NEW PUSH-PULL CIRCUITS YOU CAN TRY

Wireless Magazine

1/-

JULY 1934

SIX-GUINEA A.C./D.C. THREE

Also in This Issue: SENDING PICTURES by WIRE and WIRELESS :: The "W.M." RADIOGRAM SUPER :: WHY THERE IS a LIMIT to AMPLIFICATION :: TELEVISION COMPONENTS—ALL ABOUT THEM :: "BALANCE and CONTROL" at the B.B.C. TEN CIRCUITS for POWER AMPLIFIERS CAR RADIO, etc.

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Radiovision Editor: H. CORBISHLEY

Wireless Magazine

The Best Shillingsworth in Radio

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You All Want to Know About AMPLIFIERS!

YOU will find the July "Wireless Magazine" a sound and useful number, presenting a general survey of practicalities and other "—alities" and reaching a good level of achievement.

Perhaps its note is its articles on amplification; three thoroughly good sets covering most ordinary requirements; and an article "'Balance and Control' at the B.B.C.," revealing the clever work done behind the scenes by members of the B.B.C. staff, this being by Whitaker-Wilson, who explains how microphones for outside broadcasts are arranged, managed, and controlled so that they pick up little else than the sounds suitable for broadcast purposes.

Now as regards amplification, G. S. Scott explains why there is a limit to amplification. There are limits, of course, and the author shows that the deciding factor is the ratio of signal (the sound that is wanted) to noise (sound that is not wanted), and he explains how noises are introduced and their effect on reproduction.

In "A New Push-pull Method," F. E. Cox gives circuit diagrams illustrating a new system which he claims will give even better quality than the generally accepted methods.

We receive letters from many readers to whom the cost of a set, as long as it is at all reasonable, is not the important factor. Quality is what they want and for these particular readers S. Rutherford Wilkins has designed the "W.M." Radiogram Super, a large set built in two sections and employing eight valves, half of them in the super-het radio unit and half in the power-amplifier unit, including two large PX4 triodes which give an undistorted output of 5 watts—quite enough for small functions out-of-doors or for dances in small halls.

For the reader who does consider cost (and most readers have to, of course), we give this month the Six-guinea A.C./D.C. Three, designed especially to meet the needs of thousands of people whose houses have electric mains. The price mentioned includes every component and a moving-coil loud-speaker, but not the cabinet. This three-valver can be worked off A.C. or D.C. mains without alteration and the test report which we publish shows a highly satisfactory performance.

The All-wave Battery Three is for a different section of readers—a growing section keenly interested in short-wave listening. It is a cheap set covering from 20 to 80 metres in addition to the normal broadcast wavelengths and gives its user a lot of pleasure in tracking down the short-wave stations as well as in providing him with the usual broadcast entertainment.

Alan Hunter shows how the new Droitwich station will affect listening in this country and explains how, once it comes into operation, several of the present regional stations will become unnecessary; he has a word to say, too, about the proposed new transmissions in North Wales, Scotland, and Newcastle.

We have many good articles of a general nature, and among them I will just mention the Lowe and Phillips article, "Sending Pictures by Wire and Wireless." This is really a comprehensive survey of the history of picture telegraphy, a science whereby you have up-to-the-minute news pictures of an event—which perhaps took place hundreds of miles away—in your newspapers an hour or so after it took place. The article is well illustrated, and to prove to you the perfection that has been attained every photograph is printed without retouching.

B. E. J.

Contents

NEXT MONTH—MAKING AND USING A UNIVERSAL TESTER

Registered at the General Post Office for transmission by Canadian Magazine Post

Postage on this issue 3d. (inland and abroad)

Guide to the World's Broadcasters

Specially Compiled for "Wireless Magazine" by JAY COOTE

Metres: 29.04 **RUYSSELEDE (ORK)** *Kilocycles: 10,330*
Power: 8 kw. *(Belgium)*

Distance from London: Approximately 158 miles.

Standard Time: Greenwich Mean Time (Belgium adopts Summer Time).

Announcer: Man.

Call: "Ici Bruxelles, Poste Colonial Belge."

Times of Transmission: B.S.T. 1945, news in French; 2000-2100, concerts; 2100-2115, news in Flemish.

Transmits programmes for Belgian Congo and frequently relays Brussels (INR).

Closes down with the usual goodnight greetings and the Belgian National Anthem.

(Revised)
Metres: 30.43 **MADRID (EAQ)** *Kilocycles: 9,860*
Power: 20 kw. *(Spain)*

Distance from London: Approximately 802 miles.

Standard Time: Greenwich Mean Time (British Summer Time less 1 hour).

Call: "Aqui Madrid Radiodifusion Ibero-Americana."

Announcer: Man.

Languages: Spanish, French, and English.

Times of Transmission: B.S.T. 2330-0130 daily; also 1900-2100 (Saturdays).

Transmits programmes for European listeners and occasionally relays Madrid (EAJ7).

News bulletins are sometimes given in the English language.

Closes down with goodnight greetings in Spanish, French, and English, followed by Spanish Republican National Anthem, *Himno de Riego.*

(Revised)
Metres: 31.28 **SYDNEY (VK2ME)** *Kilocycles: 9,590*
Power: 20 kw. *(New South Wales)*

Distance from London: Approximately 10,550 miles.

Standard Time: British Summer Time plus 9 hours.

Announcer: Man.

Opening Signal: Song of the Kookaburra bird (laughing jackass) on sound film.

Call: "This is VK2ME, the Australian National Empire short-wave station broadcasting on 9,590 kilocycles, 31.28 metres."

Times of Transmission: B.S.T. 0700-0900, 1100-1500, 1530-1830 (Sundays only).

Closes down with call, followed by Kookaburra song and *God Save the King.*

Occasionally tests are tried out on 7 metres (42,860 kilocycles).

Metres: 41.84 **GRANADA (YN3RD)** *Kilocycles: 7,170*
Power: 0.2 kw. *(Nicaragua)*

Distance from London: Approximately 4,350 miles.

Standard Time: British Summer Time less 7 hours.

Announcer: Man.

Languages: Spanish and English.

Interval Signal: Bugle call.

Call (in English): "This is the amateur radio station, YN3RD, Granada, Nicaragua."

Times of Transmission: B.S.T. 2000-2100 daily.

(Revised)
Metres: 328.6 **RADIO TOULOUSE** *Kilocycles: 913*
Power: 60 kw. *(France)*

Distance from London: Approximately 560 miles.

Standard Time: Greenwich Mean Time (France adopts British Summer Time).

Announcer: Man.

Opening and Closing Signal: March: *La Toulousaine.*

Call: "Allo! Allo! Ici Radio Toulouse, Emissions de la Radiophonie du Midi!" Between items: "Ici Radio Toulouse."

Interval Signal: Gong (about fifty beats per minute).

Main Daily Transmissions: B.S.T. 0800, gramophone records; 1230, news; sacred service (Sundays), then continuous broadcasts until 1430; 1815, orchestra, records, or sound films; 1930, news, songs, relays from local cafés.

The station closes down usually at 0030 with the usual French goodnight greetings.

Metres: 476.9 **LISBON** *Kilocycles: 629*
Power: 20 kw. *(Portugal)*

Distance from London: Approximately 975 miles.

Standard Time: Greenwich Mean Time (Portugal adopts Summer Time).

Announcer: Man.

Call: "Estaçao Naçional Radio Lisboa."

Times of Transmission: B.S.T. 2145-0030.

For the present the programme schedule is an experimental one, but the broadcasts include news bulletins, studio concerts, gramophone records, talks, and dance music by English bands.

The station closes down with goodnight greetings in several languages, followed by the Portuguese National Anthem, *A Portuguesa.*

Metres: 483.9 **CAIRO** *Kilocycles: 620*
Power: 20 kw. *(Egypt)*

Distance from London: Approximately 2,100 miles.

Standard Time: Eastern European (British Summer Time plus 1 hour).

Announcer: Man.

Call: "Cairo calling." In French: "Ici Poste de Radiodiffusion du Caire" (phon.: "Care.")

Times of Transmission: B.S.T. 1100-1330 and from 1700-2230. Concerts consist mainly of Oriental compositions, but gramophone records of Western music are also broadcast.

News and announcements are given out in Arabic, English, and French; where special entertainments are transmitted for other nationalities, also in Italian and Greek.

Relay (under construction): Alexandria (Ras-el-Tin), 267.4 metres (1,122 kilocycles), 5 kilowatts.

(Revised)
Metres: 522.6 **STUTTGART (Mühlacker)** *Kilocycles: 524*
Power: 100 kw. *(Germany)*

Distance from London: Approximately 454 miles.

Standard Time: Central European (coincides with British Summer Time).

Announcer: Man.

Language: German only.

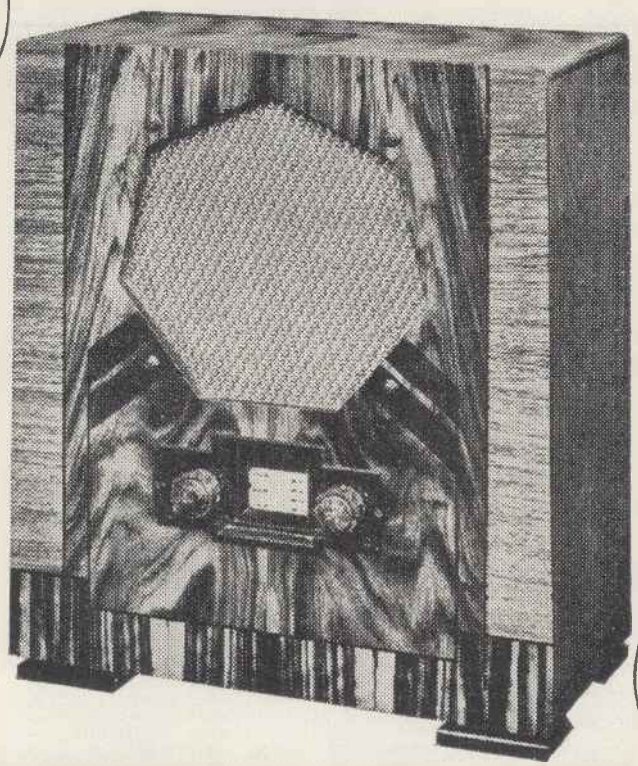
Call: "Achtung! Hier Reichssender Stuttgart."

Interval Signal: Three notes (C, D, G) repeated.

Main Daily Transmissions: B.S.T. 0545, choral concert, weather forecast, physical exercises, news bulletin; 0615, relay of concert from liner at Hamburg (Sundays), then continuous broadcast until 2000, news, main evening programme, relay of opera, play, or concert, talks; 2220, news and time signal; 2300, late musical transmission from studio and almost nightly a relay from Frankfurt-am-Main or Munich from midnight to 0100.

Closes down with the playing of *Horst Wessel* marching song, or *Deutschland Ueber Alles.*

5 VALVE SUPERHET BATTERY RADIO



9

THAT IS EQUIVALENT TO A NINE

Mains-set performance without a mains electricity supply

This set must be *heard* to be believed. For no battery set has been produced before that is in any measure equal to it. In accuracy of reproduction it is equivalent to an expensive mains set. There is a technical reason for the astonishing performance of this Battery Set. Although it is actually a five-valve radio, *one* valve, which is of a special type, does the work of *three*, and two others each act as *two!* This represents the highest achievement to date in battery radio. Not only is the *tone* of this new Columbia Model superior to that of any other battery set, but its selectivity and range are phenomenal. Every station is kept distinct. If you have no electricity supply, or live in a district where good results cannot be got from a mains set, this is undoubtedly the instrument to buy—for it gives you the quality of reception that has hitherto only been possible from "mains" -radio.

The new **COLUMBIA SUPERHET BATTERY GRAND, Model No. 1006**

Hear this new Model to-day. The more you know of it, the more positive you will be that this is the instrument you have been waiting for—the instrument you *want!* Hear it at any Columbia dealer's to-day—or write straight-away for this descriptive leaflet, "Hearing is Believing." The Coupon below, posted in an unsealed envelope with a ½d. stamp will ensure that it is sent.

15 GNS

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COUPON. Please send me particulars of the new Columbia Superhet Battery Grand Model No. 1006, without obligation.
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WORLD'S BROADCAST WAVELENGTHS

Stations best received in the British Isles are indicated in bold type

Note : Names in brackets are those of stations relayed

Wave-length	Name of Station	Dial Readings	Country
13.92	W8XK, Saxonburg (KDKA)		United States
13.97	Daventry GSH		Great Britain
14.49	**Buenos Aires LSY**		Argentine
14.58	Bandoeng PMB		Java
15.5	Bandoeng PMA		Java
15.92	Bandoeng PLE		Java
16.36	Lawrenceville (N.J.) WLA		United States
16.38	**Rugby GAS**		Great Britain
16.5	Drummondville (CFA8)		Canada
16.56	Bandoeng PMC		Java
16.56	Buenos Aires LSY3		Argentine
16.81	Bandoeng PLF		Java
16.85	Kootwijk PCV		Holland
16.86	Daventry Empire GSG		Great Britain
16.878	**Boundbrook W3XAL (WJZ)**		United States
16.88	**Eindhoven PHI**		Holland
16.89	Königswusterhausen DJE		Germany
17.05	Transatlantic liners		
19.56	**Schenectady W2XAD (WGY)**		United States
19.61	La Paz CP4		Bolivia
19.63	**New York W2XE (WABC)**		United States
19.67	Coytesville N.J. WIXAL (WEEI)		United States
19.67	Tashkent (Rim)		U.S.S.R.
19.68	**Radio Colonial FYA**		France
19.72	**Saxonburg W8XK (KDKA)**		United States
19.737	**Zeesen DJB**		Germany
19.815	Daventry (Empire) GSF		Great Britain
19.84	Rome (Vatican) HVJ		Italy
19.88	Moscow (RKI)		U.S.S.R.
20.27	Rocky Point WQV		United States
20.31	Rocky Point N.Y. (WEB)		United States
20.97	Amateur band		—
21.43	Cairo SUV		Egypt
21.53	Rocky Point WIK		United States
21.58	Rocky Point WQP		United States
21.605	Rocky Point WQT		United States
21.83	Drummondville CJA8		Canada
22.26	Rocky Point WAJ		United States
22.48	Santa Rita YVQ		Venezuela
22.68	Liners		—
22.684	Zeesen (DHB)		Germany
23.39	**Radio Maroc (Rabat) CNR**		Morocco
24.41	Rugby GBU		Great Britain
24.9	Kootwijk PDV		Holland
25	Moscow RNE		U.S.S.R.
25.25	Radio Colonial, Paris (FYA)		France
25.25	**Saxonburg (Pa.) W8XK (KDKA)**		United States
25.28	**Daventry (Empire) GSE**		Great Britain
25.34	Wayne W2XE (WABC)		United States
25.4	**Rome 2RO**		Italy
25.45	Boston WIXAL (WEEI)		United States
25.51	**Zeesen DJD**		Germany
25.532	**Daventry (Empire) GSD**		Great Britain
25.58	Winnipeg (CJRX)		Canada
25.63	Radio Coloniale FYA		France
26.83	Funchal CT3AQ		Madeira
27.65	Nauen DFL		Germany
27.86	Rugby GBP		Great Britain
27.88	Marapicu PSG		Brazil
28.28	Rocky Point (N.J.) WEA		United States
28.5	Sydney VLK		N.S. Wales
28.98	Buenos Aires LSX		Brazil
29.03	Bermuda ZFD		West Indies
29.04	Ruysselede (ORK)		Belgium
29.16	Zeesen (DIQ)		Germany
29.35	Marapicu PSH		Brazil
29.59	Leopoldville OPM		Belgian Congo
29.64	Marapicu PSI		Brazil
29.84	Abu Zabel, Cairo SUV		Egypt
30	Radio Excelsior LR5		Argentine
30.1	Rome IRS		Italy
30.4	Lawrenceville WON		United States
30.4	Tokio JIAA		Japan
30.43	Madrid EAQ		Spain
30.77	Lawrenceville WOF		United States
30.9	**Rugby GCA**		Great Britain
31.08	Nauen DGU		Germany
31.23	Mexico City XETE		Mexico
31.25	Lisbon CTIAA		Portugal
31.26	Radio Nations HBL		Switzerland
31.28	**Philadelphia W3XAU (WCAU)**		United States
31.28	**Sydney VK2ME**		N.S. Wales
31.297	**Daventry (Empire) GSC**		Great Britain
31.35	**Millis W1XAZ (WBZ)**		United States
31.38	**Zeesen DJA**		Germany

Wave-length	Name of Station	Dial Readings	Country
31.41	Jelöy LCL		Norway
31.48	**Schenectady W2XAF (WGY)**		United States
31.545	**Daventry (Empire) GSB**		Great Britain
31.55	Melbourne VK3ME		Victoria
31.55	Caracas YV3BC		Venezuela
31.58	Rio de Janeiro PSA		Brazil
31.71	New Brunswick WKJ		United States
31.9	Bandoeng PLV		Java
32.71	**Lawrenceville WNA**		United States
32.79	Maracay YVQ		Venezuela
32.88	Szekesfehervar HAT4		Hungary
33.26	Rugby GCS		Great Britain
33.59	Rocky Point (N.J.) WEC		United States
34.68	London VE9BY		Canada
36.65	Rio de Janeiro PSK (PRA3)		Brazil
37.04	Quito HCJB		Ecuador
37.33	Rabat (CNR)		Morocco
37.41	Suva VPD		Fiji Isles
38.07	Tokio JIAA		Japan
38.47	**Radio Nations HBP**		Switzerland
38.65	Kootwijk PDM		Holland
39.34	Tashkent RIM		U.S.S.R.
39.76	Moscow RKI		U.S.S.R.
39.82	Riobamba PRADO		Ecuador
39.89	Moscow RKI		U.S.S.R.
40.3	Radio Nations HBQ		Switzerland
40.5	Bogota HJ3ABB		Colombia
40.54	Rocky Point WEN		U.S.A.
41.1	Amateur band		—
41.55	Bogota HKE		Colombia
41.6	Las Palmas EA8AB		Canary Isles
41.67	Singapore VS1AB		Sts. Settl'mts.
41.84	Grenada YN6RD		Nicaragua
41.9	Manizales HJ4ABB		Colombia
43	Madrid EA4AQ		Spain
43.86	Budapest HAT2		Hungary
44.61	Rocky Point WQO		United States
44.96	Maracay YVQ		Venezuela
45	Constantine FM8KR		Tunis
45.02	Guayaquil HC2RL		Ecuador
45.38	Moscow RW72		U.S.S.R.
46.53	Barranquilla (HJ1ABB)		Colombia
46.69	Boundbrook W3XL (WJZ)		United States
46.7	Boston WIXAL		United States
47	Cali HJ5ABB		Colombia
47.5	S. Domingo HIZ		Dominican R
47.8	Domingo HIAA		Dominican R.
48.75	Winnipeg CJRO		Canada
48.78	Caracas YV3BC		Venezuela
48.83	**Saxonburg (Pa.) W8XK (KDKA)**		United States
48.86	Moscow (RKK)		U.S.S.R.
49	Johannesburg ZTJ		South Africa
49.02	Wayne W2XE (WABC)		United States
49.08	**Caracas YVIBC**		Venezuela
49.1	Halifax VE9HX (CHNS)		Canada
49.18	**Boundbrook W3XAL (WJZ)** / Chicago W9XF (WENR)		United States / United States
49.22	Bowmanville VE9GW (CRCT)		Canada
49.26	St. John VE9BJ (CFBL)		N. Brunswick
49.3	La Paz CP5		Bolivia
49.34	Chicago W9XAA (WCFL)		United States
49.39	Maracaibo V5BMO		Venezuela
49.4	Vienna OER2		Austria
49.43	Vancouver VE9CS (CKFC)		Brit. Columbia
49.47	Nairobi VQ7LO		Kenya Colony
49.5	**Philadelphia W4XAU (WCAU)**		United States
49.5	Cincinnati W8XAL (WLW)		United States
49.586	**Daventry (Empire) GSA**		Great Britain
49.6	Bogota HJ3ABI		Colombia
49.67	Boston WIXAL (WEED)		United States
49.83	**Zeesen DJC**		Germany
49.9	Singapore ZHI		F.M. States
49.92	Havana COC		Cuba
49.96	**Drummondville VE9DN (CFCF)**		Canada
49.97	Caracas YV2BC		Venezuela
50.8	Barcelona EA3AB / **Moscow RNE**		Spain / U.S.S.R.
50.26	**Rome (Vatican) HVJ**		Italy
50.42	Domingo HIX		Dominican R.
50.6	Medellin HJ4ABE		Colombia
56.9	Königswusterhausen (DTG)		Germany
57.03	**Rocky Point WQN**		United States
58.03	Bandoeng PMY		Java
58.31	**Prague**		Czechoslovakia

(Continued on page 486)

WORLD'S BROADCAST WAVELENGTHS

Continued from page 484

Wave-length	Name of Stations	Dial Readings	Country
60.3	Rugby GBC		Great Britain
62.5	Long Island (N.J.) W2X		United States
65.93	Rocky Point WAD		United States
68.18	Moscow (RFCK)		U.S.S.R.
69.44	Rugby GDB		Great Britain
70.2	Khabarovsk RV15		U.S.S.R.
73	Quito (HCJB)		Ecuador
76	Maracay (YV11AM)		Venezuela
80	Lisbon CTICT		Portugal
84.5	Berlin D4AGE		Germany
84.67	Mozambique CR7AA		East Africa
85.9	Boston WIXAL		United States
203.5	Plymouth		Great Britain
	Bournemouth		Great Britain
204.2	Pecs		Hungary
206	Fecamp		France
208.6	Miskolcz		Hungary
209.5	Beziers		France
209.9	Newcastle		Great Britain
211.3	Tampore		Finland
214	Sofia		Bulgaria
215	Radio Lyon		France
216.8	Warsaw No. 2		Poland
218.2	Basle, Berne		Switzerland
219.6	Cracow		Poland
221.1	Turin (2)		Italy
222	Dublin		Irish F. State
222.6	Bordeaux S.O.		France
	Königsberg		Germany
	Milan Vigentino (2)		Italy
224	Montpellier		France
224.1	Lodz		Poland
225.6	Hanover		Germany
	Bremen		Germany
	Flensburg		Germany
	Stettin		Germany
	Magdeburg		Germany
227.6	Magyarovar (2)		Hungary
230.2	Danzig		Germany
231.8	Linz		Austria
	Salzburg		Austria
	Klagenfurt		Austria
	Dornbirn		Austria
233.5	Aberdeen		Great Britain
234.3	Dresden		Germany
235.1	Stavanger		Norway
236.8	Nurnberg		Germany
238.5	San Sebastian		Spain
	Rome (3)		Italy
240.2	Juan-les-Pins		France
241.9	Cork		Irish F. State
243.7	Gleiwitz		Germany
245.5	Trieste		Italy
247.3	Lille PTT		France
249.2	Prague Strasnice (2)		Czechoslovakia
251	Frankfurt-am-Main		Germany
	Trier		Germany
	Freiburg-im-Breisgau		Germany
	Cassel		Germany
	Kaiserlautern		Germany
253.2	Kharkov (2)		U.S.S.R.
255.1	Copenhagen		Denmark
257.1	Monte Ceneri		Switzerland
259.1	Moravska-Ostrava		Czechoslovakia
261.1	London National		Great Britain
	West National		Great Britain
263.2	Turin (1)		Italy
265.3	Horby		Sweden
267.4	Belfast		N. Ireland
267.4	Nyiregyhaza		Hungary
269.5	Kosice		Czechoslovakia
269.6	Radio Vitus (Paris)		France
271.7	Naples		Italy
273.6	Madrid EAJ7		Spain
276.2	Falun		Sweden
277.2	Zagreb		Yugoslavia
278	Bordeaux PTT		France
280.9	Tiraspol		U.S.S.R.
283.3	Bari		Italy
285.7	Scottish National		Great Britain
288.6	Leningrad (2)		U.S.S.R.
	Rennes PTT		France
291	Heilsberg		Germany
291.7	Parede		Portugal
293.5	Barcelona (EAJ15)		Spain
296.2	North National		Great Britain
298.8	Bratislava		Czechoslovakia
301.5	Hilversum		Holland
304.3	Genoa		Italy
	Cracow		Poland
307.1	West Regional		Great Britain
312	Grenoble PTT		France
312.8	Poste Parisien, Paris		France
315.8	Breslau		Germany
318.8	Goteborg		Sweden

Wave-length	Name of Station	Dial Readings	Country
321.9	Brussels (2)		Belgium
322.2	Algiers		North Africa
325.4	Brno		Czechoslovakia
328.6	Radio Toulouse		France
331.9	Hamburg		Germany
335.2	Limoges PTT		France
	Helsinki		Finland
338.6	Graz		Austria
342.1	London Regional		Great Britain
345.6	Poznan		Poland
349.2	Strasbourg		France
350	Bergen		Norway
352.9	Valencia		Spain
356.7	Berlin		Germany
360.6	Moscow (4)		U.S.S.R.
362.8	Radio LL Paris		France
364.5	Bucharest		Roumania
368.6	Milan		Italy
373.1	Scottish Regional		Great Britain
	Salonika		Greece
377.8	Lvov		Poland
	Barcelona (EAJ1)		Spain
382.2	Leipzig		Germany
386.6	Toulouse PTT		France
286.9	Frederikstadd		Norway
391.1	Midland Regional		Great Britain
395.8	Katowice		Poland
400.5	Marseilles PTT		France
405.4	Munich		Germany
	Seville		Spain
410.4	Tallinn		Estonia
	Dorpat		Estonia
414.4	Madrid (Espana)		Spain
415.5	Kiev		U.S.S.R.
420.8	Rome		Italy
426.1	Stockholm		Sweden
431.7	Paris PTT		France
435	Belgrade		Yugoslavia
443.1	Sottens		Switzerland
449.1	North Regional		Great Britain
455.9	Langenberg		Germany
463	Lyons PTT		France
470.2	Prague (1)		Czechoslovakia
476.9	Trondheim		Norway
	Lisbon		Portugal
483.9	Brussels (1)		Belgium
483.9	Cairo		Egypt
491.8	Florence		Italy
499.2	Sundsvall		Sweden
	Rabat		Morocco
506.8	Vienna		Austria
514.3	Agen		France
514.6	Riga		Latvia
522.9	Mühlacker		Germany
531	Athlone		Irish F. State
539.6	Beromunster		Switzerland
549.5	Budapest		Hungary
559.7	Wilno		Poland
	Bolzano		Italy
569.3	Viipuri		Finland
	Ljubljana		Yugoslavia
578	Innsbruck		Austria
	Hamar		Norway
696	Oulu		Finland
726.2	Ostersund		Sweden
748	Moscow		U.S.S.R.
	Geneva		Switzerland
775.2	Boden		Sweden
824	Smolensk		U.S.S.R.
833.4	Budapest (2)		Hungary
845	Vadso		Norway
1,107	Moscow (RCZ)		U.S.S.R.
1,132	Madona		Latvia
1,181	Oslo		Norway
1,209.6	Scheveningen-Haven		Holland
1,239	Leningrad		U.S.S.R.
1,250	Vienna (Exp.)		Austria
1,261	Kalundborg		Denmark
1,293	Kharkov		U.S.S.R.
1,304	Luxembourg		Luxembourg
1,312	Ankara		Turkey
1,339	Warsaw		Poland
1,389	Motala		Sweden
1,395	Eiffel Tower		France
1,442	Minsk		U.S.S.R.
1,442	Reykjavik		Iceland
1,500	Daventry National		Great Britain
1,570.7	Deutschlandsender		Germany
1,621	Istanbul		Turkey
1,648	Radio Paris		France
1,724	Moscow No. 1		U.S.S.R.
1,807.2	Lahti		Finland
1,875	Kootwijk		Holland
	Brasov		Roumania
1,935	Kaunas		Lithuania

In Tune with the Trade

FETTER LANE'S Review of the Latest Catalogues

SEND TO US FOR THESE CATALOGUES!

Here we review the newest booklets and folders issued by eight manufacturers. If you want copies of any or all of them, just cut out this coupon and sent it to us. We will see that you get all the literature you desire.

Just indicate the numbers (seen at the end of each paragraph) of the catalogues you want below :—

My name and address is :—

Send this coupon in an unsealed envelope, bearing ½d. stamp, to "Catalogue Service," WIRELESS MAGAZINE, 58-61 Fetter Lane, E.C.4. *Valid till July* 31.

CABINETS AT HUGE DISCOUNTS

I MET Mr. Salaman, of Carrington's, in Fetter Lane last week. He pressed into my hand a copy of Carrington's cabinet catalogue and said that they were offering many of the 1933-4 models at huge discounts —40 per cent. is the figure, I believe.

There is no need for me to tell you about the fine workmanship, design, and finish of Camco " boxes." Believe me, there are some real bargains going, and I advise you to be quick and get the best of them. There are not many of these cabinets available and they are selling like hot cakes!

You can get a Camco cabinet catalogue with all the reductions marked through this free service. **396**

◆ ◆ ◆

SILENT HIGH TENSION

SILENT high-tension supply is essential for efficient short-wave reception and here we have it.

Milnes claim that their system is the most efficient, convenient, and economical. To prove that the unit will work your set well, you can arrange for a dealer to demonstrate it on your set.

A booklet, giving details of how the system works, what it is, and the cost, can be obtained free through this service.

You can read in this booklet what some of the users of Milnes' units think of them. **397**

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SMITH ACCUMULATORS

A CATALOGUE of S. Smith and Sons, Ltd., the well-known accumulator people, has just arrived.

Details of accumulators suitable for all radio requirements are to be found in this useful catalogue.

Names of commercial receivers are arranged in alphabetical order, with the corresponding suitable types of Smiths' accumulators given, so that you can tell at a glance which accumulator is required when a replacement is necessary. **398**

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SAVAGE SOUND SYSTEM

THIS Savage catalogue contains information about amplifying equipment for almost every use. Secretaries of social clubs will do well to consult this catalogue if they are considering the purchase of amplifying apparatus.

There are several types of complete units, which contain the amplifier, turntable, and pick-up in a strong wooden cabinet.

Also included are details of amplifier chassis, microphones, and loudspeakers of the exponential-horn, permanent-magnet, and baffle type. **399**

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A NEW SERVICE

A LEAFLET describing a new service for valve replacement is something new.

The V.B. Guarantee Corporation undertake, for an agreed sum, to replace any valve which for any reason goes wrong in the registered customer's receiver. This is the brief outline of one of many schemes available.

You should send for this leaflet; it is one way of solving valve replacement troubles. **400**

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NEW B.T.H. PICK-UP

A NEW needle-armature pick-up has been produced by Edison Swan Electric Co., Ltd.

The output is ample for all normal amplifying equipment and requires no special high-gain preliminary amplifier.

The pick-up and arm are so designed that record wear is reduced to a minimum. The head of the pick-up swivels upwards to facilitate needle changing and volume control is supplied with the pick-up.

It should be noted that the pick-up can be operated at full output without unpleasant resonance on any particular frequency.

I am sure every reader will be interested in this new pick-up. Details, of course, are free. **401**

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SHORT-WAVE FANS—NOTE!

THE bother about short-wave units is that they seldom can be used on batteries and A.C. mains at will. That trouble is finished. Unit Radio has sent along a copy of a booklet describing a converter that can be used on either batteries, A.C. or D.C. mains. Further, it can be used as either a detector unit or super-het converter.

This is a real opportunity to become a short-wave fan. I will have a catalogue sent along if you fill in the coupon. **402**

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EVER-READY BATTERIES

HAVE you ever had the annoying experience of the batteries of your portable set running down at the moment you are enjoying an impromptu dance in the country? Take a tip from me and always examine the wet and dry batteries before you take the portable out into the country.

The new Ever Ready catalogue gives details of batteries that will fit most portable receivers, whether home-built or commercial.

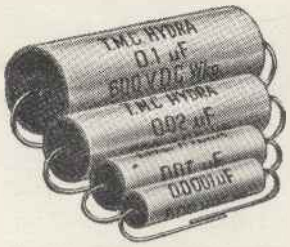
Also included are the standard batteries for the " home " receiver.

Send for this catalogue; you will find it useful for reference. " A bird in the hand is worth . . ." You know the old saying. **403**

CONSISTENCY

Corn and Condensers—what a curious combination! Yet, just as corn is a living symbol that nature never fails man—so the T.M.C. HYDRA mark on a condenser is a warrant of consistent, good performance. This unfailing consistency is only possible because T.M.C. HYDRA condensers are made from the finest raw materials, with up-to-date plant under the strictest scientific control, to tolerance figures of the narrowest margin.

Take advantage of these new standards in condenser production. Equip your set with T.M.C. HYDRA condensers—it will be better for your set and better for your pocket. They are made in all standard capacities.



Write to the Distributors if you have any difficulty in obtaining supplies.

T.M.C

BRITISH MADE

HYDRA CONDENSERS

Price List from Distributors:

T.M.C.-HARWELL (SALES) LTD

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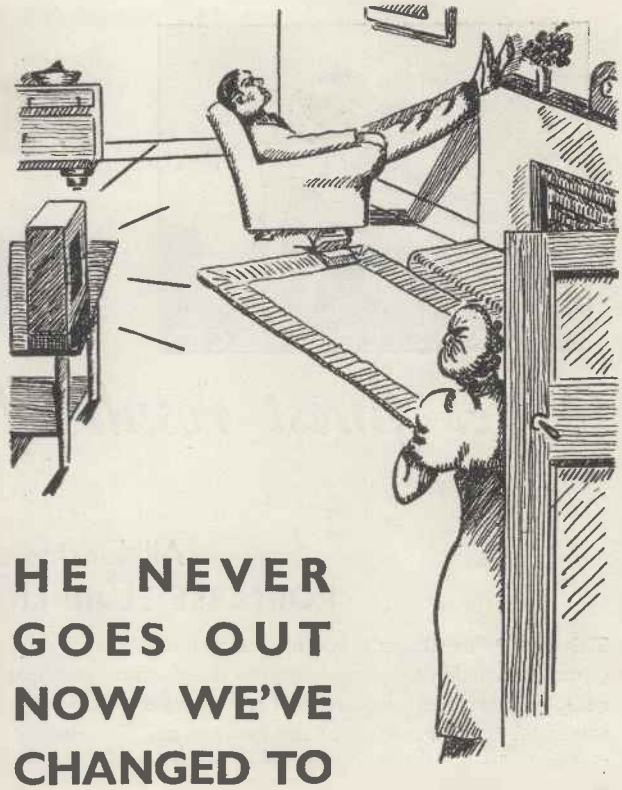
Telephone: Clerkenwell 6905

Made by TELEPHONE MANUFACTURING Co. Ltd.



HE NEVER GOES OUT NOW WE'VE CHANGED TO

SMITH'S ACCUMULATORS

To attain that purity of tone and absolute freedom from distortion which constitute perfect radio it is essential to use an accumulator of the very highest grade.
Supplied by a firm, internationally famed for the quality of its products, a Smith Accumulator will help you to achieve this ideal.

S. SMITH & SONS

(MOTOR ACCESSORIES) LTD.

CRICKLEWOOD - LONDON - N.W.2

Advertisers like to know you "saw it in the 'Wireless Magazine'"

FLUID-LIGHT TUNING

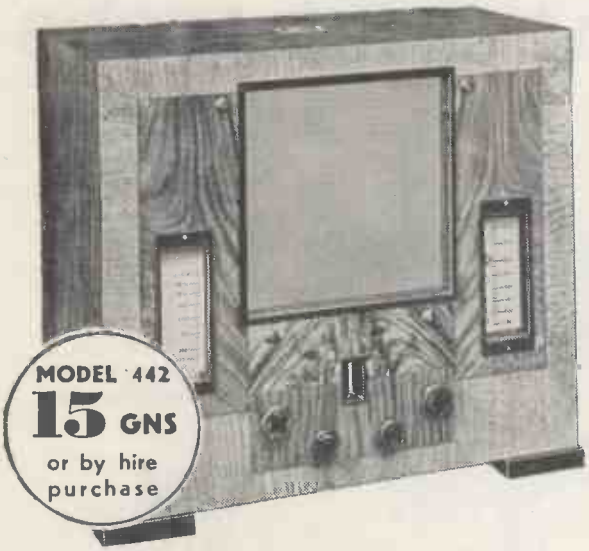
to get finest results from extreme selectivity

All Electric Superhet

PORTABLE FLUID-LIGHT SIX

This new "His Master's Voice." Mains Portable with automatic volume control and fluid-light tuning, works off the mains electricity supply and needs neither aerial nor earth. It is the answer to all who have waited for true to life "mains reception" in a portable set. Its selectivity is so acute that it is fitted with fluid-light tuning—the sensational new device that ensures accurate tuning always. In this model, two illuminated arrows gradually approach each other until they show the exact point of perfect reception. So that by sight alone, unassisted by ear, you can tell when this set is tuned to concert pitch.

MODEL 463. Mains Portable, with self-contained earth and aerial (six valves including rectifier). Fluid-light tuning incorporated in wavelength scale. Automatic volume control. For A.C. only.



All Electric Superhet

FLUID-LIGHT FIVE

A new five-valve superhet table model with automatic volume control and fluid-light tuning. It is a delight to look at, a joy to hear, and a pleasure to handle. Its range is extraordinary and every station is kept distinct. The fluid-light tuning device in this model is a thin column of light which rises and falls in a slender central window, indicating the exact spot at which perfect tuning is reached. Only by means of this fluid-light can the extreme selectivity of this set be fully appreciated.

MODEL 442. Superhet Table Model (five valves including rectifier). Fluid-light tuning in central window. Automatic volume control. For A.C. only.

"HIS MASTER'S VOICE"

Write to-day for special illustrated leaflets.

THE GRAMOPHONE COMPANY, LTD., 108c CLERKENWELL ROAD, LONDON, E.C.1. (Prices do not apply in I.F.S.)

Mention of the "Wireless Magazine" will ensure prompt attention

Radio Medley

A Radio Fan's Causerie
Conducted by BM/PRESS

H.M.V. photo

TWO "STARS"! Yvonne Printemps, the star of "Conversation Piece," about to play over one of her own records from the show on an instrument that is a "star" among radio gramophones

The Position of the Constructor

NOBODY can deny that there has been a falling off in constructional interest during the past year—and many and interesting are the explanations going the rounds of the component manufacturers.

The chief factor, of course, has been the price reductions made by producers of complete receivers; many a man who was only a luke-warm constructor and who built his own sets in the past because it was cheaper to do that than to buy one, now uys his new receiver ready made.

Real Constructors

But people who only built sets because of their comparative low cost were never home constructors in the real sense of the term. Your real constructor had, and still has, a greater interest in the hobby than the very material one of saving a few shillings.

I know that some of the keenest constructor readers of "Wireless Magazine" are wealthy enough to buy themselves several sets if they felt that way inclined; indeed, there are some who actually buy complete receivers from set manufacturers and then compare them carefully with their own home-constructed efforts! That is enthusiasm, isn't it?

Chandler photo

GETTING READY FOR AN S O S? Two yachting enthusiasts rigging up an aerial on their craft. Although far from the madding crowd they will not be cut off from the world entirely!

Another cause of hesitation on the part of constructors, as I have pointed out on several occasions in these notes, is the high cost of components in comparison with the cost of complete sets. That is a trouble that will be remedied by the manufacturers in the near future, I feel sure. But I think a gesture from the valve makers is long overdue.

What Will Olympia Reveal?

Last year's components at Olympia were conspicuous by their absence; they were there, of course, but you had to look for them—they certainly were not displayed in such a way that the visitor simply could not help noticing them.

I hope that the Radio Component Manufacturers' Federation will take steps to see that its members remedy this defect when this year's show opens on Thursday, August 16 (by the way, it remains open until Saturday, August 25).

From what I hear, there will be some interesting developments from several quarters; and when it comes to components we badly need them. If you take a look round you will find that there have been no radical alterations or improvements in component design for quite a long time. Radio is not so far advanced yet that development can have come to a standstill, provided our designers really get their coats off and come down to brass tacks.

H.M.V. photo

BRITAIN'S TRAVELLING RADIO SHOWROOM

Visitors learning all about the latest radio sets and radio gramophones in the train that is touring the whole county—the most ambitious propaganda effort ever made by a radio manufacturer. Full details for visiting the train are on page 572

At present everybody is caught in a vicious circle. The manufacturer complains that the constructor is not buying enough and rather tends to let things slide because he does not receive much encouragement from his prospective customers. And then the constructor looks round and sees that, apart from one or two valves, there is nothing much new in radio on which it is worth his while to spend time and money.

I put the question of money a long way second because I am convinced that the constructor will spend money when he is offered something worth buying.

A Great Autumn Revival?

From all of the foregoing you will see that I am one of those who firmly believe that construction has not come to an end—and that it will not come to an end. Like everything else, I think it is inevitable that interest in construction among the "borderline" cases will come and go in cycles (no pun intended!)

We have seen rapid developments during the past ten years; I think we shall see still greater developments during the next ten years. And, not to go too far ahead, I think we shall see several developments this autumn that will pull radio out of the rut into which it has fallen as far as the constructor is concerned. The future very largely lies in the hands of the component manufacturers—and, of course, the "Wireless Magazine" Technical Staff is diligently engaged in the search for worth while developments.

