot dogs but jest breakin' even on gas 'n' oil."

* * *

Although born in Greencastle, Ind., Harvey Hayes, veteran actor heard from the Chicago NBC studios, spent his childhood and youth in India, where he was raised by his sister, the wife of a missionary. He was 20 years old when he returned to the country of his nativity to take up his career on the stage, playing with Florence Reed, the late James K. Hackett and other stars.

* * *

Elvia Allman, disease and personality singer, was born in North Carolina, spent her girlhood in Texas, was educated in the University of Chicago, made her stage debut on Broadway, her radio debut in California, and sang her first coast-to-coast program from the NBC's New York studios.

* * *

A new script series dealing with the roving, adventurous lives of the hoboes is being heard over the WABC-Columbia network weekly at 9:00 p.m., EDST, Thursday. Entitled "Wayfaring Men," the script is the work of Archie Coates, staff continuity writer. Realism will be its keynote.

* * *

Edwin C. Hill, Columbia Broadcasting System news commentator, has returned to active journalism and is under contract to the Kings Features Syndicate to write six columns weekly on "The Human Side of the News." His Columbia series of the same title, heard at 10:30 p.m., EDST, Monday, Tuesday and Wednesday, will continue, although his activities will occasionally take him away from Manhattan. His broadcasts recently originated in Washington, where he was covering the Senate Banking Investigation. Hill was for 20 years star reporter of "The Sun" and "The Evening Sun" of New York City, before he devoted his time to radio.

RCA Executives Now in Radio City

The executive offices of the Radio Corporation of America have been moved from the R. C. A. building, at 570 Lexington Avenue, New York City, to the new R. C. A. structure at 30 Rockefeller Place in Rockefeller City. Among the high officials of the company who are now in the new quarters are Gen. James G. Harbord, chairman of the board, and David Sarnoff, president. Their offices are on the fifty-third floor. Three floors above them are the offices of John D. Rockefeller, Jr. and his son.

The R. C. A. has been for some years in the older building on Lexington Avenue, which has been taken over by the General Electric Company and is now named for G. E. Owen D. Young, chairman, and Gerard Swope, president, of G. E., have been occupying offices at 120 Broadway, which was the headquarters of the G. E. for many years. Formerly the R. C. A. had its offices in the Woolworth Building, from which it moved when the Lexington Avenue structure was erected before the plan of Rockefeller Centre was definitely worked out.

The present plan is to have the National Broadcasting Company move to the R. C. A. building from its present quarters at 711 Fifth Avenue. This change will probably take place early in the Fall.

Literature Wanted

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

- Hal A. Noe, Gazette and Mail, Morristown, Tenn.
- Hans Steinert, 385 Central Park West, New York City.
- Joseph Molinek, Stillson Road, Waterbury, Conn.
- Sam's Radio Shop (latest hookups of television), 44 Houghton Avenue, Trenton, N. J.
- Joseph F. Maddock, 52 Houghton Ave., Trenton, N. J.
- W. Hall Wagener, 1540 Hertel Avenue, Buffalo, N. Y.
- Theodore Vergon, 1804 W. Keefe Ave., Milwaukee, Wis.
- R. True, Cushing, Mass.
- M. I. Risley, 531 Walnut St., S. E., Minneapolis, Minn.
- F. W. Foust's Garage & Radio Shop, 103-105 West 46th St., Ashtabula, Ohio.
- W. Hall Wagener, Wagener Radio Service, 1540 Hertel Avenue, Buffalo, N. Y.
- Austin L. Thompson, 12 South Catherine St., Mobile, Ala.
- Willey Thonias, c/o Cuba Poultry Farm, Cuba, Missouri.
- Earl E. Brewer, c/o SHOP 2448-18th St., N. W., Washington, D. C.
- Albin Bernot, 4408 N. Sacramento Ave., Chicago, Ill.
- M. C. Shewcraft, 116 E. Huron St., Ann Arbor, Mich.
- J. Buryl King, 2306 North 8th St., Phoenix, Ariz.
- Walter I. Gillis, E. 2825 Mission, Spokane, Wash.
- Joseph C. Price, 108 Dyer St., Elizabeth City, N. C.
- Harvey Chapman, 11 Rugby Place, St. Louis, Mo.
- E. L. Horne, Batesburg, S. C.
- William Bibey, 1116 Meadow Lane, Chester, Penna.
- H. Robert Heinrich, 108 Fairbanks St., N. W., Grand Rapids, Mich.
- Ben Mackelprang, 854 So. 1st St., West, Salt Lake City, Utah.
- Arthur W. Johnson, 6 Watson Ave., Worcester, Mass.
- Edw. Richter, 94 W. 10th St., Ashland, Ohio.
- Geo. L. Heyer, Service Mgr., Arcade Radio Shop, 1310 First Ave., Seattle, Wash.
- Clifford Talbot, 219 Mellon Place, Elizabeth, N. J.
- Smith Radio Co., Box 525, Clovis, N. M.

