AMERICAN
A.C.—D.C.
MIDGETS

These two circuits are given as typical of American T.R.F. midget A.C.-D.C. receivers. Circuit A uses four .3-amp. valves, and circuit B uses four .15-amp. valves.

CIRCUIT A.

A SIMPLE transformer couples the aerial to a 6K7GT variable-mu pentode working as a radio-frequency amplifier. A similar tuned-grid transformer leads to a 6J7GT employed as an anode bend detector. Resistance-capacity coupling leads to a 25L6GT output tetrode.

Some models covered only 175-555 metres, others included the long-wave circuits shown in dot lines.

Volume is controlled by R1, which varies the bias on the 6K7GT, and also the amount of resistance across the aerial coil.

The rectifier is a 25Z6GT in the usual half-wave circuit. The H.T. to the rectifier is smoothed and decoupled by C8a 30 mfd. electrolytic. Other H.T. points are fed by R7 and decoupled by C7.

The original set was designed for 105-125-volt supplies. The heaters are series connected, the voltage being broken down by a 150-ohm resistance, plus a further 40-ohm section in parallel with a Mazda 44 (6-8 v. .25 amp.) pilot lamp. These resistances may be in the form of a line cord, a dropper resistance or a ballast (barretter) tube.

The American R.M.A. "standard" mains voltage is 117.5. On this voltage a set of this type should have a standard voltage dropper of 180 ohms (117.5–62.6 ÷ .3), excluding any pilot lamp arrangements. The latter are not critical and can usually be ignored, the lamp being shunted by a resistance of 40 ohms, or thereabouts.

The extra line cord (R10), for running the set on British supplies, may be either

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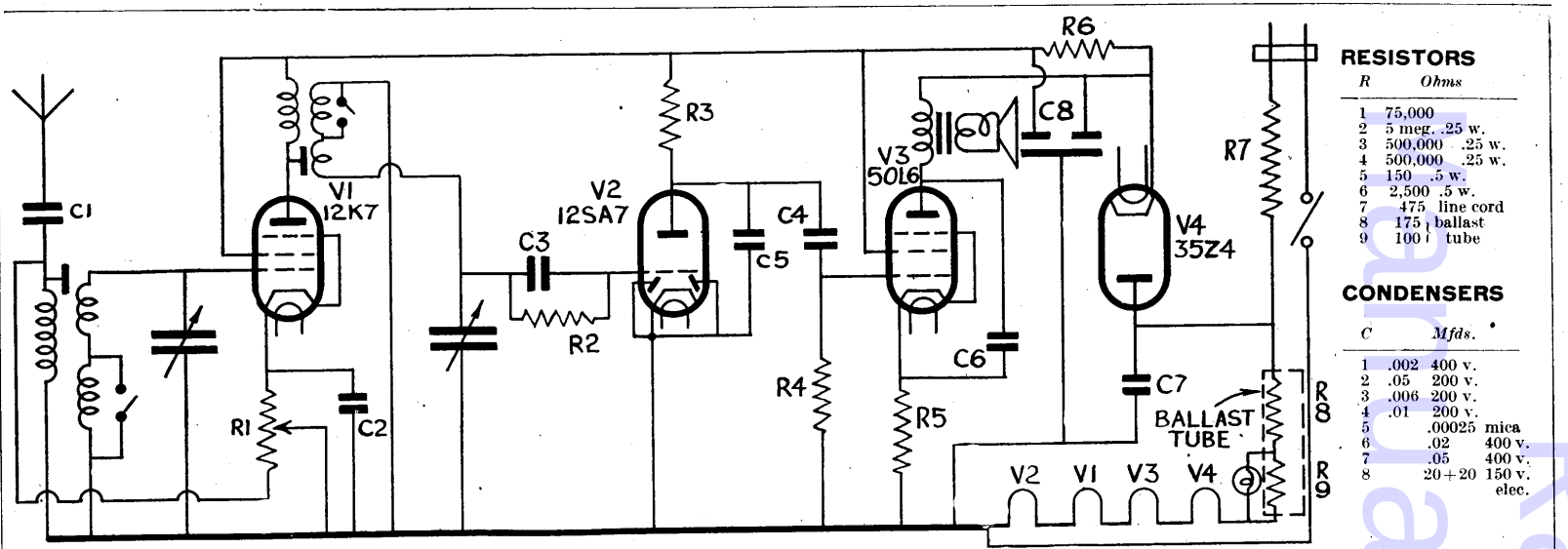