Marconiphone photo

GRANNY LISTENS-IN

The older generation still gets a thrill out of the marvels of radio; and it is a great boon to those getting on in years to have the world's best entertainers brought right into their homes

As you know from experience, it has never been their policy to "stunt" in any way. Only new ideas of real outstanding value find their way into the pages of "Wireless Magazine."

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Inefficient Loud-speakers

LOUD-SPEAKER manufacturers, please do not start throwing bricks at me when you read that heading!

I know all the improvements that have been made and how vastly superior is the loud-speaker of 1934 to that of, say, 1930. But when is somebody going to introduce an entirely new loud-speaker principle that will give us a much great conversion factor?

Speaking (or, rather, writing) without the book, I believe that the efficiency of even the best loud-speaker is only about 5 per cent. What would happen to radio sets if we had a loud-speaker of 50 per cent. conversion efficiency? (When I use the term conversion I mean, of course, the conversion of electricity into sound).

With a reproducer of this type we should probably be able to drive the reproducer direct from the detector stage, and then where would all our quality enthusiasts be? There would be practically no low-frequency arrangements for them to wrangle over!

Some time radio will resolve itself, I suppose, into a combination tuner/detector/loud-speaker no larger than an orange. But I hope that I do not live to see that day; half of the fascination of radio is in the size of the apparatus, I think. Which is one reason why constructors as a whole have never taken much interest in midget sets.

How much more impressive it is to have a set with eleven valves and about 5 ft. long—which is the size of an amateur's super-het that I was able to see recently. I at once felt that I must knock myself up at least a twelve-valver, 6ft. long!

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That Television Committee

WITHIN a few months it is likely that we shall know where we stand with regard to television broadcasts. The whole position is chaotic at the moment. Some people want the 30-line transmissions retained indefinitely; others say that television will never get anywhere until we get the real high-definition stuff; and others are arguing as to whether the latest form of entertainment should be controlled by the B.B.C. or by some new corporation or company.

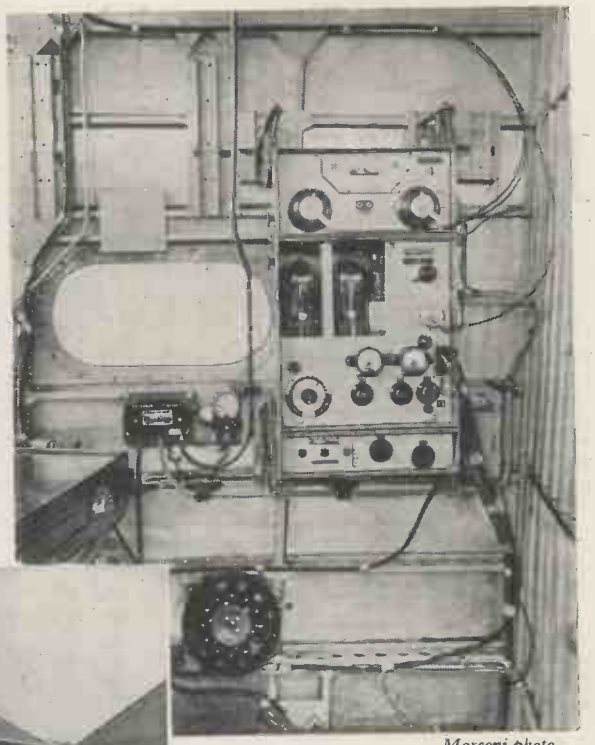
Well, the P.M.G.'s television

committee has a nice little problem to solve—and it will probably take them some time to come to a conclusion. Whatever their decision, it is certain that it will not please everybody, but some definite policy will be better than no policy at all.

It is no secret that Mr. Noel Ashbridge, the B.B.C.'s chief engineer, is in favour of high-definition television on short waves (which means of the order of 7 metres), but there are the claims of those with 30-line apparatus to be considered.

Whatever happens, as far as I can gather, we shall never have the same position that we had when broadcasting began—that of one corporation holding a sufficient number of key patents to control the whole trade. There is nothing new about the cathode-ray tube, and if high-definition television does come soon many manufacturers should be in a position to produce the necessary gear.

If we come to 7-metre stuff, it seems as if the greatest problems will be in the actual radio end of the reception and not in the pure television part of the business.



Marconi photo

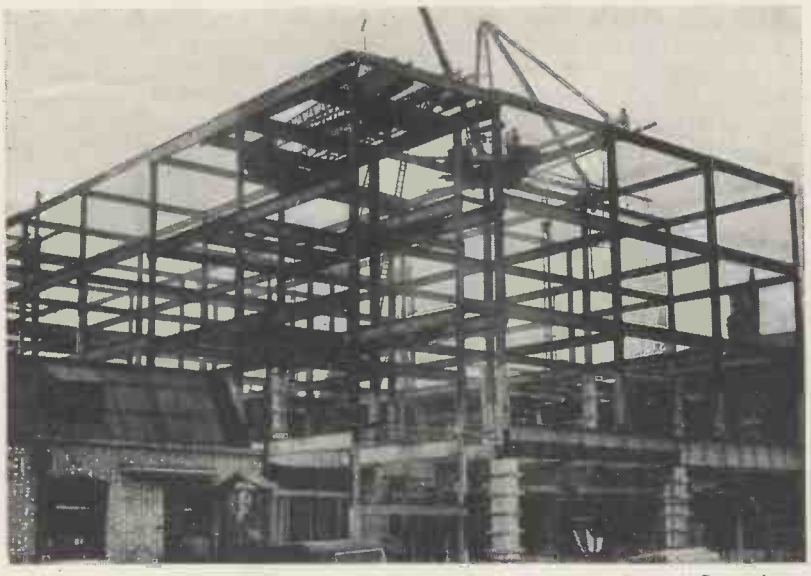
TRANSMITTER-RECEIVER

The transmitter covers the waveband of 500 to 1,000 metres, and the receiver is the well-known "screen-grid, detector, pentode" arrangement

Marconi photo

NEW FOUR-ENGINED IMPERIAL AIRWAYS LINER

A new four-engined Imperial Airways liner the "Scylla," built by Short's and radio-equipped by Marconi's. This photograph was taken by the hangars at Croydon Airport



Cossor photo

PREPARING FOR BIG RADIO DEVELOPMENTS

At least one manufacturer is convinced that radio is going to boom again soon. Cossor's, who already have extensive works at Highbury, are building a new factory to accommodate over 1,000 workers, It will be ready in the Autumn

By the way, isn't it a pity that the Committee's deliberations will be held in private ? I think that the public ought to have had the opportunity to know what evidence the Committee takes so that it can form its own opinion of the justification for the final decisions.

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Car Radio

ALTHOUGH I am still not able to make up my mind as to whether I want a car radio set or not I am glad to see that one British manufacturer has got down to a mass-production job. If radio on the road is to grow it is as well that British manufacturers should get what business is going instead of letting it go to their American rivals.

At a luncheon I attended recently, to introduce a new car radio outfit, several people got up and pointed out the difficulty of getting such sets installed and suggested the need for a series of properly organised service stations. I think that we shall see definite moves in that direction shortly.

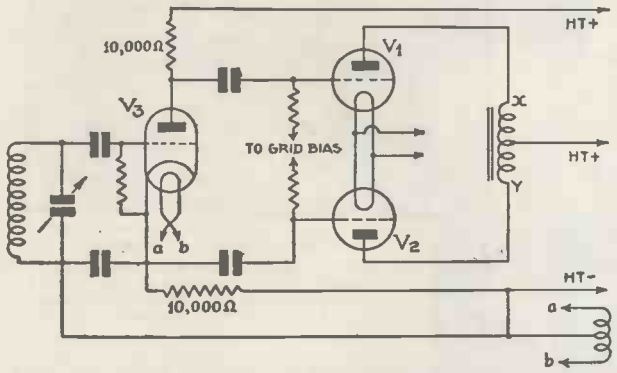
(London, W.C.2, BM/PRESS).

A New Push-pull Method

By F. E. Cox, B.Sc.

IT is accepted as commonplace fact that of all methods of coupling two valves together for low-frequency amplification, resistance-capacity provides the best quality. This is because it gives even amplification over a large range of frequencies, and can be designed to deal faithfully with transients (quick changes of low-frequency signals).

The logical conclusion in design is that in some way the advantages of resistance-capacity coupling should be combined with push-pull to avoid amplitude distortion due to curvature of valve characteristics.



RESISTANCE-CAPACITY PUSH-PULL

Fig. 1.—A circuit for resistance-capacity push-pull with an indirectly-heated driver valve for two directly-heated triodes

Until now this has been accomplished by using not less than four valves: two as output valves—let us call them V_1 and V_2—working the loud-speaker, and two, V_3 and V_4, to drive the output valves.

To obtain push-pull working from the two output valves V_1 and V_2 it is necessary to apply to the grid of V_2 an input voltage which is 180 degrees out of phase with corresponding voltage at the grid of V_1.

Old Method

Until now, using resistance-coupling, this is done by letting V_3 feed V_1, and at the same time V_3 gives V_4's grid a small fraction of its output. Then V_4 feeds the output valve V_2.

In this process the necessary phase reversal is obtained.

The writer has found (see Prov. Patent No. 9625/34) that by using one indirectly-heated valve as driver this valve can supply signals to two output valves and provide phase reversal as well. The output valves need not be indirectly-heated.

The principle involved is that the A.C. output at the anode of a valve is 180 degrees out of phase with the A.C. voltage output at the cathode of the same valve, supposing that both an anode load resistance is being used together with a cathode load resistance.

It may be recalled that it is quite easy to dispense with all forms of anode-lead load and put it instead in the cathode circuit, using any suitable coupling device between it and the next valve. Such is known as a cathode-coupling circuit.

All the writer proposes to do is to divide the output of the driver valve between anode and cathode. For this purpose, as shown in Fig. 1, an anode resistance of, say, 10,000 ohms is put between the anode and high-tension positive; also a 10,000-ohm resistance is put between cathode and high-tension negative.

A condenser and grid-leak coupling conveys a signal from the anode to power valve V_1, and a similar coupling takes a signal from the cathode to power valve V_2.

The loud-speaker may have an output transformer incorporated. In this case its primary will connect with terminals X and Y on the centre-tapped low-frequency choke used as output load to the two push-pull power valves. Alternatively, this output choke may be replaced by a centre-tapped output transformer or even by two output resistances if a sufficiently high anode voltage can be given, in which case the loud-speaker will be connected across from plate to plate without using the usual stopping condenser.

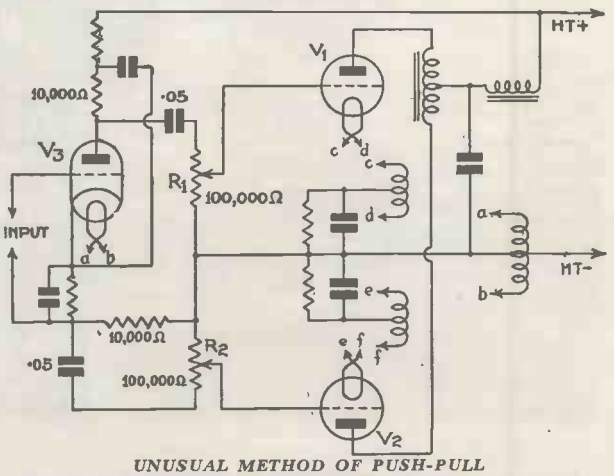
It will be noticed that the driver valve up to now is acting as a grid-leak detector, but it may equally well be an amplifying valve following a diode detector or Westector or gramophone pick-up. The suggested circuit with full decoupling is Fig. 2.

Balanced Inputs

To obtain the best results it will be necessary to balance the inputs to V_1 and V_2. The writer suggests that the grid resistances R_1 and R_2 be variable. Set both at maximum and, having pulled out V_2, take its grid lead to V_1 instead.

Now although V_1 will give good working of the loud-speaker without V_2, yet when V_1 receives inputs from both grid-leak resistances signals die away, having cancelled out. Vary R_1 to find if possible a more marked minimum signal and, if not, restore R_1 to maximum and vary R_2. With the best setting found, V_2 is inserted in its valve holder, but R_2 is returned to the grid of V_2.

If the two power valves do not require a large input the circuit of Fig. 1 suffices, but where very large power valves are required, then V_1 and V_2 must serve as intermediate low-frequency valves, passing on signals by resistance-capacity to the two chosen power valves.



UNUSUAL METHOD OF PUSH-PULL

Fig. 2.—In this circuit the input to the two output valves can be individually controlled. Separate automatic bias allows the careful matching of each output valve

Many of the topical pictures seen in the newspapers are sent to the printers by wire, and frequently by wireless, from places often 1,000 or more miles away. In this interesting article the methods by which pictures are transmitted and received are explained by W. T. LOWE and E. PHILLIPS. So that readers can appreciate the high quality of the transmitted pictures, every illustration in this article is reproduced without any retouching and exactly as received from abroad

Keystone photo

One of the authors of this article, E. Phillips, with a Siemens Karolus-Telefunken picture transmitter

Sending Pictures by Wire and Wireless

THE idea of telegraphing pictures and fascimile is not a new one by any means. Indeed, F. C. Bakewell, an Englishman, invented such a system as far back as 1850!

Shellac-ink (which, as you know, is a non-conductor of electricity) constituted the primary factor for transmission. With this, the writing or drawing to be telegraphed was inscribed on a metal cylinder. A fine metal pointer moved over the surface of the cylinder, tracing a spiral from one end to the other. Naturally, as the pointer passed over the shellac-ink, current ceased to flow.

At the receiving end a cylinder, similar to that in the transmitter, rotated at the same speed. The current decomposed a chemical with which a piece of white paper had been impregnated. This paper was mounted on the cylinder. Current passing through a metal pointer caused a brown stain to appear. The picture, or writing, came out in white on a brown background. For various reasons, this system met with no success.

In 1862 the Abbé Caselli invented an apparatus on similar lines. This was actually in use for some years on the Paris-Amiens wire. It transmitted diagrams and drawings.

Black and White Designs

And then in 1878, d'Arlincourt, of France, introduced a picture telegraph which reproduced designs in black and white. The British Post Office experimented with this instrument at the Central Telegraph Office.

The picture, which measured 12 in. by 2½ in., took seven minutes to transmit. This wasn't quick enough for St. Martin's-le-Grand, and the system was turned down. They gave the system a longer trial in France, but eventually scrapped it.

Most of the trouble was due to difficulties of synchronisation. This is as essential in picture telegraphy as in television. In the former case, variation in speed produces results which are not rectangular. They become rhomboidal.

The solution

Post Office photo

PICTURE-TELEGRAPH ROOM AT THE G.P.O.

This is where pictures are sent and received at the General Post Office, London. From left to right are the power board, telephone board, sending machine, control panel and receiving machine

TELEGRAPHED FROM MUNICH
Little detail has been lost in this telegraphed picture of the interior of St. Stephen's Church, Vienna. The picture was telegraphed from Munich to London

was not discovered until 1919. Since then the tuning-fork has been used to obtain this precision in synchronism. So sure is the tuning-fork control that it is now used in all systems of picture telegraphy.

This branch of the science of telegraphy did not make much headway, however, until the year 1873. The period coincided with the discovery of the light-sensitive properties of selenium.

Use of Selenium

An Englishman, Mr. Thorne-Baker, and a German, Professor Korn, both used selenium for translating the light and shade of a picture into electric current. The latter system was so successful that the German police actually made use of it on more than one occasion. Not only that, but our own *Daily Mirror* made a scoop by experimenting with it, and acquiring the British patent rights.

Owing to the slow response of selenium to variations of light, the system did not attain any great use. Also, it must be remembered that the lines used for transmission were not technically so good as they are today.

The discovery of the thermionic valve, the photo-electric cell, and improvement in photographic materials provided solutions to most of the problems. Picture telegraphy became a definite possibility, and in 1926 three systems were introduced as commercial propositions—the Siemens-Karolus Telefunken in Germany; the Belin in France; and the Bell in America.

Except for rapid transmission of newspaper photographs, the comparatively small distances between cities and towns in the British Isles did not offer much inducement for its use. From this country to the Continent, and between cities in the U.S.A., however, the intervening distance made it possible to open up working agreements.

Consequently, in 1930, London inaugurated its first public picture telegraph service with Berlin. At the present day the service is available to the following Continental cities: Frankfort-am-Main, Berlin, Copenhagen, Munich, Vienna, Stockholm, Rome, Oslo, Amsterdam, Paris, Lyons, Marseilles, Nice, Bordeaux, and Strasbourg. London also acts as an intermediate station between these places and America.

Although their functions are closely allied, the difference in size between a televisor, whatever the particular system, and a commercial picture-telegraph installation is enormous.

Three Rooms of Gear!

The plant for running the Siemens-Karolus apparatus, which is in operation at the Central Telegraph Office, occupies three rooms. One room contains the operating instruments; another is devoted entirely to banks of secondary cells, and a third is used for developing and printing.

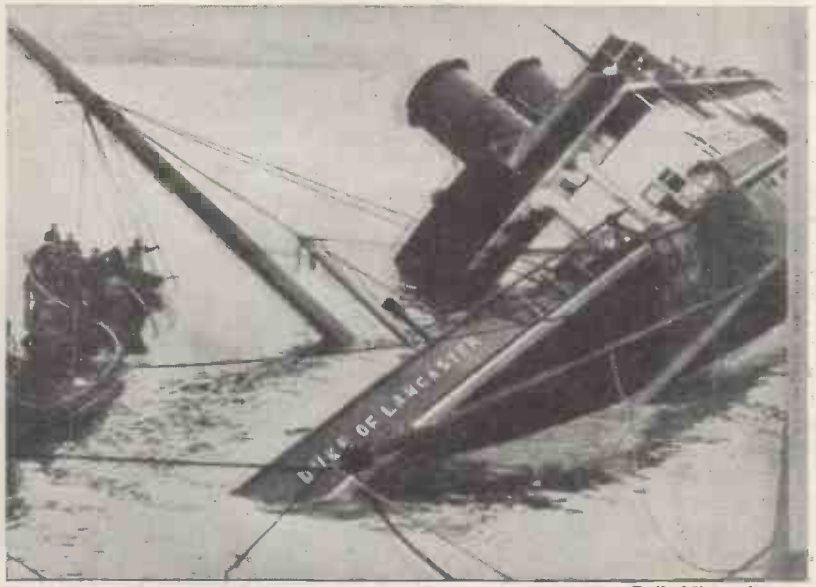
Transmitter and receiver are separate. Both are contained in metal cases measuring about 3 ft. square.

A motor for driving the mechanism is enclosed and on top a smaller metal case holds the actual sending and receiving gear. Amplifiers and other necessary details adorn a control panel, and the operator keeps in touch with the station to which he is working by means of a telephone connected to this panel.

Transmission Gear

Components consisting of a photo-electric cell, a spot-light lamp, a tooth-edged disc, Kerr cell, etc., are employed for transmission.

The matter to be telegraphed is clipped on to a metal cylinder. This



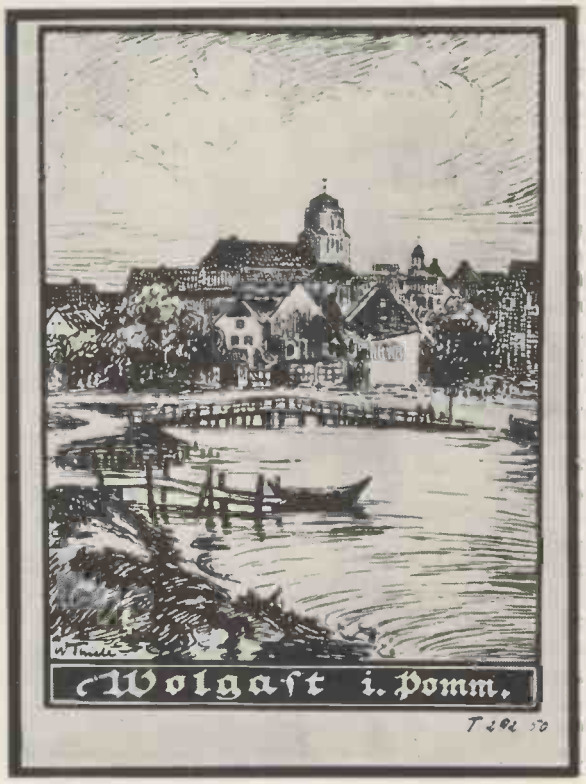
Daily Mirror photo

SPEEDING UP NEWS PICTURES
This photograph of the Irish mailboat "Duke of Lancaster" being inspected by divers and salvage men in Heysham Harbour was telegraphed to London by the Siemens process. Picture telegraphy is a great help in speeding up news pictures

REMARKABLE PICTURE FROM COPENHAGEN
Here is a remarkable example of the detail that can be maintained in telegraphed pictures. As you can see, little detail has been lost

ANOTHER PORTRAIT SENT BY TELEGRAPH
This picture was telegraphed from Copenhagen to London on August 2, 1930. Like all the illustrations in this article, this picture has not been retouched

SENDING MAPS BY WIRE
This line drawing showing communication between London and the Continent was sent by a system of facsimile telegraphy



TELEGRAPHED DRAWING FROM BERLIN
Measuring 315 square centimetres, this drawing was sent from Berlin to London. The cost for this drawing was £3 5s. 7½d.

CONGRATULATED ON WINNING A TOURIST TROPHY RACE

Stanley Woods, the well-known racing motor-cyclist, being congratulated on winning a T.T. race in the Isle of Man. This picture was telegraphed to the "Daily Mirror" in London. The detail is especially good.

revolves continuously in front of the photo-electric cell. The spot-light lamp directs a beam of light upon the surface of the picture, and the tooth-edged disc rotates in the path of this light.

Form of a Ring

In the Siemens-Karolus picture telegraph the photo-electric cell is made in the form of a ring. The light passes through the central hole to the picture.

So that the light shall be focused on the picture, a lens is mounted just behind the cell, the whole system being mounted on a screw. This is turned by gearing with the driving motor.

The cell is placed close to the cylinder on which the picture is clipped. If the light-tight case could be removed you would see the cylinder revolving and the photo-electric cell and lens gradually moving up and down. Point by point the picture is being scanned by a spiral of light, top to bottom.

If a telephone be placed in circuit, we should hear a burbling note, similar to that heard in television vision broadcasts.

Preparatory to reception, a film is clipped on to a cylinder in the dark room. This is then enclosed in the light-tight case, which has a shutter. When the case is placed in the receiver, the shutter opens.

Focused on the film through the lens, light from the spot-lamp passes through an optical system of nicol prisms and Kerr cell, and the variation in light value, due to incoming currents passing through the Kerr cell, affect the photographic film point by point according to light and shade in the picture being transmitted.

The film is then taken into a dark-room, developed, fixed, washed and dried; about thirty minutes being required to turn out the finished print.

Daily Mirror photo

VIA ATLANTIC CABLE

This fire-rescue picture was telegraphed via Atlantic cable by the Bart-lane system to the "Daily Mirror"

Incidentally, the light spot at both ends traverses a surface of about 7 in. by about 10 in., or 18 by 25 centimetres—the size of the cylinders in use. The area of the whole surface is approximately 450 square centimetres. The spot-light travels at the rate of four lines to each millimetre of depth. This approximates 100 lines to the inch and therefore 720 lines from top to bottom complete the picture.

Each spot of light is contiguous with the preceding one, so that the finished picture shows no sign of roughness.

The total distance travelled from top to bottom by the spot of light is 661 ft. and takes 12½ minutes for a full-size picture.

Daily Mirror photos

ADMIRAL BYRD IN ARCTIC KIT

This photograph of Admiral Byrd in Arctic kit was telegraphed from New York to London by cable

HIGH-DEFINITION PHOTO

The definition of this picture, telegraphed by cable from New York to London, is really quite satisfactory

The Post Office, however, has a minimum charge for an area of 96 square centimetres; but between the two extremes, any area can be telegraphed at appropriate charges.

The apparatus used in France is that invented by M. Edouard Belin. This employs the photo-electric cell for transmission, but for reception uses an oscillograph. This is a small mirror vibrating between the poles of an electro-magnet.

French Methods

A rectangular beam of light is directed on to the mirror and thence reflected on to a triangular opening. A lens is placed behind which concentrates the beam into focus on the receiving cylinder.

The light may shine either on the broad base or at the apex of the triangle. The amount of light passing through the lens thus varies. Movement of the mirror is affected by the currents from the sending apparatus, and the picture is built up by means of the consequent vibrations.

This system scans at the rate of 5⅓ lines per millimetre, approximately 130 lines to the inch.

On the Marconi-Wright picture telegraph installation it is possible to simultaneously transmit two messages or pictures. The system differs considerably from any other. Messages occupying a space of 10 in. by 4 in. have been received in the fast time of four and a half minutes.

FROM THE MIDLANDS TO LONDON

A photograph of the Princess Royal in the hunting field telegraphed by the Siemens system from the Midlands to London

In the interests of speed—always the first consideration in telegraphy—a useful feature is that it is not necessary to stop the apparatus every time another picture is placed in the transmitter, or taken from the receiver. The instrument runs continuously. Time taken in repeated synchronising and restarting is therefore obviated.

The Bart-Lane system, which works over the Atlantic cables, gives pictures with a heavy grain, but show a good range of tones.

Three pictures typical of the Bart-Lane system are reproduced—without retouching—on the opposite page. There is no difficulty in identifying the subjects although the grain is definitely coarse.

Pictures are also flashed across the Atlantic by wireless. Imperial and International Communications, Ltd., has coined the word "Photograms" and the system is known as the Wireless Photogram Service. Incidentally, this company publishes an illustrated brochure which presents information of the service in an interesting and picturesque manner.

At least a week is saved by thus sending pictures and facsimile across the *Pond*.

Use in Russia

In Russia, wireless is extensively used for the same purpose. Much newspaper work is conveyed by this method—sheets of printed matter being dealt with *in extenso*.

Although Knudsen obtained only crude results, it will perhaps be news to the majority of readers that the transmission of pictures by wireless was first attempted in 1908.

And we daresay our enthusiastic friends will be delighted to know that, with a simple form of apparatus invented by Mr. Thorne-Baker, it is possible to pick up broadcast pictures with a two-valve receiver!

There seems to be room here for yet another feature of fireside entertainment. Many readers will, no doubt, still remember the attempts of the B.B.C. to broadcast pictures by means of the Fultograph some years ago.

TELEGRAPHED PICTURE OF A RAILWAY SMASH

A picture of a railway smash at Wardleworth, near Rochdale, which was telegraphed to the "Daily Mirror" in London. The caption is transmitted with the picture

Very soon we shall be hearing the last signals from Daventry National. Here you see the first control panel used in the transmitting hall at Daventry

Droitwich Means New Regional Plans

says ALAN HUNTER

DROITWICH may have called you by the time these words are printed. We are as near as that, I mean, to a complete change in the B.B.C.'s system of broadcasting.

For many years we have been approaching the completion of what everyone knows as the Regional Scheme. Twin centres of broadcasting, giving to listeners using relatively simple sets a choice of at least two programmes, one national and the other of local or at least of regional interest and origin.

Five of these centres went into the making of that broad plan. Brookmans Park for London and the south-east of England; Daventry for Birmingham and the Midlands; Moorside Edge for Manchester and the vast industrial north; Westerglen for Glasgow, Edinburgh, and the Lowlands of Scotland; and, lastly, Watchet for the West Country and South Wales.

Indeed, a brave scheme of broadcasting, conceived at a time when stations were relatively few in number and most certainly low in power. The scheme aimed at providing a truly homogeneous service of programmes if not to every nook and cranny of the country, at least to every area of dense population.

Progress in broadcasting all over the world, and particularly in Europe, did not stand still while this Regional Scheme crystallised. Stations sprang up, powers increased, and demands on the ether became ever more onerous.

Conference after conference under the auspices of the International Broadcasting Union made it clear to all that watertight national schemes of broadcasting must needs fit in with international obligations.

Foreigners looked with critical eyes on this Regional Scheme of ours. Why, they asked, do you need so many wavelengths for your national programme when you have in Daventry a station fully able to serve the whole of the country ?

It was a question the B.B.C. could not with real justice brush aside. In this country, too, listeners began to realise that, although there might be five centres of twin radiation, one programme from each was the common National—a programme already available to them from Daventry.

That the B.B.C., in pursuing its idealistic Regional Scheme, was guilty of an indefensible wastage of wavelengths became palpably obvious. From that moment the Regional Scheme as originally conceived was doomed—the more especially as the

NEW STUDIOS FOR WESTERN LISTENERS
"The B.B.C. is well developed with up-to-date studios," says Alan Hunter. This is one of the palatial new studios recently built at Cardiff

" nooks-and-crannies " listeners of these islands were growing restless for want of reliable programmes denied them under the five-centre system of transmission.

At this point it is only fair to say that when the Regional Scheme was conceived no one had any idea how broadcasting would develop—certainly no one imagined there would be such a colossal increase in the power of transmission.

When Daventry was brought into service with its 35 kilowatts it was hailed as a veritable giant among broadcasters, which, of course, it was in comparison with prevailing low-powered transmitters in this country and in Europe generally.

Any idea of expecting the Post Office to grant permission for a power of over 100 kilowatts would have been absurd. The B.B.C. had fight enough to get as much as 35 kilowatts.

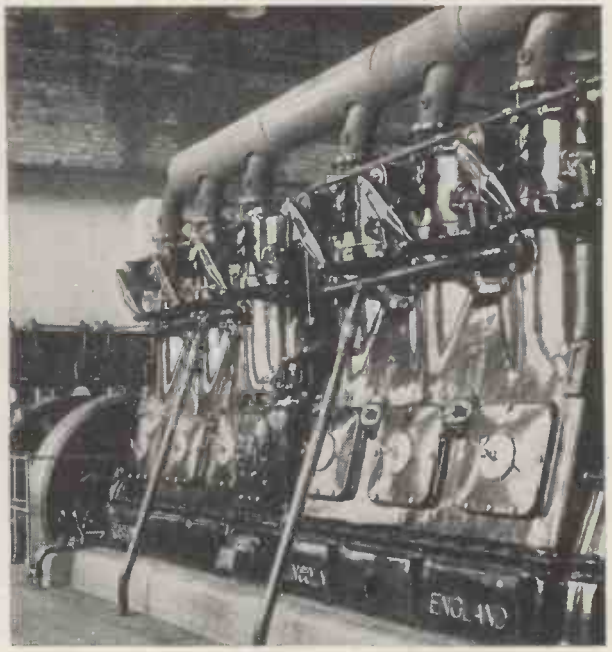
Yet it was possible, even in those days, to say that while Daventry would give a very good signal within say, 150 miles of its site, it would fade out appreciably at the far points, such as Devon, Cornwall, and Northern Scotland and Wales.

Unfortunately, the twin centres of radiation that followed the erection of Daventry did nothing to help these out-of-the-way listeners. In fact, amazing though it may seem in retrospect, each of the " little Nationals" at Brookmans Park, Moorside Edge, and Watchet did little more than duplicate the Daventry National programme, without appreciably extending the reliable range of the National programme.

That is to say, listeners who could obtain fade-free reception of little Nationals at night could in any case get Daventry quite well, whereas those who were on the fringe of the Daventry service area were still quite hopelessly outside the service areas of the little Nationals.

Droitwich, with its 150 kilowatts, will provide an average of two and a half times the strength of signal of Daventry. Its effect will be mostly felt in the outlying districts—beyond the present reliable range of Daventry, that is.

In this way, then, we can hail in Droitwich the first real nation-wide service station. Everyone, no matter which nook or cranny of the country he may dwell in, should be able to rely on Droitwich for his National programme. That is a real advance from the B.B.C.'s service point of view.



DIESEL ENGINES AT SLAITHWAITE

There are two of these huge Diesel engines at Slaithwaite—one for driving each transmitter. Both engines will be used for driving an improved Regional transmitter under the new plan

If the little Nationals were tending to be redundant with Daventry, they most certainly are redundant with Droitwich. Without any qualm, the B.B.C. intends to shut down the Nationals at Brookmans Park, Moorside Edge, and Watchet.

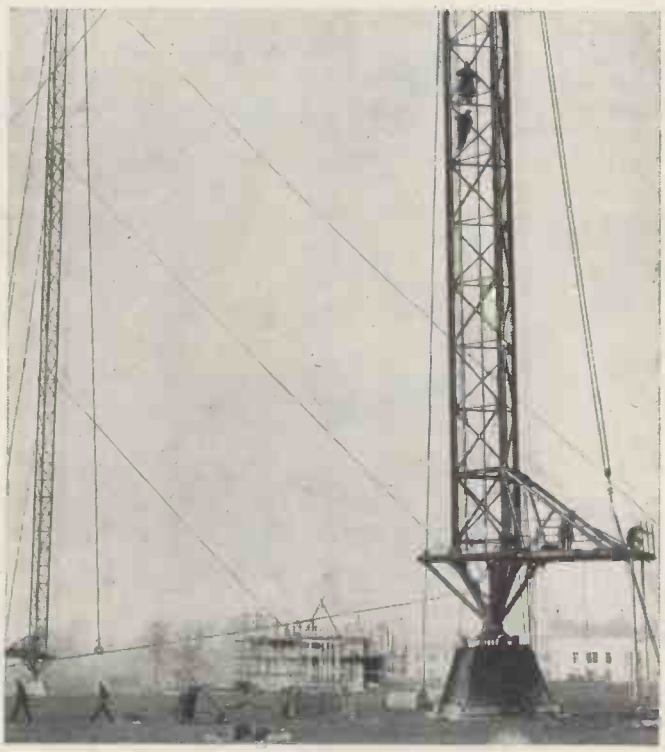
Few will mourn their passing. On mediocre medium wavelengths they have not been the success anticipated—at least, not outside a very short radius from the station site.

For example, living about forty-five miles from Brookmans Park, I have never been able to get London National at night without severe distortion and fading. Since it has been synchronised with West National reception has been a farce except in the early afternoon.

Thousands of listeners must be similarly placed in relation to the other little Nationals and, like me, they have for years gone over to " woomphy " Daventry for the National programme.

Such listeners will benefit enormously from the coming of Droitwich. Quality of transmission will undoubtedly be very much better than from Daventry, a station which we ought not to forget was in the nature of an experimental plant, anyway.

By the closing down



AT THE FOOT OF THE HUGE DROITWICH MASTS

Workmen putting the finishing touches to the two 700-ft. steel masts at Droitwich. The new Droitwich aerial will be slung between the two masts and the new Midland Regional aerial will be slung from the top of one mast to a point near ground level

of the three little Nationals at Brookmans Park, Moorside Edge, and Watchet two wavelengths will be released—not three, because as already stated, London and West Nationals are sharing a common wavelength.

Three transmitting plants are also released. Not to be scrapped, of course, for the B.B.C. is using the opening of Droitwich to slide gradually from twin-station broadcasting to its new and saner system of one-point regional transmission.

London National as a station will be moved to Droitwich, where it will become, with new power plant, the new Midland Regional transmitter.

West and North Nationals, with an entirely new plant like them, will be shared out among the projected North-Ireland Regional, North-eastern Regional and North-Scottish Regional.

North-Ireland Regional will probably take over the present Belfast wavelength, while Midland Regional will be accounted for by some change over of its present wavelength with another. The two released wavelengths of North and West Nationals will help when North-eastern and North-Scottish stations come on the air.

At the moment it is impossible to say how one present group of wavelengths will be rearranged. Considerable alteration is certain. The Midland Regional, for example, with its higher power and closer proximity to Birmingham, will have to manage with a shorter wavelength than now.

Incidentally, while listeners are waiting for the changeover from the present twin-station system to the one-point system the B.B.C. will utilise its released wavelengths for Aberdeen and Newcastle. Whether this is for fear of foreigners "jumping our claims" is not officially stated—but I have my own opinion.

At each of the Regional stations, all of which I have had the pleasure of examining as they were opened, there are three giant Diesel engines, two in use and one in reserve. When the sites are denuded of their little Nationals all these engines will remain in order to boost up the power of the Regionals to a power of 70 kilowatts. The B.B.C. has no intention, you see, of allowing foreigners to shout us down.

Some scrapping of plant is inevitable, naturally. The transmitters at Daventry giving us the Midland Regional and the Daventry National programmes will both go. They have served their turn more than well.

As a site, then, Daventry will be left free for the Empire stations. For the present it is intended to keep up the 500-ft. Daventry masts, which will serve to support short-wave aerials to radiate to various Empire zones. Meanwhile, 350-ft. masts are taking the place of the original 80-ft. masts with which the Empire service was started.

So that, even when Daventry is no longer a part of the home broadcasting scheme, it will go on being one of the most important links in B.B.C. activities.

For reasons best known to themselves, the B.B.C. engineers consider the synchronising of London and West Nationals a success. This can be the only reason for their idea of erecting a relay transmitter to serve neglected South Wales, to be synchronised with West Regional. But that is looking ahead, rather.

Droitwich will have other important effects. For instance, when it provides the south coast with a really good National programme, the low-power transmitters at Bournemouth and Plymouth will not be restricted to relaying the National programme. They will be able to take a pick of the Regional programmes, and thus give their local listeners an alternative.

Claims of the extreme west and of the Duchy of Cornwall cannot be indefinitely ignored. It is likely that, to placate these listeners, who undoubtedly have a real grievance, the B.B.C. will move the present low-power Plymouth plant to a point outside the city and increase its power.

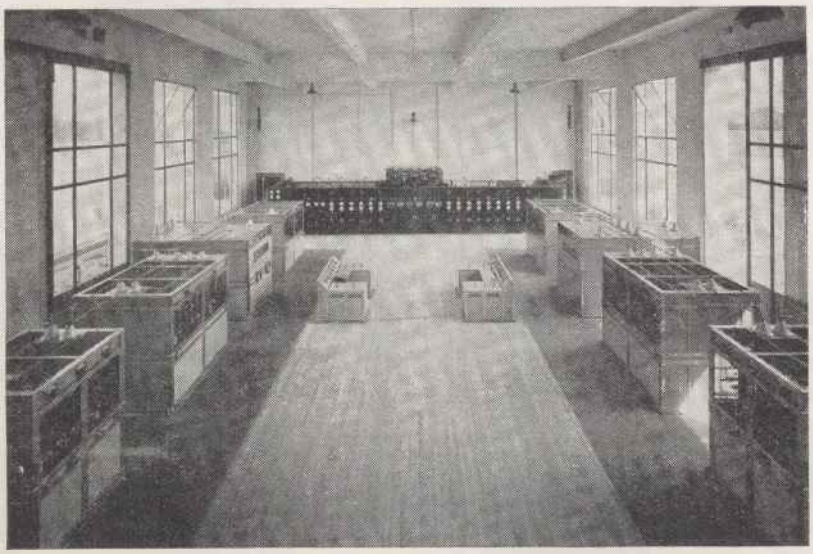
Another idea, which is not more than a remote possibility, is to erect a low-power relay right in the Duchy and synchronise it with Plymouth or West Regional.

So much, then, for impending station changes—all following the successful operation of the new Droitwich National. I have told you enough to prove that the old Regional Scheme is dead and a new scheme is coming.

I ought to have mentioned, perhaps, that Scotland will retain its little National, as the B.B.C. engineers are not confident that Droitwich will be able to supply a really good signal over the border.

As for feeding all these new radiation points, the B.B.C. system is remarkably well developed with up-to-date studios. Very little additional accommodation is contemplated. Bangor will be the only important addition, to serve Wales and West Country.

North-eastern Regional will be fed from the newly enlarged Newcastle studios and will be able to draw upon the palatial Manchester and Leeds studios; the West will have its studios at Cardiff, Swansea, and Bristol; Scotland will be well provided by Edinburgh, Glasgow, and Aberdeen.



TRANSMITTING HALL AT WEST REGIONAL

On the left you see the National transmitter and on the right the Regional gear. Very soon the National gear will be dismantled and erected in one of the new projected Regional areas

Here we give full constructional details of an ambitious super-het radio gramophone. It has been designed by S. Rutherford Wilkins and is described by the "Wireless Magazine" Technical Staff. The set is arranged with a push-pull output stage giving about 5-watts undistorted speech output. One-knob tuning and delayed self-adjusting volume control are two outstanding features of the design.

The "W.M." RADIOGRAM SUPER

ALTHOUGH this set is not everybody's meat—its size and cost preclude that possibility—yet every constructor will learn something from reading the description of it. It represents the last word in circuit arrangement and in construction—every worth-while trick of modern technique has been used in its production, and in its class it will be extremely hard to beat.

Many Months of Work

A receiver of this kind cannot be knocked up in a few days; it takes a week or two to get the best out of a simple three-valver, and when it comes to an ambitious multi-valve super-het like this "W.M." Radiogram Super, then the designer has to get down to many weeks of hard work before everything is working smoothly with really tip-top results.

In its final form the set approaches as near the ideal super-het as it is possible to get with present-day methods. There is, of course, tremendous power—both in the way of range and actual output—and it goes without saying that the selectivity is of a very high order.