CORPORATION REPORTS

Kolster-Brands, Ltd. (Controlled by Orange Securities Corporation, which, in turn, is controlled by Mackay Radio and Telegraph Company of America)—Net loss for the ten months ending Dec. 31, 1932, £12,234, after depreciation and other charges, contrasted with net profit of £86,469, equal to 7.42 per cent on £1,166,000 ordinary stock, for the year ending Feb. 29, 1932.

ASSIGNMENT

George Reubens, 4,245 White Plains Ave., Bronx, New York City, radios and radio supplies, assigned to Miriam Parks, 480 Lexington Ave., New York City.

TRADIOGRAMS

By J. Murray Barron

That there is considerable interest in short-wave reception is more fully emphasized by the sales of not only kits and completed units of this type, but also of short-wave converters. The smaller outfits are perhaps the beginning of large future sales of the more expensive short-wave sets.

Often it is good practice to begin in the small way and thus gain the experience, patience and skill that are so helpful in developing a good list of foreign stations.

The three types of outfits are separate and distinctive in their purpose and in no way conflict. To the experimenter there comes the real thrill of constructing a complete receiver and getting it to perform, so his real interest is in kits. Many others who may be deeply interested in radio, both broadcast and short-wave, perhaps would like to experiment, but either because of lack of knowledge or mechanical skill do not do so. The third type of prospect is the owner of a broadcast receiver and who is interested in short-wave reception but does not care to construct or purchase a short-wave set. For him a good converter will answer, which when attached to his present receiver makes it an all-wave receiver. With a properly-designed short-wave converter and a sensitive broadcast receiver it is possible to receive great distance and records show reception the world over.

* * *

Harry Lefkowitz, who more recently has been on the road selling the trade, is now back in New York City and is associated with the Bell Radio Co., 168 Greenwich Street.

* * *

An interesting figure in the downtown radio district of New York is Walter Kelly, who caters to the fan and experimenter in radio literature and publications. His stand might well be termed the "Gateway to Cortlandt Street." For a number of years Mr. Kelly travelled all over the country as a professional entertainer and made a host of friends, today he still possesses many of these friends and in addition has acquired many new ones. On account of his location at the northwest corner of Cortlandt and Greenwich Streets he comes in contact with thousands of people daily and acts as a guide and bureau of information to the many strangers. Always there is the right and ready answer.

* * *

The transformer division of the Universal Microphone Co., Inglewood, Cal., has gone into production of transmitting transformers for short-wave work. These have been created for the amateur experimenter from specifications of Don C. Wallace, winner of the Hoover cup in 1925 and writer of the "1933 Short Wave Manual."

* * *

Postal Radio Corp., 135 Liberty Street, New York City, announces its production is now ready to take care of immediate orders for its new all-electric automobile radio receiver, also the battery model. This outfit is sold complete, with quick action installation method. This is just a new number with Postal and they are still handling all former number in sets and B eliminator and also their kits.

* * *

The Fanning Radio Labs, 377 Eighty-seventh Street, Brooklyn, N. Y., announces some new literature and a special circular on short-wave kits and receivers. They also have an interesting offer for those interested in the 1933 "Short-Wave Manual" by Don C. Wallace.