CIRCUIT A (below).—This is a typical three-valve, plus rectifier, "straight" midget using .3 amp. valves and with an extension line cord to suit British mains voltages.

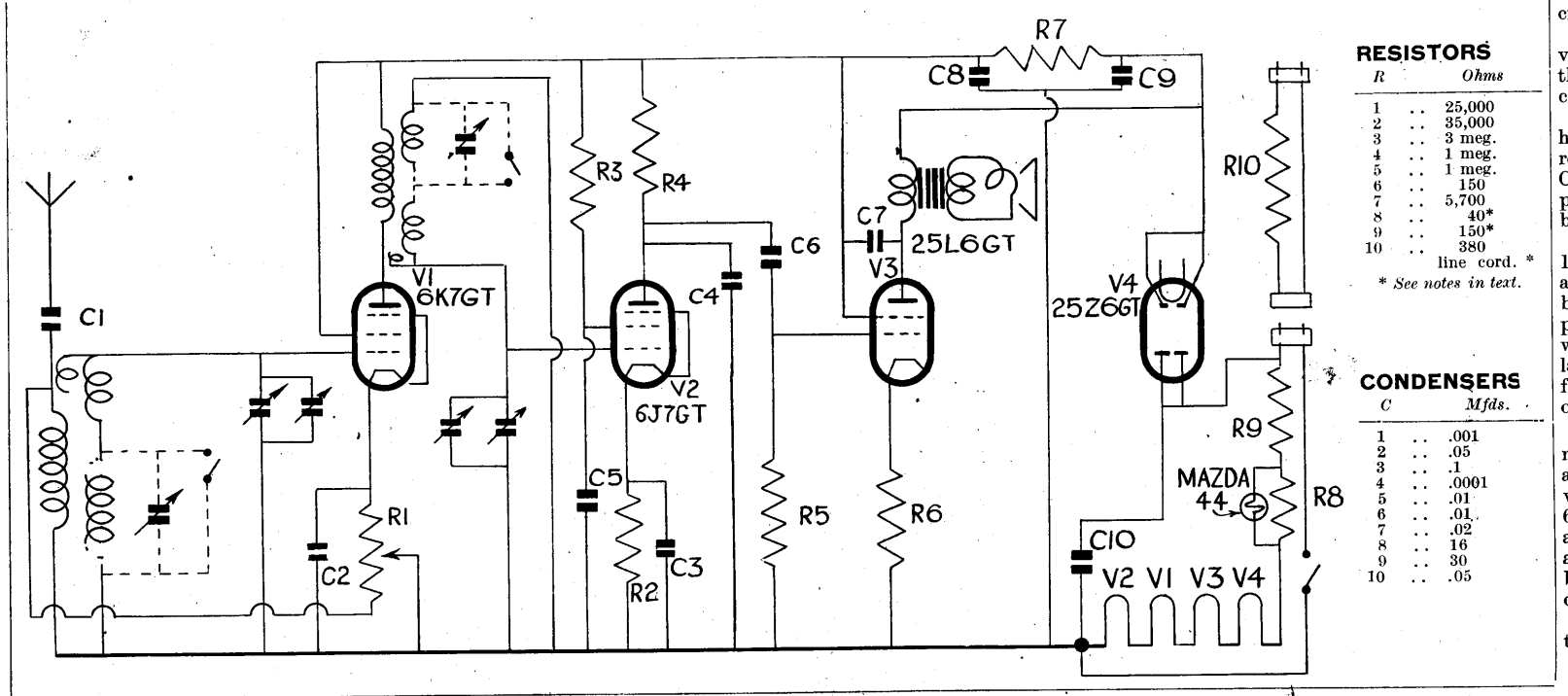
CIRCUIT B (above).—A representative three-valve, plus rectifier, "straight" midget using .15 amp. valves. This uses a ballast tube as well as line cords.