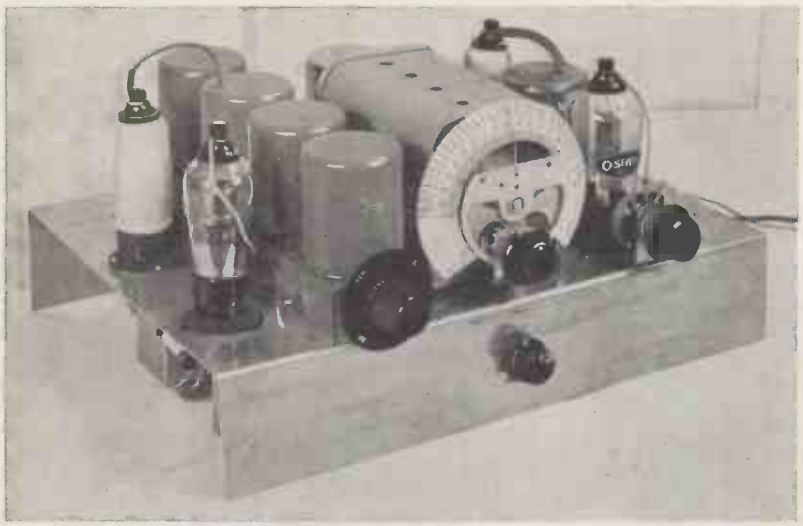
As a radio set the "W.M." Radiogram Super is something to take note of; and on the gramophone side its arrangement is equally impressive.

Let us look into this he-man's set stage by stage and see how and why certain things have been done. But before we do that let us just say that the set is arranged to operate from A.C. mains; and care should be taken to order the mains transformer for the correct voltage and frequency of supply.

Nine Valves Pulling their Weight

It will be seen from the photographs that there are nine valves in the set altogether, but not all of these are used at once. For radio reception seven valves are used in addition to the mains rectifier; and for gramophone-record reproduction four valves are used in addition to the mains rectifier.

The seven-valve radio part of the outfit comprises a six-stage super-het with one intermediate-frequency stage (working at 126 kilocycles, as is usual with all "Wireless Magazine" designs). There are only six actual amplifying stages because the last two valves



CONTROL LAYOUT ON THE RADIO UNIT

The four control knobs on the radio unit are, from left to right, the wave-change switch, the main tuner above the noise-suppressor control, and the radio volume control

SIMPLE AND EFFICIENT LAYOUT

As you can see from this back view of the radio unit, the condensers, coils, and two of the valves are screened to ensure complete stability. On the back of the chassis are the aerial and earth sockets

are arranged in a push-pull combination and count therefore only as one stage.

For gramophone work the first four valves are switched completely out of circuit, but an additional low-frequency amplifier to allow of good tone compensation is automatically switched in; thus there are four valves comprising three actual amplifying stages.

As the power stage remains unaltered the output remains the same whether the gear is used for radio or gramophone work; in each case there is between 4 and 5 watts undistorted speech output. This, of course, is enough to drive several loud-speakers, and anybody building the set up will have ample power to wire a number of reproducers up in various parts of the house.

The set would be ideal for a club house and is also suitable for use in quite large sizes of halls where the audience may be as many as 300 or 400 people.

Looking into the radio side first, we find that the six stages are arranged in the following sequence:

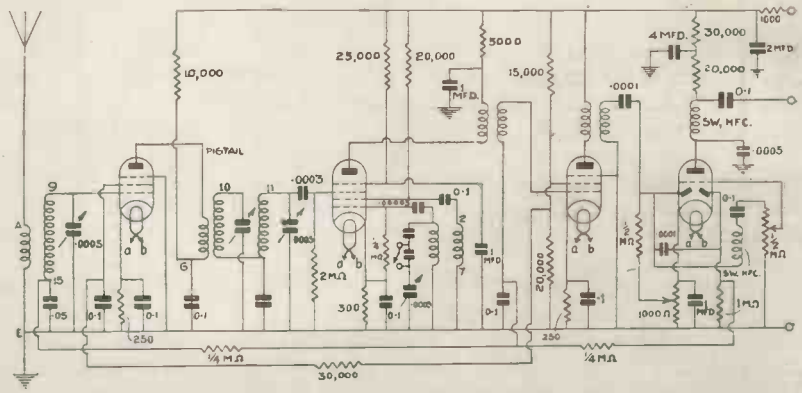
Very Latest Valves

(1) Preliminary high-frequency stage, making use of one of the latest high-frequency pentodes. This valve gives really good high-frequency amplification and, of course, obviates any possibility of second-channel interference. It is recognised that the preliminary high-frequency stage is desirable, and even essential, for the best results in the present congested state of the ether.

(2) The second valve is a combined detector-oscillator, and here a pentagrid is employed—the best valve that has yet been produced for this dual function. That, of course, is because it is really two valves in one (by the way, a pentagrid is the same thing as a heptode).

Intermediate-frequency Stage

(3) Then we come to the single intermediate-frequency stage, which is another high-frequency pentode giving a high degree of amplification. This valve amplifies at a frequency of 126 kilocycles and needs two intermediate-frequency transformers; these, however, are fixed-tuned and do not need any adjustment at all by the operator.



CIRCUIT OF THE "W.M." RADIOGRAM SUPER

As you can see from this circuit, four valves are used in the radio unit, and in the amplifier there are two stages of low-frequency amplification besides the push-pull output. Only one of the low-frequency amplifiers is used when the set is on radio, both are brought in use for gramophone reproduction

(4) The second detector is another combination valve, a double-diode-triode. One diode rectifies in the usual way; the second diode is used for getting self-adjusting volume control; and the triode amplifies the rectified signals before passing them on to the next stage.

(5) The fifth valve is an intermediate low-frequency amplifier, not often found in present-day sets but needed here because a large grid voltage is needed to load up the two push-pull power valves.

Push-pull Output

(6) The sixth stage is the push-pull output arrangement. For the sake of quality—tone compensation would be needed if pentodes were employed—triodes are used in this stage. Each gives an undistorted output of the order of 2.5 watts, so that the set will give all that any ordinary user can possibly require of it.

That is all very well, you will say, but how many controls do all those valves entail? That is a point that has been carefully watched, with the result that there are only four controls on the front of the set. But before we go into their functions there are the tuning arrangements to be considered.

Eight Tuned Circuits

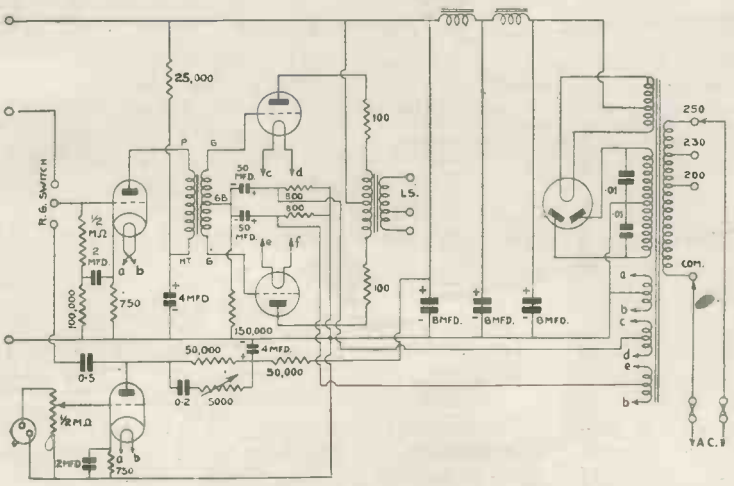
In all there are four variable-tuned circuits and four fixed-tuned circuits, making a total of eight: this number means that the selectivity is all that can be desired and that stations working on adjacent wavelengths under the Lucerne Plan, except when the set is used within a few miles of a broadcasting station, can be separated without difficulty.

ANOTHER BACK VIEW OF THE RADIO UNIT

This photograph emphasises the simplicity of the radio unit. The set has been designed so that the beginner with little experience at set construction will find building a really easy job. The metal chassis can be obtained ready drilled

HOW THE AMPLIFIER SECTION IS ARRANGED

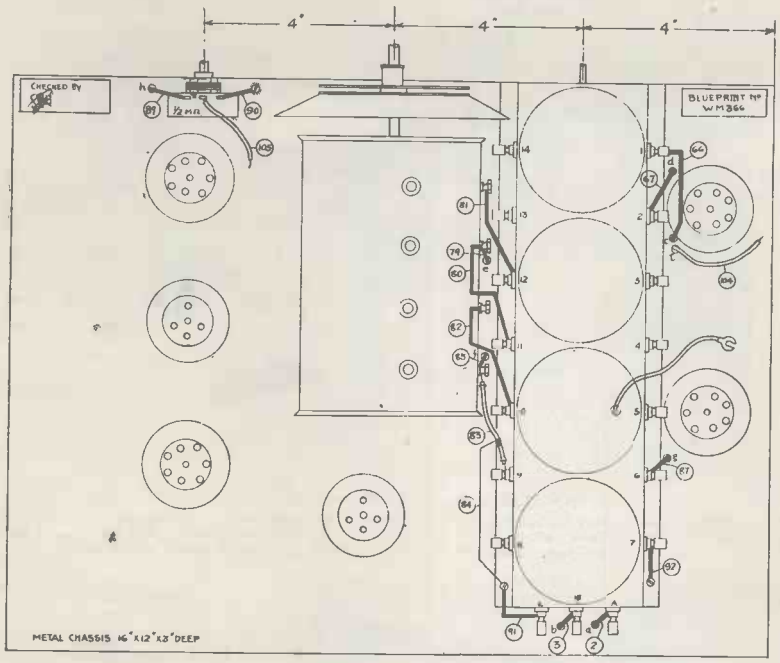
The amplifier unit contains the whole of the low-frequency portion of the set, together with the mains-rectification and smoothing circuits. The plugs and sockets are for the mains input and a spare one for use if required

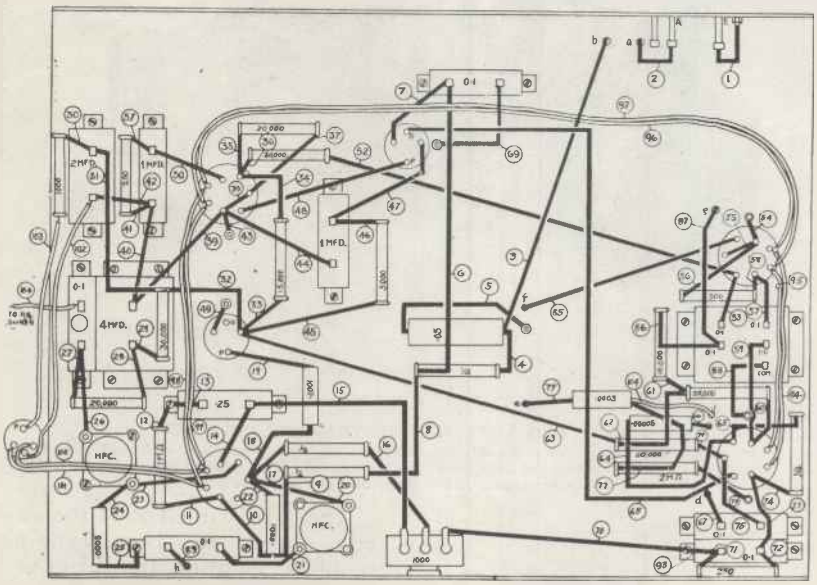


The aerial circuit is of the single type, but there is a band-pass coupling between the first high-frequency pentode and the pentagrid detector-oscillator. There are a number of advantages of having the band-pass circuit in this position instead of in the aerial circuit, not the least being that the ganging is considerably simplified. The fourth tuned circuit is the oscillator coil.

It will be noted that the coils used in the "W.M." Radiogram Super are of the air-core type and are not iron-core models. In a super-het with a number of tuned circuits sufficient selectivity can be obtained without the use of iron-core coils; which is why few manufacturers have

Quarter-scale Wiring Plans





QUARTER-SCALE WIRING PLAN OF THE RADIO UNIT

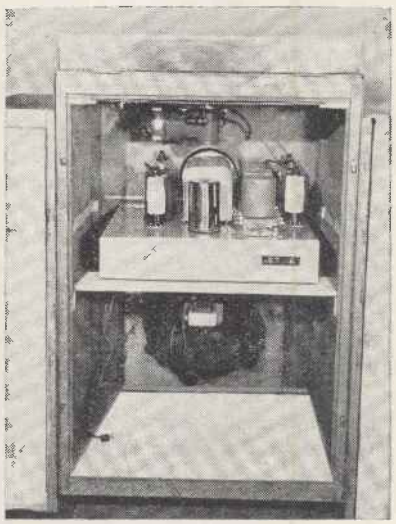
Full-size blueprints of the radio unit, shown above, and the amplifier section, shown on the next page, can be obtained for half price—that is 9d., post paid—if the coupon to be found on the last page is used before July 31. Your application should be addressed to the "Wireless Magazine" Blueprint Department, 58-61 Fetter Lane, London, E.C.4

yet worried about developing iron-core models for super-het work. In practice very little would be gained by the substitution of iron cores for air cores, and there is no doubt that the ganging would be more difficult than it is.

All four circuits are tuned by a single four-gang condenser. Ganging is not as difficult in practice as it is with some sets using fewer valves. It will be seen from the circuit diagram that the aerial coil is provided with an aperiodic winding so that the aerial load remains substantially constant. Because the aerial load has been removed from the band-pass circuit this part is easier to keep in gang. And the oscillator coil, which is of a new type, also remains in step throughout the wave ranges covered by the set without a lot of fiddling.

Double-diode Triode

The chief interest in the set centres in the double-diode triode. The



THE SET IN ITS CABINET

The radio unit fits snugly into the top half of the cabinet while the amplifier is fixed vertically behind the loud-speaker at the bottom

self-adjusting volume control is delayed so that full amplification is obtained on weak signals. This "delay" simply means that the first high-frequency and intermediate-frequency valves are not biased until signals reach a certain level; when they do reach that level the self-adjusting volume control comes into action.

Full A.V.C.

The self-adjusting control voltage (or A.V.C., if you prefer to call it that) is fed back to both the preliminary high-frequency stage and also to the intermediate-frequency stage so that full control is obtained. In practice it will be found that fading of signals is reduced to such an extent that to all intents and purposes it is non-existent for the majority of stations that you are likely to want to pick up.

Unavoidable Fading

Of course, with bad fading on distant low-power stations there will be a variation in strength, but that is unavoidable with any system of this kind.

The decoupling incorporated in the set is extensive—as it needs to be when there are so many valves that are likely to go "up the loop" unless adequate precautions

are taken. It will be noted that the grid circuits of the push-pull valves are decoupled to obviate low-frequency oscillation in the output stage.

High tension is obtained by means of a valve rectifier connected to the mains transformer; this is of the full-wave type, and a double smoothing circuit is employed. With seven valves it is necessary to take what may seem to be elaborate precautions to keep down the mains hum; but the hum has been kept down to limits that will satisfy the most fastidious, and we do not anticipate any criticisms on this score.

Advantages of Large Electrolytic Condensers

Most of the large-capacity condensers used in the set are of the electrolytic type to save both space and money. Electrolytics are much smaller than paper types for a corresponding capacity, and they are also much cheaper.

So much for the radio end of the gear; now let us consider the gramophone arrangements for a moment. As has already been pointed out, the first four valves are automatically switched out of circuit when the gramo-radio switch is put over for electrical reproduction of records.

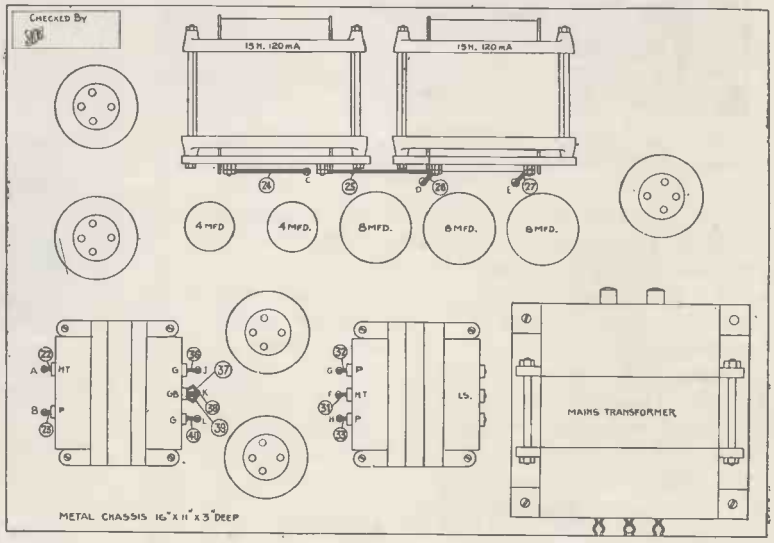
Full Tone Compensation

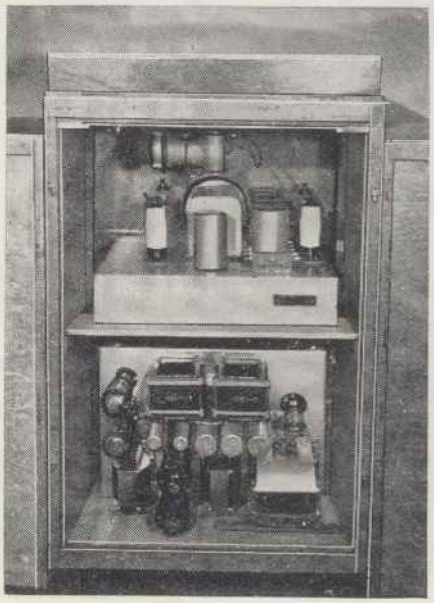
More than this, however, an extra low-frequency valve is brought into use. This is employed so that full tone compensation can be obtained without affecting the total amount of amplification available. Tone control resolves itself into cutting down the strength of the frequencies above a certain level, and if the volume is not to suffer it is obviously necessary to provide amplification to make up for this cut-off, which may be at either end of the frequency scale.

The tone-compensating arrangement used is a resistance and condenser in the anode circuit of this extra valve; the tone being controlled as the user desires by altering the value of the resistance, which is made variable for this purpose. Once the tone has been adjusted to suit individual tastes, it will not be necessary to change it, so this resistance has been mounted on the back of the chassis, out of the way.

Controls for Radio and Gramophone

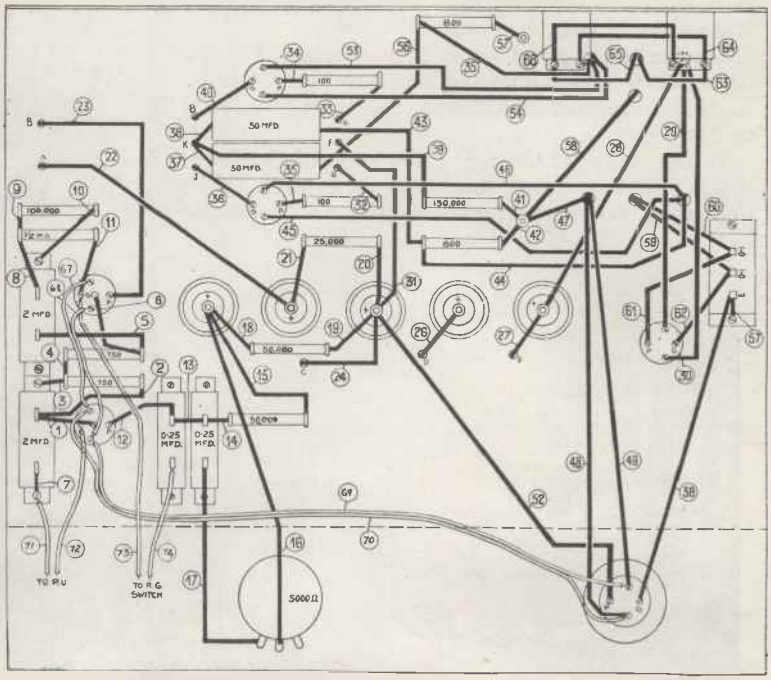
Separate radio and gramophone volume controls are provided, the former on the front of the set and the latter on the motor-board under the lid of the radio-gramophone cabinet. Whilst mentioning that, let us





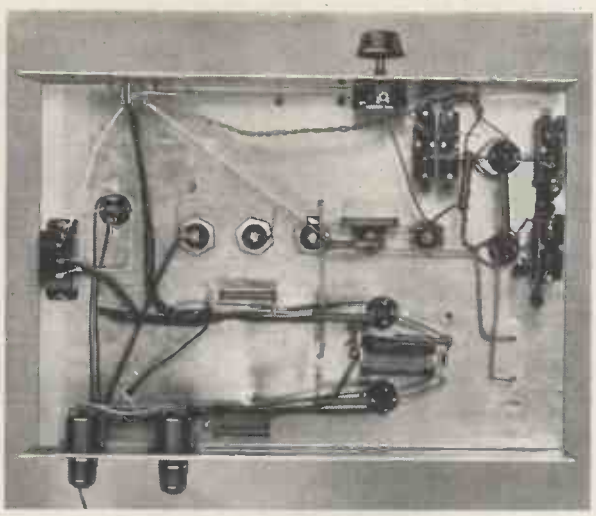
THE FINISHED OUTFIT

You can see very clearly how the set and amplifier chassis are arranged by this photograph and that at the top of the previous page



QUARTER-SCALE WIRING PLAN OF THE AMPLIFIER SECTION

In conjunction with the above wiring plan and that on the previous page, you should find no difficulty in building up the "W.M." Radiogram Super. Of course, you will find a full-size blueprint of immense value; they can be used as templates and every wire is numbered in the best order of assembly



PLAN OF THE AMPLIFIER UNDERSIDE
There are very few components mounted on the underside of the amplifier section and the wiring, as you can see, is quite straightforward

point out that the model used for housing our original set is provided with compartments at each side for storing a selection of discs.

For the sake of convenience we have used a motor-board that is obtained from the makers complete with turntable, pick-up and volume control, all mounted together as a single unit on a stout metal plate. This can be fitted into the top of the radio-gramophone cabinet without difficulty and the user is spared the trouble of drilling holes for fitting up the various components.

How the Controls are Arranged

The controls on the front of the set are four in number and are arranged in the following way, as will be clear from the photographs.

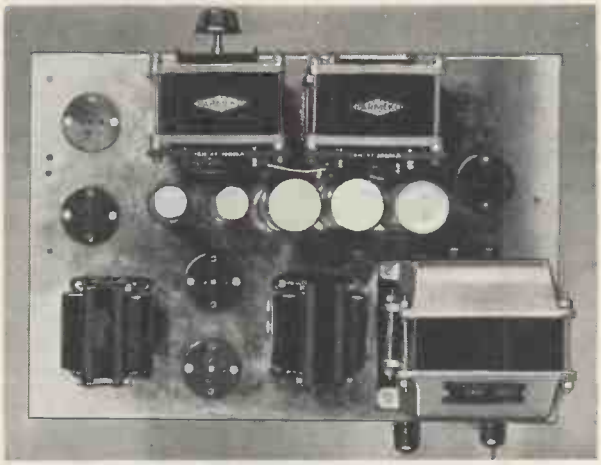
On the left is the wave-change switch. The set covers the usual medium and long wavebands, that is, from 200 to about 550 metres, and from about 800 to 2,000 metres.

In the centre at the top is the knob of the four-gang condenser; below this is a noise control. This delays the rectifying action of the signal diode on the weak mush signals. On the right is the radio volume control.

Besides these controls there are, as already mentioned, the gramophone volume control on the motor-board and the tone control on the amplifier chassis. The radio gramophone switch is also mounted on the motor-board.

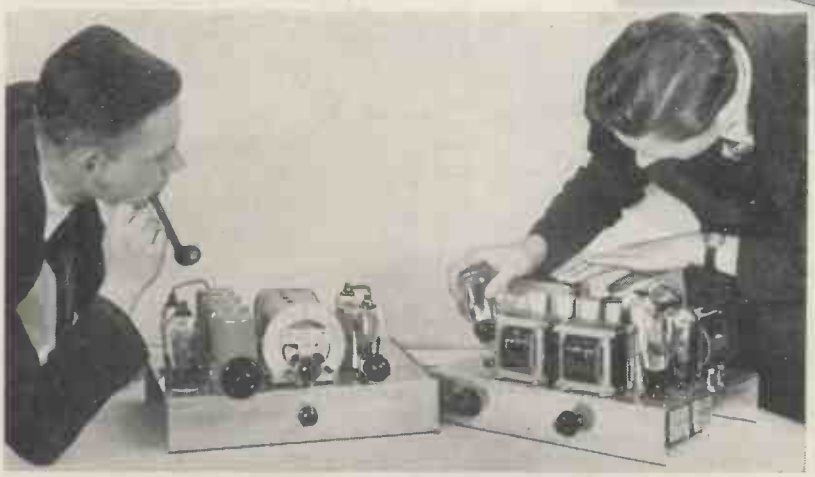
Using an On-off Switch

It will be noted that we have said nothing about an on-off switch. Actually we have not incorporated one anywhere in the original design. As the current taken by the whole outfit is comparatively heavy, it



TOP OF THE AMPLIFIER UNIT
Nothing difficult about this! The two smoothing chokes are at the top, the electrolytic condensers in the centre, and the push-pull and mains transformers at the bottom

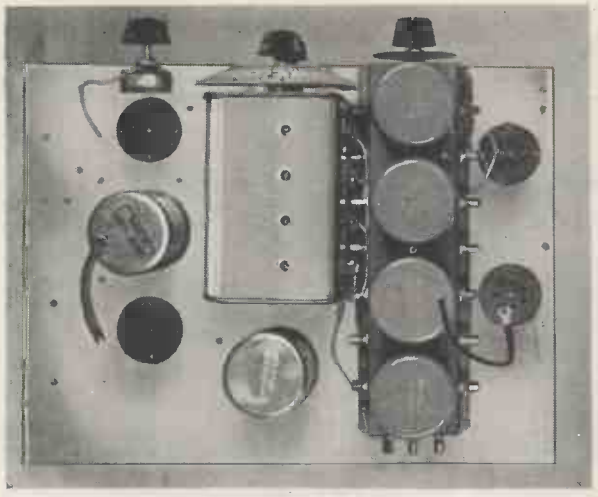
FRONT VIEW OF THE AMPLIFIER
The control on the right is the tone compensator and the valve-holder socket is for inserting the plug which carries high- and low-tension current to the radio unit



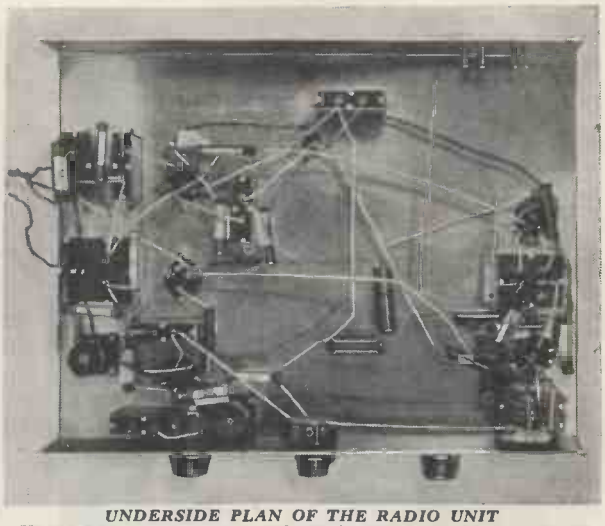
AN OUTFIT FOR THE CONNOISSEUR!
Builders of the "W.M." Radiogram Super will have a super set of which they will have every right to be proud!

is safer to switch the set on and off at the mains socket. For this reason we advise the use of a wall socket that is combined with a switch and fuses. A suitable unit is made by M.K. Electric, Ltd., and Varley's also make a similar fitting but with a power switch.

When it comes to construction the first point to note is that the set is built up in two sections; the first contains the first four valves and is



TOP OF THE RADIO UNIT
Used in conjunction with the wiring plan on page 506, constructors will be able to see exactly how the wiring is carried out on this side of the radio unit



UNDERSIDE PLAN OF THE RADIO UNIT
How the few components on the underside of the radio unit are arranged can be seen from this plan view. All the fixed resistances are supported by the wiring

purely a radio combination. The second part of the set contains the low-frequency stages (including the tone-compensating valve) and all the mains-rectifying gear.

Both parts are built up on stout metal chassis and look very professional in appearance, although they are quite accessible and easy to assemble and wire.

In these pages we reproduce at quarter scale the layout and wiring guides for both parts of the set; as usual, a full-size blueprint is available at half price, that is, 9d., post paid, for those who desire one. It should be noted that this price includes both parts of the set; they are not supplied separately. Applications for these half-price blueprints must be accompanied by the coupon to be found on the last page of the issue and must reach us not later than July 31; the address is "Wireless Magazine" Blueprint Dept., 58/61 Fetter Lane, London, E.C.4. Remember to ask for blueprint No. WM366 when ordering.

Two points should be noted about the blueprints, and the quarter-scale reproductions that appear in these pages. All the connecting wires are numbered in the best and most convenient order of assembly, and the holes in the chassis for leading wires through from the top to the bottom are marked with small letters so that there shall be no confusion as to which is which.

If the constructor intends to drill his own chassis (they can be obtained already drilled with holes for fixing screws and connecting leads for a few shillings) the full-size blueprint should be used as a template for marking out the positions of all the holes to be drilled.

Continued on page 571

COMPONENTS NEEDED FOR THE "W.M." RADIOGRAM SUPER

	£	s.	d.
CHASSIS			
1—Peto-Scott aluminium 16 in. by 12 in. by 3 in.		7	6
CHOKES, HIGH-FREQUENCY			
2—Wearite, type HFS (or Goltone)		9	0
COILS			
1—Set Wearite, type GN4	2	0	0
CONDENSERS, FIXED			
5—British Radiophone, type tubular, values: .00005-, .0001- (2), .0003-, .0005-microfarad (or T.M.C. Hydra, Telsen)		2	6
1—T.M.C. Hydra, type tubular, value .05-microfarad		1	0
10—T.M.C. Hydra, type 25, values: .1- (6), 1- (2), 2-, 4-microfarad (Dubilier, T.C.C.)	1	1	6
1—T.M.C. Hydra, type 40, block comprising .1- (3), 1-microfarad (1)		5	0
CONDENSERS, VARIABLE			
1—Polar four-gang .0005-microfarad, type Star Minor, complete with semi-circular slow-motion drive	1	10	9
HOLDERS, VALVE			
6—Clix, type chassis-mounting, four-pin (2), seven-pin (4)		5	4
RESISTANCES, FIXED			
19—Erie, values: 250- (2), 300-, 1,000-, 5,000-, 10,000-, 15,000-, 20,000- (3), 25,000-, 30,000-ohm (2), ¼- (3), ½-, 1-, 2-megohm (or B.A.T., Telsen)		19	0
RESISTANCES, VARIABLE			
1—Claude Lyons 1,000-ohm, type M1		5	6
1—Claude Lyons ½-megohm, type ST500		6	6
SUNDRIES			
1—British Radiogram 1½ in. metal mounting bracket			4½
1—British Radiogram 4-pin adaptor		2	0
1—Bulgin single-pole change-over toggle, type S81T		1	6
4—Bulgin knobs, types K14 (3), K12		1	7½
Round tinned copper wire No. 20 gauge, for connecting, say			9
Oiled sleeving, say		1	0
4 yds. thin flex, say			4
1—Clix terminal strip, marked: A1, A2, E			7
TRANSFORMERS, INTERMEDIATE-FREQUENCY			
2—Wearite, types OT1, OT2		15	0
AMPLIFIER UNIT			
CHASSIS			
1—Peto-Scott aluminium, 16 in. by 11 in. by 3 in.		7	0
CHOKES, LOW-FREQUENCY			
2—Parmeko 15-henry 120-milliampere, type D15/120	3	10	0
CONDENSERS, FIXED			
4—T.M.C. Hydra, type 25, values: .25-, .5-, 2-microfarad (2)		9	9
1—Dubilier, type BE328, value: .02-microfarad centre-tapped		2	6
2—Ferranti, electrolytic type 92, value: 50-microfarad		7	0
5—Dubilier, electrolytic type 500-volt working, values: 4- (2), 8-microfarad (3)	1	5	6
HOLDERS, VALVE			
6—Clix, type chassis-mounting four-pin (3), five-pin (3)		4	3
RESISTANCES, FIXED			
12—Erie, values: 100- (2), 800- (2), 750- (2), 25,000-, 50,000- (2), 100,000-, 150,000-ohm, ½-megohm (or B.A.T., Telsen)		13	0
RESISTANCE, VARIABLE			
1—Claude Lyons 5,000-ohm (or Ferranti)		5	6
SUNDRIES			
2—Bulgin flush-mounting mains plugs and sockets, type P20		4	0
Round tinned copper wire, No. 20 gauge, for connecting, say			9
Oiled sleeving, say		1	3
3 yds. thin flex, say			3
TRANSFORMERS, LOW-FREQUENCY			
1—Ferranti, type AF5c	1	14	0
1—Ferranti, type OPM6c	1	6	6
TRANSFORMER, MAINS			
1—Sound Sales, type 25M	2	2	6

ACCESSORIES

	£	s.	d.
CABINET			
1—Peto-Scott, type Adaptagram de Luxe	6	10	0
GRAMOPHONE MOTOR AND PICK-UP			
1—Garrard, type 202A with volume control	4	6	9
HOLDERS, FUSE			
1—Bulgin twin, type F14, complete with 1-ampere fuses		2	3
LOUD-SPEAKER			
1—Magnavox permanent-magnet, type 252	3	3	0
VALVES			
2—Mazda AC/VP1 (*pre-high-frequency and intermediate-frequency amplifiers*)	1	15	0
1—Ferranti VHT4 (*Detector-oscillator*)	1	0	0
1—Marconi MHD4 (*second detector*)		15	6
1—Marconi MH4 (*tone-corrector valve*)		13	6
1—Marconi MHL4 (*low-frequency amplifier*)		13	6
2—Marconi PX4 (*output valves*)	1	13	0
1—Ferranti R4 (*rectifier*)		15	6

The prices mentioned are those for the parts used in the original set; the prices of alternatives as indicated in the brackets may be either higher or lower

An enthusiastic amateur, W. E. Everard, uses a Murphy A8 super-het receiver with a R.I. Antinodal short-wave converter. He has picked up hundreds of stations from all parts of the world

New Converters for Short-wave Listening

By the "W.M." Technical Staff

NOW that world-wide short-wave stations are radiating programmes that can be picked up on the simplest apparatus, the more important set manufacturers have been quick to realise the importance of short-wave listening.

In the early days we used to pick up America on headphones, but background noises and fading made the transmission valueless from the entertainment point of view.

Not Luck !

In these days of high-power short-wave stations everyone with a wireless set of any kind should take steps to make sure that long-distance programmes are receivable.

No longer is it a matter of luck whether you pick up any stations at all, for so much data has been collated from all parts of the world that we all should know what stations can be heard and when.

Short-wave fans will bear witness to the fact that with a moderately good short-wave set an average of twenty to thirty stations can be relied upon to give programmes of reasonable entertainment value to while away an evening's listening.

If any further proof is required, just consider for a moment the position regarding the various stations in many big countries that have been erected for the sole purpose of providing programmes for Colonial listeners.

There are four examples that instantly spring to mind. Our own Empire stations which, in addition to being picked up in the Empire, are heard by foreigners all over the world.

FYA, Radio Colonial in Paris, is another example of the efficiency of the short waves, for this station maintains a regular schedule with different French colonies, including Indo-China.

Stations Worth Hearing

And so we go on—Pittsburgh, Schenectady, Zeesen, Nairobi; these are but names to the ordinary listener, but to the owner of a short-wave converter or adaptor these names mean programmes of real entertainment value.

Unfortunately owners of sets which only cover broadcast wavelengths have, until just recently, been in a difficult position, for suitable adaptors were few and far between.

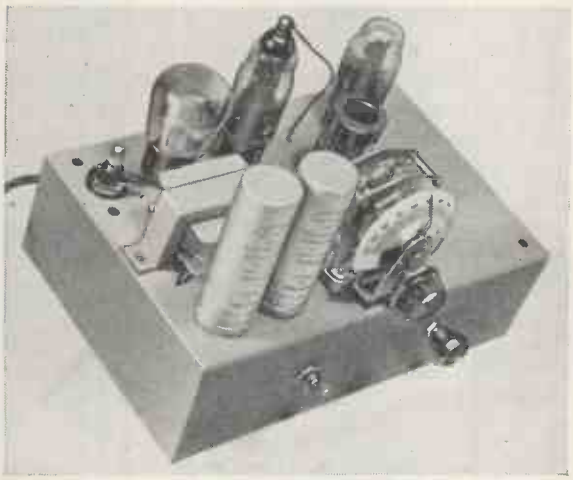
Efficient Super-het Converter

One of the first set makers to come to the rescue of such listeners was Kolster-Brandes, who made special provision on most of their receivers for the use of a short-wave converter. They went still further and designed a special all-wave super-het for new listeners.

After improving the original K.B. converter out of all recognition, it is, as may be well imagined, one of the best of its kind.

This converter is designed for use with Kolster-Brandes receivers, but it can be used with any commercial or home-built receiver—with one or more high-frequency stages—and will turn it into a powerful short-wave super-het.

It consists of one of the latest high-frequency pentodes used as a combined

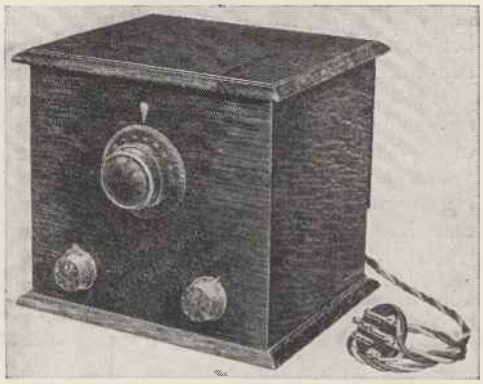


UNIVERSAL MAINS SHORT-WAVE CONVERTER
This short-wave converter, made by Universal High Voltage Radio Co., incorporates its own power pack and can be used on both A.C. and D.C. mains

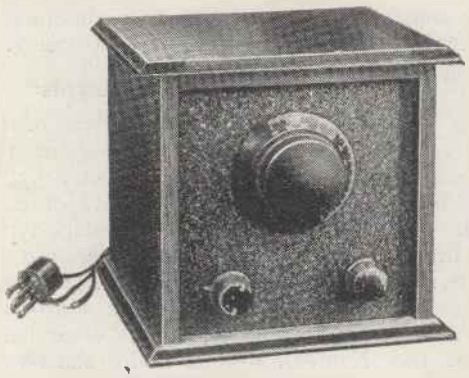
oscillator-detector, with internal dual-range coils for all wavelengths between 15 and 80 metres.

As these wavebands cover all of the more important stations, such as Boundbrook, Pittsburgh, Sydney, Cape Town, Buenos Aires, and Rio de Janeiro, one can fairly claim to be in touch with the whole world.

In order to obviate the necessity of mains pack duplication, the unit is provided with a plug, which is connected to the family set to obtain the little current required.



INTERESTING SHORT-WAVE CONVERTER
This Unit short-wave converter is interesting in that it can be used on A.C. and D.C. mains or with batteries as the user desires



SHORT-WAVE ADAPTOR
This neat-looking short-wave adaptor, made by J. J. Eastick & Sons, incorporates a dual-range coil of special design

The total cost of the unit is only £4 10s., and this figure represents the total expenditure of converting your set into a short-wave super-het. Remember that the conversion only takes a matter of seconds.

Universal Converter

When the family receiver is operated from D.C. mains a little difficulty may be experienced in obtaining a suitable converter or adaptor. I have used for some time a unique unit that embodies its own power pack and, at the same time, is suitable for either A.C. or D.C. mains, without any alteration.

This converter, marketed by the Universal High Voltage Radio Co., is a two-stage affair using a high-frequency stage in front of a combined first detector and oscillator. This extra valve increases the range very greatly and makes quite sure that a lengthy aerial will not cause blind spots.

As the mains equipment is self-contained, there is no need to worry about tapping the broadcast set. All that one has to do is to link the converter to the broadcast set by means of a single wire and the job is done.

With this unit all wavelengths between 12.5 and 180 are covered, so that it is doubly universal. There are two receiving valves and a mains rectifier in this unit, which costs only £6 6s.

Such a unit can be made up by the home constructor using Ostar-Ganz valves and, as you can see by the circuit Fig. 1, reproduced in these pages, construction will not be a difficult job.

Where a more simple type of broadcast set is in use, such as one without a high-frequency stage, a modified circuit must be used. This is called an adaptor and must not be confused with the converter we have just mentioned, which can only be used with sets having one or more high-frequency stages.

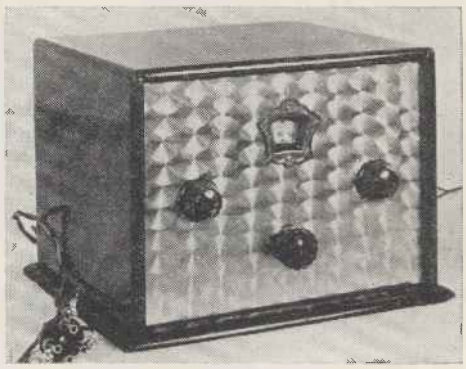
An adaptor is a unit which consists of a tuning circuit for the short waves only and is plugged into the detector valve holder of the ordinary set. This adaptor then takes the place of the detector stage as far as the tuning circuit is concerned; the low-frequency stages are used in the normal way.