* * *

From Chicago, William C. Grunow, president of the Grunow Corporation, announced a contract has been signed for the merger of that company with the United States Radio & Television Corpor-

Business Is Better, Westinghouse Reports

Business is definitely improving, according to officials of the Westinghouse Electric and Manufacturing Company who are on a tour of the Westinghouse plants.

After officials had completed their inspection of the Company's East Springfield (Mass.) Works, Chairman A. W. Robertson stated:

"Having visited all departments of the East Springfield plant, I feel encouraged to find them operating at an overall capacity of 65 per cent and those departments devote to the manufacture of refrigerators working at 100 per cent of capacity. Twenty five hundred employes are working full time. This condition is especially encouraging because a large part of the plant facilities are devoted to the making of household appliances and household appliance accessories. It indicates a definite stimulation in retail sales for this class of products."

Mr. Robertson was accompanied by President F. A. Merrick; N. G. Symonds, vice-president in charge of sales; and C. H. Champlain, general works manager.

April Excise Taxes

Internal Revenue Bureau collections during April of the Federal 5% excise tax on radio and phonograph records amounted to \$138,587.02 according to an official statement just released in Washington. The April collections on mechanical refrigerators were \$207,843.

Since initiation of the special 5% tax on radio and phonograph products last June, following is a summary of collections:

1932		1933	
June 20-July 31	\$32,848.57	January ..	\$283,425.27
August	76,445.47	February ..	173,987.28
September	165,710.65	March	149,859.66
October	218,722.70	April	138,587.02
November	298,577.85		
December	392,204.81		

ation. Grunow stated that the merger would be subject to the approval of stockholders, which he said undoubtedly would be forthcoming as soon as usual legal time requirements and other points were complied with.

* * *

Clifton V. Edwards, of New York, and John Briggs, Jr., Wilmington, Del., appointed receivers for the Jenkins Television Corporation. The two receivers appointed last January have resigned. The old ones are receivers for the De Forest Radio Company and said they were resigning as receivers for the Jenkins Company because the De Forest was eager to buy the assets of that organization and was willing to bid \$100,000.

* * *

Fanning Radio Labs, 377 Eighty-seventh street, Brooklyn, N. Y., find a considerable demand for the small ac-dc universal radio receivers which are fine for the out-of-town trip or as an extra set and come equipped with R. C. A. tubes. The four-tube and the five-tube sets receive police signals and some of the amateur and ship-to-ship conversations, besides broadcasts. They are quite powerful and selective and for a high-grade guaranteed product cannot be confused with the cheaper types. These receivers are licensed R. C. A. sets and have first-grade tubes and are most modest in price. There is a circular on these and other short-wave kits, as well as on automobile receivers.

* * *

Try-Mo Radio Co., Inc., 85 Cortlandt Street, N. Y. City, has brought out what promises to be a big favorite to the traveling public or to any who want a radio receiver that can be taken away to the mountains or seashore. It is a new portable ac-dc set that covers from 15-550 meters. Contained in an attractive case, it may be had in completely wired model or in kit form and furnished with diagrams quite understandable to anyone.

New Move is Made to End Radio Tax

"Equal taxation" of industry and abolishment of special discriminatory taxation were the principles urged by the RMA upon Congress in connection with new taxes for the Roosevelt Administration public works program.

On behalf of the radio industry and in concert with the automotive and other industries, the RMA presented a brief to the Ways and Means Committee of the House of Representatives favoring a small general manufacturers' sales tax rather than selective excise taxes now burdening the radio and other industries.

"The radio industry is willing to bear its just proportion of any tax which is generally distributed," Bond Geddes stated to the House Committee on the tax plan for raising revenue for the administration's public works plan. We favor a general sales tax or a small

general manufacturers' tax, from one to two per cent, as distinctly preferable to a selective and discriminatory excise tax," Mr. Geddes argued to the House Committee. If a general sales tax should be adopted by Congress, Mr. Geddes contended to the House Committee that the radio industry should be relieved of the present special and discriminatory 5 per cent. excise tax and radio products bear only the general industry tax, in like proportion to other industries.