RESISTORS

R	*Ohms*
1	75,000
2	5 meg. .25 w.
3	500,000 .25 w.
4	500,000 .25 w.
5	150 .5 w.
6	2,500 .5 w.
7	475 line cord
8	175 ballast
9	100) tube

CONDENSERS

C	*Mfds.*
1	.002 400 v.
2	.05 200 v.
3	.006 200 v.
4	.01 200 v.
5	.00025 mica
6	.02 400 v.
7	.05 400 v.
8	20+20 150 v. elec.



RESISTORS

R	*Ohms*
1 ..	25,000
2 ..	35,000
3 ..	3 meg.
4 ..	1 meg.
5 ..	1 meg.
6 ..	150
7 ..	5,700
8 ..	40*
9 ..	150*
10 ..	380 line cord. *

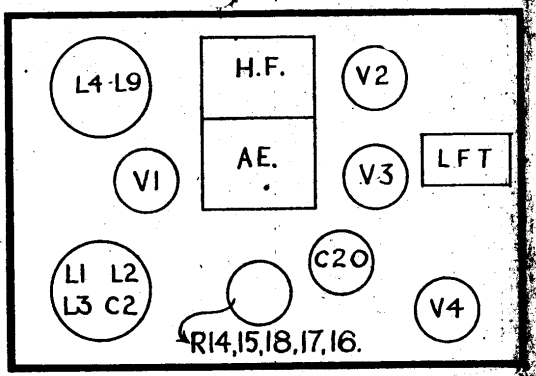
** See notes in text.*

CONDENSERS

C	*Mfds.*
1 ..	.001
2 ..	.05
3 ..	.1
4 ..	.0001
5 ..	.01
6 ..	.01
7 ..	.02
8 ..	16
9 ..	30
10 ..	.05

COSSOR 50

Three-valve, plus rectifier, two-waveband tuned radio-frequency receiver for use on 200-250-v. A.C. or D.C. supplies. Made by A. C. Cossor, Ltd., Highbury Grove, London, N.5.



Left, the top-of-chassis layout diagram for the Cossor model 50. The set is an A.C.-D.C. "straight" model, and the chassis is arranged on logical and accessible lines.

Circuit.—A simple transformer couples the aerial to V1, a pentode radio-frequency amplifier. This valve has a tuned anode circuit with coupled windings in the grid circuit of V2, another pentode, used as a reactive grid-leak detector.

A parallel-fed auto-transformer couples up V3, an output triode. H.T. is obtained from the usual half-wave A.C.-D.C. circuit and all the heaters are series run.

Volume is controlled by the bias on V1 and by reaction. R6 and R8 are reaction stabilisers.

R14 is a bleeder to drain off excess output of the rectifier, and R15 protects the pilot lamps from surges. R14 may be on the mains resistance or may be a separate unit underneath.

Connections are provided for a high-impedance (2,000 ohm) extension speaker. The consumption on A.C. is 55 watts approximately. The valve readings are taken on 200 v. A.C. at maximum volume setting.

GANGING.

T1 is carefully set at the factory for correct calibration and should not be readjusted if avoidable.