Although the adaptor is not so good as the converter, it is simple to operate, cheap to build or buy and, in a beginner's hands, is likely to bring in more stations.

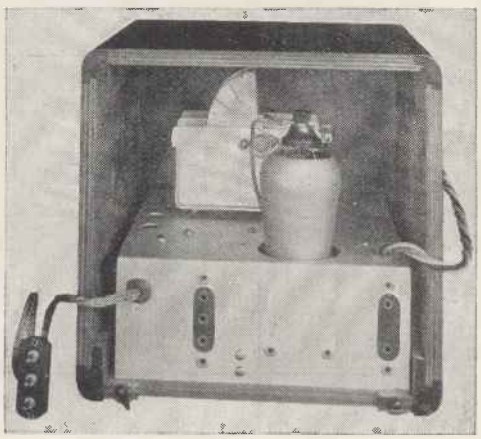
Suitable Adaptors

One of the best known adaptors is that made by J. J. Eastick & Sons and called the Eelex Duplex model and costing £2 12s. 6d.

It is suitable for either battery or mains-operated receivers; an internal switch changes over from one source of supply to the other.



ADAPTOR BY PETO-SCOTT
An efficient adaptor for short-wave working is that made by Peto-Scott and selling for 45s. It operates from batteries and A.C. mains



WELL-SCREENED DESIGN
This short-wave converter is made by Kolster-Brandes for use with their own sets, but it can be used with most commercial sets

The special coil provided covers all wavelengths between 16 and 30 metres and 28 to 60 metres. When it is used with a receiver having one or more low-frequency stages it is a comparatively easy matter to tune a large number of American stations as well as some from Australia and Asia.

A new firm with the right idea about short-wave reception is Unit Radio, who have designed a very interesting unit. It can be used with batteries, A.C. or D.C. mains and as either a converter or an adaptor.

This unit, although only cost-

ing £1 17s. 6d., covers all wavebands between 15 and 100 metres and is supplied with two plug-in coils.

It is simple to operate, there being only one main tuning control and an unimportant reaction condenser.

Peto-Scott have long been associated with short-wave gear, so that their latest adaptor must not be forgotten. This consists of a highly

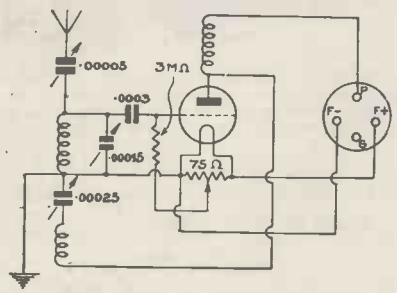


Fig. 2.—This is a circuit for a simple battery-operated short-wave adaptor

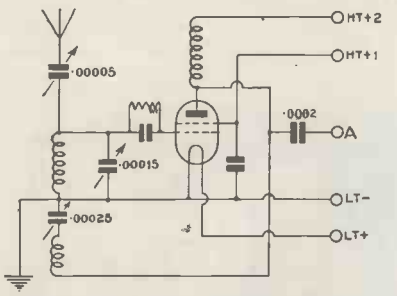


Fig. 3.—A circuit for a unit for converting a domestic set into a short-wave super-het

efficient tuning coil covering the wavelengths of all the worth-while short-wave stations without switching. The unit is suitable for battery or A.C.-mains working without alteration, and it can be used with almost any standard broadcast receiver.

Simple Operation

This Peto-Scott adaptor is, without question, a simple unit to operate and, at the price of £2 5s., it is a real short-wave investment.

A circuit of a simple plug-in adaptor for the home constructor is shown in Fig. 2. It consists of a tuning coil, a .00015-microfarad tuning condenser, a .00025-microfarad reaction condenser, the usual valve holder, high-frequency choke, and grid-leak condenser circuit.

In Fig. 3 we have shown the circuit of a simple battery-operated short-wave super-het converter, with a screen-grid valve used as a combined detector-oscillator. The values of all the components are given in the circuit diagram and, therefore, you will be able to build it up at home with little difficulty.

There are two low-tension connections, but no high-tension negative connection. In practice the two filament leads are taken either to the 2-volt accumulator of the set or the low-tension terminals on the set itself, in which case there is, of course, no need for a high-tension negative lead.

On the other hand, if for some reason or other you use a separate accumulator, then the two negative terminals of the accumulators must be joined together.

A Magnum unit manufactured by Burne-Jones & Co., Ltd., appears—from our initial tests—to be more than usually simple to operate.

This unit is suitable for almost any kind of British or American mains-operated or battery-driven set, which makes use of one or more high-frequency stages. It is the usual type of combined oscillator-detector and is connected between the receiving set and the aerial so that all of the valves in the receiving set are used. This is a great advantage over the picture type of unit which only uses the low-frequency amplifying valve.

With the unit are supplied two short-wave coils covering all wavelengths between 18 and 40 metres and 38 and 80 metres. The price is only £2 5s. As it requires a special valve and in some cases entirely separate high and low tension, the necessary batteries can also be supplied on request.

With these additional components the cost rises to £3 3s.

Simplicity of operation is of great importance with short-wave listening. The Magnum unit has only three controls; a master tuner, combined reaction and volume control and an on-off switch. Two aerial and two earth terminals are provided so that the external aerial and earth can be connected directly to the unit; connections from the unit are linked to the aerial and earth terminals on the receiver.

No difficulty will be experienced in tuning-in such stations as W2XAD, Pittsburg, as well as other well-known short-wave stations provided care is taken in operating.

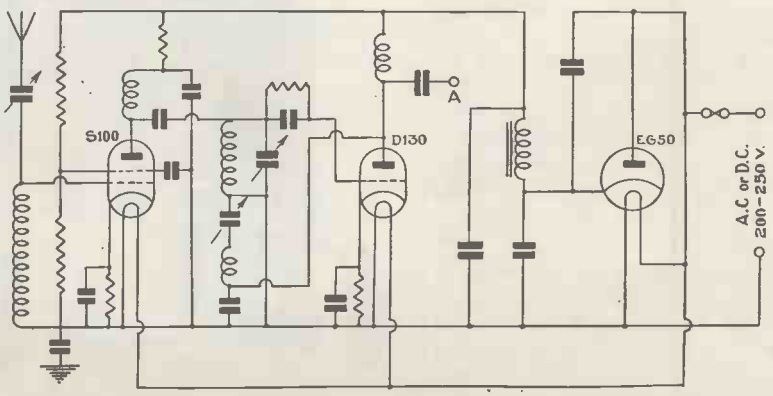
Standard Components

Adaptors and converters of the varying types mentioned in this article can all be constructed by the amateur; in the majority of cases the components are standard types. The coils, for example, can be purchased from any of the manufacturers specialising in short-wave components or, on the other hand, Kenneth Jowers, in his short-wave notes on page 547, gives details for making a short-wave coil at home.

Making H.F. Chokes

High-frequency chokes can be purchased for a few shillings. If you are of a constructional turn of mind this is one of the components that really can be made and is well worth the making.

Any chemist will supply a glass test-tube of ½-in. diameter and about 4 in. long. This tube, complete with cork, only costs about 2d. Wind on the tube about 100 turns of 30-gauge double-silk-covered wire fasten the ends by means of some Chatterton's Compound and fix the whole to the baseboard by screwing down the cork. This makes an efficient short-wave choke.

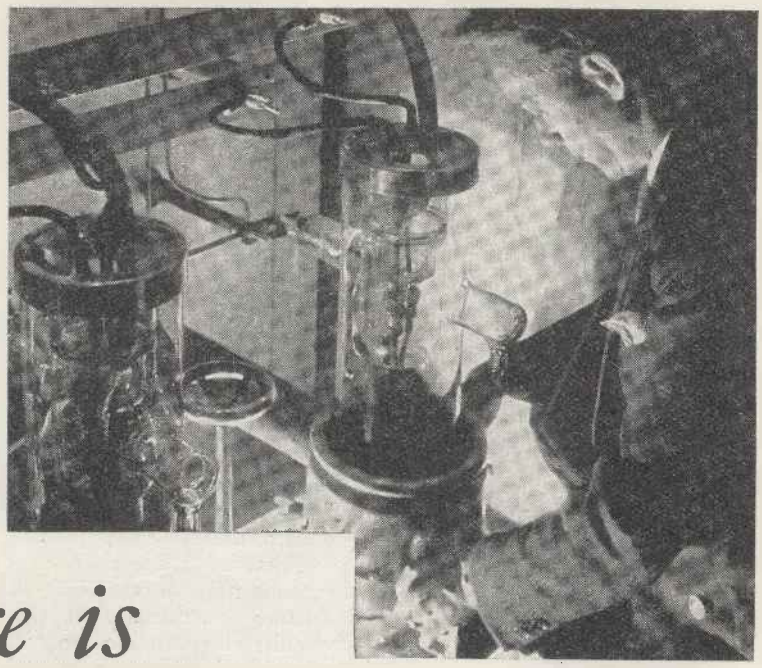


CONSTRUCTOR-BUILT UNIVERSAL MAINS CONVERTER

Fig. 1.—This circuit for an A.C./D.C. converter uses Ostar-Ganz high-voltage valves and does not rely for its power on the domestic set. Constructors should find no difficulty in building up an adaptor to this design

HOW much does a set amplify? It is rather difficult to say, because of the different transformations of energy between the ether and the final air wave from the loud-speaker. Overall specification of amplification also becomes impossible because of the interposition of detection, and we may have two such stages (as in a super-heterodyne) giving frequency conversions which completely upset simple equations such as x times y equals z.

The intermediate-frequency stages of a multi-valve super-heterodyne may have a voltage amplification of the order of 10,000; amplifiers of special characteristics and of gains of a million times (in voltage) and more are in use for various purposes.



Crosley photo

Joseph Chambers, engineer of the American Crosley stations, handling one of the huge 100,000-watt water-cooled valves at WLW, the new 500-kilowatt transmitter which has just been put into regular service

Why There is a Limit to Amplification

By G. S. SCOTT

But for our present purpose the quotation of actual limiting figures is of little concern.

The main point is that there are definite limits of amplification—we cannot go on indefinitely.

Inherent Instability

These limits, or rather the factors governing them, have, however, varied in the history of amplifier development. The very first serious limit encountered was that of the inherent instability of a number of stages, especially in the bad old days before we knew all the tricks we do now.

Instability is, of course, another word for oscillation, but is applied particularly to uncontrollable and undesirable oscillation.

Even in the very earliest days—when we used to pile up low-frequency amplification—it was not very difficult to run into audible " hooting." Later, when high-frequency amplification with three-electrode valves became fairly general, high-frequency instability became the bane.

Super-heterodyne methods, neutrodyning, the screen-grid valve, and general screening within the set, all represent successive steps in the struggle to combat it. Neutrodyning in broadcast receivers is now effectively dead, but the others mentioned still play their parts in the building up of high-frequency amplification without instability.

Incidentally it is interesting to recall that this was practically the sole genesis of the super-hetrodyne system. The development of the screen-grid valve eclipsed it for a few years, and its revival in recent years has been dictated as much as anything by the ease with which it gives us band-pass characteristics—more, indeed, for this reason than for needs of stability. At the same time, the division of total gain into different frequencies is inherently a good thing.

Problems of instability are now pretty well solved, but we still have an outstanding problem which imposes a very definite limit on the amount of amplification that we can use. This is noise !

Signal to Noise Ratio

It is being increasingly recognised that the final factor governing reception in all cases, broadcast or commercial, is the ratio of signal to noise. If, for any reason, this ratio is bad, then our efforts at amplification are useless, for amplifying is of little value if it brings up noise and leaves the signal unintelligible.

While uncontrolled oscillation was a real difficulty, it was almost invariably the case that instability took charge first and *noise as such* was not so serious. Now it is !

Noise Explained

The term " noise " is, of course, a very wide one. A.C. hum might reasonably be regarded as coming within the description. Interference from atmospherics and from man-made static definitely comes within the general description of noise, especially so far as concerns a good signal-to-noise ratio, which determines whether our signal is intelligible as communication or enjoyable as a programme.

HUGE SHORT-WAVE RECEIVER

A new Marconi receiver which operates by the diversity method of reception to prevent fading. A huge amount of amplification is used, twenty-nine valves in all being utilised

Apart from this incoming noise, however, there is still a serious source of noise which can best be described as self-generated in the set. In the first place set-noise can be generated by a number of means. Loose contacts of any sort are a well-known source of aggravating noise. Defective high-tension batteries can give a good approximation to the same thing.

Sources of Noise

So can badly fitting valves, and badly soldered joints can produce quite a fair imitation of any type of annoying noise that can be imagined. Internal defects in valves, also, are not unknown, and a noisy high-frequency valve can produce effective modulation of the carrier which comes through the detector and low-frequency stages as an audible noise.

Different valves of the same type can, and do, behave very differently as noise-producing agencies when used as oscillators in a super-het. Incidentally, however, the increase of noise in a super-het when the oscillator is introduced must not necessarily be blamed on that valve. The introduction of the oscillator gives an enormous increase of sensitivity to the detector and this may bring up noise from an earlier high-frequency circuit which the desensitised detector (in the absence of heterodyne) failed to reveal. This is quite apart from differences in sheer noise-production as between one valve and another of the same type.

All these internal sources can, however, be regarded as artificial in that they are all capable of being corrected by methods within the knowledge and skill of man.

There still remain, however, two further sources of noise which must meantime be regarded as fundamental and natural because they are caused by electrons, and by the fact that we cannot get away from electrons.

These are, respectively : (*a*) spontaneous noise in the electrical conductors (particularly of the input circuit) attributable to what is generally described as thermal agitation; and (*b*) " Schrot effect " or " shot " effect generated in the valve due to the fact that the filament-to-anode path is not completely continuous, but is made up of a number of electrons.

Both effects are, indeed, different aspects of the fact that our essential electrical agencies are those minute particles known as electrons.

For many years the view has been held that the known facts of electrical conduction, as in metals, could be regarded as due to a large number of free electrons moving about the molecular interspaces. Thus we picture it that everywhere in the conductors there is a " gas " of free electrons which are in frequent collision with the molecules of the metal.

If we consider a small length of conductor where this is happening, there are, on the average, as many electrons moving in any one direction as in any other, and the net effect is zero. This, however, is only on the average.

If we consider a sufficiently small instant of time there may well be an excess movement *at that instant* in one direction, giving us a small voltage generated in that section. Naturally any such effect is extremely minute, but if it exists in the input circuit of a high-gain amplifier it is in the very place to make its presence felt.

Proved by Experiment

That the effect becomes real in these conditions has now been proved beyond doubt. Recent experiments have shown that the noise generated in this way varies, for example, with temperature, in exactly the manner that purely theoretical considerations suggest that it should do.

The noise is mainly dependent on the resistance of the input circuit, increasing with the resistance. It is always in the form of a scratchy hissing noise, but the general level of pitch varies with the frequency of the circuit.

The seriousness of the noise also varies with the width of frequencies passed by the amplifier. For example, it is often possible to use a

PLENTY OF AMPLIFICATION HERE !

Two Marconiphone engineers are seen busy at work on one of the amplifiers used at the World Economic Conference held in London last year

narrow-band amplifier with high amplification for key-speed morse, while the noise becomes excessive if the same amount of amplification is used over a wide band for good commercial telephony quality, let alone high-quality broadcast reception.

Amplifier Problems

The very wide band of frequencies necessary in television is already causing the amplifier problem to become a serious one, for example, in the circuits between the photo cell and the modulator, while the photocell and its associated circuit is also an unhappy type of input circuit so far as concerns noise production.

The second electron effect, described before as " Schrot effect " is due to the fact that the current passing from filament to anode of a valve is a stream of individual electrons. The passage and arrival of each electron thus causes a disturbance among the electrons already on the anode, and consequently produce shock-excitation in the anode circuit.

There is thus a separate effect due to the arrival of these individual electrons which is different from, and additional to, any effect due to thermal agitation. The effect is somewhat similar to that of rain falling on a roof. Even our traditional " sheets of rain " consist of individual drops, at least the writer has mercifully been spared a literal " solid " mass of water.

A Serious Problem

Experiment has shown that the effect is least when the valve is working in its rated conditions.

Either or both of these electron effects may exist, and it is difficult to say which is the more important. Opinion is, indeed, still somewhat divided as to their relative importance. Neither is of absolutely new discovery, but the progress and development of high-gain amplifiers have brought them into prominence.

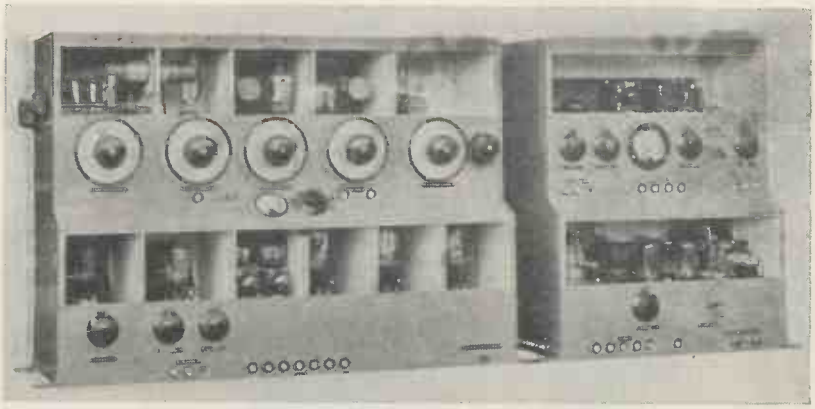
In commercial receivers, such as those used for transatlantic reception, the problem of noise is definitely one of the utmost seriousness. Even in broadcast receivers the problem is sufficient to cause makers considerable worry and to set a limit to the design of the most sensitive receivers.

That is why the makers even of the most sensitive sets usually recommend something in the way of even a small outdoor aerial or any other method which gets the strongest input signal and therefore the best ratio of signal to noise throughout the set.

It is very doubtful if the problem is capable of a complete solution, but several methods of attack appear to be worth considering—for example, the relative amounts of amplification at high-frequency, intermediate-frequency and low-frequency, the type of detection, upper-frequency cut-off characteristics, etc.

Theoretical considerations suggest that the " Schrot effect " can be minimised by attention to valve design, for example the construction of screen-grid valves giving greater mutual conductance at lower values of anode current.

In any case, the problem is now engaging the attention of both theoretical and practical men. And it is not the first problem that radio has set us to solve.



HIGH-GAIN MARCONI RECEIVER

This huge Marconi short-wave receiver uses two stages of high-frequency amplification, first detector, first oscillator, three stages of first I.F. amplification, second detector and second oscillator, followed by three more I.F. stages, third detector and low-frequency amplifiers. Some set for short-wave fans!

Have You Logged WLW?

AMERICA has joined in the great race for high-power transmitters. As you may have heard, the Federal Board, which controls the American broadcasting stations, has given permission for WLW, a 500-kilowatt station at Cincinnati, Ohio, owned by the Crosley Radio Corporation, to work on a wavelength of 428 metres during regular American broadcasting hours.

Many readers have reported strong reception of this new American giant during its tests. WLW's present schedule is from 6.30 a.m. right through the day until 1.30 a.m. the following morning. This is American time, of course!

The Crosley Corporation has always been one of the pioneers of high-power stations in the States. Their new station aims at having a vast service area with a possible reception area of about 5,000 miles. This means, of course, that the whole of the British Isles is included in the possible reception area.

WLW's aerial is of the new vertical type, the aerial itself being in the form of a huge steel mast. WLW's mast is 831 ft. high and weighs 136 tons. The system is the same as that used at the Hilversum transmitter, which was described in these pages last month.

Providing Reliable Reception

Powel Crosley, jun., president and founder of Crosley Radio Corporation, believes that listeners in any part of the world and in a good location should be able to pick up signals from this new Cincinnati giant, providing they have a fairly up-to-date set.

The Crosley president also believes that the only way to provide reliable reception, free from static interference, is by means of really high-power signals.

Jot down the wavelength and times of WLW's transmissions in your notebook. You stand a really good chance of hearing America clearly on the medium waves!

Marconi photo

AIRCRAFT INSTALLATION—1920

An operator on a Handley-Page machine using one of the earlier 'plane transmitters. The aerial of the 'plane is seen partially wound up in the bottom right-hand corner

New Stations

W. OLIVER Reviews the

THE design of broadcast receivers is constantly changing for the better. Each year sees a steady progress towards higher efficiency, more compact assembly, neater appearance and easier control.

As with receivers, so it is with transmitters. The same steady improvement is evident in the design of equipment at important transmitting stations carrying on land, sea, and air services.

Just as the home-built crystal set of 1924 looks like a museum curiosity beside the super-het of 1934, some of the early transmitters seem almost incredibly quaint, untidy contraptions in comparison with their up-to-date counterparts !

The outcome of the past fourteen years' progress in the design of broadcasting transmitters, for instance, is exemplified in the modern 60-kilowatt installation at Athlone, illustrated in these pages.

By way of contrast, compare this gleaming giant of efficiency with the obsolete 2MT, the pioneer broadcasting station at the Marconi Works near Chelmsford. "Two Emma Toc" used to send out speech and music (of sorts !) as far back as 1919, and, as you can see from the photograph, the announcer used to read news items into a hand microphone in immediate proximity to the actual transmitting plant.

In other branches of radio communication, almost equally great strides have been made. Aerodrome stations are a case in point, and of these the installation at Croydon Airport may be cited as a typical example.

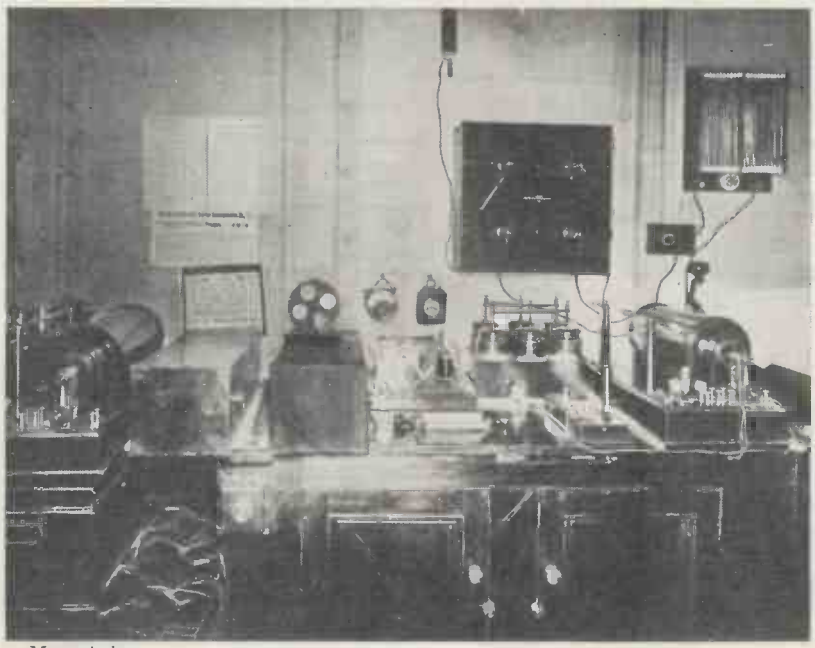
Contrast the primitive and untidy-looking gear in the photograph of the transmitter at the old aerodrome (at Waddon) with the fine installation which superseded it when the new airport was opened in 1928.

Four Transmitters at Croydon Airport

The present station is situated at some little distance from the actual airport to avoid interference with direction-finding reception there. The transmitters are remote-controlled by landline from the Croydon Control Tower.

There are four independent 3-kilowatt units which can maintain communication in telephony and telegraphy, on different wavelengths, with other aerodromes and air liners in flight. As the photograph shows, these sets are typically modern in their straightforward simplicity of layout and design.

The sending and receiving sets installed in the big air liners, which enable the operators on board to keep



Marconi photo

1902 MARCONI SHIP INSTALLATION

This photograph of the radio equipment on the s.s. "Minneapolis" was taken in the very early days—1902. This was one of the first spark outfits to be installed on a ship. The lead to the ship's aerial is in the top centre of the photograph

for Old!

Progress of Transmitter Design

in constant touch with aerodrome stations while the machines are in flight, have also been improved to a remarkable extent during the past fourteen years or so.

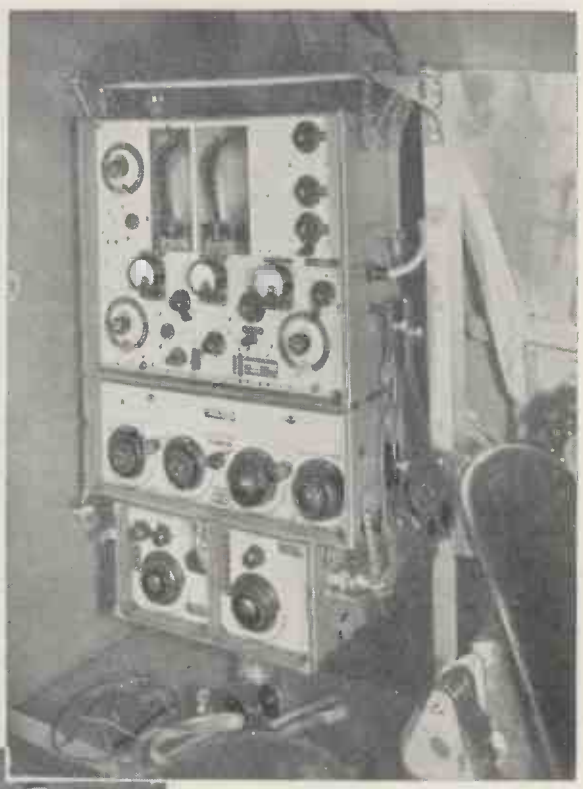
The operator in our photograph is using a wireless telephone set installed on a Handley-Page air liner flying on the London-Paris route in 1920. Compare this with the fine example of modern design provided by the transmitter and receiver installed in the Atlanta type of air liner used on the Indian and African routes of Imperial Airways.

Radio Gear on a Modern Air Liner

The transmitting and receiving equipment shown in the Atlanta photograph works with telephony and telegraphy and covers the short wavelengths of from 40 to 80 metres as well as the 500 to 1,000-metre band. The top section of the set is the transmitter, the middle section the receiver, and the smaller section at the bottom is a special Marconi "homing" device. This ingenious adjunct is a valuable aid to navigation.

Not only on land and in the air, but on the sea, also, great progress has been made in the design of wireless installations. The quaint-looking spark transmitters, with their big induction coils and spark-gaps, shown in the photo of the equipment of the liner *Minneapolis* is typical of a ship station *more than thirty years ago*. The date on the calendar hanging on the wall behind the apparatus shows that the photograph was taken in 1902 !

Thirty years on—and we come to the highly efficient and luxuriously convenient installation carried by the C.P.R. liner, *Empress of Britain*. The equipment shown in the photograph is of the long-wave telegraph

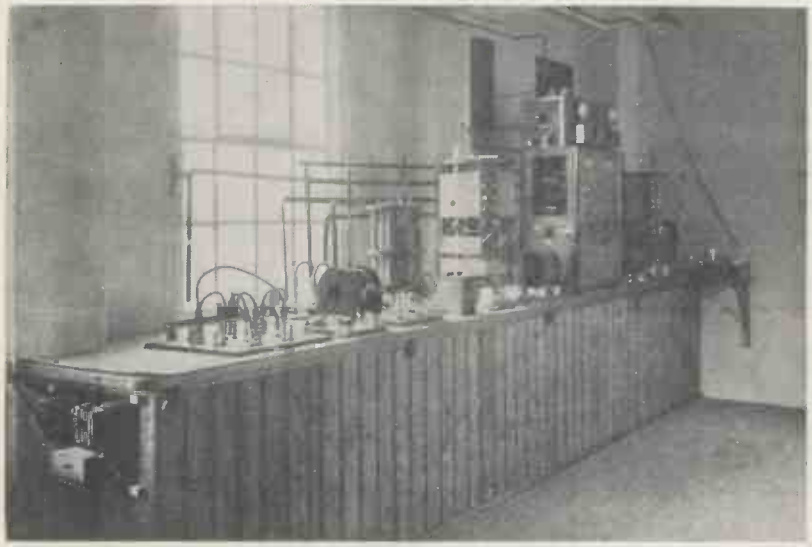


Marconi photos

(Above) The latest type of aircraft transmitter as used by Imperial Airways on their Indian and African services. (Left) An example of up-to-date design in broadcast transmitters is shown by this photograph of the Marconi transmitter at the Athlone high-power station in Ireland

SUPER RADIO GEAR OF THE PRESENT DAY

Here is a corner of the radio room on board the C.P.R. liner, "Empress of Britain." On the left is the long-wave telegraphy transmitter, and on the right is the latest Marconi direction-finder, a fine aid to navigation



Marconi photo

(Left) Compare this installation used at Waddon aerodrome before 1928 with the present up-to-date installation shown in the lower photograph

A lot has been said of the advantages of the direction-finder. With it a ship can obtain bearings from several shore stations, and by plotting these bearings on the ship's chart, find out its exact position. On the North Atlantic, particularly, where there is always a great deal of fog, these direction-finders are an essential part of a ship's navigating equipment.

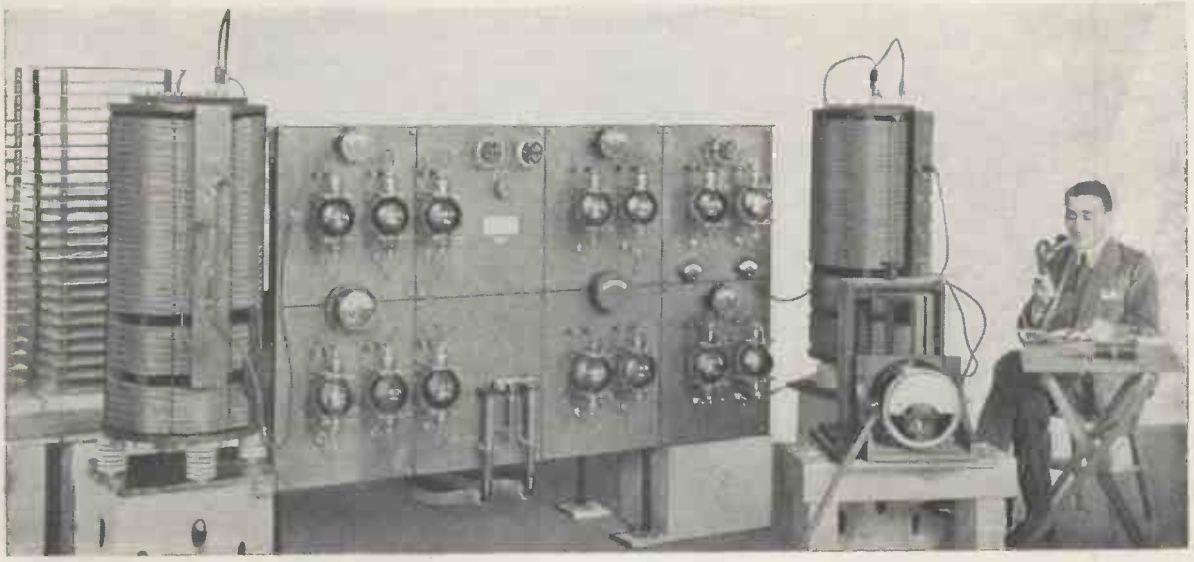
Although some of these up-to-date transmitters look as if they had almost attained perfection, in thirty years time, no doubt, they will seem as primitive and old-fashioned as the spark set of 1902 seems to us to-day !

apparatus. A 2-kilowatt transmitter is on the left ; beside it, at the top right, is an emergency transmitter.

In front of the operator is the receiving equipment covering the enormous waverange of from 15 to 20,000 metres. Beside the typewriter, within easy reach of the operator's right hand, is a special type of telegraphic sending-key used for tapping out morse messages.

The neat-looking instrument with a sloping panel, on the right of the picture, is one of the latest Marconi direction-finders which is an invaluable aid to navigation.

(Right) This is the main transmitting room for Croydon Airport. It is situated at Mitcham Common and operated by remote control from Croydon, three miles away



Marconi photo

Reading the news in 1919 ! W. Ditcham at the microphone of "Two Emma Toc," the experimental broadcasting station at the Marconi Works at Writtle, near Chelmsford. Seasoned listeners will well remember the thrill of logging 2MT !

Designed by the "W.M." Technical Staff

You will agree with us that this six-guinea set is a neat-looking job. And it works well, too!

The Six-guinea A.C./D.C. Three

Here we present details of a reliable all-mains three-valver that can be operated from both A.C. and D.C. supplies without alteration. The price of £6 6s. includes every component used in the set with the exception of the table cabinet

THIS set will come as a blessing in disguise to many thousands of listeners who desire mains sets but cannot afford the cost of ten or twelve guineas for the small commercial models. We had in mind when we designed this six-guinea outfit the vast number of people with very moderate means who have moved out to the borders of the countryside into newly built houses and who are probably tasting the advantages of electric light for the first time. These people usually have not a lot of money to spend on radio.

A.C. and D.C. Mains Without Alteration

To these, and to anyone else who requires a reliable mains three-valver that will work on either A.C. or D.C. mains without alteration, we draw attention to this "W.M." design. It is up to date in every way and will give satisfactory reception of home and a large number of foreign stations.

The price of six guineas given in the set's title includes every part necessary to build the set—components, valves, loud-speaker, and so on; in fact everything except the cabinet.

Let us get right down to business and see what our Six-guinea A.C./D.C. Three is, and what it will do. In the first place, you will notice from the photographs that the set has four valves. Of these, three are receiving valves, the fourth being a rectifier, the only job of which is to rectify A.C. to D.C. when the set is used on alternating-current mains.

Simple Straightforward Circuit

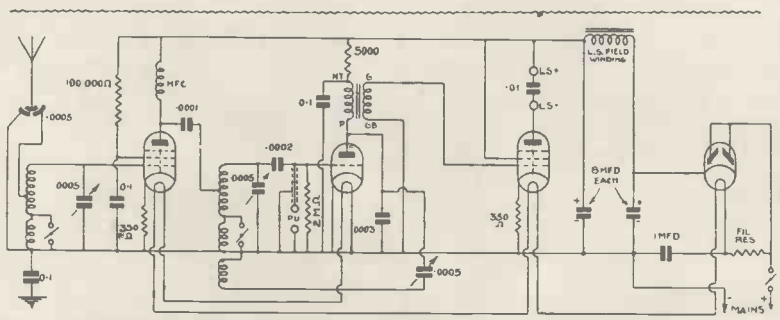
At first the circuit may seem rather unusual, but if you look closely you will see that it is not merely straightforward but highly simplified. First, A.C./D.C. valves have been used with their filaments connected in series and heated directly from the mains.

There is, of course, a dropping resistance in circuit to ensure that the correct filament voltage is applied The use of these A.C./D.C. valves does away with the necessity of using a mains transformer and so helps to keep the price of the set to within low limits.

Unusual but Efficient Ideas

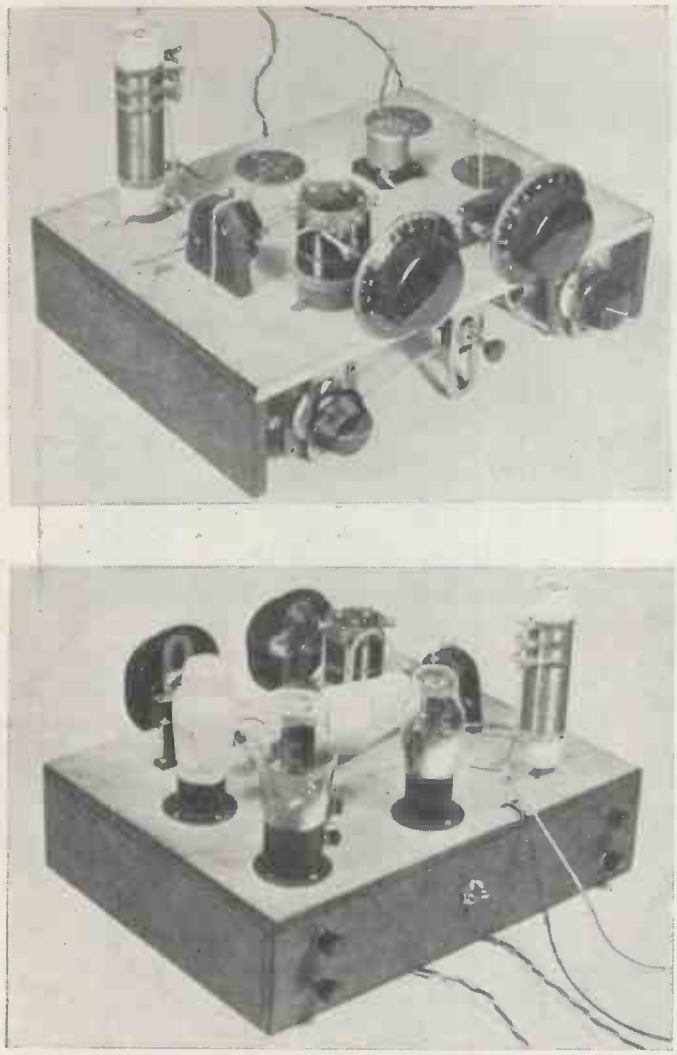
Another feature of the set is that block condensers have been used in place of separate ones, both in the decoupling and in the high-tension smoothing circuits. In the latter instance we have used a dry electrolytic condenser consisting of two 8-microfarad capacities in the same case, one of which acts as a reservoir condenser and the other as a smoothing condenser.

Another important feature, which also helps in the production of a cheap set, is that we have utilised the field winding of an energised moving-coil loud-speaker



NOTHING COMPLICATED ABOUT THE CIRCUIT!

As you can see, the circuit of the Six-guinea A.C./D.C. Three is very simple. The valve combination is a high-frequency pentode, detector, and pentode. A valve rectifier comes into use when the set is worked on A.C. mains

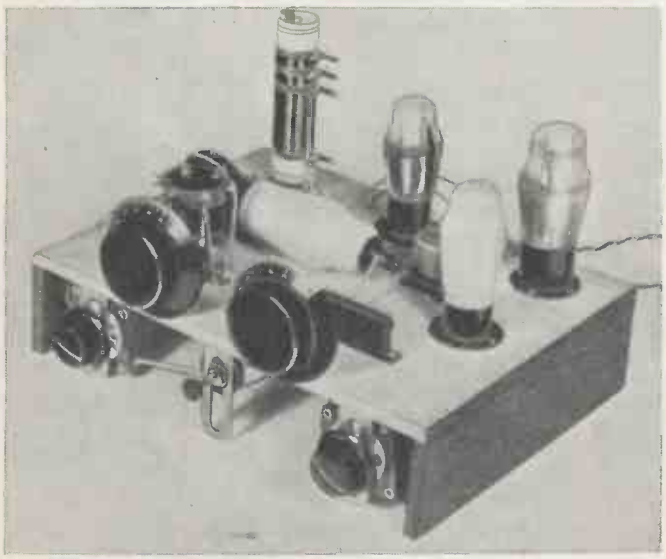


These two photographs are a good guide to the arrangement on the top of the metallised wood chassis. In the lower photograph the valves, reading from left to right, are the detector, output pentode, high-frequency pentode and the valve rectifier

for a smoothing choke. This does away with a separate choke. In this way the current taken by the valves serves to energise the loud-speaker.

Let us look into the circuit and see what has been done. You will see that a three-valve arrangement has been used consisting of a high-frequency pentode, a triode detector, and a pentode for the output stage.

A differential condenser is connected in series with the aerial and the aerial tuning coil, and this acts as a high-frequency volume control and a selectivity control. It is the usual practice to use an ordinary condenser in this position, but with a differential condenser the capacitative load across the aerial coil remains constant at any setting of the condenser. This is useful because it means that the setting of the aerial condenser is not altered as the capacity of the aerial-input condenser is altered.



Four dials and a wave-change switch form the controls on the front. The two tuning condensers are on top and underneath, from left to right, are the aerial-series condenser, wave-change switch, and reaction control

Unscreened Dual-range Coils

Two small dual-range coils are used, both unscreened, with the waveband switching brought out to a switch on the front of the panel. By fitting one of the coils on the top of the metallised wood chassis and the other underneath, adequate stability is obtained.

Tuned-grid coupling is used between the high-frequency pentode and the detector, separate condensers being providing for both the aerial and grid tuning circuits.

The grid leak and condenser follow normal practice, and need no comment. It will be noted, though, that provision has been made for a pick-up between the grid of the detector valve and the cathode circuit.

It is perhaps as well to remind readers that when a pick-up is used it is preferable to use one with a built-in volume control or some form of external volume control will have to be adopted.

Arrangement of the Detector

The detector valve is transformer-coupled to the output pentode. It will be noticed that we have not included a high-frequency choke in the anode circuit of the detector. We found during our initial tests that the choking effect of the primary of the low-frequency transformer provided enough feedback for reaction purposes. A .0003-microfarad by-pass condenser is used to prevent unwanted high-frequency currents from getting through to the low-frequency stage.

The detector anode resistance has a value of 5,000 ohms, and with a by-pass condenser of .1-microfarad is sufficient decoupling to prevent instability.