"The radio industry has been taxed specially on the apparent assumption that radio is a luxury or semi-luxury. Radio is an important agency of public information, frequently used as such by the President and other government and state officials, for dissemination of information, culture, religion, education, and in manifold other public and private services, and is not a luxury or semi-luxury."

DIAMOND PARTS

Tuned Radio Frequency Sets FIVE-TUBE MODEL

A-C operated circuit, 50-60 cycles, 105-120 volts, using two 58 t-r-f stages, 57 power detector and 47 output, with '80 rectifier. Three gang shielded condenser and shielded coils in a sensitive, selective and pure-tone circuit. Dynamic speaker field coil used as B supply choke. Complete kit of parts, including 8" Rola speaker and all else (except tubes and cabinet). Cat. D5CK @.....\$15.09
Wired model, Cat. D5CW (less cabinet) @.... 17.19

Kit of five Eveready-Raytheon tubes for this circuit. Cat. D5T 4.97

FOUNDATION UNIT, consisting of drilled metal subpanel, 13 3/4 x 8 3/4 x 2 1/4"; three-gang Scovill 0.00035 mfd., brass plates, trimmers, full shield; shields for the 58 and 57 tubes; six sockets (one for speaker plug); two 8 mfd. electrolytic condensers; set of three coils. Cat. D5FU..... 6.19
Super Diamond parts in stock.

FOUR-TUBE MODEL

The four-tube model is similar, except that there is one stage of t-r-f, and a two-gang condenser is used. Tubes required, one 58, one 57, one 47 and one '80. Complete kit, including 8" Rola dynamic speaker (less tubes, less cabinet). Cat. D4CK\$13.58

Kit of four Eveready-Raytheon tubes for this circuit. Cat. 4D.TK\$3.39

FOUNDATION UNIT, consisting of drilled metal plated subpanel 13 3/4 x 2 1/2 x 7"; two-gang 0.00035 mfd. SFL condenser; full shield; two shields for 58-57; center-tapped 200-turn honeycomb coil; five sockets (one for speaker plug); two 8 mfd. electrolytics; set of two shielded coils; 20-100 mmfd Hammarlund equalizer for antenna series condenser. Cat. D4FU\$5.48

INDIVIDUAL PARTS



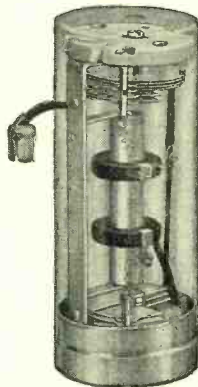
Travelling light vernier dial, full-vision 6-to-1 vernier, projected indication prevents parallax; takes 1/4" or 3/4" shaft; dial bracket, lamp, escutch con.
0-100 for 5-tube Diamond, Cat. CRD-0. @ \$8.91.
100-0 for 4-tube Diamond, Cat. CRD-100. @ \$8.91.
[If dial is desired for other circuits state whether condense

closes to the left or to the right.]
8 mfd. Polymer electrolytic insulating washers extra lug. Cat. POLY-8 @.....\$ 4.9
Rola 8" dynamic for 47 with 1800 ohm field coil tapped @ 300 ohms. Cat. FP @..... 3.83
2 coils for 4-tube. Cat. DP @..... .90
3 coils for 5-tube. Cat. DT @..... 1.35

DIRECT RADIO CO.
143 WEST 45th STREET
NEW YORK, N. Y.

Mr. SERVICEMAN
Take a tip! Get Rider's Volume II of the Perpetual Trouble Shooter's Manual. Buy it today. Don't wait until you cannot repair a receiver because you do not have the data. **FREE.** If you are a Service Man, write for the color code chart of the resistors used in Atwater Kent receivers. Enclose 3c to cover postage.
RADIO TREATISE CO., Inc.
1440 Broadway New York City

NEW \$2.65 INTERMEDIATES



465 kc. model is used in 12-Tube Push-Pull Diamond

Highest grade intermediate transformers, 465 kc or 175 kc, with or without secondary center tap, just released by Hammarlund, use air-core condensers for tuning.