If realignment is necessary, first check

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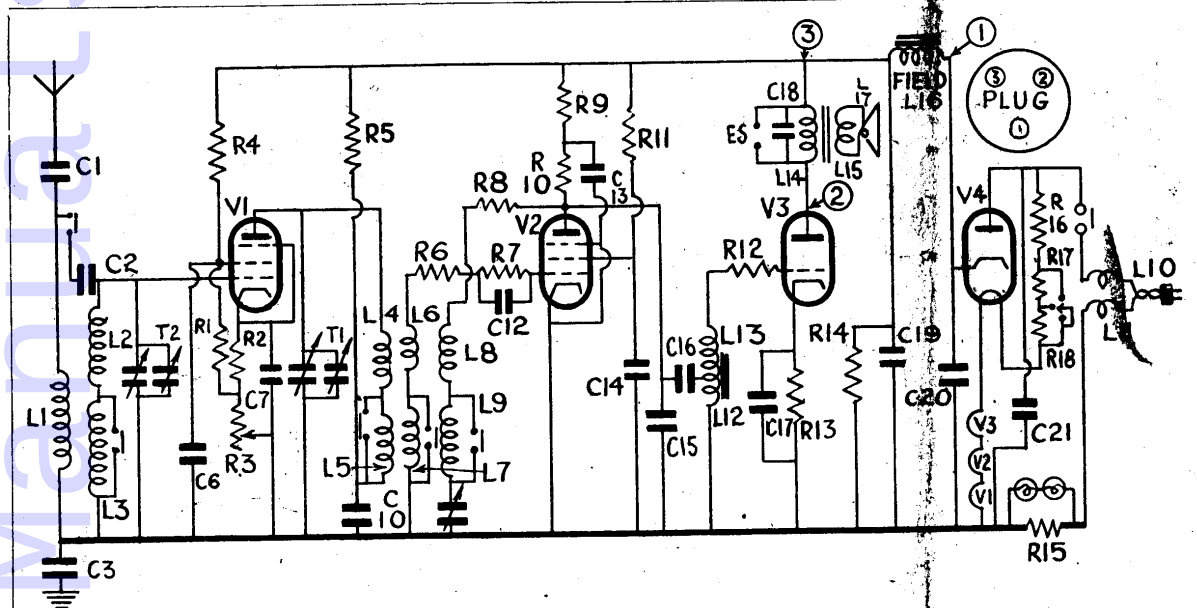

A pentode is used as a grid-leak detector with manually controlled reaction. An auto-connected L.F. transformer feeds an output triode. The mains section comprises the usual A.C.-D.C. half-wave rectifier.

American Midgets—*Continued*

an average value or a value chosen to suit the particular voltage in use. The resistance is ascertained as follows:—

$$\frac{\text{Mains voltage—set voltage}}{\text{Valve current.}}$$

For example, on 230-volt mains, the extra line cord should be:—

$$\frac{230-117.5}{.3} = 380 \text{ ohms, approx.}$$

Cords for 200 and 250 volts are usually rated at 280 and 450 ohms respectively.

For details of a five-valve .3 amp. set using a ballast tube plus line cord, see Belmont 650 in October SERVICE ENGINEER.

GANGING

With a T.R.F. set of this type, the trimmers should be set for accurate calibration at about 250 metres. A compromise adjustment for best average results over the whole band may be necessary.

CIRCUIT B.

AS in the previous circuit, the aerial is coupled by a simple transformer to the first valve, in this case a 12K7 variable-mu R.F. amplifier. Volume is controlled by R1 which regulates the bias and the aerial shunt load.

Tuned grid coupling follows to a 12SA7 used as a leaky-grid detector (the diodes are not employed). The grid leak is of high value—5 megohms. Resistance-capacity coupling leads to a 50L6 output tetrode.

H.T. from a half-wave 35Z4 is fed to the output valve with a 20-mfd. section of C8 for smoothing and decoupling. H.T. for the rest of the set is reduced by R6 and decoupled by 20 mfd.

The valves are .15-amp. types, the voltages being 12.6, 12.6, 50 and 35 in the order given above. Although the circuit of this set was marked 235 v., the 275-ohm ballast tube and 475-ohm line cord are actually suitable for an "average" mains input of 225v. approximately.

Suitable line cords for accurate adjustment to other voltages would be: 200 v. 325 ohms, 230 v. 525 ohms, and 250 v. 650 ohms.