A very unusual feature of this set is that no by-pass condensers have been connected across the biassing resistances of the high- and low-frequency pentodes. Theoretically this is not good practice, but we found that by careful design of the rest of the circuit, the omission of these two condensers did not cause instability. Again, another point that helped to keep the price of the set low!

As far as the output pentode circuit is con-

cerned, the arrangement follows standard practice; a .01-microfarad condenser connected across the loud-speaker terminals prevents undue accentuation of the high notes.

If you look at the filament circuit of the detector valve you will see that one side is connected to high-tension negative. This is important, and is done to prevent hum occurring, owing to the high-voltage filaments of the valves used.

And now for a most important danger sign. You will see that a .1-microfarad fixed condenser is included between the earth terminal and the high-tension negative circuit in the set. This is to prevent any short-circuit occurring when the set is used on D.C. mains having the positive main earthed.

Earth Lead to the Earth Terminal

On no account must an earth lead be joined to any part of the set except to the earth terminal on the back of the wooden chassis. Don't forget this important point!

No fuse is provided in the set, but we have specified a wall plug in which a fuse is incorporated. These are not expensive, and should be used, for if a short-circuit did occur no damage would be done to the set.

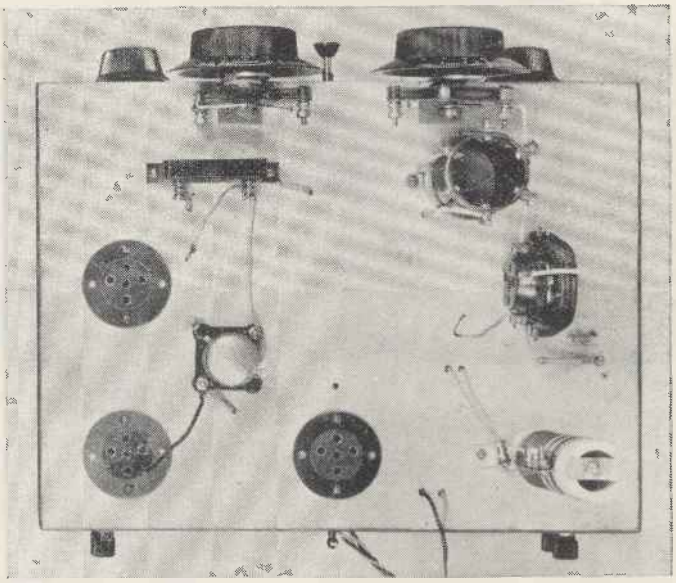
So much for the technical features of the set. Let us turn our attention to more practical considerations.

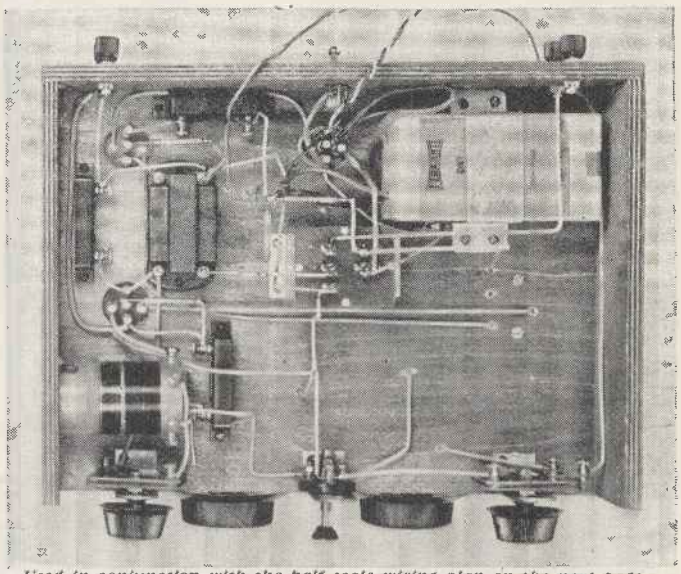
In the first place we must point out that the neatness and compactness of the set is due to the use of chassis construction. The set has been built up on a wooden chassis with the top side metallised—it is easier to drill than metal, and the finished appearance of the set is just as good.

How the Components Are Arranged

Mounted on the top of the chassis are the four valves, the aerial tuning coil, the mains dropping resistance, the high-frequency choke, and one of the fixed condensers. The two main tuning condensers are mounted on brackets also fixed to the top.

The remainder of the parts are all mounted on





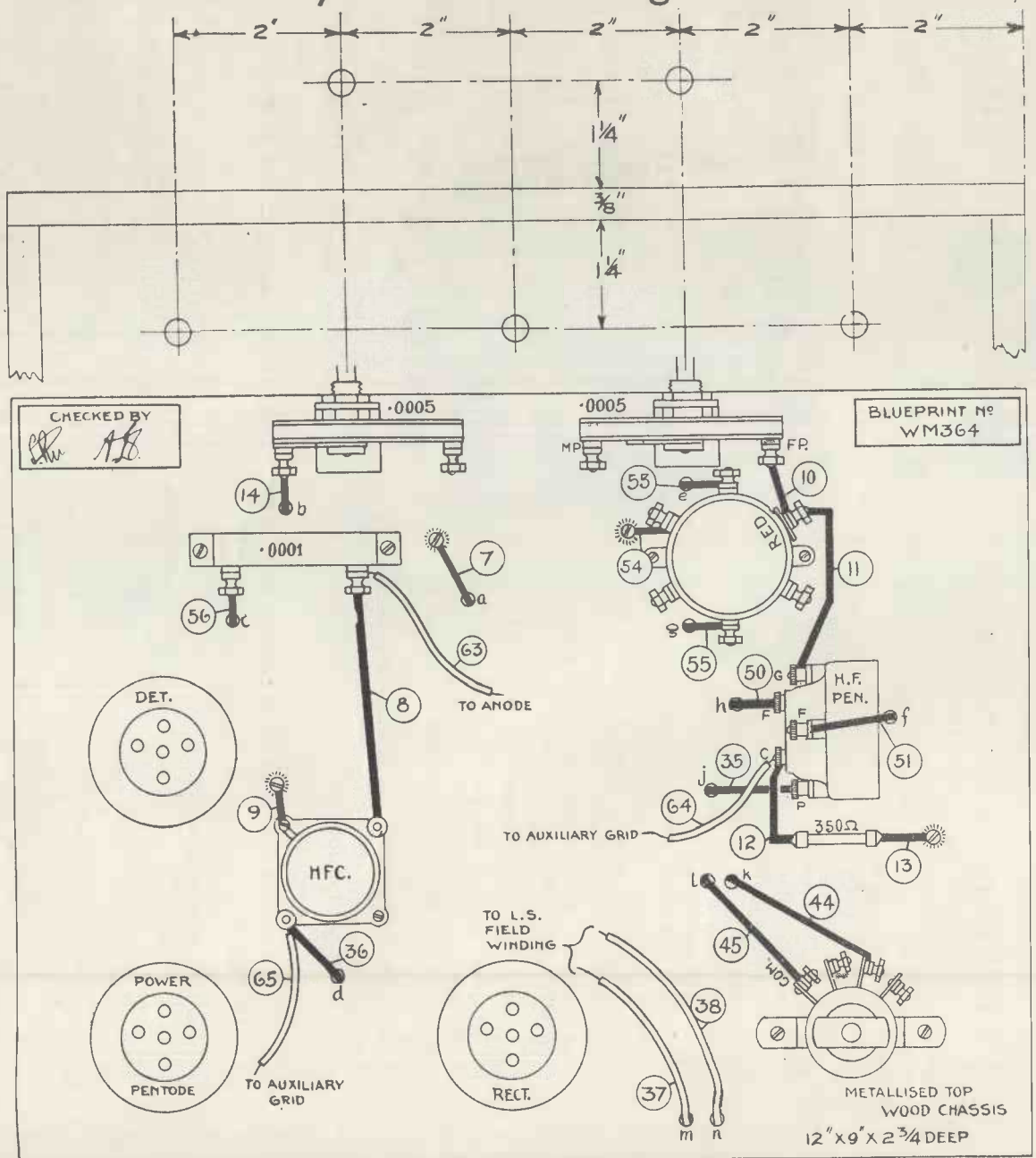
Used in conjunction with the half-scale wiring plan on the next page, these two plan views will be found most helpful to constructors. As you can plainly see, the construction could not be simpler

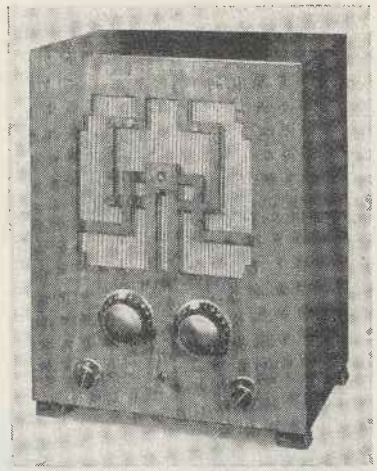
LIST OF PARTS NEEDED FOR THE SIX-GUINEA A.C./D.C. THREE

	£ s. d.
CHASSIS	
1—Peto-Scott 12 in. by 9 in. by 2¾ in., with Metaplex top ...	2 3
CHOKE, HIGH-FREQUENCY	
1—Wearite screened, type HFPJ (or Bulgin)	2 0
COILS	
2—Kinva, type PDR	5 6
CONDENSERS, FIXED :	
4—Lissen mica type, values : .0001-, .0002-, .0003-, .01-microfarad (or Telsen, T.C.C.)	2 6
1—T.M.C. Hydra block of .1- (3) and 1-microfarad, type B1004	5 0
1—Ferranti twin 8-microfarad electrolytic, type CE100	7 9
CONDENSERS, VARIABLE	
2—Polar .0005-microfarad, type Compax (or Lissen, Telsen) ...	5 0
1—Graham-Farish .0005-microfarad, differential type ...	2 0
1—Graham-Farish .0005-microfarad, reaction type (or Telsen, Lissen)	2 0
HOLDERS, VALVE	
3—Clix five-pin, type chassis-mounting (or Wearite, W.B.)...	2 3
1—Lissen, type LN739	1 3
RESISTANCES, FIXED	
5—Siemens, type SS½ watt, values : 350- (2), 5,000-, 100,000-ohm, 2-megohm (or B.A.T., Erie)	2 11
1—Bulgin series filament, type MR25	4 0
SUNDRIES	
5—British Radiogram 1½-in. metal mounting brackets	1 8
Aluminium strip, 7 in. by 1 in., say	2 0
1 ft. shielded sleeving, say... ...	2
Round-tinned copper wire No. 20 gauge for connecting, say ...	6
Oiled sleeving, say	9
Plywood 2 in. by 2 in., for mounting screen-grid valve holder, say ...	1
1—Ferranti 5-ampere fuse plug ...	2 0
SWITCHES	
1—Bulgin, type S80T (or Claude Lyons)	1 3
1—Bulgin, three-point shorting, type Junior	1 0
TERMINALS, ETC.	
4—Belling-Lee, type R, marked : A, E, Pick-up (2)	1 0
TRANSFORMER, LOW-FREQUENCY	
1—British Radiogram (or Telsen, Varley)	4 6
ACCESSORIES	
CABINET	
1—Peto-Scott, type No. 141017 ...	12 6
LOUD-SPEAKER	
1—Peto-Scott, type DC2500 ...	15 0
VALVES	
1—Tungsram HP2118	14 6
1—Tungsram R2018	10 6
1—Tungsram PP2018	17 0
1—Tungsram V2018	10 6

The prices mentioned are those for the parts used in the original set; the prices of alternatives as indicated in the brackets may be either higher or lower

Half-scale Layout and Wiring Plan





This neat-looking cabinet is supplied complete with an energised moving-coil loud-speaker for the modest sum of 27s. 6d.

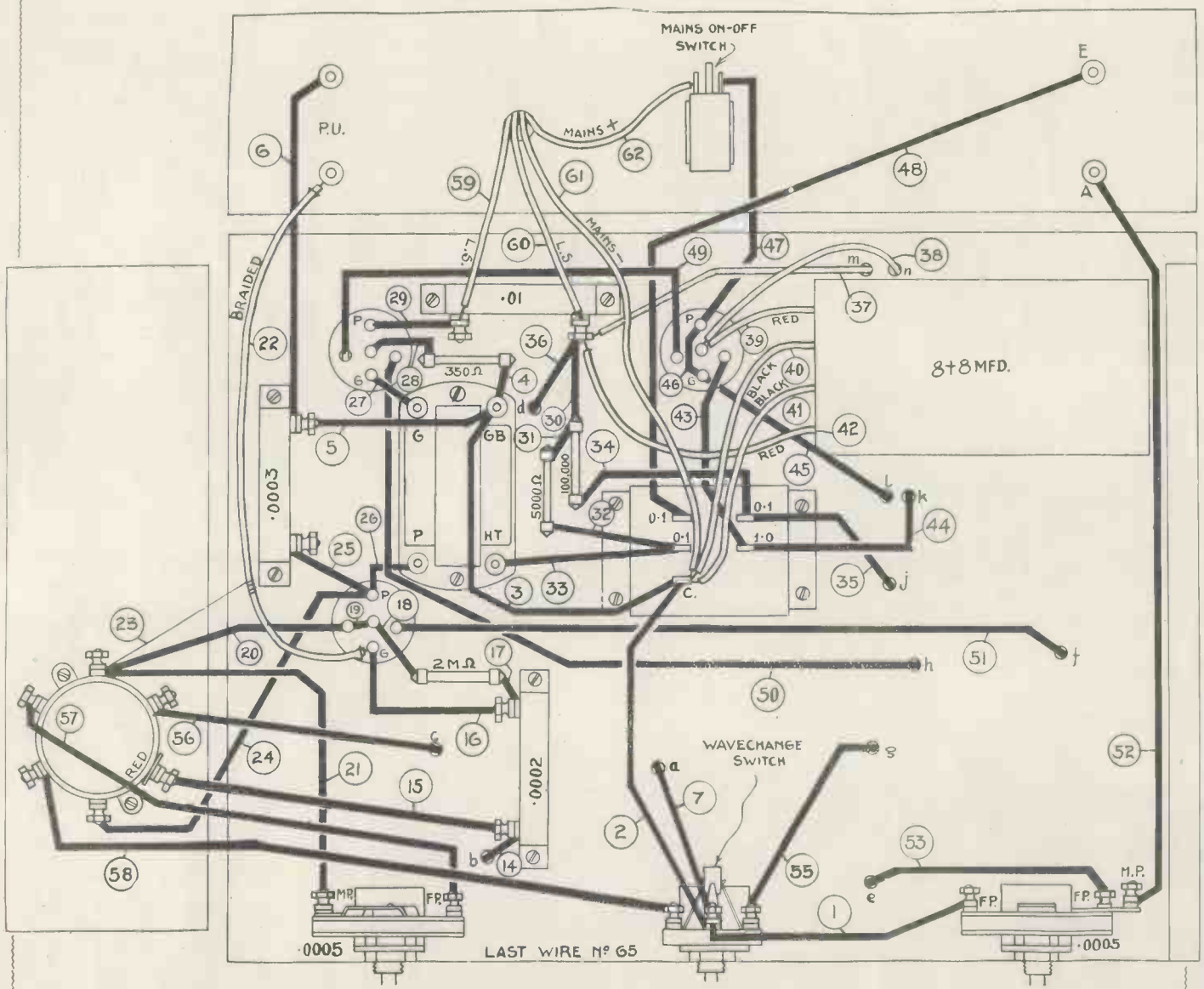
the underside. A glance at the photographs will show that there is nothing complicated about the construction of the underside.

There are, however, two points that must be mentioned. The first is that the block condenser and the fixed resistances are not fitted with terminals, and therefore they have to be soldered. The second is that the other tuning coil is fixed to the side of the chassis underneath.

Simple to Build

A glance at the half-scale blueprint and wiring plan reproduced in these pages should clear up any doubts about this particular point of the construction. We want to make it quite clear that there is nothing difficult about the building of this set. All the essential details are included in these pages.

However, many constructors may prefer to work from one of our full-size blueprints. Copies of a full-size blueprint of the Six-guinea A.C./D.C. Three can be had for half price, that is 6d., post paid, if the coupon on the last page is used before July 31. The address to which



HOW TO OBTAIN A FULL-SIZE BLUEPRINT FOR HALF-PRICE

If desired, a full-size blueprint can be obtained for half price, that is 6d., post paid, if the coupon to be found on the last page of this issue is used before July 31. Address your application to the "Wireless Magazine" Blueprint Department, 58-61 Fetter Lane, London, E.C.4, and ask for No. WM364. There is no need to remind readers that our full-size blueprints show the position of every wire, numbered in the best order of assembly. They can, of course, be used by constructors as templates.

the application should be sent is familiar by now, but here it is in case it has slipped your memory: "Wireless Magazine" Blueprint Dept., 58/61 Fetter Lane, London, E.C.4. Ask for No. W.M.364.

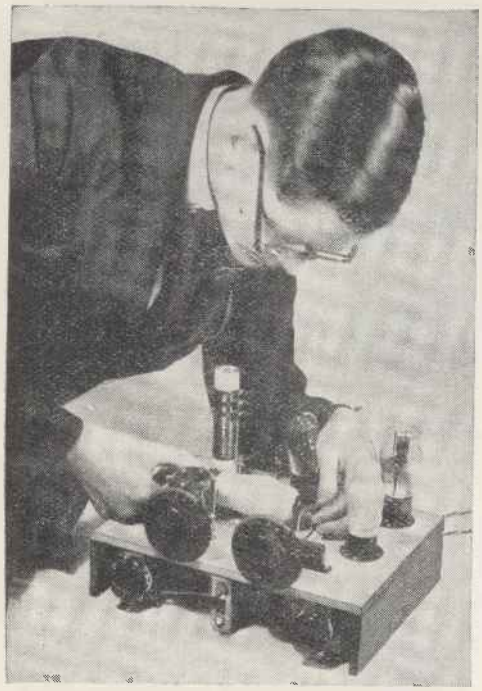
The first thing to do after the set has been built and the valves inserted in their correct holders—the position of the valves is given on the blueprint and in a caption to one of the photographs—is to get familiar with the control layout.

Layout of the Controls

At the top on the left is the aerial tuning condenser, and on the right, also fitted above the chassis, is the other tuning condenser. In the centre underneath is the wave-change switch, which is pulled out for medium-wave reception, and to its right is the reaction control. The other control, on the left, is the aerial-input condenser which is, in practice, the set's volume control.

Continued on the last page of this issue

As you can see, there is plenty of room for the set below the loud-speaker. The terminals on the back of the set chassis are for pick-up, aerial and earth



The Six-guinea A.C./D.C. Three is very easy to build—you need no experience. The test report gives a good idea of the results that can be obtained by the average person

Thirty-six Stations in an Hour's Test

The Six-guinea A.C./D.C. Three Proves its Worth!

TAKING into consideration the cheapness of this set, I did not expect very great things from it. I was agreeably surprised at the results obtained during my short test at Upminster, Essex, the other night; thirty-six programmes at good loud-speaker strength, during an hour between 9 and 10 o'clock in the evening, is no mean feat.

Hum-free Background

Quality was quite good, especially considering the small loud-speaker used. Tone was crisp and particularly well balanced.

On D.C. mains the background was absolutely hum-free, and ample volume was obtained on nearly all the stations listed to fill a large living-room. On A.C. mains the volume output, if anything, was slightly greater than on D.C., but there was a slight hum background.

Adequate Smoothing

This hum gave me the impression that it was not due to any 50-cycle A.C. ripple, which appeared to be adequately smoothed out, but was very probably due to some extraneous noise getting in via the filaments, which are heated directly from the mains supply.

When first switching on the set, tuning appeared to be quite flat, as was to be expected when there were only two tuning circuits before the detector. By careful use of the input volume control, however, combined with the judicious application of reaction, a marked improvement in selectivity was noted, and *I was able to get Scottish Regional at loud-speaker strength clear of London Regional.*

This I considered excellent for a simple set of this description. When I obtained Copenhagen with only a slight background of the London National, however, my opinion went up still further. Medium-wave tuning range is another excellent feature of this little set. Fécamp at 206 metres came in at 5 degrees on the right-hand dial, and Budapest was obtained just above 90 degrees. I should say that the medium-wave tuning range extends from 200 metres to well over 600 metres.

On long waves the sensitivity seemed well up to standard, all the usual transmissions coming through at full loud-speaker strength. Selectivity was also quite good, as after some juggling I was able to listen to a programme from Königswusterhausen without any noticeable interference from either Daventry National or Radio Paris.

Good Daylight Range

Daylight range was quite good, for in a half an hour before breakfast one morning I was able to listen to programmes from the medium-wave Hilversum, together with Radio Paris and Luxembourg on the long waves.

Entirely apart from the above qualities, however, the major point that should induce you to build this excellent little set is its price.

I understand that it only costs about £6 6s., which is, as far as I can see, far lower than that which you would have to pay for any three-valve all-mains set on the market. This is an achievement on which the "Wireless Magazine" Technical Staff is to be heartily congratulated. A really good set! *S. T. B.*

STATIONS LOGGED ON THE SIX-GUINEA A.C./D.C. THREE

Station	Right-hand Condenser Dial Reading
LONG WAVES	
Huizen	80
Radio Paris	74
Königswusterhausen	69
Daventry National	63
Eiffel Tower	55
Luxembourg	48
Kalundborg	46
Oslo	35
MEDIUM WAVES	
Budapest	88
Beromunster	78
Athlone	70
Vienna	66
Florence	64
Brussels No. 1	62
Prague	59
Lyons	58
North Regional	55
Paris PTT	52
Rome	50
Munich	48
Midland Regional	46
Leipzig	44
Lvov	42
Scottish Regional	40
Strasbourg	37
London Regional	35
West Regional	30
Hilversum	28
North National	26
Scottish National	25
Bordeaux	24
London National	20
Copenhagen	16
Lille	13
Gleiwitz	11½
Nurnberg	10½
Fécamp	5

"Balance and Control" at the B.B.C.

How the microphones in the broadcasting studio and concert hall are arranged and controlled to pick up programmes suitable for broadcast reception is revealed in this interesting article by

WHITAKER-WILSON

BALANCING programmes at Broadcasting House is divided into two sections—music under Stanton Jefferies, drama and variety under Paul Askew.

"Balancing a programme," Stanton Jefferies says, "is placing members of a musical ensemble in such relative positions to the microphone as will ensure the ensemble being heard perfectly in the musical sense by the listener.

"In other words, the idea is to re-present the music to the listener as *nearly* to the original presentation as broadcasting conditions permit."

In order to make his methods plain to you I asked him to draw diagrams for each of the various combinations in common use. He sketched them roughly, and they have been reproduced in these pages.

The man who controls and balances all serious-music broadcasts, Stanton Jefferies

It is very obvious to me that the first essential for anyone aspiring to balance a programme is musicianship. I go so far as to say that if Dr. Boult is conducting a Beethoven symphony, and Stanton Jefferies is balancing, Jefferies must have studied the score just as much as Boult.

If the balancer has not done so, he is quite likely to let the conductor down.

It is for the conductor to present his programme and for the balancer to re-present it to the listener. Failure on the part of one is as serious as on that of the other.

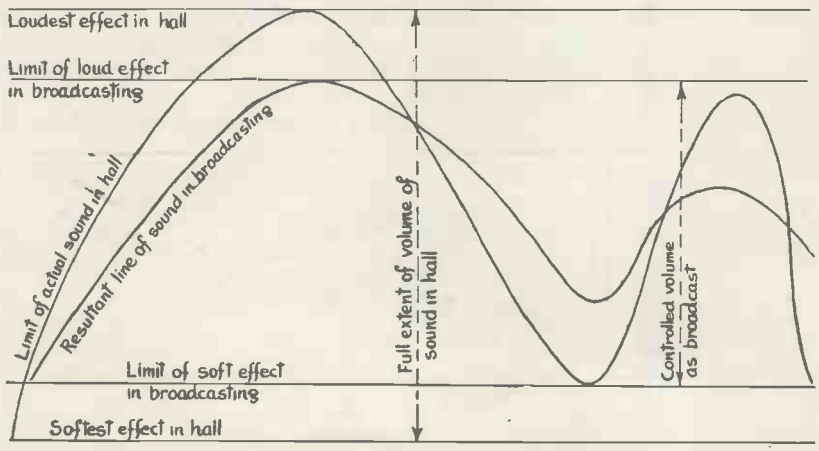


Fig. 1.—The wide lines show the variation in volume produced by an orchestra in Queen's Hall. The narrow lines show how this volume variation has to be controlled for broadcast purposes. There is a lot of work attached to this side of broadcasting

Fig. 1 shows the main aim in programme control. The wide curves represent the line of sound as heard in Queen's Hall, the narrow curves show what the listener hears after the sound has been balanced for broadcasting.

At first sight it might appear as though the whole subject was capable of a very simple solution—merely a case of keeping within limits. Never too loud, never too soft. Unfortunately, it is not quite so simple.

Most of you have heard Ravel's *Bolero*. If you haven't, it is easily described. A tune repeats. It has sections to it, but the main idea is the repeated tune—each time with an added instrument or two. Gradually it increases in volume from the softest possible to the loudest possible.

Mr. Jefferies pointed out to me that this is "the very devil" to control. Supposing he made the initial mistake of setting the strength too heavy at the start—unless he modified the graduated effect by turning it down (as soon as he had realised his mistake) the work would go on increasing every moment and end up by blasting heavily

I have mentioned this because I want to show how necessary musicianship is. Without actually quoting any specified musical work as an example, I will try to give you an idea of how the control is effected. The increase of volume—the *de*crease

Paul Askew, who was music director of the B.B.C. at Aberdeen, is in charge of the balance and control of such items as plays, dance music, light comedy, talks, and sound television broadcasts. He is seen here at a music control panel at Broadcasting House

of it, for that matter—goes on throughout an orchestral work, just as the composer has directed.

Those increases and decreases are brought into effect at the conductor's instigation. Fortunately, however, they begin and end logically; they are musical sentences. This is where the balancer has to be a musician. He has his score before him. He sees, for example, an outburst of trumpets and trombones—probably drums as well.

He has been at rehearsal and he knows just what is likely to happen. If he *lets* it happen (without action of any kind on his part) the result will be chaos from your loudspeaker. Instead, he watches for a convenient chord in the music and acts so quickly that the brass and percussion instruments are given no chance to " blast."

He has thus controlled the volume at the beginning of a new phrase in such a way that you, who may be following with a score, have not detected where he did it without destroying the light and shade of the music. Balancing is a tricky job!

If you want a good example of the actual effect of control, listen for the outburst of applause after a work has finished in Queen's Hall. You may hear the diminution of volume as the volume control is turned down. The controller is beaten there because he does not know what reception a work is going to receive in terms of hand-clapping.

Also, he is not so particular. It does not matter if he does show his hand, whereas during a symphony it would matter very much.

So much for control, except to add that this stage is not final. After a programme has been balanced it goes from Queen's Hall to Broadcasting House, where the quality is again checked up before being sent on to the transmitters at Brookman's Park.

Fig. 2 shows at a glance the difference between Dr. Boult's method and Sir Henry Wood's of arranging the orchestra on a concert platform. Dr. Boult divides his violins; Sir Henry keeps his together. The microphones have to be adjusted accordingly.

These microphones are so placed that it is possible to bring into prominence any part of the orchestra or, conversely, to fade it down.

In Fig. 3 you see the method employed for a choral work at Queen's Hall. Note the microphones placed on the top balconies in order to take the sound from the chorus. Also, incidentally, from the organ if used. If the chorus is singing as an accompaniment to a soloist, and seems too loud, the balcony microphones can be faded down and the soloist's microphone brought up. A perfect balance for broadcasting will then be produced.

I have often felt in Queen's Hall that the orchestra has sounded a little heavy for a singer at a Wagner Promenade Concert. It is natural because Wagner scores heavily. Yet, when I have heard the same work and singer by wireless the balance has been perfect. *Balance and control!*

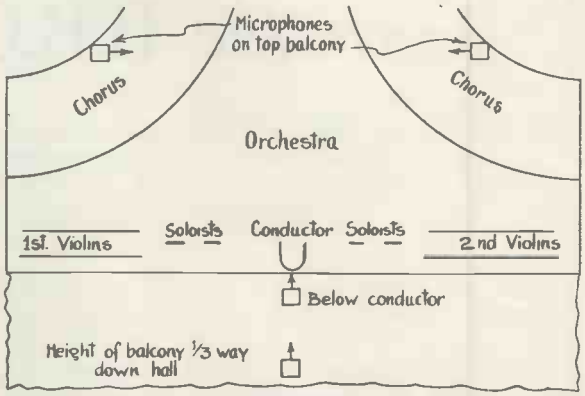


Fig. 3.—Showing how the microphones are arranged at Queen's Hall for a symphony concert in which a chorus is taking part with the orchestra

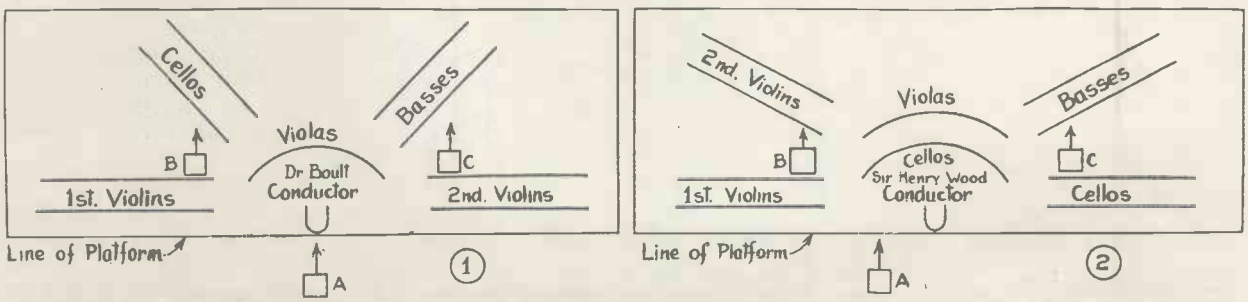


Fig. 2.—Showing the positions of the microphones for a symphony concert at Queen's Hall (1) under Dr. Boult and (2) under Sir Henry Wood. A is the main " mike " used for orchestral purposes and B and C for soloists playing or singing with the orchestra. Note that A is to the left when the violinists sit together

Fig. 4 shows the method used at Covent Garden Opera House. It will be seen that two microphones are suspended near the top of the proscenium arch, one on each side. In addition to these, a "wandering mike" is sometimes used for the Valkyries in *Die Walkure*, and in other instances where special effects are wanted. A microphone is placed central, well down stage in the vicinity of the prompt box, and two more appear on the rail of the orchestra.

By judicious balance and control any part of the production, whether soloists, chorus, or orchestra, can be brought up into prominence or faded down as required.

These are the more elaborate sections of the work. Mr. Jefferies has also under his control the lesser musical combinations. String quartets, for example, need careful balancing.

Here it is not a case of suiting the microphone to the players, but of the players to the microphone. They will not form a perfect square because the 'cello is moved further away from the microphone than the viola. The same thing applies to a singer with a piano. The microphone is placed in position and the performers arranged accordingly.

Enough has been said to show how musical the controller has to be. It is not a case of an engineer who is musical. It must always be a musician who has some technical knowledge. Stanton Jefferies, of course, is a first-rate musician. You remember him as conductor of the Wireless Orchestra in the very early days of radio.

Drama and variety come under Paul Askew. The actual placing of actors before a microphone in a broadcast play is generally a matter for the producer who works in conjunction with Mr. Askew or one of his assistants, of which there are four. All are experts at their work. Sometimes the microphone is on a stand. Then the actor seems to speak *into* it.

Recently, however, different types of microphones have been suspended above the actors' heads, when they speak *under* it. This technique allows freedom of action.

Although I prefer personally to talk to a mike I can see, when the play demands a large cast the other method is more convenient.

It must be realised that the multiple-studio method is used because background effects may have to be used while the actor is speaking. In order that both actor and effects can be dealt with separately, he and they must not be in the same studio.

Mr. Askew has under his care the balance and control of all plays, the Children's Hour, talks, debates, dance bands—all light comedy of the *Frederica* type, and the sound part of television transmissions. Also all variety, whether studio or in St. George's Hall.

It is now well known that stage technique is used by Mr. Askew at St. George's. An elaborate diagram showing how Paul Askew is able to balance a show in that hall is shown in Fig. 5. The original was drawn by him actually in the control box on the side of the stage.

Paul Askew is a musician—a violinist—and an old member of the Scottish Orchestra, and for some years he was musical director at the Aberdeen Station of the B.B.C.

If you will study Fig. 5 you will see exactly how his panel operates in the control box. It shows how the microphones are used at one of the Old-time Music-hall shows, where they have a chairman and do things in the old-fashioned style.

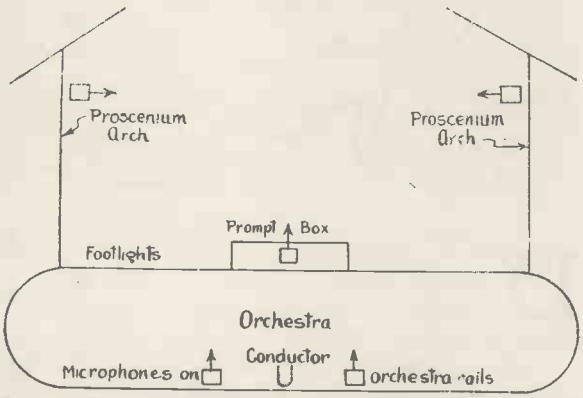


Fig. 4.—The five microphones used at Covent Garden Opera House are arranged as shown in this diagram

Two tables are provided for the use of the chairman and his company.

From the diagram it will be seen that there are eight faders on the mixing panel. The first of these controls the volume from the microphone placed for the artists. No. 5, incidentally, is a stand-by in case of a breakdown.

The second microphone is placed over the chairman and the third is the orchestral microphone. No. 2 will also take part of the orchestra. The fourth takes the applause of the audience.

During a rehearsal Mr. Askew faded down Nos. 2 and 3 and gave me the effect of the orchestra in the gallery of the theatre by bringing up the fourth microphone.

The mixer takes the sum-total of all the units and connects the result with Broadcasting House, from which the transmission is finally sent out to the transmitters taking the show.

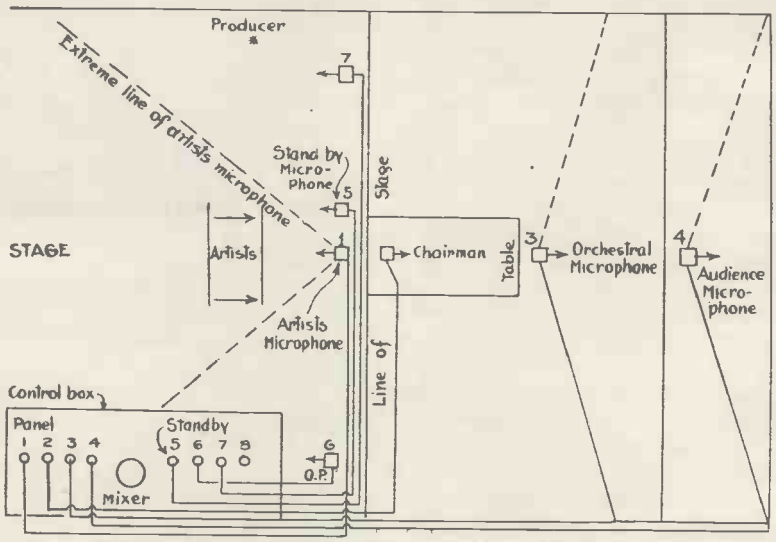


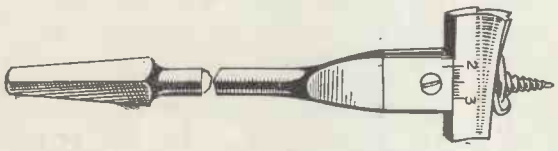
Fig. 5.—Elaborate arrangements are made in the position and control of the microphones at St. George's Hall for variety broadcasts. This plan was specially drawn by Paul Askew, who is in charge of the arrangements there

Wireless Jobs Made Easy for Mr. Everyman

By R. W. Hallows M.A.

DO you know that very useful tool known as the expanding bit which is illustrated in Fig. 1?

It fits any standard brace and its purpose is to allow clean-cut holes of large diameter to be made in wood.



USEFUL TOOL FOR THE CONSTRUCTOR
Fig. 1. The expanding bit is among the most useful of tools for the home constructor

If you look at the drawing you will see at once how it works. The centre is fixed, but the cutter runs in a slot.

It can be moved in either direction by loosening the screw and then firmly fixed by tightening it. The expanding bit can thus be set to make a hole of any size within its capacity.

The most useful size for wireless work is that with a range of diameters from ⅜in. to 3 in. If you think for a moment, you will realise how handy it is.

You're making a set, for instance, which incorporates chassis-mounting valve holders. You could make the necessary holes in the base with a fretsaw or with another neat little gadget that I shall describe in a moment. But with either tool the job is a long and rather fiddling one and you can do it in the proverbial two ticks with the expanding bit. There are dozens of other little jobs where this bit will be found handy.

Other Jobs for the Bit

If your set is a bit "boomy" about the bass owing to cabinet resonance, you can often improve matters a whole lot by making a number of large round holes in the back of the cabinet (and perhaps in the sides as well) with the expanding bit.

If you want to mount a milliammeter on your panel as a visual tuning meter for your superhet, the job is a simple one with the expanding bit.

Why not make a stand for your spare valves? Fig. 2 shows how it is done and I can assure you that it is a great safeguard against casualties. Instead of a stand, I actually use a special valve shelf fitted into a cupboard in which I keep spare parts. Either the stand or the shelf are equally useful. They keep your valves safe and you can take out instantly any one that you want.

Valve caps vary a good deal in size. The best all-round diameter for the holes is just under 1½ in. For some of the fat seven-pin valves, the holes have to be made a little bigger.

All you need to make the stand is some plywood, the bit, screws and common sense. It's quite easy!

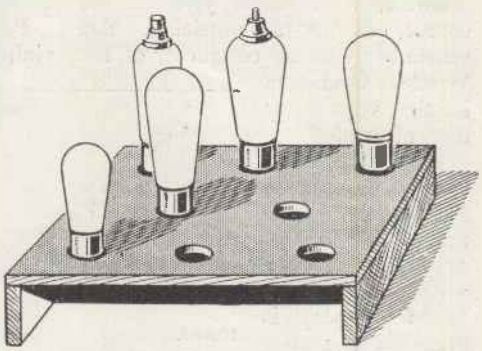
Saws Made at Home

The little home-made saw seen in Fig. 3 is one of the most time-and-trouble-saving gadgets you ever . . . no, I won't inflict that one on you.

The only ingredients required are the haft of an old pocket knife and a good quality hacksaw blade such as the Eclipse-Flex made by Neill's of Sheffield. It *must* be a good blade and it *must* be of the kind that will stand an occasional bit of bending; otherwise it will "come to pieces in you hand," like the china that the charwoman washes up!

The first thing to do is to dismember the old knife by punching out the rivets that hold it together. There are generally three of these. With a small file remove their heads on one side; then drive them out with a fine punch.

What? You haven't a fine punch? Very well, then, use a nail.



HANDY STAND FOR SPARE VALVES
Fig. 2. This simple rack for keeping spare valves will be found useful. It will lessen the risk of "casualties" among spares!

You must now soften one end of the hacksaw blade, the softened portion being just about the same length as the knife haft. To do this, bring it to red heat with the help of a burner of the gas cooker and then allow it to cool slowly.

Mind that you heat up only this part of the blade.

Shaping the Blade

When it is cool, lay the blade on a flat piece of wood and put one half of your knife haft upon it. Insert a drill of suitable size into one of the holes that formerly housed a rivet and drill through the blade. Remove the drill and fix both haft and blade temporarily to the piece of wood beneath by means of an escutcheon pin. You will now have no difficulty in drilling the remaining two holes in exactly the right places, using the haft as a template.

Pull out your escutcheon pin and then rivet the two halves of the knife haft to the saw blade. I showed you last month how to do riveting and you will find that small escutcheon pins are just what you want to make the rivets.

The next process is to point off the blade as shown in Fig. 3. The part protruding beyond the haft should not be more than about 4 in. long. Grind it to a point with a grindstone or better still an emery wheel.

What the Saw can Do

You now have a saw, the fine point of which will go into quite small holes and which is capable of cutting anything from brass to ebonite, from wood to mild steel.

A SAW YOU CAN MAKE AT HOME

Fig. 3. This little saw, made out of a haft of an old pocket knife and a hacksaw blade, is worth its weight in gold!

It is the very thing for making large holes of any shape in metal chassis, ebonite or wooden panels.

If you are making either circular holes or the special shaped ones required for condenser escutcheons and the like, mark them out in pencil, then drill a number of $\frac{1}{4}$- or $\frac{3}{4}$-in. holes inside the pencilled lines and cut away the webs between them with the little saw. A rasp and after that an old file of D-section will enable you to finish up the work nicely. Besides jobs of this kind, the little saw will tackle almost any light work in the way of cutting out or cutting off.