The transformer is of the tuned primary-tuned secondary type, with both plate and grid coils being tuned by air-dielectric variable condensers of special design. These condensers are mounted on an Isolantite panel 1 1/2-1 3/4 inches in diameter. The rotor is carried in a single bearing in the Isolantite panel and consists of two circular and three semi-circular brass plates of 3/4 inch radius riveted to the rotor shaft. The stator, also of brass, consists of two circular and two semi-circular plates soldered to stator support rods which in turn are soldered in the bushings in the Isolantite panel. Contact is made to the rotor plates by phosphor bronze spring under considerable tension. No locking device is necessary, as the tension of the contact spring is sufficient to maintain the setting of the rotor even where extreme vibration is present. A screwdriver slot is provided in the end of the rotor shaft to facilitate tuning.

The use of these air variables practically eliminates the variations in gain and selectivity inherent in intermediate transformers in which the coils are tuned by means of adjustable condensers of the compression type using mica as dielectric. The transformers are pre-tuned to the desired frequency. List price, \$4.50; net, \$2.65 each.

Guaranty Radio Goods Co.
143 West 45th Street

Quick-Action Classified Advertisements

7c a Word—\$1.00 Minimum
Cash With Order

GERMAN, WITH BEST REFERENCES, intends migrating to Spain; wishes to represent well-known American export radio concern. Kurt Prager, Roschstr, 15, Charlottenburg, Berlin, Germany.

SALE OR TRADE: Early tubes suitable for radio museum or exhibit; also early National parts and miscellaneous. Box 965. Plainfield, N. J.

AUTOMOBILE BLUEPRINTS, using latest type tubes. All practical working circuits. Five blueprints, 25c, or 12, 50c (coin) Super Engineering, 1313 40th St., Brooklyn, N. Y.

URUGUAY STAMPS—100 different stamps, \$1.00. 200 different stamps, \$3.50. Stamps will be shipped direct from Uruguay. Heriberto Meyer, care Radio World, 145 West 45th St., New York City.

BARGAINS in first-class, highest grade merchandise. Phono-link pick-up with vol. control and adapter, \$3.32; .00025 mfd. Dubilier grid condenser with clips, 18c. P. Cohen, Room 1214, at 143 West 45th Street, New York City. N. Y. C.

"A B C OF TELEVISION" by Yates—A comprehensive book on the subject that is attracting attention of radioists and scientists all over the world. \$3.00, postpaid. Radio World, 145 West 45th St., N. Y. City.

RADIO WORLD AND POPULAR MECHANICS MAGAZINE—Radio World is \$6.00 a year, and Popular Mechanics Magazine is \$2.50 a year. Popular Mechanics Magazine does not cut rates, but Radio World will send both publications to you for one year for \$7.00. Radio World, 145 West 45th St., New York City.

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

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

THE FORD MODEL—"A" Car and Model "AA" Truck—Construction, Operation and Repair—Revised New Edition. Ford Car authority. Victor W. Page. 708 pages, 318 illustrations. Price \$2.50. Radio World, 145 W. 45th St., New York

TROUBLE SHOOTER'S MANUAL, Nos. I and II

Having assembled 2,000 diagrams of commercial receivers, power amplifiers, converters, etc., in 1,200 pages of Volume No. 1 of his Perpetual Trouble Shooter's Manual, John F. Rider, noted radio engineer, has prepared Volume No. 2 on an even more detailed scale, covering all the latest receivers. Volume No. 2 does not duplicate diagrams in Volume No. 1, but contains only new, additional diagrams, and a new all-inclusive information on the circuits covered. Volume No. 2—Perpetual Trouble Shooter's Manual, by John F. Rider, Shipping weight 6 lbs. Order Cat. RM-VT @.....\$5.00
Volume No. 1 (8 lbs.). Order Cat. RM-VO @.....\$5.00
We pay postage in United States on receipt of purchase price with order. Canadian, Mexican and other foreign remittances must be in funds payable in New York.