This particular model has no ganging adjustments; but where these are provided it is advisable to arrive at a compromise setting giving best average calibration and sensitivity.

Continued from previous column

that pointer is vertical with condenser fully anti-clockwise.

Inject 240 m. (1,250 kc.) to aerial and earth, set pointer to this wavelength and adjust T1 and T2 for maximum.

There are no separate adjustments for long waves.

VALVE READINGS

V	Type	Electrode	Volts	Ma.
1	13VPA	Anode	128	2
		Screen	48	.5
		Cathode	2	
2	13SPA	Anode	30	.8
		Screen	22	.2
		Cathode		
3	402P	Anode	157	19
		Cathode	12	
4	SUA	Cathode	197	82

Dial lamps, 8 v., 1.6 w., M.E.S.

RESISTANCES

R	Ohms	R	Ohms
1	25,000	4	50,000
2	750	5	10,000
3	12,000	6	200

RESISTANCES—*Continued*

R	Ohms	R	Ohms
7	1 meg.	13	600
8	300	14	3,000
9	50,000	15	70
10	.1 meg.	16	440
11	.5 meg.	17	90
12	.25 meg.	18	90

CONDENSERS

C	Mfds.	C	Mfds.
1	.0005	13	.25
2	15 mmfds.	14	.1
3	.1	15	.0001
6	.1	16	.1
7	.1	17	50
10	.1	18	.005
11	.0005	19	8
12	.0001	20	8
		21	.1

WINDINGS

L	Ohms	L	Ohms
1	9.5	10	7.5
2	1.5	11	7.5
3	13.5	12	1,600
4	1.5	13	2,250
5	12.5	14	175
6	1.2	15	.19
7	13.3	16	400
8	.6	17	2
9	3.4		

TYPICAL MIDGET with ·15 amp valves

RCA 45X11, 45X12, 45X13

Four valve, plus rectifier, single waveband superhet (540-1600 kc), with self-contained frame aerial. Designed for operation from AC or DC mains, 105-125 volt (50-60 cycles in the case of AC), but may be fitted with line cord for operation from 200-250 volt mains.

The 45X11 has a mahogany coloured bakelite cabinet; 45X12 has an antique ivory bakelite cabinet, and 45X13 has a walnut wood cabinet. Made by the RCA Manufacturing Co., Inc., Camden, NJ, USA.

THE frame aerial winding is also the tuning coil for the signal circuit of V1, the pentagrid converter valve. Aerial and earth terminals are provided and these are connected to a coupling winding with an isolating condenser, C1, in the earth lead.

The frame aerial winding is tuned by VC1 section of the gang condenser while VC2 section tunes the grid coil, L2, of the oscillator section of V1. R1 and C2 are the grid leak and condenser. The reaction coil, L1, is in the cathode circuit.

An IF transformer, L3, L4, transfers the IF signal to the grid of the amplifier valve, V2. Standing bias for this valve is derived from R2, while the grid circuit of both V1 and V2 are returned to the AVC line.

A second IF transformer, L5, L6, couples V2 to the strapped diodes of V3, a double diode triode. The IF filter in the LF and AVC circuit comprises R3 and C3 while the load is the volume control R5. AVC is fed to V1 and V2 *via* the decoupling components, R4, C4.

The LF signal is fed *via* C6 to the grid of the triode section of V3, R6 being the grid leak. Resistance-capacity coupling is employed between V3 and V4, R7 being the coupling resistance, C7 the coupling condenser, and R8 the grid leak.

V4, the beam power output valve, is biased by R9 and a permanent degree of tone correction is effected by C8. The energised loudspeaker is coupled to V4 by the output transformer, L7, L8.