Remember when you are using it, that you must go carefully since the blade is unsupported. Don't therefore tackle work in the proverbial bull-at-a-gate manner. Use it gently and this little saw will serve you well. When a new blade is required, it doesn't take long to make and fit it.

Eliminating Knobs

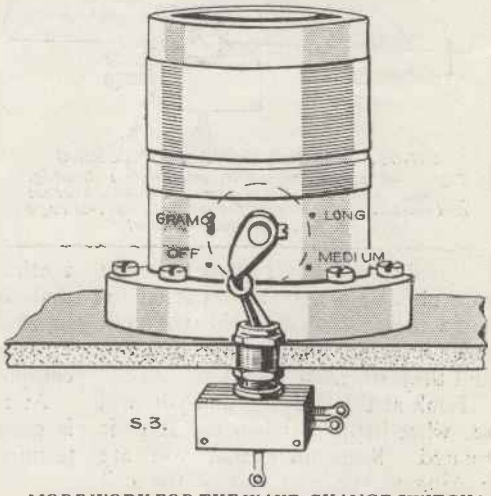
Though I don't believe in unduly cutting down the number of controls in the receiving set, there are some knobs that can often be eliminated without making any difference to the set's performance or impairing fine tuning.

Many sets have no less than three switches, each with a knob of its own. These are (1) the on-off switch, (2) the wave-change switch and (3) the radiogram switch. In many cases it is quite easy to make one knob work the whole lot.

Solving the Problem

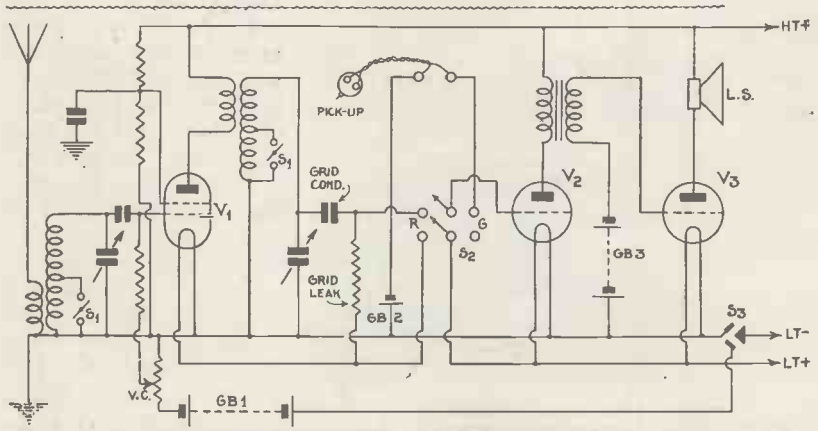
Here's the way in which I dealt recently with this problem in connection with a particular set of ganged coils. The coils have a rotary wave-change switch, arranged to take you over from the long waves to the medium and vice-versa but nothing else.

For each complete revolution of the knob there are four positions



MORE WORK FOR THE WAVE-CHANGE SWITCH!

Fig. 4.—This is the first stage in one-knob switching. The on-off switch is fitted on the end of the wave-change spindle of the coils



ONE-KNOB SWITCHING IN A SIMPLE CIRCUIT

Fig. 5.—A simple three-valve circuit in which all switching is done by the knob of the wave-change switch. S1, S1 is the ganged wave-change switch and S2 and S3 the radiogram and on-off switches respectively

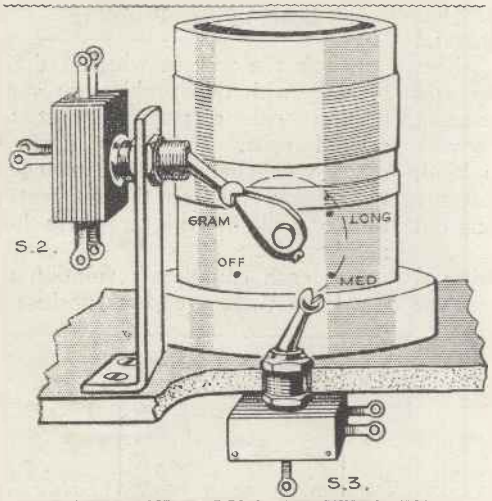
The first click means that you are on the medium waves, the second that you are on the long. Then click No. 3 brings in medium waves again and click No. 4 the long once more.

I didn't see the use of having two medium-wave and two long-wave positions for a full rotation. Before I had finished with it, the switch was so arranged that it would rotate in one direction only. Starting from the off position the next switched on the set and brought in the medium waves, then came long waves and lastly, the gramophone pick-up. A stop pin prevented the switch from being rotated clockwise

beyond the gramophone position.

Fig. 4 shows how the first stage of the work was carried out by fitting an on-off switch actuated by the knob working the wave-change arrangement.

A three-point switch of the Bulgin toggle type with split dolly was mounted below the baseboard in such a position that a small brass cam attached to the rear end of the spindle of the wave-change switch meshed with the cleft in the dolly.



ON-OFF AND RADIOGRAM SWITCHING

Fig. 6.—A step forward in one-knob switching. The radiogram switch can be mounted on a bracket and worked from the cam fitted on the wave-change spindle. An effective idea!

Possibly you don't know that you can obtain almost all varieties of these toggle switches with the split dolly illustrated in Fig. 4. You can and they are most useful.

Look at the drawing and you will see what happens when the knob is rotated. Remember that you are looking at the *rear* end of the coil assembly, which means that when the knob is turned clockwise, the cam appears to travel *counter*-clockwise.

In the position shown in the drawing, the set is "off". The first click makes the cam move the dolly over and switch on the set, besides bringing in the medium-wave range of the coils. At the next click the set is still switched on and the long-wave range comes into action. At the third click, the set is still on so far as this switch is concerned : another switch actuated by a separate cam is used for radiogram switching.

The knob cannot travel any farther because the cam comes up against the stop. In Fig. 5 is seen the way in which one-knob switching is applied in a simple three-valve circuit, consisting of a variable-mu high-frequency stage, detector and an output valve. S_1, S_1 is the ganged wave-change switch, S_2 the radiogram switch, and S_3 the on-off switch.

It will be seen that the filament switch, when in the "off" position disconnects the grid battery of the variable-mu valve. This is necessary, for otherwise current would always be flowing from the battery through the volume-control potentiometer.

The radiogram switch is worth attention. It is of the double-pole double-throw type and, like the filament switch, is of the toggle pattern with split dolly. In the radio position all valves are brought into operation and the grid of the detector V_2 is taken straight through to the grid condenser and grid leak.

When the switch is turned over to the pick-up position, the filament circuit of V_1 is broken. The valve being thus cut out, the possibility of radio break-through from a powerful local station is eliminated—and both high- and low-tension current are saved. Note that in the pick-up position S_2 breaks the *positive* filament of V_1; the chassis and its associated components thus remain earthed.

At the same time, the grid of V_2 is connected to one of the pick-up terminals, the other being permanently connected to the negative pole of a small grid-bias battery.

Though a simple battery circuit is shown in Fig. 5, the one-knob switching arrangement is applicable to circuits of all kinds, mains as well as battery.

The double-pole change-over radiogram switch, again of the toggle type, with split dolly, may be mounted in the rear of the on-off switch and operated by a second cam attached to the spindle of the wave-change switch. Or, if there is not room to place the radiogram switch as suggested, it may be mounted on a bracket attached to the baseboard or chassis as shown in Fig. 6.

A comparison of Figs. 4 and 6 makes the working of the one-knob switching arrangement quite clear. In Fig. 4 the wave-change switch is actually in one of its two long-wave positions, but as the cam has moved the dolly of the toggle switch S_3 to the "off" position, the whole set is out of action.

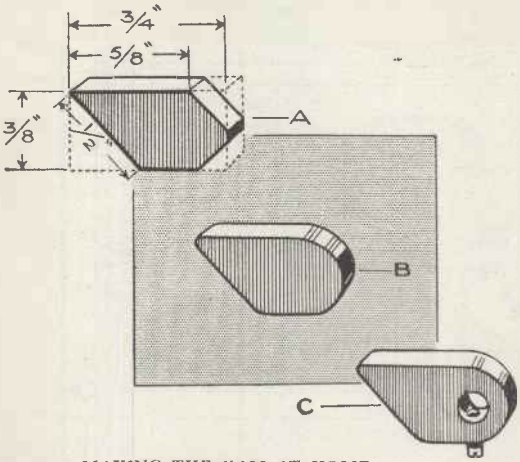
An Idea Worth Trying

The first quarter-turn clockwise switches on and brings in the medium-wave windings of the tuning coils. A further quarter-turn keeps all valves "on" and changes over to long waves. The next quarter-turn actually brings us to the second medium-wave position of the wave-change switch, but the tuning coils and the filament (or heater) of V_1 go out of action as the cam has now turned over the dolly of S_2.

But what about those cams? Well, they are made by Colvern for operating an on-off switch in their G-type coils.

If, though, you prefer to make your own, you will not find it difficult to file them up from pieces of $\frac{1}{4}$-in. thick brass measuring $\frac{3}{4}$-in. by $\frac{3}{8}$ in.

Fig. 7 shows the three stages of the work. First of all the cam is roughly shaped with the hacksaw or with a coarse file. Next it is shaped up and rounded off by fine filing. Lastly the hole for the spindle is drilled and a set-screw or grub-screw is fitted to fix it to the spindle.



MAKING THE CAM AT HOME

Fig. 7.—Here are the three stages for making the cam at home. Incidentally, it can be obtained ready made from Colvern, Ltd., of Romford

Our Tests of New Sets

By the "W.M." Set Selection Bureau

A CHAIN is as strong as its weakest link! The truth of that old saying nobody will dispute, and how readily it can be applied to radio.

The rapid reduction in the price of modern receivers has meant a very big increase in sales. This reduction is all very well in a way, providing that the standard of sets is kept up to the original high level. Just recently we have been subjecting commercial receivers to far more stringent tests necessitating the sets being sent by train to our country laboratories, some forty miles away from town.

While the majority of commercial receivers perform very creditably before transport, there is a different story to tell when they are tested a second time. None of the receivers are actually damaged in transit, but the shaking up they get does bring to life any weak points. We were surprised to find what a very big percentage of receivers are faulty after this comparatively short train journey.

Kolster-Brandes photo

On Whit Sunday congregations of 220 churches in the Ripon diocese listened to their Bishop's broadcast sermon from Ripon Cathedral. Sets were lent by Kolster Brandes, Ltd., to the poorer parishes, and here is the Vicar of Hunslet installing a K.B. 666 in the pulpit of his church

After collating our records we were able to divide these faults into two distinct classes—one where it was obviously due to the low price, and the other where the fault was outside the control of the manufacturer. The first includes faulty connections, bad workmanship so that the components become loose, and, finally, but to a lesser degree, faulty components.

The weak link—outside the control of the manufacturer—is faulty valves. The percentage of receivers that fail through a faulty valve, or valves, is exceptionally high. In some instances the receivers fail to function from the very beginning, while others "give up the ghost" after two or three days' working.

In spite of specially hooked filaments and anchored electrodes, we still get battery valves, such as double-diode-triodes, with the filaments touching the grid, while the number of output valves that go soft is also very high.

There is much to be said for the American type of multi-valve receiver using nine valves. As each valve is much less efficient than its English equivalent, the percentage of breakdowns is very small. We must say that in all the American receivers we have tried this year, the faults located have not been worth mentioning.

You must not think from this that we are in favour of boosting American-built receivers—far from it—but in view of the ever-decreasing prices of British sets, we do not feel that the same amount of care is taken in that final test, which is so important and upon which so much depends.

We feel sure that the time will come when the efficiency of each component is decreased, the overall efficiency of the receiver being kept up by the simple method of increasing the number of stages, as is done in America.

There are distinct signs that next season the popular sets will be three and four-valve super-hets, with amazingly complicated multi-electrode valves—combined detector-pentodes, seven- and eight-electrode frequency changers.

This, combined with the gentle manner in which railway porters handle radio sets, is not likely to improve reliability.

FREE ADVICE TO PROSPECTIVE SET BUYERS

To make the most of this free advice service, we ask you to answer the following questions :—

(1) The maximum price you wish to pay, and whether you are prepared to exceed this if there is no suitable set at your desired price.

(2) The locality in which the set will be installed.

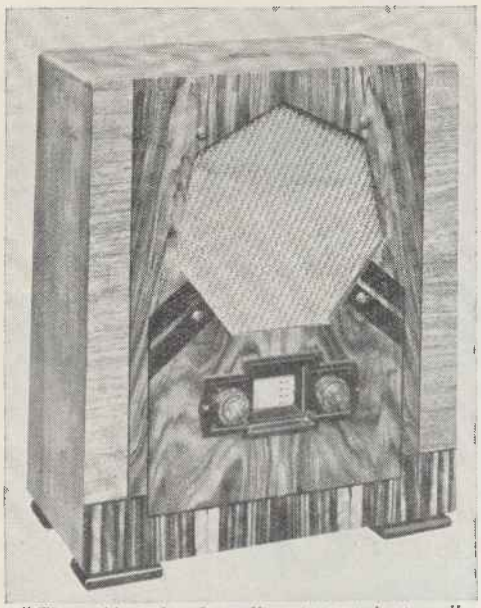
(3) The stations required, that is, locals only or a selection of foreigners.

(4) Whether you want an entirely self-contained set or one with external aerial and earth.

(5) Whether battery or mains driven. If the latter, whether A.C. or D.C.

A stamped-addressed envelope for our reply is your only expense. Address your inquiry to Set Selection Bureau, "Wireless Magazine," 58-61 Fetter Lane, E.C.4. Tell your friends about this useful service, exclusive to "W.M."

Columbia Super-het Battery Grand



"The cabinet is of medium-tone walnut, well finished and very compact. The tuning controls are as simple as it is possible to make them"

FEW new receivers have been introduced by Columbia during the last twelve months, so we were very glad to hear of the new battery super-het.

This receiver is the culmination of many months' research, and we must say that it is undoubtedly one of the most efficient battery-operated super-hets we have ever tried,

BRIEF SPECIFICATION

MAKERS: Columbia Graphophone Co., Ltd.
MODEL: 1006.
PRICE: £15 15s.
VALVE COMBINATION: High-frequency stage (Marconi S23), combined oscillator-detector (Marconi S23), single intermediate-frequency stage (Marconi VS24), double-diode-triode second detector (Marconi HD21), quiescent push-pull output (Marconi QP21).
POWER SUPPLY: Internal combined high-tension and grid-bias battery, with wet low-tension accumulator.
TYPE: Self-contained battery-operated super-het receiver, table model.
REMARKS: A highly recommended battery set.

irrespective of the number of valves employed.

Although it uses only five valves, these really do the work of eight or nine, for there is the three-in-one double-diode-triode and the QP21, which is two pentodes in one bulb, both of which pull their weight to the highest degree. Consequently, as might be imagined, the results are exceptionally good.

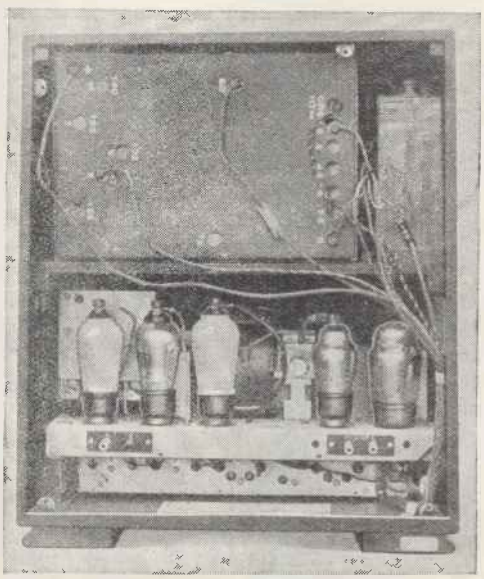
The cabinet is of medium-tone walnut, well finished and very compact. The tuning controls are as simple as it is possible to make them. There are two main knobs, but concentric with them are two switches, both with a decisive action.

The outer right-hand knob is the master tuner, which drives a tuning drum with a scale calibrated with station names and wavelengths. This dial, of course, is illuminated when the set is on. The left-hand knob is a master volume control, operating on both radio and gramophone.

On the centre of this knob is the four-position switch, controlling the long and medium waves, gramophone pick-up, and, at the same time, switching the set on and off.

The remaining switch is rarely used as it is the local-distance switch. It is only brought into circuit when one is close to the local station or wishes to cut down the volume from a powerful transmitter.

A 120-volt high-tension battery is fitted internally, and the average anode current when the set is not tuned to a station is 12 milliamperes, this rising to 14 milliamperes with normal volume. The maximum speech output is a little over 1,250 milliwatts, which is ample for the average house, and is the maximum one can obtain from dry batteries if running costs are to be considered.



"Only uses five valves; these really do the work of eight or nine, for there is a three-in-one double-diode triode and the QP21"

A glance at the circuit immediately shows up a whole host of novel ideas. The aerial is coupled to the grid of an S23 high-frequency amplifier through an aerial coupling transformer, one-half of the secondary of which acts as a second-channel whistle suppressor. This method of suppression automatically cuts out second-channel interference without affecting the volume of the stations that are tuned in.

The grids of the high-frequency and intermediate-frequency amplifiers are controlled—giving delayed automatic volume control—by negative bias supplied by one diode of the double-diode-triode second detector.

An entirely new Marconi valve, type HD21, is used as the second detector, and this feeds directly into two push-pull pentodes—both in one bulb—which give really good quality.

The loud-speaker is of the permanent-magnet low-resistance type, complete with matching transformer.

The receiver was tested thirty miles north of London, and after we had connected up the battery and accumulator and switched on, we noticed that the local stations, as well as Radio Paris, could be tuned in on the loud-speaker in broad daylight, *without any aerial or earth.*

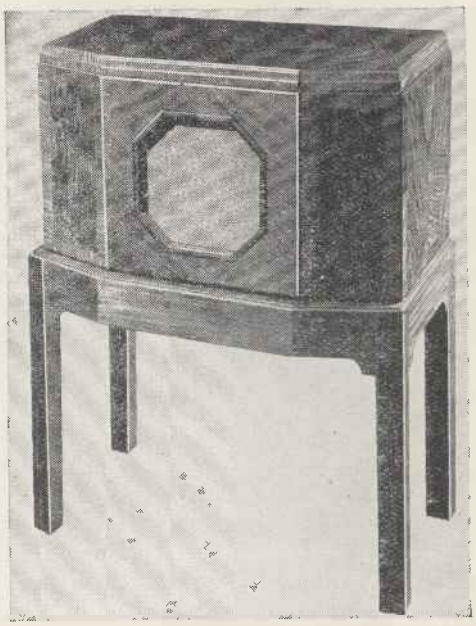
This was a good start, and gave us some idea of what we might expect in the way of sensitivity. But the point which instantly struck us was the quality. It was really equal to the bulk of mains driven sets that we have tested.

We connected up an external aerial—ours was 80 ft. long and were rewarded with colossal volume from the local station, which even with the local-distance switch in circuit was too loud for a small room.

With this receiver selectivity need never be considered, as all of the stations according to the Lucerne Plan can be separated.

Wireless Magazine. July, 1934

Pye CR/DC Cambridge Super-het Console

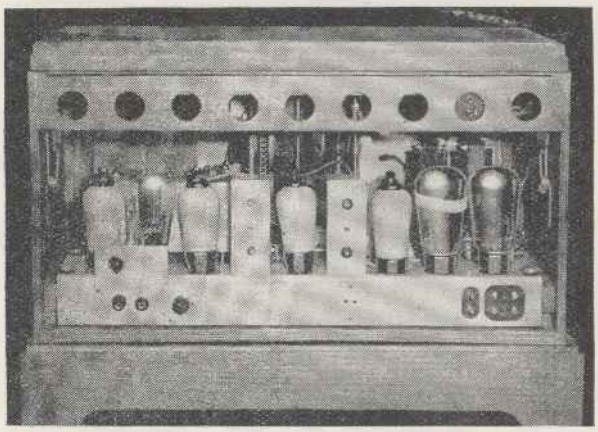


"An original note has been struck in the design of the cabinet. It is constructed of grained walnut and is the only cabinet we have seen of this design"

WE very strongly admire the policy of the Pye people in producing receivers of the highest quality rather than compromising between quality and price. Their latest Cambridge range includes, without question, some of the finest receivers that have ever been produced in this country.

The cabinet work alone is sufficient to sell the receiver, while the technical reader will go into rhapsodies over the highly efficient circuit and layout used. An original note has been struck in the design of the cabinet. It is constructed of grained walnut and is the only cabinet we have seen of this design.

All of the controls are grouped together underneath the lid, so that once the receiver has been tuned-in the lid can be shut down, making a self-contained unit and more a piece of furniture than a radio receiver.



"The technical reader will go into rhapsodies over the highly efficient circuit and layout used. . . . A local-distance switch is fitted on the back of the chassis"

On the left-hand side of the cabinet is the on-off switch and is entirely separate from the wave-change and gramophone switch in the centre of the cabinet under the lid. On the left-hand side of this switch is the tone control, on the right-hand side the master tuner, and at the bottom the volume control.

All these controls are clearly marked so that there will be no difficulty in obtaining satisfactory results from the very beginning. An ingenious visual tuner, or "tuning compass," as Pye call it, is visible through an opening in the moulded escutcheon plate beneath the tuning dial.

When the set is switched on, but not tuned to any particular station, the tuning metre needle will remain over to the left-hand side. When the set is tuned in to a station the pointer will move over to the right in the direction of the arrow. The receiver is correctly tuned when the needle is deflected as far as it will go to the right-hand side.

A local-distance switch is fitted at the back of the receiver immediately above the aerial terminal. The tuning dial is brilliantly lit by means of a 15-watt miniature bulb, and as the dial is boldly calibrated with station names, as well as in wavelengths, it is quite a simple matter to determine to which station the receiver is tuned.

The manual volume control operates on both radio and gramophone and should be used in addition to the automatic volume control, which prevents fading without any external adjustments being made. Provision has been made for an external loud-speaker, and the two sockets for this are at the back of the chassis.

A noise suppressor is provided which reduces electrical interference and the general background noise.

The output stage consists of two D.C. pentodes, giving a very high output. As may be expected, the quality is superb, and the loud-speaker handles the huge output from these two pentodes without the slightest trace of dither or distortion.

With a gramophone pick-up plugged into the two sockets provided at the back of the chassis the output is sufficient for quite a large hall. As a rough estimate we would say that the volume is sufficient for dancing by forty or fifty couples.

The first point noticed during our test was the exceptional smoothness of all the controls, the entire absence of background noise, or mains hum of any kind, and the unusual sensitivity.

BRIEF SPECIFICATION

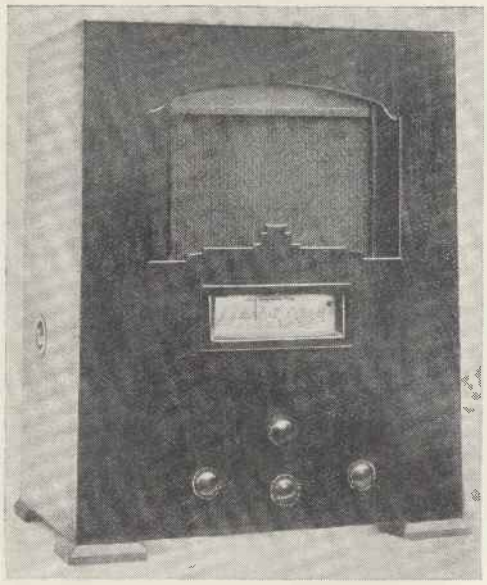
MAKERS: Pye Radio, Ltd.
MODEL: CR/DC.
PRICE: £21, or £23 2s. with stand.
VALVE COMBINATION: High-frequency stage (Mazda DC2/SG/VM), first detector (Mazda DC2/SG), oscillator (Mazda DC3/HL), single intermediate-frequency stage (Mazda DC2/SG/VM), double-diode-triode second detector (Mazda DC2/HL/DD) and two pentodes in push-pull (Mazda DC2/Pens).
POWER SUPPLY: D.C. mains only.
TYPE: A highly sensitive D.C. super-het with push-pull output.
REMARKS: A receiver for the connoisseur.

On an aerial 80 ft. long the selectivity was of the order or 8 to 9 kilocycles on medium waves, and a little better than 10 kilocycles on the long waves.

During our tests we were able to receive the sixty-eight stations marked on the tuning scale and an additional twenty which were not identified, making a total of eighty-eight stations.

Selectivity, sensitivity, quality, and appearance are all of a very high standard, and the receiver at twenty guineas is exceptionally cheap.

Kebtex Proscenium Straight Four



" The cabinet is obviously the product of an artist. It is of dark grained walnut, with a high degree of polish "

WE were glad to have the opportunity of testing the product of the Kebtex Company, who are comparative newcomers to radio.

This firm is concentrating on one fine receiver that is suitable for either A.C. or D.C. mains at will. We soon discovered how they arrived at the name of Proscenium for the loud-speaker fret takes the form of a theatre stage and is very realistic as it is slightly recessed, giving the impression of depth.

BRIEF SPECIFICATION

MAKERS: Kebtex Radio.
MODEL: Proscenium Four.
PRICE: £11 11s.
VALVE COMBINATION: Screen-grid high-frequency stage (Tungsram SE2018), triode detector (Tungsram R2018), multi-grid output valve (Tungsram PP2018), and half-wave valve rectifier (Tungsram PV4018).
POWER SUPPLY: A.C. or D.C. mains of any voltage between 110 and 260 volts, any frequency A.C.
TYPE: Table receiver for A.C. or D.C. mains.
REMARKS: A really fine straight set.

The cabinet is obviously the product of an artist. It is in dark grained walnut with a high degree of polish which we were surprised to find is permanent. We understand that the cabinets are actually cellulosed which accounts for this polish.

Although the receiver is entirely self-contained, it is far from being bulky. The overall height is 19½ in. with a width of 14½ in. and a depth of 9½ in. The controls are quite conventional. In the centre is the main tuner, while beneath it, from left to right, are the reaction condenser, volume control, which varies the gain in the high-frequency stage, and on the extreme right a combined wave-change and gramophone switch.

The on-off switch is entirely separate and is fitted to the left-hand side of the cabinet. A tone control enabling one to vary the pitch to suit individual taste is fitted on the right-hand side of the cabinet.

This is the first receiver we have ever tested that has the tuning dial calibrated with certain American stations as well as with the normal medium- and long-wave Europeans. In view of this we were inclined to think that the manufacturers were taking rather an optimistic view of the capabilities of the receiver, but after we had made only a few tests we were obliged to change our opinion.

The circuit uses three receiving valves and a rectifier, which comes into use on A.C. mains only. The first valve is a variable-mu screen-grid high-frequency amplifier which is coupled to a steep-slope triode detector. Transformer coupling is employed between this valve and the multi-grid output valve which gives a large output of over 2.5 watts.

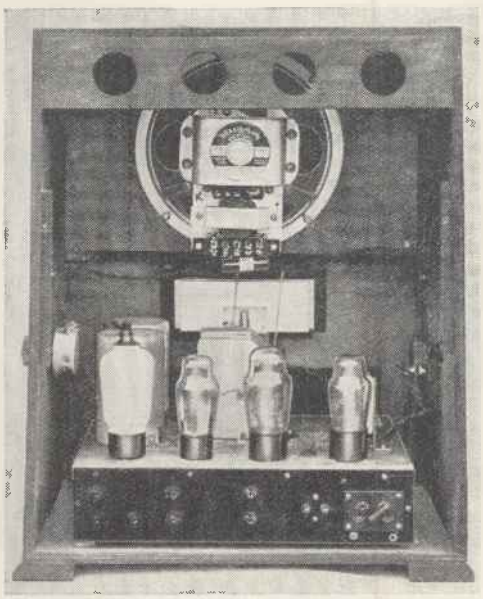
Such little things as careful matching between output valves and the loud-speaker and by using a transformer of massive dimensions have produced quality of a high level. This, in conjunction with a tone control, really does make the receiver an outstanding one.

A metal chassis is used and all of the smaller components are fitted beneath this so that the chassis appearance is very clean and businesslike.

On test the receiver more than justified the claims of the manufacturers. The tuning dial is of unique design, and it is so accurately calibrated that it is a simple matter to identify the numerous foreign stations received.

On an aerial having a total length of 80 ft., and without an earth connection—this as specified by the manufacturers—we were able to obtain 12- to 14-kilocycle selectivity.

If a short indoor aerial has to be used, we suggest 8 to 10 ft. of wire round the picture rail. With this an average of twenty stations can be heard on the loud-speaker, speaking well for the efficiency of the high-frequency stage. After dark no difficulty is experienced in logging sixty European stations.

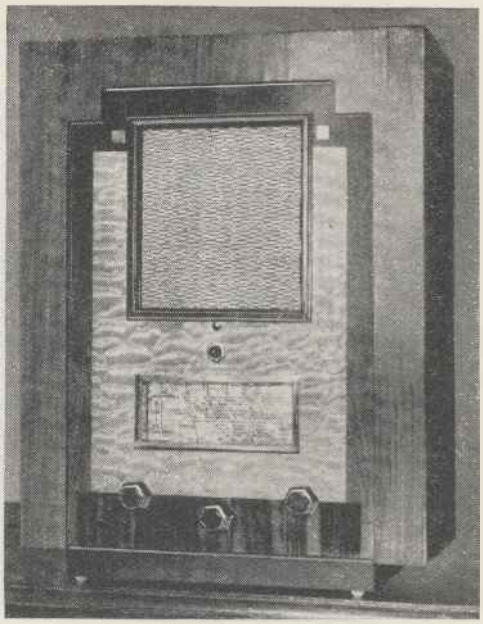


" The circuit uses three receiving valves and a rectifier. . . . A metal chassis is used and all the smaller components are fitted beneath "

Those readers who listen to low wavelength relay stations or Fécamp need have no fear about the set not tuning down to 200 metres, for Fécamp comes in with about eight degrees to spare. One evening during a late test we were able to pick up no less than seven American medium-wave transmitters, including W1OD, Miami Beach, WCAU KDKA and WT1C.

Wireless Magazine. July, 1934

Ferranti Arcadia Super-het Receiver



"Every knob seems to move an indicator on the tuning dial . . . only three knobs, all of which are simple and flexible in operation"

WE spent a good half-hour amusing ourselves with the amazing tuning dial on the Ferranti set before we even attempted to test it. This new Ferranti product is, without question, a most interesting receiver, which, although costing but fifteen guineas, embodies all the finer points that one only thinks of finding in a really expensive set.

Every knob seems to move an indicator on the tuning dial. The wave-change switch, for example, moves a little pointer which tells one to which waveband the receiver is tuned. The left-hand knob indicates another pointer showing the position of the volume control.

The centre knob actuates a long upright knife-edge which travels across a silver scale calibrated in black with station names. Correct tuning is indicated by means of a visual tuning device.

One might well expect that with all those little refinements the controls would be complicated, but here again there are only three knobs, all of which are simple and flexible in operation. There is, of course, a tone control, but this does not often have to be adjusted.

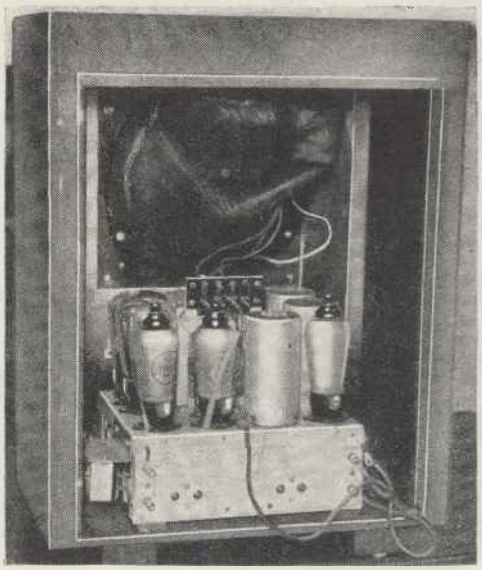
The cabinet is an entirely new departure. It is of the upright type in three tones of walnut inlaid with maple, which, combined with a chromium plated escutcheon, looks very effective.

The circuit is a very special one evolved by Ferranti to suit Ferranti valves. The first valve is a combined oscillator-detector (VHT4 heptode). Without this valve full automatic volume control would not have been possible. It is followed by a single intermediate - frequency stage using a variable-mu high-frequency pentode. This is in turn coupled to a double-diode-triode second detector.

Contrary to usual practice the output valve is a power triode giving excellent quality and an output of 2.5 watts.

An energised loud-speaker is used with a built-in switch so enabling an external loud-speaker to be used on its own.

The receiver is supplied ready for 220 to 230 volts A.C. mains, but it can be adjusted for any voltage between 200 and 250, 40 to 100 cycles.



"The circuit is a very special one evolved by Ferranti to suit Ferranti valves. . . . An energised loud-speaker is used with a built-in switch

On the left-hand side at the back of the chassis are two terminals for the gramophone pick-up leads. Through the hole in the chassis, immediately above the top terminal, comes a wire which must be disconnected before the pick-up is used.

For our first test we used the mains aerial and with this we were able to log quite an appreciable number of the stations calibrated on the tuning dial. The only point against the mains aerial was that our noisy supply caused the background noise to be rather objectionable.

With a short external aerial of about 30 ft., and a good earth connection we were immediately impressed with the absence of background noise and mains hum. When the receiver was not actually tuned to a station it was almost impossible to detect that it was working. The only indication was the illuminated dial.

The minimum wavelength on the medium band is approximately 198 metres. Fécamp could be tuned in on its wavelength of 206 metres a good loud-speaker strength at any time of the day or evening. At the other end of the scale Budapest was receivable during the late afternoon.

BRIEF SPECIFICATION

MAKERS: Ferranti, Ltd.
MODEL: Arcadia Consolette.
PRICE: £15 15s.
VALVE COMBINATION: Combined oscillator and first detector (Ferranti Heptode VHT4), single intermediate-frequency amplifier (Ferranti high-frequency pentode VPT4), double-diode-triode second detector (Ferranti H4D), super-power triode output (Ferranti LP4), and full-wave valve rectifier (Ferranti R4).
POWER SUPPLY: A.C. mains, 200 to 250 volts, 40 to 100 cycles.
TYPE: An unusually handsome super-het receiver.
REMARKS: Outstanding value for money set in every way.

All the intermediate stations with 9-kilocycles or more separation could be heard without interference and without having to increase the volume control to anywhere near the maximum point.

As one would expect with a Ferranti receiver, the quality is of a very high order, even when the output is increased to the maximum of 2.5 watts.

Philco Model 16 Table Super-het

" Owing to the extraordinary compactness—there is not an inch wasted anywhere—the receiver is no larger than many English four-valve sets"

WE must hand the cake to the Philco people when it comes to designing multi-valve receivers. Our tests show without any doubt whatsoever, that some of their seemingly extravagant claims for the model 16 receiver are, after all, a trifle conservative. The average reader cannot possibly realise the results that can be obtained with an eleven-valve set of this kind.

With only single-dial control, five waveband switching with five separately calibrated and separately illuminated tuning scales covering all wavebands between 13 and 556 metres, one can, in fact, hear the whole world.

When we were told that the Philco model 16 was ready for test we imagined that as it had eleven valves it would be a colossal receiver and would require a bench all to itself. To our surprise, owing to the extraordinary compactness—there is not an inch wasted anywhere—the receiver is no larger than many English four-valve sets.

Owing to the elaborate screening nothing can be heard whatsoever without an aerial or earth, although with 9 in. of wire Europe can be toured with ease. Throughout our tests we used a 30-ft. aerial, at a distance of 40 miles from London.

The receiver is calibrated in frequencies which will please those who are accustomed to thinking in kilocycles rather than in metres, but for the uninitiated a conversion table is supplied. We can confidently say that at any single minute of the twenty-four hours a large number of stations can always be heard.

The short wavebands are sheer joy. The bottom band tunes between 13 metres or 23 megocycles, and 27.3 metres or 11 megocycles. On this band we were able to hear all the more important American commercial broadcast stations, well over one hundred 20-metre amateur stations and whole hosts of ships and other stations of a similar kind.

During one evening we heard no less than 110 20-metre amateur stations in a little over one hour and, in addition to these, we heard between seven and eight American broadcasters, Atlantic liners, etc.

Such stations as K4SA in Porto Rico, W8XK in Pittsburgh, and other long distance stations came in at amazing volume. Even on the lowest possible wavelength of 13 metres the receiver was perfectly stable and quite as easy to handle as a medium-wave broadcast set.

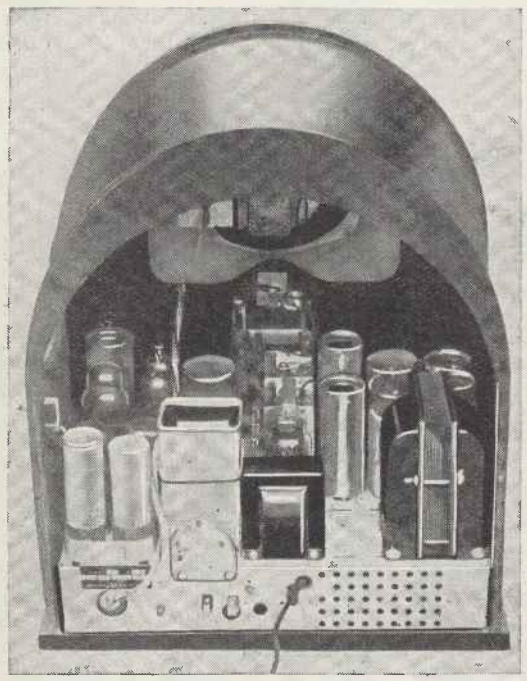
BRIEF SPECIFICATION

MAKERS: Philco Radio and Television Corporation of Gt. Britain, Ltd.
MODEL: 16.
PRICE: £36 5s.
VALVE COMBINATION: Oscillator (Philco 76), first detector (Philco 77), two intermediate-frequency stages (Philco 78), diode second detector (Philco 37), first low-frequency amplifier (Philco 77), driver stage (Philco 42), class-A output (two Philco 42's). Q.A.V.C. control valve (Philco 78), and full-wave rectifier (Philco 80).
POWER SUPPLY: A.C. mains, 200 to 250 volts, 40 to 100 cycles.
TYPE: An eleven-valve all-wave super-het.
REMARKS: Truly a set to pick up the whole world!

A two-speed tuning control is provided, which enables one to tune in short-wave stations by merely a little knob twiddling. The second tuning band is between 25 metres (12 megocycles) and 51.7 metres (5.8 megocycles), and between these wavelengths one can hear numberless short-wave stations at good strength. For example, VK2ME of Sydney was heard for a whole hour at 11 o'clock on a Sunday morning. Between 50 and 200 metres, which is covered in two steps, there were far too many stations for us to enumerate.

Little trawlers on the North Coast of Scotland or the Irish Sea were coming in at full loud-speaker strength. On the medium waves the results were equally as good, every degree on the dial bringing in a programme at full loud-speaker strength.

It is the first receiver that we have actually tried where we can be assured that the non-technical listener will be able to receive shortwave stations without previous experience.



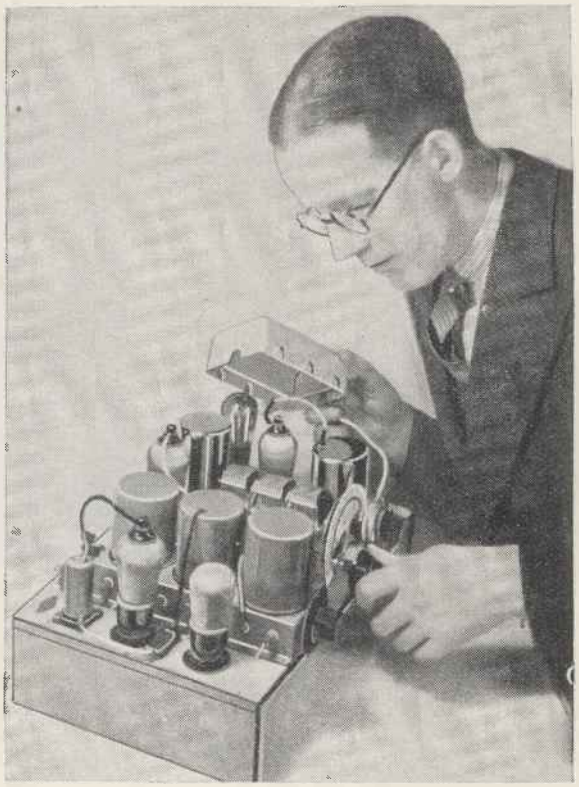
" Owing to its elaborate screening, nothing can be heard without an aerial or earth. The circuit . . . is absolutely full of brand-new ideas"

Principles of Set Design—No. 6

Reaction and Detector Output Circuits

By Percy W. Harris,

M.Inst.Rad.E.



A member of the "W.M." Technical Staff busy at work in the Fetter Lane laboratories at London

SO far we have considered the principles of set design up to the point where signals are fed into the detector valve. We now come to some very important considerations which merit our closest attention, for unless they are properly understood the whole functioning of the receiver may be upset.

Simple Tuned Circuit

Consider Fig. 1, in which I have drawn a simple tuned circuit connected to the conventional grid-leak and condenser detector. We have seen from previous articles that grid current plays an important part in the rectification, and the net result is that in the output circuit we have a combination of high-frequency and low-frequency currents. What do we want to do with them?