RADIO WORLD
145 West 45th Street New York City

Special Summer Trial Subscription Offer

FOR

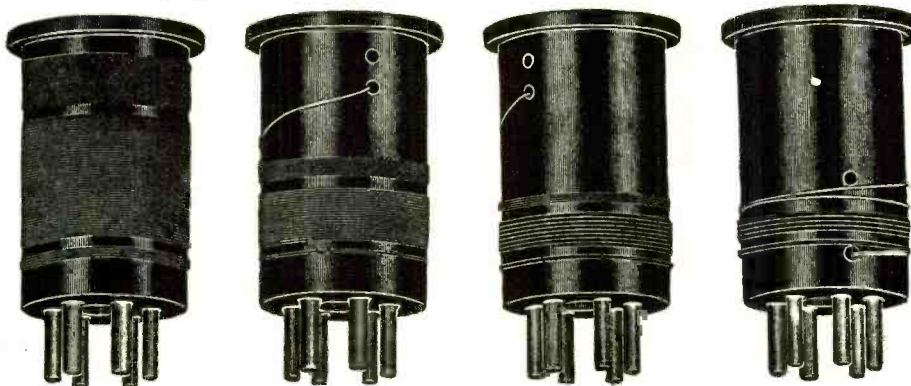
NEW SUBSCRIBERS

Send \$1.00 in cash, check, P. O. money order or stamps, and receive Radio World postpaid from now until Sept. 2.

Sub. Dept., Radio World, 145 West 45th St., N. Y. City

SHORT WAVES

14
to
200
Meters



Use
0.00014
Mfd.
Capacity

SIX-PRONG PLUG-IN COILS FOR DETECTOR STAGE

P LUG-IN COILS with six-prong bases that fit into six-pin tube sockets (used as coil receptacles) provide three separate windings: primary, secondary and tickler. The three-circuit coil is most efficient in detector sockets.

Either of the two following uses applies:

- (1)—As detector input from a tuned radio frequency stage, with primary in the plate circuit of a screen grid tube;
- (2)—As detector alone, where there is no r-f amplification ahead of the detector, primary in the antenna-ground circuit.

See coil connections illustrated below.

The form diameter is 1.25 inch, with gripping flange.

T H E S E coils have proved their effectiveness in many circuits and lend themselves to all types of circuits save those with moving-coil ticklers.

The coils are designed for use with 0.00014 mfd. tuning capacity to tune from 200 meters to below 14 meters. The higher frequency coils have secondaries wound with very thick wire.

The bakelite coil forms are seasoned so that the inductance will not be affected by moisture-content of the forms.

The base pins are strong and durable and the coils will last for several years.

Four coils sent free with 6 months subscription (26 weeks) @ \$3.00. Order Cat. PRE-SWBP.

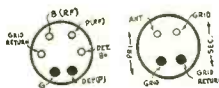
FOUR-PRONG PLUG-IN COILS FOR ANTENNA STAGE

When a short-wave tuned radio frequency set is built with a stage of t-r-f, the antenna coil should be of the four-pin, two-winding type. Centers of cores should be 6 inches apart or more to prevent back-coupling. No shielding should be used in either case. Coupling between coils makes a circuit tricky to tune. Shields reduce sensitivity too much in t-r-f short-wave circuits.

The four-pin coils are wound with secondaries for 0.00014 mfd. and these match the secondaries of the six-pin coils.

The diagram at left shows connections to make to the sockets of both the UX (four-pin) and six-pin coils. The bottom views of socket connections are shown. The primary of the UX coil connects to Ant. and ground (Grnd.). Follow these connections carefully. If oscillation fails when desired, reverse connections of the secondary (transpose grid and grid return.)

Four UX wound coils sent free with 6 mos. subscription @ \$3. Order Cat. PRE-SWAP.



COIL FORMS



Those who desire to wind their own plug-in coils may use the same forms that prevail in the factory-wound coils detailed above. These coil forms are obtainable in three types. A set of coils of any type consists of four forms.

Any set of four coil forms (not wound) will be sent free for an eight-weeks trial subscription at the regular price, \$1.00.

- UX forms (four) order Cat. PRE-CFUX.
- UY forms (four) order Cat. PRE-CFUY.
- Six-pin (four) order Cat. PRE-CFSX.