The HT and heater circuits are conventional, the heaters being all connected in series across the mains input. The pilot lamp is across a portion of the rectifier

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VALVE READINGS

V	Type	Electrode	Volts
1	12SA7	Anode	90
		Screen grid	90
2	12SK7	Anode	90
		Screen grid	90
		Cathode	1.3*
3	12SQ7	Anode	61*
4	50L6-GT	Anode	84
		Screen	90
		Cathode	5.1*
5	35Z5-GT	Cathode	123

Pilot lamp 7.5 volts .2 amp.

* Actual volts. Make allowance for meter resistance.

WINDINGS

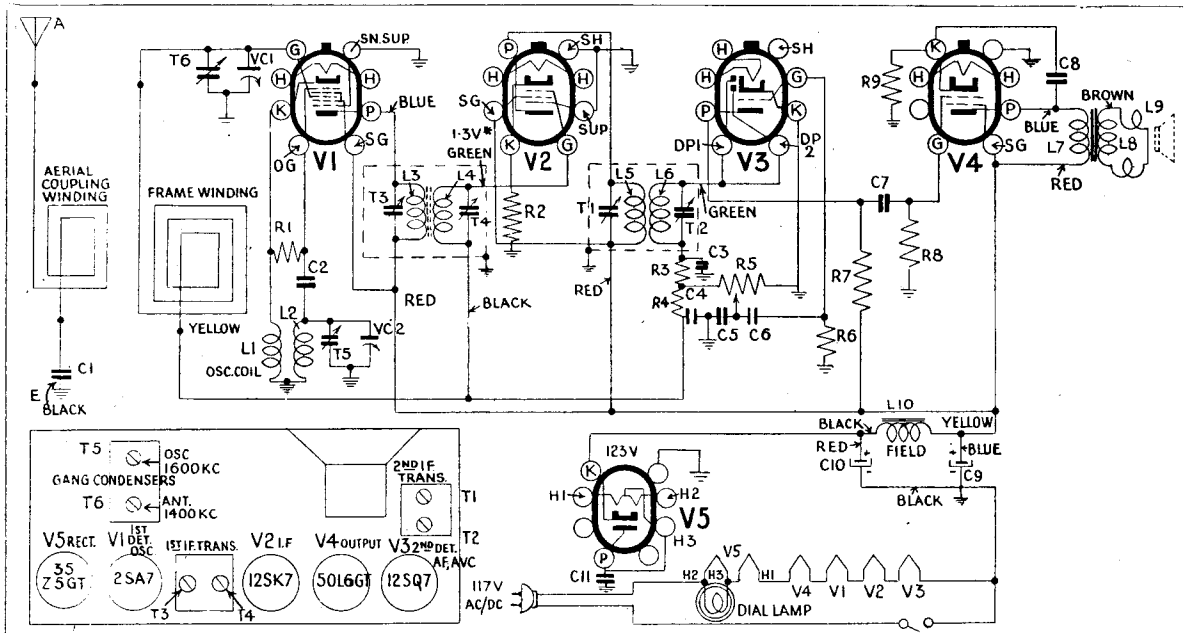
L	Ohms	L	Ohms
1	1	6	16
2	6.8	7	160
3	15	8	Very low
4	16	9	3.9
5	16	10	400

RESISTANCES

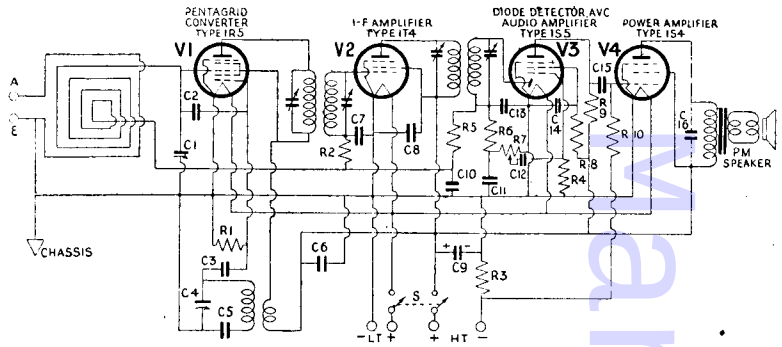
R	Ohms	R	Ohms
1	22,000	6	10 meg
2	120	7	220,000
3	47,000	8	470,000
4	2.2 meg	9	120
5	.5 meg		

CONDENSERS

C	Mfds	C	Mfds
1	.01	7	.01
2	68 mmfd	8	.025
3	.00022	9	12
4	.05	10	20
5	.00022	11	.05
6	.005		



Circuit and chassis layout diagrams for the RCA Midget. Most sets with ·15 amp valves are of very similar design.