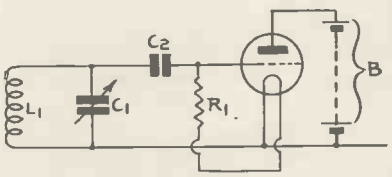


Fig. 1.—A simple tuned circuit connected to the detector by the conventional leaky-grid method

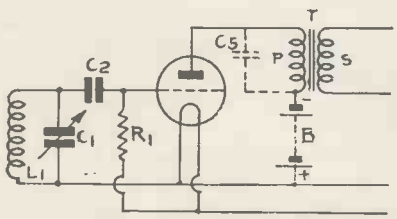


Fig. 2.—Similar to Fig. 1, with the anode current flowing through the primary of a low-frequency transformer

The beginner sometimes forgets that a low-frequency valve differs from a high-frequency valve only in certain relatively minor points, the low-frequency valve being more suited for its particular purpose. Both valves, however, will magnify signals at almost any frequency, and this is the reason why it is so dangerous to allow high-frequency currents to get into the low-frequency part of the circuit. On the other hand, the high-frequency component in the output side of the detector is of great value to us when we want to obtain reaction.

In Fig. 1 I have joined in the plate circuit nothing but a high-tension battery, so that we have changes of current only, there being no resistance or impedance of any high value in this circuit across which a practicable voltage can be set up.

If now we want to use transformer coupling (the various low-frequency couplings will be dealt with in a separate article) we connect it as Fig. 2. Here again I have simplified matters as much as possible, showing a separate battery for the detector valve. When a common battery is used for several valves the arrangement will be slightly different, but we are not at the moment dealing with any other than the detector output itself.

Only One Path

In Fig. 2 the changes of current flow through the primary of the transformer and set up voltages across the secondary s. Actually matters are not quite so simple as this, but at the moment this explanation will serve.

The point I want to make is that as the diagram is drawn both high- and low-frequency currents have only one path—through the transformer and the battery—and if the transformer is a good modern one its primary inductance will be such as to make it impossible for the high-frequency current to take an inductive path.

Experiment You Can Try

It has got to get back somehow, and therefore it will choose the self-capacity of the windings (which may be considerable) and will thus get back to filament that way.

If you have the odd apparatus, try fixing up a detector and one low-frequency stage in this way, using a transformer of good quality but one which does not include a fixed

WHERE ALL THE DESIGNS ARE WORKED OUT
Here is a corner of the Fetter Lane laboratories of "Wireless Magazine," showing a member of the Technical Staff busy engaged testing a "W.M." design

condenser inside the casing. Listen to the strength of signals, and then shunt across the transformer a capacity of, say, .0002 microfarad and notice how signals go up owing to the fact that the efficiency of the detector is greatly improved by providing a proper path for the high-frequency current.

Not a Good Method

It may be, however, that the set will be unstable because the high-frequency currents are still passing through the common high-tension battery, and the mere shunting of the transformer primary by a condenser is not, by any means, a complete method of keeping the high-frequency currents where we want to keep them.

Let us take our design a stage further and in Fig. 3 see what can be done with a simple reaction detector circuit followed by a transformer-coupled valve. There is considerably more complication now, but each part has a special purpose. We have, for example, connected to the plate circuit of the valve a variable condenser C_3 joined round to the reaction coil coupled to the tuning coil L_1.

Very High Inductance

Equally at the point where the condenser is joined to the plate circuit we have one terminal of a radio-frequency choke HFC, which is made to have a very high inductance sufficient to offer a high impedance to any radio-frequency current within the wavelength ranges we desire to receive with this set.

Although this inductance is high it will not afford any appreciable barrier to the flow of low-frequency or rectified currents which we desire to pass on. Thus these go through the primary of the transformer T, and out through a resistance (about which we shall speak later) to high-tension positive.

Theoretically, at least, we seem to have got rid of the radio-frequency current through the path C_3-L_2 back to filament, passing on only the audio- or low-frequency currents we want. If, however, things were as simple as this the lot of the set designer would be a much easier one!

There are several possible sources of trouble here. The first concerns the condenser C_3 which, being variable, may have a very low value (insufficient for good detection) at the point of minimum reaction which we require. If this figure is actually reduced to zero then we no longer have any condenser to by-pass the radio-frequency currents, and if we increase the capacity up to a point where it is doing its job satisfactorily we may get too much reaction.

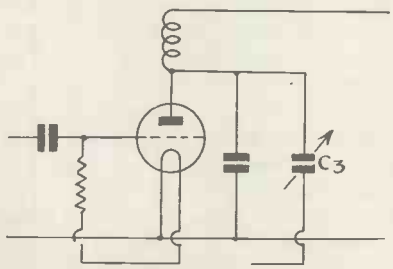


Fig. 4a.—An ordinary reaction circuit with a fixed condenser between the anode and filament and a variable condenser to control reaction

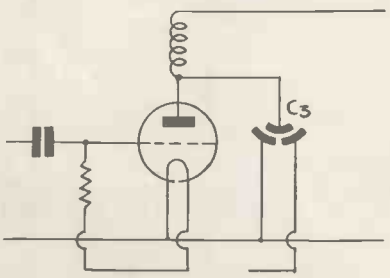


Fig. 4b.—Another form of reaction using a differential reaction condenser. This scheme has several advantages

Simple Reaction Methods

There are two ways of overcoming this difficulty, shown in Fig. 4*a* and 4*b* respectively. In Fig. 4*a* we have a small condenser joined permanently between the plate of the valve and the negative low-tension, while the condenser C_3 remains as before, variable, and thus, even when the reaction is set at zero, there is still an adequate by-pass for the high-frequency currents in the fixed condenser.

In Fig. 4*b* we have what is known as a differential-reaction condenser, conventionally drawn as shown, and in which we consider the upper curved line as the moving plates. When the moving plates are completely enmeshed with the plates on the right, then we have the full reaction effect, and the capacity can be arranged to be fully sufficient for our maximum.

Differential Reaction

On the other hand, when we move the moving plates over to left until they are fully enmeshed with the other set, then the radio-frequency currents have one path only—straight to the filament.

At intermediate positions the capacity is shared between the reaction condenser and the *straight* condenser, and the total capacity at any position of the moving plates is such that the capacity through the reaction coil to filament, plus that direct to the filament, is always the same.

The differential reaction scheme has several advantages. First of all, the total capacity shunted across the detector is always kept constant; secondly, this capacity, which is also across the primary of the transformer; does not vary, and this may be very

important if we are designing a set for the best possible audio-frequency output; thirdly, we have less difficulty in designing a suitable reaction coil.

There are numerous variations of the reaction circuit, and a whole article could easily be given to the subject, but as space does not permit this I will refer to only one variation of the scheme, namely, that given in Fig. 5. It differs from the scheme previously shown, because the path of the radio-frequency currents from the detector plate instead of going through the condenser and then through the reaction coil, is through the reaction coil first and then through the condenser.

Hand-capacity Effects

At first glance a beginner may think this change an unimportant one. In practical design the change is by no means slight. In all set designs it is customary to arrange the moving plates of the variable condenser as near as possible to earth potential so as to reduce hand-capacity effect.

In the scheme shown in Fig. 3 or 4, both fixed and moving plates are at a radio-frequency potential above earth, and therefore there may be, if we are not careful, slight hand-capacity effects.

Satisfactory Reaction

Normally, in a well-designed set hand-capacity effect will not be noticed, but in short-wave receivers they may become very important. The advantage of the scheme shown in Fig. 5 is that the moving plates of the reaction condenser are directly at earth potential, and therefore the handling of this condenser is less liable to produce hand-capacity effects.

Against this must be set the fact that the windings are completely separate, and this may complicate switching schemes. It is no longer possible, too, to adopt the simple differential-reaction scheme shown in Fig. 4*b*, and we must use a condenser C_4 to afford the necessary by-pass for radio-frequency currents when the condenser C_3 is set at a minimum or at a very low value. It is possible to design a differential reaction scheme to avoid this trouble, but we will not go into this here.

The next series of problems concerns the radio-frequency choke. It is comparatively easy to wind an inductance high enough to act as an effective choke for currents in the medium waveband, and if slot-honeycomb, or other forms of low-capacity winding are used, the distributed capacity can be kept quite small and a good choke made.

It must be remembered, however, that every winding has some capacity—it is impossible to design a purely non-capacity winding—and when we have raised the inductance sufficiently high to give a proper choking effect on the long waveband the stray capacity together with the inductance will form a tuned circuit, the frequency of which may fall somewhere in one of the wavebands we wish to receive.

Poorly designed radio-frequency chokes are often found to have a natural frequency right in the middle of the long waveband, and in Fig. 6 I have shown just why this can be so pernicious.

Once more I have explained the matter very simply so that the principles may be understood clearly. Here we have in the plate circuit a radio-frequency choke with its distributed capacity dotted, the primary of the transformer and the high-tension battery, with a dotted condenser across the primary of the transformer and the battery to represent the distributed capacity here.

Now this radio-frequency choke and its distributed capacity will form a tuned circuit, the natural frequency of which may fall somewhere within one of the wavebands we wish to receive. If then the tuned circuit

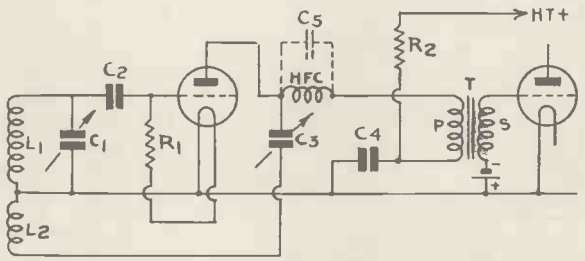


Fig. 3.—A simple circuit, with a leaky-grid detector and reaction coupled by a low-frequency transformer to a low-frequency amplifier using a triode output valve

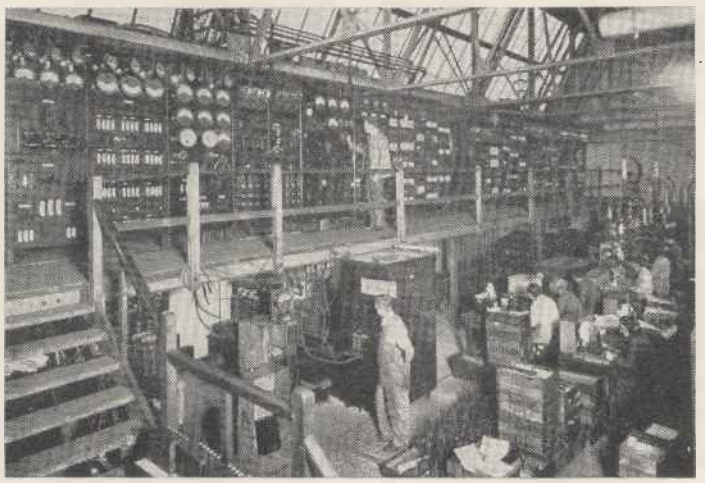
L_1-C_1 is tuned to the same frequency as that of the circuit formed by the choke and its capacity, resonance will occur.

Self-oscillation

In this case there will be no need of any reaction circuit to bring about oscillation, for the inter-electrode capacity of the valve itself will be quite sufficient to couple these two circuits together, even if there is no stray coupling between the choke itself and the coil L_1, which often happens.

In such circumstances the symptoms are generally as follows. First of all we tune our set in the ordinary way and adjust the reaction to be suitable for the signal we require. As we tune up the scale thereby increasing the capacity C_1 and reducing the frequency, we increase our reaction a little more—quite a normal proceeding as everyone who handles a set knows.

Then, as we go still further and approach this point of resonance, of which I have spoken, we find that instead of *increasing* the reaction setting we have to *decrease* it to prevent self-

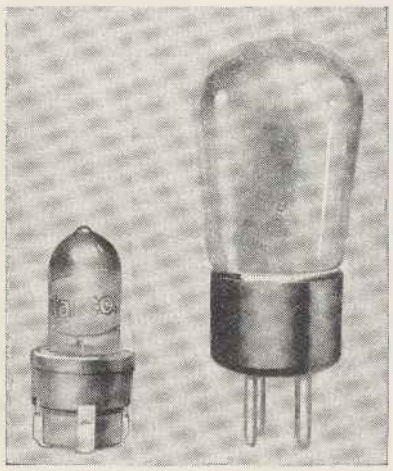


WHERE BIG AND SMALL CONDENSERS ARE TESTED THOROUGHLY

Thousands of electrical tests are made daily in the works of the Dubilier condenser people. Here is a scene in the factory with the main switchboard on the left

oscillation, and we rapidly approach a point where we have reduced our reaction condenser to its minimum setting and still the set is not stable. In fact, it may oscillate violently whenever the condenser is anywhere near the setting of resonance between the two circuits.

If you carefully examine the circuit shown in Fig. 6, you will see that the condenser connected directly



NEW MARCONI MIDGETS

Marconi-Osram have produced a new range of midget valves with a filament current of only .1 ampere at 1 volt. Their size can be gauged from this photograph of a midget and a standard type detector

between the plate of the valve and the filament is virtually in parallel with the stray capacity of the radio-frequency choke—a point which is often overlooked by set designers. For this reason a radio-frequency choke which may be perfectly satisfactory in a non-reaction circuit may upset the whole design if used in a reaction circuit.

Preferable Scheme

Furthermore, if we use the circuit shown in Fig. 4*a*, the total shunting capacity, being variable, may introduce a further complication, for the point at which the set may be unstable can easily vary with different settings of the reaction condenser as well as with the tuning. For this reason the scheme shown in Fig. 4*b* is often preferable.

A well-designed radio-frequency choke will have its point of resonance with its self-capacity outside of the wavebands on which we wish to receive. It does not follow that a set will not work if we omit a radio-frequency choke. What we want to do is to provide an alternative and much easier path for the radio-frequency currents than they will have by going through the low-frequency portions of the circuit.

It is possible to use a resistance in place of a choke for the purpose of offering the necessary high impedance. A resistance, of course, will have no resonance problems, but on the other hand if it is high enough to do what we want it may cut down our voltage wastefully.

Speaking of alternative paths, one easier than the other, if you refer back to Fig. 3 you will see that after the low-frequency currents have left the transformer they have two paths, one through the resistance R_2, the high-tension battery and thus back to filament; and the other through the condenser C_4 direct to the filament.

If we connected the transformer straight to the high-tension battery without this resistance there would be only one path back to filament for the low-frequency current, that is through the high-tension battery.

A good high-tension battery in first-class condition will have a comparatively low resistance, but it will still be an appreciable one, and these currents flowing through such a resistance are bound to set up voltages across it. Furthermore, as this battery is common to all of the valves, it follows that any voltages set up across this resistance of the battery must automatically be handed to any other valves connected to the same battery, thus giving a coupling effect and a frequent source of howling and instability.

By inserting a resistance R_2

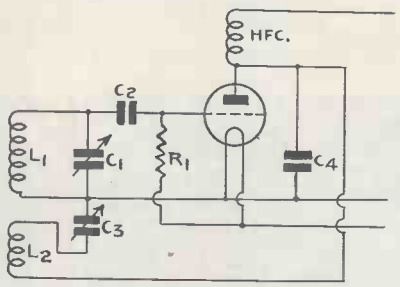


Fig. 5.—A form of reaction control in which the radio-frequency current flows first through the coil and then through the reaction condenser

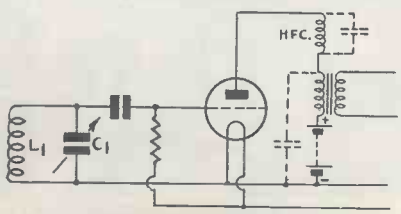


Fig. 6.—The condenser connected between the plate of the detector and the filament is virtually in parallel with the stray capacity of the high-frequency choke

(theoretically a choke will also serve the same purpose, except that we cannot design a practical one very well without heavy expense) and providing a condenser C_4, there are two alternative paths. If C_4 is of 2-microfarads or more capacity it will offer a very low impedance to these audio-frequency currents, whereas the resistance of the order of 20,000 to 50,000 ohms will offer a difficult path, so the low-frequency currents go through C_4 back to the filament, only a negligible proportion of them going through the battery. This is called de-coupling, and is essential in a well-designed set.

About Feedback

Too many beginners in set design think a set is stable if it actually does not howl. Now howling or self-oscillation represents a degree of feedback sufficient to make normal reception impossible, but it should be remembered that a certain amount of feedback, sufficient to spoil quality, can occur without the user of the set realising the effect is there at all.

The modern transformer is so well designed that if properly used in a correctly de-coupled circuit the quality can be of the highest order, but unfortunately in comparatively few sets (owing to the expense and trouble probably) is there sufficient de-coupling to enable the low-frequency portions of the set to work as the designer originally intended they should.

Resistance-capacity Coupling

It is also assumed quite wrongly in most cases that if resistance-capacity coupled amplification is used good quality is assured, provided, naturally, that adequate de-coupling is included.

Again, in super-hets, which have their own special problems and cannot be dealt with to a large extent in this series of articles, we are faced with the second-detector problem, different from that of the ordinary straight set in that the high-frequency side of the detector (more accurately called intermediate-frequency side) is so low in frequency in some cases as almost to come near the upper limit of the audio frequency and, therefore, offer difficulties in the design of the radio-frequency choke.

Next month we will consider the various forms of low-frequency coupling and how to use them so as to get the best quality.

The Vatican Short-waver

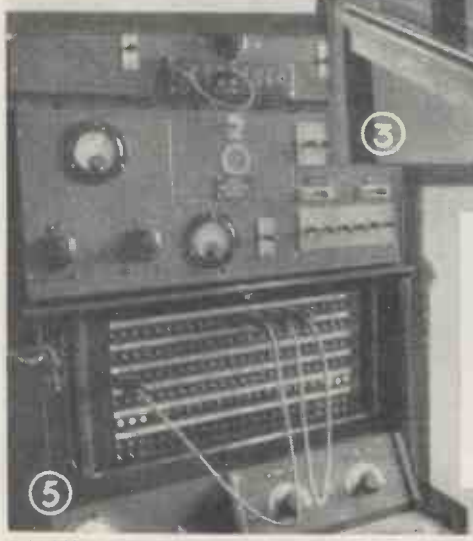
HJV, the Vatican station, works on wavelengths of 19.8 and 50.26 metres. The station, built in the heart of the Vatican, is intended to keep Catholics throughout the world in touch with Rome

(1) This delightful view is taken from the roof of the Vatican station. In the background is the famous dome of St. Peter's, Rome

(2) This shows the picture telegraph receiving apparatus at the Vatican broadcasting station. It was presented to the Pope by its French inventor, M. Belin

(3) One of the Vatican engineers at the control panel of the transmitter checking the quality of the outgoing programmes

(4) This is the chief engineer of the Pope's broadcasting station at the Vatican



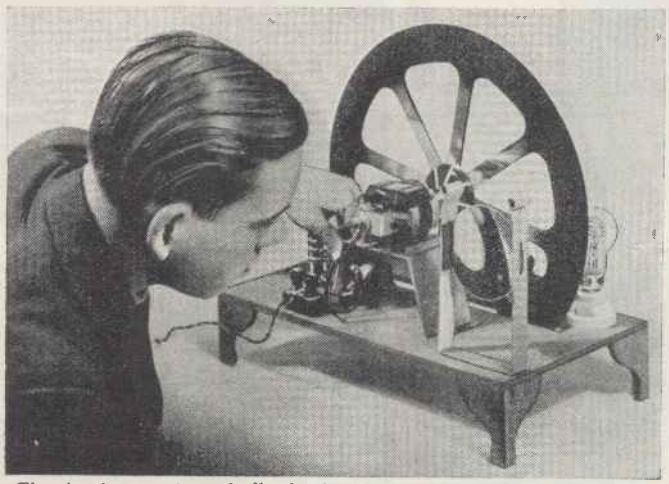
(5) This is the central switchboard at HJV, where all the connections between the microphones in the Vatican Palace, St. Peter's, etc., can be switched to the transmitter. (6) Pere Gianfrancesci, the famous scientist, is responsible for the technicalities of all Vatican broadcasting. (7) The mast of the Vatican station is just inside the great wall

HOME TELEVISION SECTION

Television Components —and All About Them

By H. CORBISHLEY

AT the present time practically all television receivers are home assembled, and this means, of course, that a certain number of components must be purchased which are beyond the ability of the amateur to construct. How many are the parts that are purchased will depend upon the inclination and the facilities of the experimenter, so it will be helpful to consider the parts in detail. For convenience we can divide the receivers that are most generally used into four types —the disc, the mirror screw, the mirror-drum, and the cathode-ray, in order of simplicity and cost.



The simplest receiver of all—the disc; note the use of the beehive-type lamp, a single viewing lens and spoked disc

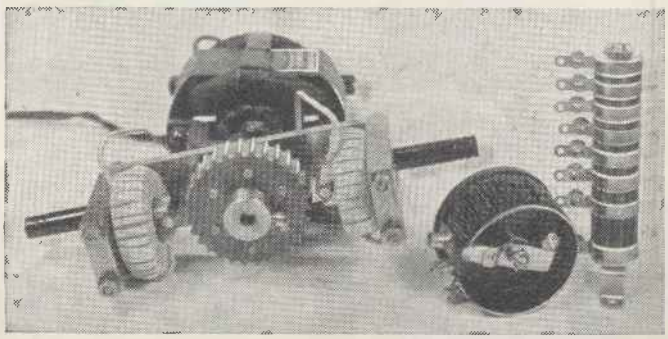
The Scanning Disc

The disc receiver consists of three essential parts—disc, motor, and neon lamp, a refinement being added in the way of a lens for magnifying the image. The disc consists of a circular piece of 32-gauge aluminium, and near the periphery are punched a series of holes in spiral formation, the size of the holes being .02 in. square. A plain disc will answer quite well, but it is usual to provide it with eight spokes. There are two reasons for this, one being that a spoked disc is somewhat lighter and will require less power to drive, and the other that the eight spokes when viewed by the light of a lamp operated from 50-cycle A.C. supply provide a stroboscopic effect and appear to be stationary when revolving at the correct speed of 750 revolutions per minute. This gives us a frictionless speed indicator of great value.

Scanning discs can be, and often are, amateur made, but the work entailed necessitates great accuracy if a successful disc is to be produced. This will be appreciated if it is remembered that when the disc is revolving the holes must pass across the field of vision on exactly adjacent lines and be exactly spaced angularly, otherwise the picture will be marred by black or white lines and have a stepped appearance.

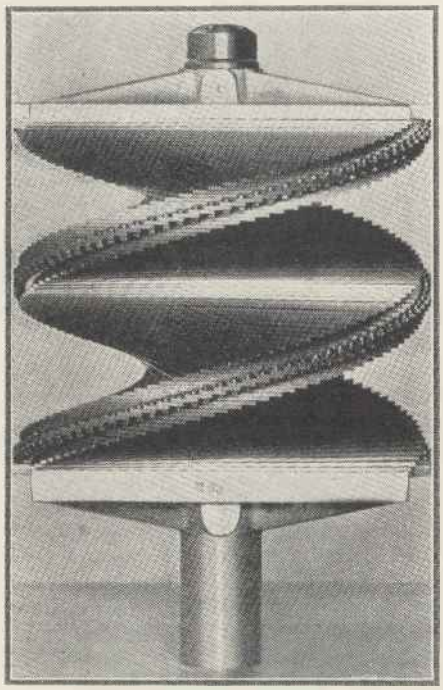
Motors

The disc, as stated before, must be driven at a speed of exactly 750 revolutions per minute, so this entails the use of an electric motor. Practically any small motor will do for this purpose, though it is advisable to use one of a power which will just be capable of the correct speed. A motor of too high a



A small television motor fitted with synchronising gear. On the right are two resistances, one variable and the other semi-variable for speed control

power will be difficult to maintain at the correct speed which is so essential to successful reception. Motors which are available commercially and have been designed for the purpose will run very consistently at about the correct speed; also they are fitted with specially long spindles for a purpose which will be noted later.



A photograph of a mirror screw; this is for ninety line transmissions and horizontal scanning

As the load on the motor is practically constant the type always used is series wound, which is another factor in ensuring steady speed. Small toy motors can be used, but as a rule these have a small number of armature sections and do not run steadily. It is important that the motor should be able to run for considerable periods without getting more than appreciably warm, and, needless to say, there should be no sparking at the brushes, as otherwise a great deal of interference will be caused which will have its effect upon the picture received.

Finally, of the essential components of the disc machine we have the neon lamp which provides the light from which the picture is produced. For this class of receiver there are two types of neon lamp ordinarily used—the beehive and the flat plate. The former is an ordinary commercial article which has happened to lend itself to television purposes, and the latter is a specially designed type for this class of receiver.

A neon lamp requires a minimum voltage of about 185 before it will strike or light up, and for its successful use in a television viewer a current of from 20 to 25 milliamperes must be available according to the type. A particular feature of the neon lamp so far as television is concerned is that the light produced is exactly in accordance with the current that is passing through it, and also its action is practically instantaneous. It will be understood, therefore, that in the neon lamp we have a device which will produce a value of light corresponding exactly with the input energy. This energy is supplied from the wireless set, the lamp taking the place of the loud-speaker.

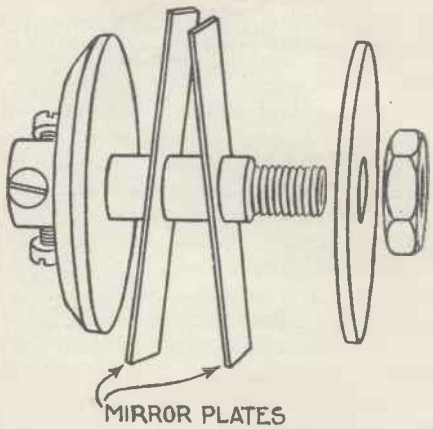
These remarks apply to either type of neon lamp, the only difference being in the electrode structure. In the beehive lamp there is a spiral of wire of beehive shape, hence its name. Better and more even illumination, however, is obtained by the use of a flat plate in place of the spiral. When the beehive type is used it is usual to mask a portion of the bulb leaving a small window which is then covered with oiled paper in order to secure an even field of light; with the flat-plate lamp this is not necessary and so greater light efficiency is secured. A recent development of the flat plate neon lamp is a fine wire grid in place of the plate, and behind this there is another plate which forms the other electrode and also acts as a reflector, partially reflecting the light through the wire grid.

It was mentioned earlier that it is usual to employ a lens in conjunction with the disc machine. The simplest type of lens is a double convex about four inches in diameter, but better results are obtained by using two lenses, one four inches in diameter and the other about two inches. Such a combination will reduce distortion.

Another refinement is a small neon lamp of the indicator type which is supplied from current from the mains and is used to provide light for viewing the spokes of the disc and producing the stroboscopic effect. This is arranged so that it can be switched on and off at will.

It is not usual to fit synchronising gear to the simple disc machine, for the speed can be controlled fairly well either electrically, by means of a resistance, or mechanically with a frictional device of a simple character.

However, provision is made on the motor for the fitting of this auxiliary piece of apparatus if desired, this being the purpose of the extension of the motor spindle remarked upon earlier.



This diagram shows how the plates of the mirror screw are assembled on the central boss through which the spindle passes

In order of simplicity the next type of scanner is the mirror screw, and with the exception of the actual

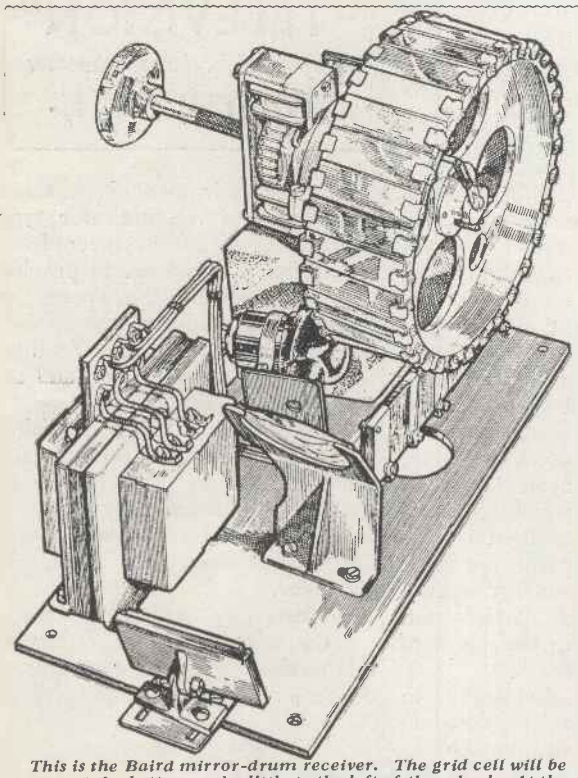
screw the units used for this machine are the same as those used for the disc. A neon lamp of the plate type must, however, be employed as a line of light is required and this is obtained by masking the lamp and leaving a narrow slit.

The mirror screw consists of an assembly of flat metal plates approximately three and a half inches long, three-quarters of an inch wide, and about a sixteenth thick. One edge of each plate is silvered, and the whole series of plates are arranged in spiral formation, their number corresponding to the number of scanning lines it is wished to produce.

The mirror plates are mounted on a central boss through which a spindle passes, and it is customary to drive the whole assembly which, of course, is run horizontally, by means of a rubber belt from the motor. The use of a rubber belt has two advantages, it allows of a step-up drive so that the motor can be run at a higher and more economical speed, and it also acts as a mechanical filter and prevents any irregularities of the motor being transmitted to the screw.

A stroboscopic device is also provided with the mirror screw, and in this case it takes the form of eight webs on the boss, the edges of which are painted white. Speed control is rather more difficult with the screw than the disc, for the weight/diameter ratio is much less and so there is not the same flywheel effect.

Synchronising gear can, however, be added quite simply.



This is the Baird mirror-drum receiver. The grid cell will be seen at the bottom and a little to the left of the wheel. At the front are the reflecting mirror and lens

A lens is not required with mirror screw apparatus, but a plane mirror is used to reflect the light emerging from the slit in the mask over the lamp on to the screw upon which the image appears.

So far we have only considered apparatus with which the image is viewed subjectively and in which the light is modulated direct. The mirror drum receiver, however, throws the image on to a screen, and the usual type employs a constant light source, and this light is modulated on its way to the screen; there is, however, apparatus of this type in which a special neon lamp, called the crater point, is used.

The mirror drum consists of a wheel, usually made of aluminium, upon which are mounted thirty small plane mirrors each one being set at a small angle with the axis of the wheel and with each preceding mirror, so that a spot of light when reflected from the mirrors as the wheel is revolving travels up the screen in a series of lines, thirty lines of traverse being produced at each revolution of the wheel. As there is what may be termed a large optical leverage with this type of scanner, it will be appreciated that the mirrors must be set very accurately on the wheel and the construction must be such that variations of temperature will not affect the positions of the mirrors.

Some mirror drums are provided with means of adjusting the mirrors, but the Baird Co. employ a wheel with accurately machined mirror beds, and the mirrors once set in position are a fixture. Various means are employed for adjusting mirrors which are not fixed permanently, some sort of screw adjustment or ball-and-socket mounting being the usual methods. Whatever means are provided for adjustment, this is a rather tedious task, though it is usually within the ability of the average amateur.

Mechanical Filters

The best mirror drums are provided with a mechanical filter which compensates to some extent for any uneven torque of the motor. The actual drum is mounted so that it can turn either one way or the other, within limits, upon a central boss. This boss is secured firmly to the motor shaft, and there is a spring link between the boss and the drum so that a small amount of spring-controlled movement can take place between the two.

It was remarked earlier that a constant source of light was usually employed in conjunction with the mirror drum. This is obtained from an ordinary incandescent lamp of the bunched filament type, the candle-power being approximately 200. Modulation of this light is obtained by passing it first through a prism of Iceland spar, then between a number of small metal plates arranged something like a condenser and immersed in nitro-benzine, and finally through another Iceland spar prism. A varying potential is applied to the metal plates, and the light which passes is in accordance with this potential, so that the arrangement acts as an instantaneous light shutter which

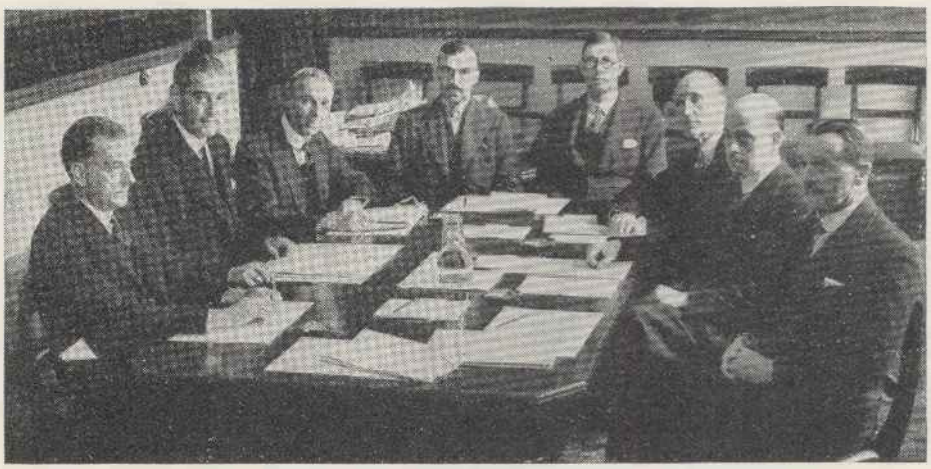
has no moving parts. A cell of this description is known as a Kerr cell or grid cell. As a rule about eight plates are used, and the surfaces of these between which the light passes are approximately an eighth of an inch square. It is most important that the nitro-benzine used in the Kerr cell should be pure and free from moisture, so in order to prevent the absorption of moisture from the air the Baird Co. seal the whole assembly in a glass bulb.

Mirror-drum Light Sources

There are two special types of lamp which can be used with mirror-drum apparatus in place of the ordinary projection lamp, and the use of either of these eliminates the necessity for using a Kerr cell light valve, as they both can be modulated directly in the same way as the ordinary neon. One is, in fact, a neon lamp of special construction—the crater-point—to which reference has been made earlier. This, as will be seen from the photograph and drawing, consists of two electrodes separated by an insulator within a glass envelope. In the outer electrode, which is the anode, there is a small aperture, and the discharge is concentrated here. The discharge, therefore, is of small area and very intense.

The Mercury-vapour Lamp

The mercury-vapour tube has been primarily designed for recording sound on film, but it lends itself excellently for television reception with mirror-drum apparatus. A photograph is shown of this also. The cathode is the central electrode, and is contained within an inner glass tube. The outer envelope contains a mixture of neon and mercury vapour, and the normal operating colour of the light is bluish-white which fills the whole of the inner tube. When used for television purposes it is usual to mask the envelope, leaving only a small aperture at the end through which the light can pass.



P.M.G'S. TELEVISION COMMITTEE

The first meeting of the committee set up by the Postmaster General to advise on the conditions under which a public service of television should be provided. From left to right the members are: Sir John Cadman, The Rt. Hon. Lord Selsdon (chairman), F. W. Phillips, J. Varley Roberts (secretary), O. F. Brown, Vice-Admiral Sir Charles Carpendale, Noel Ashbridge and Col. A. S. Angwin

Both the crater-point and the mercury-vapour tubes are connected directly or coupled to the output valve of the amplifier.

One disadvantage of the mercury-vapour tube is that it requires a high initial voltage to enable it to strike, though this can be produced quite simply in a variety of ways as, for instance, by a condenser discharge or a momentary high voltage obtained from a small spark coil.

Smaller Screens

The use of either of these types of lamps simplifies the construction of mirror-drum apparatus considerably, but there is one disadvantage in their use in that the value of the light obtainable is not so great as can be obtained by the use of a projection lamp and Kerr cell combination, and this means that the screen on which the image is projected must be smaller or some amount of brilliance sacrificed.

The lenses used with mirror drum apparatus are of the simplest type. When a projection lamp is used there is a short focus condensing lens of the plano-convex type which is used to concentrate the light upon the elements of the Kerr cell and then between the reflecting mirror and the mirror drum there is a double convex lens of long focus for the purpose of concentrating the spreading beam of light on to the mirrors of the drum, from which it is reflected to the screen where it forms a spot.

It will be clear from the foregoing that all the components used in mechanical television receiving gear are of quite a simple nature if the special ones such as the lamps just described be excluded, and the assembly of them is well within the ability of the average amateur constructor.

News of the Short Waves

By Kenneth Jowers

DURING the past month or so I have been able to persuade a fair number of ordinary listeners—all absolute disbelievers in my short-wave claims—to build up simple sets and to see if there is any thrill in short-wave listening.

In the early days of radio—about the year 1922, say—before there were such things as tuning dials calibrated in wavelengths, super high-power stations and foreign-programme guides, hearing good foreign programmes was a matter of luck.

Fun Out of Radio

All who remember those days will surely agree with me that there was much more fun to be obtained out of the radio set than can be had today, in spite of all the superhets with multi-electrode valves and all the other paraphernalia of modern sets.

I well remember using a three-valve super-regenerative set with a pair of headphones and raking in all the European stations there were on the air. There was great excitement when Nottingham and some of the other relay stations were tuned in, of course accompanied by the usual super-regenerative whistle.

Short-wave Uncertainty

The position on the short waves to-day is somewhat similar to those early days. It is not possible to sit down and tune in a certain station 100 times out of 100, although there are always a number of interesting stations on the air.

It is the uncertainty of the short waves that makes them so fascinating. Signal strength, fading, or background noises cannot be taken as a guide as to whether any station heard is a local or not. Very often the local station is a weak signal, while another station that comes in like the local is some far-off little transmitter at the other side of the world.

From the very beginning do not imagine that the short-wave set is going to take the place of the broadcast set. Nothing is farther from the truth. On the other hand, I listen to stations below 50 metres far more than I do to the ordinary B.B.C. stations.

On the short-waver, except that I know just what stations are on the air, I have no idea what stations I shall hear. The station I want may be unobtainable through bad conditions or morse interference, while stations considered miles out of range oblige with fine entertaining programmes.

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Let me tell you some of the items heard during the last month, and then, after weighing up the cost of a simple set, I think you will agree that there is a thrill waiting on the short waves.

You remember the French flyers, Rossi and Codos, who were going to fly non-stop to San Francisco last month? I came home from the office on the Monday evening, went into the radio den and tuned to the 19-metre band just to see what was doing.

W2XAD of Schenectady, on 19.56 metres, at 1950 playing a cinema-organ record was the first signal logged. A record, by the way, is played at this time every evening so that long-distance listeners can adjust their receivers. Two degrees higher up the tuning scale was W8XK on 19.72 metres broadcasting a musical programme. There were two stations on this band.

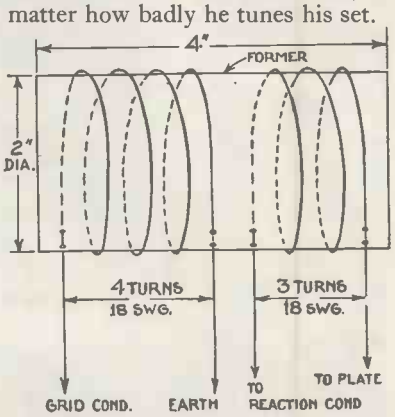
As W2XAD was the stronger of the two I hung on to hear the opening announcements at 2000. My patience was well rewarded, for the microphone was taken over to the Floyd Bennett flying field for a relay of the speeches made by the French flyers.

I was able to hear all about the flight—straight from the horse's mouth! Rossi spoke in English, while Codos had an American interpreter. This programme went on for twenty minutes or so, and, believe me, it was worth hearing.

On going back to W8XK I heard a programme of organ music coming from New York. It can be said that we hear quite enough organ music from the B.B.C., but, say what you will, the American style is so different that it makes a welcome change.

Searching for Entertainment

A great deal, of course, depends on knowing where to look for your entertainment. It is a waste of time searching over the short wavebands when all but 20 per cent. of them may be quite useless at the time you are listening. Do not get despondent about this, for it does not mean that you will not hear a signal; even the biggest ham-handed Henry cannot fail to tune in some stations, no matter how badly he tunes his set.



HOME-MADE SHORT-WAVE COILS
Here are the dimensions for making the grid and reaction coils described in this article

To get the utmost out of a short-waver with the minimum of trouble study world times. Remember that the time of the east coast of America is five hours behind us, so it will not be any good trying for American stations much before 1500 or after 0600 or 0700.

On the other hand, Australian time is 10 hours fast, so the morning hours will be better when looking in that direction.

Put these notes in your diary for immediate use; they will help a lot.

Using a simple three-valve set there is not much to be heard during the morning except the Empire stations and the 19-metre Vatican station at 1000. At 1500 W3XAL Boundbrook, New Jersey, on 16.87 metres is a certain bag three times out of four. Round

about 1600 W8XK comes in at fair strength, reaching a peak at 2000 — the wavelength is 19.72 metres.

Times to Listen

Between 1600 and 2000 reception will be confined to the stations mentioned, and the Europeans such as Berlin, Kootwijk, the Empires from Daventry—which can be very useful if you have missed the news from the local station—Paris, Moscow on 45.38 and 50 metres, and an odd South American or two, Buenos Aires and Rio in particular.