TUNING METER

Some short-wave enthusiasts like to tune in stations by the meter method. Thereby they can watch the meter needle for greatest deflection to ascertain resonance. A sensitive milliammeter serves the purpose. One of 5 ma full-scale deflection may be connected in series with the plate feed to an r-f, or intermediate tube, or in the common screen lead of several tuner tubes, or in any other circuit where the steady value of current does not exceed 2 or 3 milliamperes. In all tuner amplifier stages the needle will show higher readings at higher signal levels (modulation is upward) and therefore if only a few milliamperes flow in such circuits the meter may be used. The meter may be used for any d-c current measurement in its range.

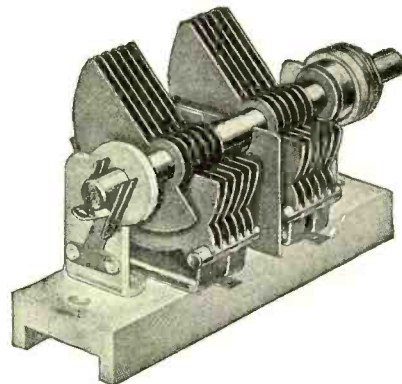
The 0.5 milliammeter is of the panel-mount type and is sent free with a six-months subscription (26 weeks) at the regular price of \$3. Order Cat. PRE-TUM.

MICROPHONE



A general utility microphone for home use, that enables you to use the audio amplifier in your receiver and "broadcast" in your home. This microphone is of the high-resistance single-button type, and is useful not only for serious work but also for playing pranks. No battery required. With the microphone are supplied socket templates and directions for connections to detector tubes of various types of receivers. Good results are enjoyably obtained. The microphone will be sent free on receipt of \$2.00 for sixteen-weeks subscription (16 issues), the regular price. Order Cat. PRE-MK.

CONDENSERS



The Hammarlund junior midline short-wave condensers, 0.00014 mfd., work exceedingly well with the coils offered above, but also may be used to advantage in any short-wave set, with any other coils intended for that capacity. These condensers have Isolantite bases, thus enhancing the low-loss construction that prevails throughout.

The condensers illustrated are the single 0.00014 mfd. and the dual 0.00014 mfd. The shafts are 1/4 inch. A vernier dial should be used. See vernier dial offers, for a-c and battery sets, on another page.

Single condenser sent free with four months subscription (17 weeks) at regular price of \$2.00. Order Cat. PRE-E14. PRE-S-14.

Double condenser sent free with eight months subscription (34 weeks) at regular price of \$4.00. Order Cat. PRE-DU-14.

Manual trimmer (40 mmfd.), free with trial subscription, 8 weeks. \$1.00. Order Cat. PRE-MNT.

RADIO WORLD, 145 West 45th Street, New York, N. Y.
(WE PAY POSTAGE ON ALL PRODUCTS LISTED ON THIS PAGE)

PADDING CONDENSERS



Either capacity, 50c

A HIGH-CLASS padding condenser is required for a superheterodyne's oscillator, one that will hold its capacity setting and will not introduce losses in the circuit, for losses create frequency instability. The Hammarlund padding condensers are of single-condenser construction on Isolantite base, with set-screw easily accessible, and non-stripping thread. For 175 kc. intermediate frequency use the 850-1350 mmfd. model. For i.-f. from 460 to 365 kc., use the 350-450 mmfd.

0.0005 HAMMARLUND S. F. L. at 98c.

A sturdy, precision straight frequency line condenser, no end stops. The removable shaft protrudes front and rear and permits ganging with coupling device, also use of clockwise or anti-clockwise dials, or two either side of drum dial. Front panel and chassis-top mounting facilities. True straight line. This rugged condenser has Hammarlund's high quality workmanship and is suitable for precision work. It is a most excellent condenser for calibrated radio frequency test oscillators, any frequency region, 100 to 60,000 kc., short-wave converters and adapters and TRF or Superheterodyne broadcast receivers. Lowest loss construction, rigidity; Hammarlund's perfection throughout.