The extremely small American "personal" receivers usually have circuits similar to this one recommended by RCA.

PERSONAL RECEIVERS

QUITE a number of miniature receivers of American origin are finding their way into the country, with the American Forces, and a few notes on these sets may be of assistance to engineers asked to repair them.

The receivers are often housed in cases which resemble cameras or cigarette caskets, and being so easily transportable they are termed "personal" receivers. They employ miniature valves of which there are at present four types. The characteristics and base connections are given below.

HT is derived from a small battery having a voltage of 45 while LT is supplied by a 1.5-volt dry cell.

An internal aerial is provided so that no outside aerial is necessary for the reception of the more powerful stations, but by means of a coupling turn of wire and two terminals, an external aerial and earth may be used for weaker stations if desired.

Continued from previous col.

valve, V5, heater. HT is smoothed by the field winding, L10, and condensers, C9, C10.

GANGING

IF CIRCUITS.—Inject 455 kc signal into the grid of V2, using a .01 mfd. series condenser. Tune to a quiet point at 600 kc end of the dial.

Adjust T1 and T2 for maximum output. Transfer oscillator signal input to stator of VC1 and adjust T3, T4 for maximum.

HF CIRCUITS.—By means of a loop of wire comprising two turns of 18 in. in diameter radiate a 1,600 kc signal into the frame aerial.

Turn condenser gang to minimum capacity (fully clockwise) and adjust T5.

Inject and tune in a signal of 1,400 kc, and adjust T6 for maximum output.

RESISTANCES

R	Ohms	R	Ohms
1	100,000	6	50,000
2	100,000	7	1 meg
3	500	8	3 meg
4	10 meg	9	1 meg
5	2 meg	10	2 meg

CONDENSERS

C	Mfds.	C	Mfds.
1	.00041	9	8
2	* 5 mmfd	10	.05
3	50 mmfd	11	100 mmfd
4	.00041	12	.0025
5	420 mmfd	13	100 mmfd
6	.1	14	.1
7	.05	15	.0005
8	.1	16	.002

*Only necessary a frequencies higher than 5 mc.

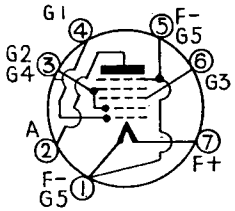
Although some receivers of this type employ a TRF circuit, the superhet is most favoured and a circuit recommended by RCA is reproduced here. The circuit is quite straightforward and the values of the condensers and resistances are given in the accompanying tables. It will be seen that AVC operates from the LF load of the single diode in the 1S5 valve.

Resistance-capacity LF coupling is employed between V3 and V4, R9, C15 and R10 being the coupling components. V4 is biased by means of the resistance, R3, in the negative HT line.

The output transformer has a primary impedance of about 8,500 ohms and the total HT battery current is approximately 8.5 ma. The LT current is 250 ma. Any replacement resistance may be of the .5 watt type.

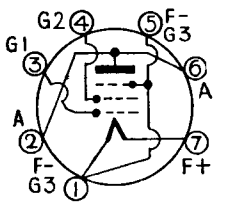
Typical working values of voltage and current are given in the valve characteristics tables on page viii

AMERICAN MINIATURE ALL-DRY 1·4 VOLT VALVES



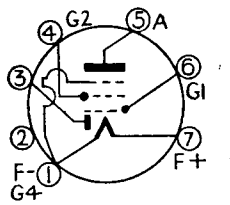
1R5
Pentagrid Converter.