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STRAIGHT-LINE CHART

Relating Inductance, Capacity and Frequency. Gives The Unknown When Two of the Others Are Known

Edward M. Shiepe, M.A., M.E.E., Massachusetts Institute of Technology, devised the first method of relating inductance, capacity and frequency so that the "curves" are straight lines. He drew the result on graph paper 18 x 20 inches, encompassing the hitherto unachieved ranges of 0.000001 mfd. (1 mmfd.) to 0.1 mfd., 1 microhenry to 100 millihenries, and 5 to 50,000 kc, hence covering from audio frequencies to ultra frequencies. This important document is now published for the first time, and we are the first to offer it. It is full-scale (no reduction from original), and will obviate any computation, as the chart may be read quickly to an accuracy of 1 per cent.

Send \$1.50 for a 13-weeks subscription for RADIO WORLD (13 issues) and order this chart (Cat. PRE-SLCH) sent free.

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

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Precision short-wave plug-in coils, wound on 1 1/4" diameter. Form has gripping flange. Four coils to a set for each tuned circuit. Approximate frequencies with 0.00014 mfd. are 1490-3080 kc, 3000-6600 kc, 6000-13200, 13800-30000 kc.

Two-winding coils, UX base. Cat. SWA (four coils)..... \$1.20
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SCREEN GRID COIL CO., 145 W. 45th Street, New York City

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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.

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A dual-range receiver, 1550—535 kc, 1525—4200 kc, using a perfected superheterodyne circuit, frequency-stabilized oscillator and electron coupling between modulator and oscillator. Ten tuned circuits, four variable. Two stages of t-r-f, tuned modulator, tuned oscillator, with switch for wave-changing. Output 15 watts from 2A3's in push-pull. Full-wave second detector, with 56 driver of output. 52 mfd. of B filter capacity. Automatic volume control of two i-f tubes. Automatic inter-channel noise suppression. Selectivity enough to blot out strong locals 10 kc removed from distant station. No squeals whatever.

Tubes used: Five 58's; two 55's; one 56; two 2A3's; one 5Z3.

Wired Model of 12-Tube Push-Pull 8-Tube Model, 2A5 output, complete kit, speaker, tubes, \$24; wired, \$29.50.

Super Diamond, including speaker, tubes and everything else, except cabinet. Lined up and padded by experts. Licensed \$41.27

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115 DIAGRAMS FREE

115 Circuit Diagrams of Commercial Receivers and Power Supplies supplementing the diagrams in John F. Elder'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 8 1/4 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.

Circuit include Bosch 54 D. C. screen grid; Balkite Model F Crosier 20, 21, 22 screen grid; Eveready series 50 screen grid; Eria 224 A.C. screen grid; Fearless 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., New York, N. Y.

NEW MODEL SHIELDED TEST OSCILLATOR!

An improved modulated test oscillator, fundamental frequencies, 50 to 150 kc, enabling lining up of intermediate frequency amplifiers, t-r-f and oscillator circuits, is now ready. It is shielded in a metal box 9 1/2" wide x 6 1/2" deep x 4 1/2" high, with beautiful Japanese finish. The test oscillator is obtainable in two models, one for a-c operation, the other for battery operation. The same cabinet is used for both.

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

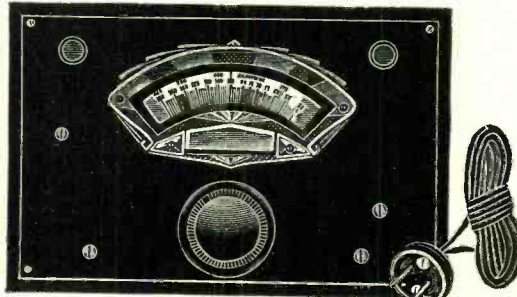
The modulation in the a-c model is the a-c line frequency, 60 cycles, effected by using the line voltage on the plate of the tube. In the cabinet there is a very high resistance between the shield cabinet and the a-c, a double preventive of line-shorting and application of a-c line voltage to the user.

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

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

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

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



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

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THE a-c model is completely self-operated and requires a 56 tube. The battery model requires external 22.5-volt small B battery and 1.5-volt dry cell, besides a 230 tube. The use of 1.5 volts instead of 2 volts on the filament increases the plate impedance and the operating stability. The battery model is modulated by a high-pitched note. Zero beats are not obtainable with the battery model.

Directions for Use

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

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

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

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