Fil. Volts	—	1.4
Fil. Current	—	.05
Anode V.	45.0	90.0
Anode Mas.	.7	1.7
Screen V. (G2, G4)	45.0	67.5
Screen Mas.	1.9	3.0



1S4
Output Pentode.

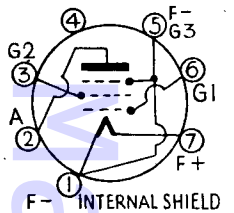
Fil. Volts	—	1.4
Fil. Current	—	.1
Anode V.	45.0	67.5
Anode Mas.	3.8	7.2
Screen V. (G2)	45.0	67.5
Screen Mas.	.8	1.5
Grid V. (G1)	−4.5	−7.0



1S5
Diode Pentode

Fil. Volts	—	1.4
Fil. Current	—	.05
Anode V.	45.0	90.0
Anode Mas.	*	3.0
Screen V.	45.0	90.0
Screen Mas.	*	.7

* Very low in R-C circuits.



1T4
RF Pentode.

Fil. Volts	—	1.4
Fil. Current	—	0.05
Anode V.	45.0	90.0
Anode Mas.	1.9	3.7
Screen V. (G2)	45.0	67.5
Screen Mas.	.7	1.25

ABOVE are the characteristics and base diagrams (looking from underside) of the four valves comprising the American miniature range of 1.4 volt filament valves for use in all-dry sets where the filament supply is drawn from a dry battery. The valves are particularly small and are employed in the personal type of receiver which is often no larger than a cigarette casket or camera case. They fit into a 7-pin button base socket. Dimensions are $2\frac{1}{8}$ in. overall length, and $1\frac{7}{8}$ in. from top to pins. In the above tables of characteristics the first column gives typical working values and the figures in the second column are maximum values.

INTERMITTENTS

Continued from page iii

First, give the chassis a thorough clean up and inspection. Shake it up to dislodge any loose nuts or drops of solder. Then connect the voltmeter across the smoothing choke and see if the needle remains steady when all the mains-section leads are given firm, but not vicious, test-tugs. Start with the primary connections of the mains transformer and work back through the secondary leads to the rectifier. See that the valve pins are making good contacts and check the leads back to the smoothing choke and the electrolytics.

Next, tap the voltmeter between chassis and various parts of the main HT bus-bar and the valve anodes, prodding the wiring to check for disconnections or shorts. Try the leads to resistances and condensers. Check over valves for good pin connections, good top cap connections and properly earthed metalising. See that screens are rigid and properly contacting with chassis and see that trimmers are not fouled with dirt and grease.

Should the fault come on during testing try paralleling decoupling and coupling condensers.

Injection Test

If the trouble has not been located by now, start a stage by stage signal test, putting through a generous signal from the service oscillator to each grid in turn, working back from the output valve. As each stage is under test continue prodding at wires, connections, components and screens.

Where success still eludes you inject LF to the first stage LF valve and cover the loud-speaker so that it warms up to perhaps something a little over normal temperature. Follow this by covering the chassis to warm it up.

If the trouble now occurs it will be known to be in the LF amplifier and not in the loud-speaker or radio section. The radio section can be checked in turn by injecting to the aerial.

Finally, it will be necessary to replace the valves one by one, giving the heat test in each case.

Symptoms Simplify Tests

In many cases a full testing as described above will not be necessary as the nature of the fault—hum, crackling, and so on—may show at once that only certain circuits or parts are suspect. Reference should be made, therefore, to the articles dealing with the particular type of fault concerned.

Generally speaking, intermittent silence in a superhet suggests oscillator trouble, probably the valve, its grid leak and condenser or HT supply being faulty. If the trouble is limited to one band, the switches, coils, trimmers and padders in use on that band are first-order suspects.

Intermittent hum is probably due to a poor connection, to a smoothing condenser, or earth lead, or to a valve.