At a few minutes to 2000 don't forget W2XAD, for signal strength from this station is colossal. After 2100 to 2200 *forget* the 19-metre band and concentrate on 25 metres, and a little later 31 metres. After 2330 the 50-metre band will offer most entertainment, usually from America and Canada.

Tuning-in Amateurs

These times all apply to the broadcast stations and not to amateurs, who come in at quite different periods. During the summer the best amateur channel is, without question, 20 metres. This is well worth watching between 2000 and 0100. Between 0100 and 0300 try the 40-metre channels, and after this go up to the 80-metre band. As this band is good until 0700 for the West Coast Americans, try getting up early in the morning; it's not bad after you have done it once or twice.

You can get a lot of fun listening to the English amateurs on a Sunday morning. The 80- and 160-metre channels are the most favoured, and remember, the time of day doesn't matter much, although things are quieter when the B.B.C. stations are on the air.

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I am not going to say much about tuning the short-waver; it will take far too long, but if anyone is in trouble just drop me a line about it.

The selectivity on the grid-tuning condenser is bound to be good, but the aerial tuner can be flattened out by connecting the aerial to the grid of the first valve. This will not affect the set to any extent, but it will make tuning easier for the beginner.

The dials must never slip or the panel allowed to move, otherwise the calibrations will change and stations will be difficult to tune in. Hand capacity is almost a thing of the past, but in case of accidents make sure that the moving plates of the tuning condenser go to the "earthy" end of the tuning coil. Similarly with the reaction condenser, see that this has one side going to earth and not to the anode of the detector valve.

If the coils are of the same make, the tuning dials will probably be in step. If they are not, it is an easy matter to take half a turn or so off one of them to do the trick.

The receiver should always be on the verge of oscillation when searching for stations, the final tuning adjustments being made later. Invariably the tuning condenser will require readjustment after the reaction condenser has been altered and vice versa.

Don't have too high a voltage on the anode of the detector valve, it will not give a big increase in volume, and the valve is almost bound to be noisy or microphonic. I always use a variable resistance to control this voltage: it is such a great help.

When on wavelengths below 20 metres it is a good idea to use coils without any former. As you will only want two to three turns at the most, the coils will keep rigid without any help if you use 14 S.W.G. copper wire. This will make a big difference to the signal strength on these very short waves.

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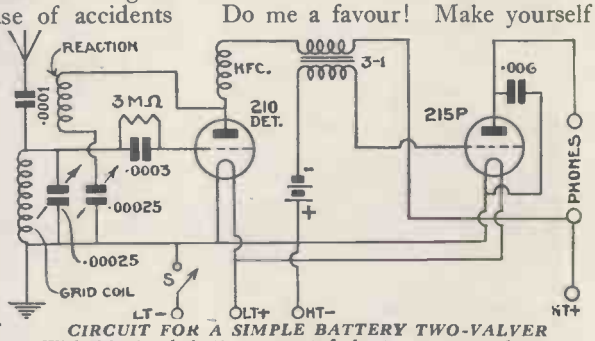
Do me a favour! Make yourself a two-valve short-waver. The components can be bought from the local man or Stratton's, of Birmingham, or, alternatively, you can make some of them at home.



CIRCUIT FOR A SIMPLE BATTERY TWO-VALVER
With this simple battery-operated short-wave two-valver you can taste all the pleasures of short-wave listening. The valve sequence is a detector transformer coupled to a triode output

The tuning condenser is a .00025-microfarad, and will cover a wide waveband without making tuning difficult.

Winding the Coil

Wind the coil on a piece of 4 in. by 2 in. ebonite or paxolin former. Put on four turns of 18-gauge wire and space each turn from its neighbour by twice the diameter of the wire. Leave long leads, and the grid coil is finished. For reaction, wind on three turns of the same wire and in the same direction.

The drawing will show you how easily the job is done. The circuit reproduced on this page is the simplest form of battery-operated two-valver for use on the short waves. The value of every component is given, so there should be no difficulties.

The short-wave coil can be wound to cover any waveband under 150 metres. And further, the waveband coverage can be adjusted to suit your own tuning condensers. It is a great advantage to be able to tune-in the required waveband towards the end of the tuning condenser. These coils will work efficiently in a short-wave adaptor or converter.

AN AMERICAN AMATEUR STATION YOU CAN HEAR WELL
Short-wave fans in this country regularly tune in to broadcasts by the American amateur station W8CPC, of Buffalo, N.Y., on the 20-metre band

Mantovani with his Tipica Orchestra

PROGRAMME NOTES and NEWS

By T. F. HENN

TIME is in the news again. You remember what I said about the stupidity of the B.B.C.'s attempt to foist the twenty-four hour clock upon listeners? The last time I visited Broadcasting House I passed the entrance to Queen's Hall, which is just opposite B.H., and I noticed that the "Prom." announcements on the hoardings outside stated that they would begin

Reginald Foort is now broadcasting from the Regal Cinema at Wimbledon

at 2000. I laughed heartily and passed on.

Inside I told an official exactly what I thought of their time, and asked if they intended to stop it. The reply was that the B.B.C. *would return* to the use of sane time, but when was not yet decided. In any case, twenty-four hour time would last the summer out. Another experiment fails !

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As I revealed last month, Reginald Foort has returned to broadcasting. I have just received the news that the organ at the Regal Cinema at Wimbledon is the second largest cinema organ in Europe. I believe that the Trocadero Cinema at the Elephant and Castle, London, still holds the record.

The Wimbledon organ was built by a North of England firm who have been building church organs for nearly a century. Reggie Foort designed the instrument, and it was built under his supervision.

These cinema organists have a hectic time. Mr. Foort was recently in Rome, where he opened the first cinema organ to be installed in that city. He left immediately after the ceremony by 'plane for Hilversum where he had an engagement to play the organ in the broadcasting studios.

The machine in which he was travelling got up to 10,000 ft. when one of the engines failed. The 'plane eventually got back to Rome where Mr. Foort chartered another and set off again for Hilversum, which he reached just half an hour before his broadcast.

Soon after he got down to work at Hilversum, the transmitter was struck by lightning, and there was no more Dutch broadcasting that night. All that excitement for a two-minute broadcast !

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It was unfortunate that we did not have the pleasure of hearing Greta Keller with Ross and Sargent, the American duettists, during the Entertainment Hour in June. The reasons for their non-appearance were outside the scope of the artists and the B.B.C., and the

A famous soprano, Eva Turner has made a welcome appearance in June programmes

Diana du Cane made her first broadcast in the "Songs of the Shows"

arrangements had to be cancelled.

It is, anyway, good news that another tentative date, again in the Entertainment Hour, has been fixed for a broadcast. So unless anything unforeseen happens we shall hear these famous variety artists in the National programme on July 4.

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Excerpts from the Parliamentary Pageant will be relayed to listeners on July 2. The pageant will be a spectacular affair depicting ceremonial parliamentary events through the past centuries. The final scene, which will be broadcast, will depict the modern period.

Full details are not available at the time of going to press, but some of the items we will hear sound most attractive. Callenders band playing Eric Coates' *Knightsbridge* will accompany the Procession of the People of Today, then Leslie Bridgewater and the orchestra will play Marquardt's *Regal Episode* during the assembly of the peers and peeresses, and finally there will be a performance of a new poem by Rudyard Kipling, *Non Nobis Domine*, set to music by Roger Quilter, and sung by the Royal Choral Society.

The relay will take place in the National programme after the second news bulletin.

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I was glancing through some Saturday-night programmes for July when I came across what is undoubtedly, to my mind anyway, the ideal type of Saturday night entertainment.

I have translated the times into English and here is the programme. At 6.50 the Band of the Irish Guards start the entertainment, at 7.45 Christopher Stone gives a recital for half an hour of gramophone records, then follows forty-five minutes of Jack Hylton before the news. After the news we have an hour of the Theatre Orchestra and Henry Hall's Guest Programme.

Our old friend Norman Long with Joe Batten getting a laugh out of his new tongue-twister song, "I've brought you some narcissus, Cis." (Left) Jenny, Howard, the famous comedienne and her companion, Percy King, were heard last month

I do give the B.B.C. some credit for this selection; I hardly think they will better Saturday-night entertainment of this sort.

By the way, Sunday, July 8, will see an outstanding relay from Holland. During the evening programme we shall have the pleasure of hearing Beethoven's *Fifth Symphony* played by the famous Concertgebouw Orchestra of Amsterdam. The concert will be relayed in the National programme.

I have spent many a pleasant Sunday afternoon listening to this orchestra broadcasting from one of the Dutch stations. Acoustics are especially good. Make a note of this; the concerts usually start at 2.10 p.m.

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Max Kester, who recently joined the light entertainment staff of the B.B.C., is producing a broadcast entertainment on July 7. It is called *Sketch Book*, and will consist of five or six short sketches ranging from a thriller to a comedy. Incidental music will be played on two pianos, but Max Kester makes it plain that no jazz items will be included in the musical programme.

Max Kester has written one of the sketches, called *The Interview*. The plot concerns a film star who has had her jewels stolen by a crook posing as a newspaper man.

Max Kester has done practically everything since he left school. He has worked on a farm, been on a newspaper, been a music teacher, and has worked a linotype machine in a newspaper office.

Yvette Darnac, the French singer, is a favourite broadcaster

One of the oldest of broadcast singers John Thorne, the famous baritone

A newcomer to broadcast dance music, Lou Preager who broadcasts from Romano's Restaurant

He is not new to broadcasting by any means. He was on the staff of the Leeds station in the early days and has two hundred sketches, mostly for broadcasting in the Children's Hour programmes, to his credit.

In 1928, he became manager of a gramophone shop in Doncaster with the idea of gaining a commercial insight into the gramophone record business.

He succeeded in this aim and joined the staff of H.M.V., where he was in the recording department, specialising in comedy and burlesque records, until he rejoined the staff of the B.B.C. a couple of months ago.

At the moment, members of the B.B.C. Symphony Orchestra are away abroad, at the seaside and in the country enjoying a well-earned rest after their busy time last season. They are due back at Broadcasting House about the middle of July and will immediately start rehearsals for the eight-week Promenade season, which opens at Queen's Hall on August 11, at eight in the evening.

A new photograph of the famous artist, Eve Becke, who is frequently heard on the air

At the time of writing, Sir Henry Wood, in conjunction with the music department of the B.B.C., is arranging the programmes for the forty-nine concerts. A part of every concert will be broadcast either in the National or Regional programmes.

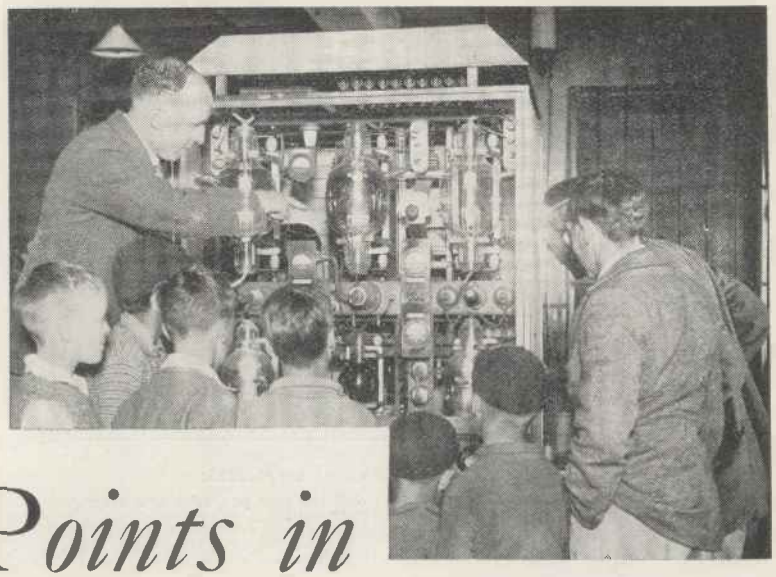
This will be the fortieth season of promenade concerts, all of which, with very few exceptions, have been conducted by Sir Henry Wood.

Whilst at the B.B.C. recently I made inquiries about the vaudeville and variety shows that are to be given again at Radiolympia this August.

Except for the fact that the theatre in Olympia will hold 3,000 people, instead of 2,000 as last year, a very hush-hush attitude is being maintained over the programmes that will entertain visitors. I do know, however, that they will be produced by John Watt and arranged by Eric Maschwitz. The only information I could get about the shows themselves is that they will be "gigantic." A visit to Radiolympia should be well worth while this year!

Tessa Dean has been heard in many vaudeville and music-hall shows

With a good dance band, Billy Merrin broadcasts from Midland Regional every Saturday afternoon. It is about time he took a regular late evening turn in National programmes



Schoolboy wireless enthusiasts inspecting the gear at the Croydon Airport transmitting station at Mitcham, Surrey

Practical Points in Amplifier Design

By the "W.M." Technical Staff

LAST month, you will remember, we delved into the subject of suitable public-address gear for the amateur and gave much practical information on the choice of suitable amplifiers and equipment.

For those who wish to build up their own amplifiers, we are taking a more technical line on amplifier design this month by giving useful information on typical amplifiers with numerous circuits for all types and to operate from both mains and batteries.

Let us consider the battery-operated amplifier as being the easiest and cheapest. We want to make the most of our high-tension current, so that the obvious solution is class-B amplification.

Valves such as the Cossor 240B with 150 volts high-tension will give an output of a little over 2 watts, providing it is driven by a small pentode valve. Fig. 1 shows a typical class-B circuit of this kind.

Most Economical Battery Amplifier

The microphone or pick-up input is connected to the grid of a triode amplifier, which is in turn resistance-capacity coupled to a small pentode valve acting as a driver to the 240B. Such an amplifier will consume a current of a little under 25 milliamperes and is the most economical that can be devised.

The only alternative arrangement is the use of two pentodes of the Mazda Pen 220A class, as in Fig 2, which will give 2,200 milliwatts with an anode current of at least 35 milliamperes.

This arrangement has the added advantage that there is only one low-frequency stage, so it is simple to construct and less expensive than the class-B method. Here again the pick-up or microphone is connected to the grid of a triode amplifier which is transformer coupled by means of a high-ratio transformer to two Pen 220A valves in a push-pull arrangement.

Excellent Quality, but One Snag

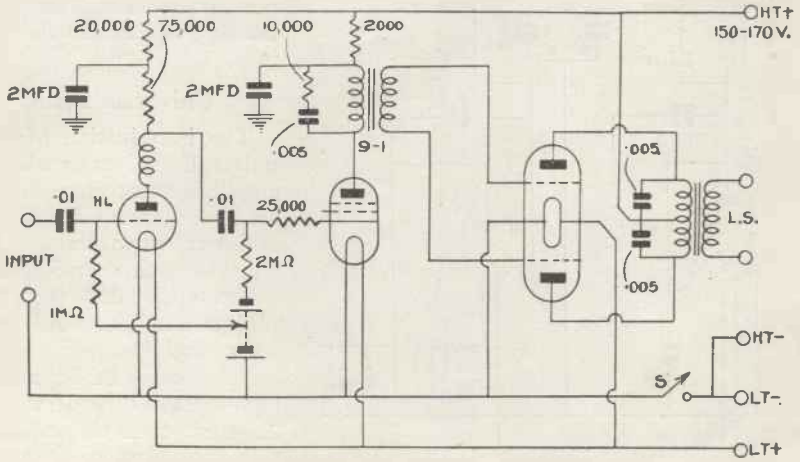
Such an arrangement will give excellent quality, but has one snag. It is necessary to use loud-speakers with special input transformers—this means twin loud-speaker leads.

The same amplifier, arranged as in Fig. 3, with two pentodes in parallel will give a little under 2,000 milliwatts, but with a choke-filter output circuit only a single loud-speaker lead is required. We always advise a choke-filter output circuit for this reason.

The quality from the amplifier should tend to be on the high side. This is really necessary for immediately the amplifier is used in a hall with a number of people the pitch will drop to normal level.

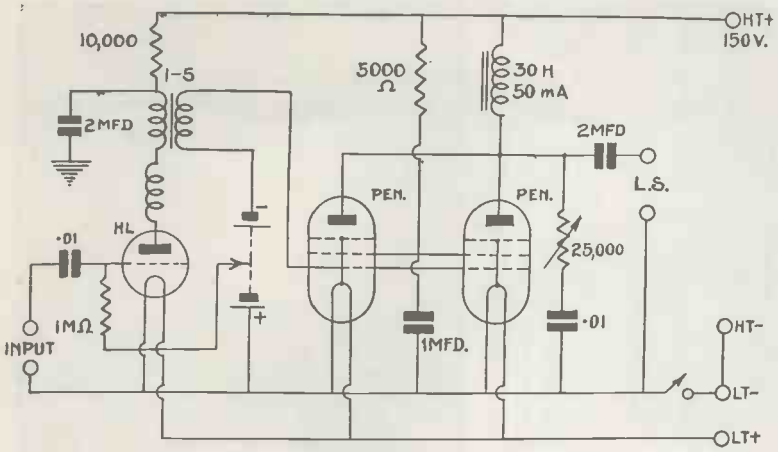
If the quality is previously adjusted with an empty hall, the reproduction will be very boomy when the hall is filled. This point must be borne in mind.

However, it is advisable to fix a tone control either between the anode and



TYPICAL CLASS-B AMPLIFIER

Fig. 1.—A class-B battery amplifier with a triode resistance-capacity coupled to a small pentode which drives the class-B output



ANOTHER BATTERY-OPERATED AMPLIFIER

Fig. 3.—This circuit is similar to Fig. 2, except that the two pentodes are arranged in parallel instead of push-pull

In this case, instead of using a low-frequency transformer, the low-frequency stages are resistance-capacity coupled. This does not give the same stage gain as the transformer, but the quality and stability are considerably better.

This type of amplifier, illustrated in Fig. 6, is the most useful that we can advise for D.C. mains. It is inexpensive, gives quite a reasonably large output, and is simple to construct.

Where very large volume is required the D.C. amplifier described in the June issue of "Wireless Magazine" should be constructed, which has four pentodes in parallel. The minimum output from this is 10 watts and is enough for all practical purposes.

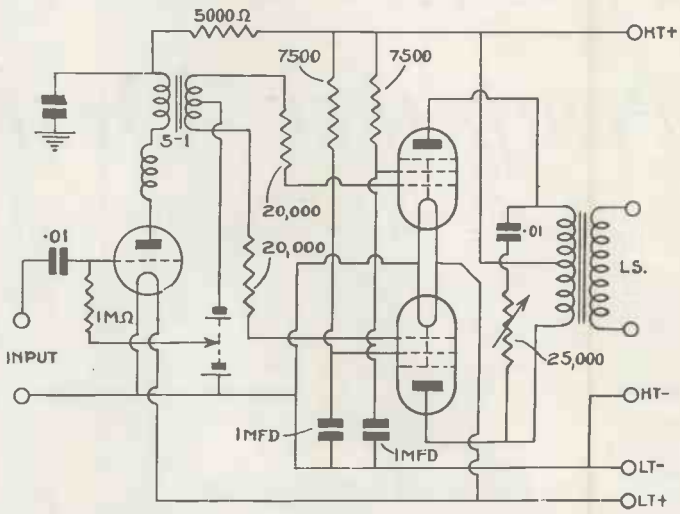
You will notice that with all these amplifiers we have embodied tone control. This is essential as it enables the pitch of the loud-speaker to be varied according to the type of hall and the number of people in it.

earth of the output valve or across the loud-speakers. The latter arrangement has one advantage. If you have loud-speakers in different halls, the pitch of each loud-speaker can be adjusted to suit the acoustic properties of each hall. Fig. 4 shows a typical circuit for such a tone corrector. It consists of a .01-microfarad condenser, two variable resistances and a small choke.

Amplifiers for D.C. Mains

Amplifiers for use on D.C. mains are a little more flexible and there is more scope for originality in design. The most suitable amplifier is a two-valver with pentode output, as shown in Fig. 5. With the valve filaments in series with the mains and automatic grid bias incorporated, it is entirely independent of battery supply and gives an undistorted output of a little over 3 watts.

Here again we have a triode amplifier transformer coupled to a pentode valve connected to the loud-speaker by means of a choke-filter output circuit. The output could be increased by modifying it to use two driver low-frequency stages for two pentodes in parallel.



BATTERY AMPLIFIER WITH PUSH-PULL PENTODES

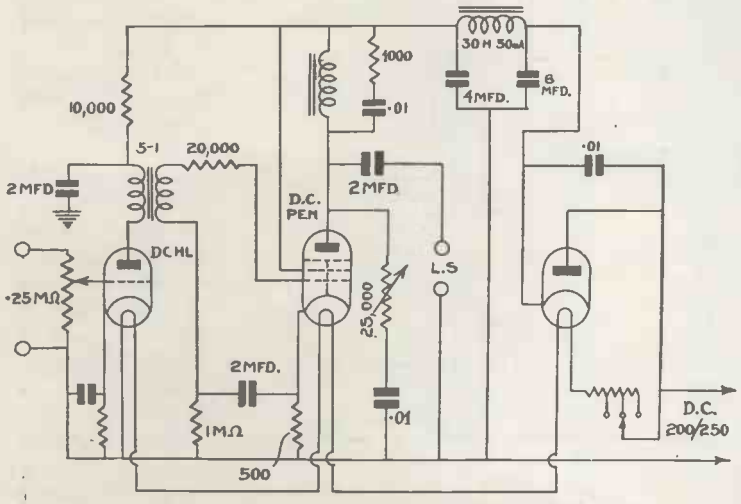
Fig. 2.—A simple battery-operated amplifier with a triode transformer coupled to two pentodes arranged in push-pull

Universal Mains Amplifiers

The introduction of the new Mullard universal valves makes the universal amplifier an accomplished fact. In Fig. 7 we have shown two low-frequency stages, followed by two pentodes in parallel, which will give well over 5 watts, but the main attraction is that the amplifier can be plugged into either A.C. or D.C. at will—a very useful amplifier for the radio dealer.

Variations can be made by using the high-voltage type of valve or the 16-volt .25-ampere D.C. valves, such as the Cossor or Marconi-Osram types.

With A.C. mains available we really can design the highest-quality amplifiers. A



SIMPLE AMPLIFIER FOR USE ON D.C. MAINS

Fig. 5.—A two-valve amplifier for D.C. mains working, giving an undistorted output of 3 watts. The valve sequence is a detector followed by a pentode output

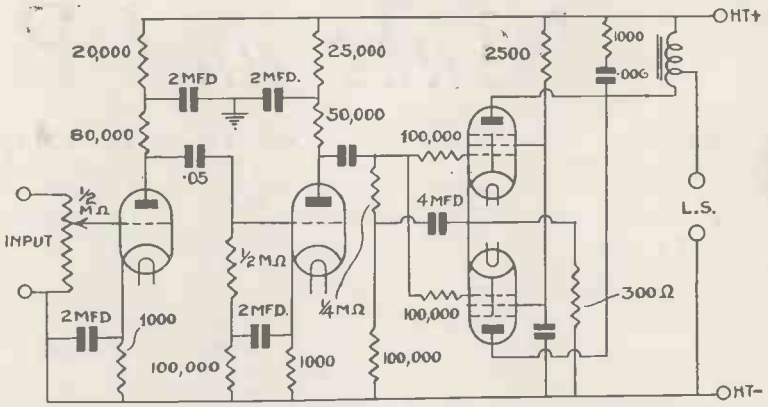
simple two-valver, using a triode amplifier, transformer coupled to a valve of the PX4 type is shown in Fig. 8. This arrangement is very compact, inexpensive, and will give an output of over 2 watts. It is shown complete with fader, automatic volume control, and tone control.

Interesting A.C. Amplifier

An interesting circuit we have developed is shown in Fig. 9. It consists of a screen-grid amplifier of the variable-mu type, resistance-capacity coupled to two PP5/400's in parallel. This ingenious circuit makes use of the variable-mu characteristics of the screen-grid valve for controlling the stage gain and actually is one of the few circuits where the volume can be controlled logarithmically.

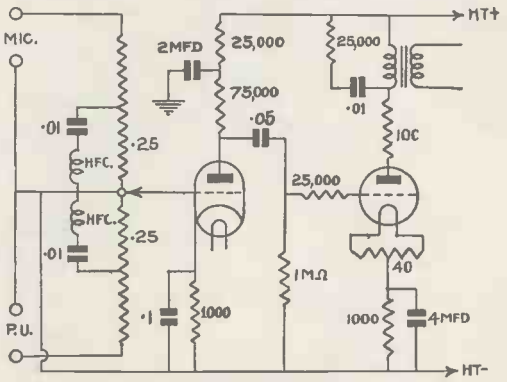
With a gramophone pick-up giving an output of 1.5 volts the stage gain is sufficient fully to load the PP5/400 valves to give an undistorted output of 10 watts. Fig. 10 shows an amplifier that we have found to give exceptional quality with ample output. It is a two-stage resistance-capacity arrangement feeding a triode valve of the Cossor 660T type, which gives well over 11 watts at 500 volts.

The same circuit can be adapted to take the Mazda ES75 output valve, which gives an undistorted output of 17.5 watts. The only disadvantage of using the ES75 is that it requires an anode voltage of 1,000. Of course the original circuit using the Cossor 660T can be modified to use two of these valves in parallel which would give an output of 20 watts with only 500 volts and an anode consumption 250 milliamperes. This arrangement is greatly favoured in talkie equipment.



THREE-STAGE D.C. AMPLIFIER

Fig. 6.—Good quality is assured by using a D.C. amplifier of this type. Here the combination is two low-frequency stages and two pentodes in parallel, resistance-capacity coupled throughout

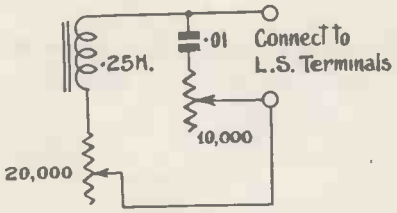


TWO-VALVE AMPLIFIER FOR A.C. MAINS

Fig. 8.—A simple form of A.C. amplifier with a triode transformer coupled to a power triode output

These amplifiers will be more satisfactory if they are constructed upon a metal chassis or metallised-wood chassis, so that the negative connections can be taken directly to the chassis. This form of construction simplifies the wiring, reduces the number of connections, and makes the whole job look very workmanlike.

Of course, there are snags to the idea—there always are. Take particular care to see that all of the connections that go through the chassis are insulated by means of ebonite bushes or two thicknesses of good-quality sleeving.



TONE-CORRECTOR CIRCUIT

Fig. 4.—A simple tone-corrector arrangement for fitting across a loud-speaker

Wisdom of the Choke-filter Output

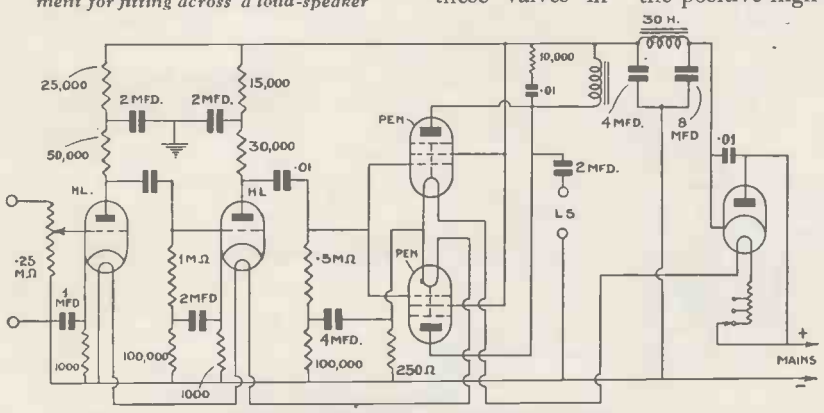
When dealing with voltages over 200 or 300 it is surprising how easy it is for arcing to take place between the positive high tension and a negative chassis, causing a breakdown.

In almost every circuit we have shown a choke-filter output and you will see the wisdom of this idea when you come to wire up the loud-speakers.

Even if the idea of public-address work does not appeal to you, some of the amplifiers mentioned can be used after the radio set to give additional volume or better quality.

In most cases, if the output from the detector valve is taken directly to the input of the amplifier, cutting out the low-frequency side of the receiver, results will be greatly improved.

Continued on page 554



5-WATT AMPLIFIER FOR UNIVERSAL USE

Fig. 7.—An undistorted output of over 5 watts is given by this arrangement of two low-frequency stages feeding into two pentodes in parallel. The circuit is for universal A.C./D.C. valves

Make and Break!

"LISTEN," nudged one of the H.T. leads. "I'm —I'm going to" . . . he swelled into open and glorious revolt . . . "Yes, I *am*—I'm going to come unstuck and stop functioning. Why should I be a mere slave to some snob of a knob-twister? I'm all for the liberty of the individual. Freedom is the birthright . . . "

"You've been reading Rousseau," interposed the High Tension complacently. "Did the same myself when I was young. You'll grow out of it. All these young fellows think they're the only ones who . . . " His gurglings became indistinct.

The H.T. lead shivered irritably.

"Well, I hope you all realise that I mean what I say. The whole set goes phut without me, and I'm stopping. See?"

His neighbour temporarily free—whilst a famous soprano drew breath—said shortly: "Don't be liverish; you can't leave us to do everything." He bent to his task again.

The Grid Bias lead, who had had a better education than the rest, insisted gently:—

"But, old chap, you can't do that. It wouldn't be playing the game. I mean to say . . . "

Unfortunately no one heard him. His delivery was rather weak, and he was beginning to feel the strain. Socialism was all very well in its way, but it mustn't be allowed to interfere with the welfare of the circuit.

The H.F. valve winked knowingly. "I've heard all this before—but he never does anything."

"Don't know so much," mused the L.F. valve. "I feel something isn't pulling its weight." He glimmered uneasily.

The detector valve giggled.

"I'm feeling so silly," she oscillated. "Ooh—ooh—don't touch me. I'm ticklish."

The first valve strained fiercely.

"Something's up," he muttered. "Thought the detector would be the first to give. She's always been a bit weak. Where's everybody—I can't see any more . . . "

"That," said the H.T. lead a trifle defiantly, "is that. At last I'm free from the shackles. No more blind obedience, and no more eternal continuity."

He sizzled uncertainly.

"But where do I get out? I can't see without the valves, and everything's gone dead."

He thrust gropingly towards the Terminal.

"Say, I'm sorry—please . . . "

The contact revived him.

Heh! you fellows, I'm on again."

The dead current leapt to life and galvanised the circuits—the soprano's voice rang out clear and true.

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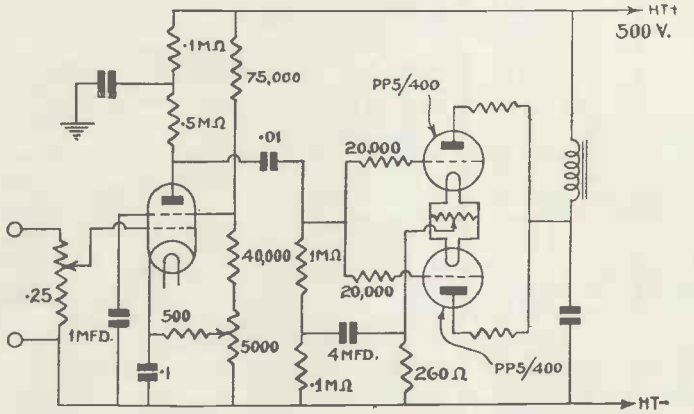
"Henry, dear, what happens when the set stops suddenly like that and then goes on again?"

"Oh, it's nothing to do with the set, my dear; just a temporary fault at the transmitting end."

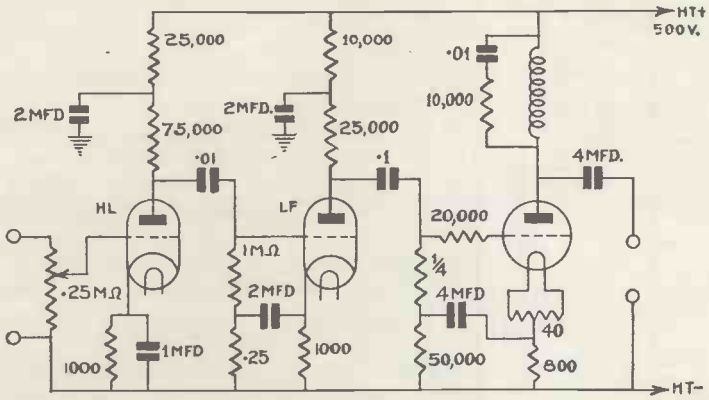
Which is, of course, one explanation.

S. J. H.



INGENIOUS CIRCUIT FOR AN A.C. AMPLIFIER

Fig. 9.—This circuit consists of a variable-mu screen-grid amplifier resistance-capacity coupled to two large triodes in parallel. The output given exceeds 10 watts



LARGE AMPLIFIER FOR USE ON A.C. MAINS

Fig. 10.—An output of 10 watts is obtained with two resistance-capacity coupled stages feeding a triode of the Cossor 660T type. This circuit can be adapted to give larger outputs

PRACTICAL POINTS IN AMPLIFIER DESIGN

Continued from page 553

The only trouble likely to be encountered is low-frequency instability, which is commonly known as motor-boating. This can be overcome by increasing the values of the decoupling resistance in the detector stage or in extreme cases by double decoupling.

Room Strength with 12 Watts

When an amplifier of 10 or 12 watts output is used, do not get the idea that the volume cannot be turned to reasonable room strength. A good high-resistance potentiometer will cut down the output from the largest set. It is mainly for *quality* that we suggest that you use a large amplifier after the radio set.

TESTS OF NEW APPARATUS

Osram Double-diode Triode :: B.T.H. Senior Pick-up :: Mains Power Trickle Charger :: Ferranti Screen-grid Valve :: Gard Lightning Arrester :: Bulgin Tone Control

OSRAM DOUBLE-DIODE TRIODE

APPARATUS: Double-diode triode.
MAKERS: General Electric Co., Ltd.
PRICE: 9s.

THE new Osram HD21 is a 2-volt valve comprising a triode and double-diode assembly in one bulb. In order to obtain the maximum efficiency a separate filament system is used for the triode and diode portions, the valve being arranged somewhat similar to a class-B assembly. This particular construction also enables the two diodes to be adequately shielded from the triodes—a point of some importance.

The valve has a variety of applications. It may be used as a straightforward detector-amplifier using one or both diodes for rectifying and the triode for subsequent amplification. The efficiency of this arrangement is equivalent to that of the ordinary grid-detector, but the usual bugbear of overloading is largely avoided.

The valve may be used to provide combined rectification and automatic volume control. In this case it is desirable to use the diode in a special way. One diode is nearer to the positive end of the filament than the other and therefore commences to conduct slightly earlier. This diode is used for the signal rectification, while the other diode is employed for A.V.C., thus obtaining a slight delay.

The HD21 is mounted in the customary five-pin holder, but the grid of the triode is brought out *at the top*. Instead of the familiar screw terminal a metal cap is provided over which a clip is located similar to standard American practice. The valves can be supplied either clear or metallised.

A 2-volt double-diode triode just released by Osram

The triode portion is rated to have an amplification factor of 27 and an impedance of 18,000 ohms, corresponding to a slope of 1.5 milliamperes per volt.

We found on test that the valve was up to its rating and that it can be used with very satisfactory results.

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B.T.H. SENIOR PICK-UP

APPARATUS: B.T.H. Senior needle-armature pick-up.
MAKERS: Edison Swan Electric Co., Ltd.
PRICE: £2.

IN view of the extremely low output voltages usually associated with needle-armature pick-ups we read the makers' claims to a big advance in sensitivity with more than usual interest. An examination of the pick-up also proved interesting.

This showed that whilst the needle is free at the input end, it is held by non-magnetic material at the far end in such a manner that it is still in the magnetic field and both ends are free.

Exceptionally pleasant results were obtained from listening to a variety of records with this pick-up, and although there was some little accentuation of the upper register, this was not displeasing. Measurements of the volts output over a wide range of frequencies showed that the makers' claims were substantially correct.

The new B.T.H. Senior needle-armature pick-up gives exceptional results for a pick-up of its type

A voltage output table at four different frequencies when using different needles is reproduced on the manufacturer's instruction sheet.

The volume control is smooth and the general finish of the pick-up and tone-arm, which is of oxydised metal, is pleasing. In general, we feel that this component marks a distinct advance in needle-armature pick-ups.

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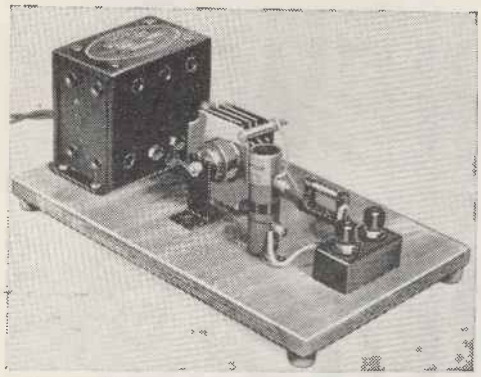
MAINS POWER TRICKLE CHARGER

APPARATUS: Trickle-charger kit.
MAKERS: Mains Power Radio, Ltd.
PRICE: .5-ampere type £1 2s. 6d.; 1-ampere type, £1 6s.

THE assembly of the components of this trickle charger is extremely simple and can be accomplished in less than an hour with the aid of two tools only—a screwdriver and a pair of pliers. No soldering is necessary.

There are only five components and the designers have provided against danger of shock. The kit tested was for use on 200-250 volts, with a charging rate of .5-ampere,



This trickle charger is supplied by Mains Power Radio as a kit of parts. It is easily assembled

but we are informed that alternative kits are available for use with 100-120-volt mains and that either type is suitable for charging at 1-ampere. The requirements should be made clear when ordering.

Metal rectification is employed, and a ballast resistor in the positive output lead ensures current regulation and also places a limit on the current should the battery be wrongly connected. A fuse of an easily replacable type is incorporated, so making the kit practically foolproof.

After assembly, we used the kit on 240-volt mains and measurements showed that a voltage of 2.8 at .5-ampere was being supplied, an adequate figure for battery charging at home.

Economy of high-tension current is a feature of the new Ferranti VS2 screen-grid valve

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FERRANTI SCREEN-GRID VALVE

APPARATUS: Variable-mu screen-grid valve.
MAKERS: Ferranti, Ltd.
PRICE: 15s. 6d.

THE VS2 valve is a short-base screen-grid valve used by Ferranti in their own sets. It is more or less normal in construction, except that the anode is oval in shape instead of consisting of a flat plate, as is more usually the case.

It is finished with the standard four-pin cap, having the anode brought out to the top terminal, but instead of a screw terminal a push-on fitting is employed, similar to American practice. Copper metallising is used.

The valve appears to have been designed to give a rapid control with economy of current. At zero volts on the grid the anode current was only some 1.25 milliamperes. The amplification factor was 500 and the internal impedance 500,000 ohms.

This corresponds to a slope of 1, which is a little lower than usual, but is, presumably, deliberate in order to allow reduced high-tension consumption to be obtained.

At 4.5 volts negative bias the slope was reduced to .07 milliamperes per volt, a decrease of nearly 20 to 1 in the sensitivity.

The valve will be found useful where rapid cut-off is required, coupled with economy of high-tension current.

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GARD LIGHTNING ARRESTER

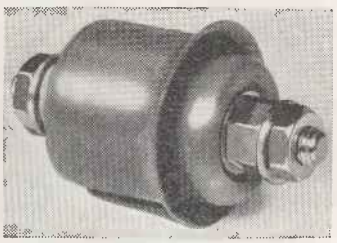
APPARATUS: Gard automatic lightning arrester.
MAKERS: Graham Farish, Ltd.
PRICE: 2s.

A NEW Gard automatic lightning arrester has been produced and replaces the earlier model. We find, on examination, that it is intended for connection to the aerial-earth system out of doors and that adequate protection against weather conditions to maintain its efficiency is provided.

An erinoid tube into the ends of which two threaded brass rods are screwed provides a passage to earth for any heavy discharge, the inner ends of the rods being just separated from each other by an insulated washer to provide the necessary gap.

The tube is encased in a double-metal outer covering that can be relied upon to provide protection from damp. The arrester can be easily fitted to an existing aerial in a few minutes.

No ill-effects on reception are likely to be experienced when using this gadget, as steps have been taken to ensure that any capacity is negligible, while it should respond readily to any lightning discharge, since we found that the gap broke down at just over 2,000 volts A.C. It forms an inexpensive insurance against damage to a set during thunderstorms.



This Gard lightning arrester will give adequate protection during thunderstorms

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BULGIN TONE CONTROL

APPARATUS: Dual tone control.
MAKERS: A. F. Bulgin & Co., Ltd.
PRICE: 7s. 6d.

WITH the object of obtaining tonal balance to suit every ear, A. F. Bulgin & Co., are now marketing a de-luxe Controlatone. It is intended to be connected across the output load on a receiver or, in cases where more than one low-frequency stage is employed, across the load of the penultimate valve.

Designed for panel-mounting, the unit, which consists of a small condenser, an air-cored choke and a variable resistance, is enclosed in a cylindrical bakelite case finished in mottled green and measuring $1\frac{1}{2}$ in. in diameter by $2\frac{1}{4}$ in. in length, exclusive of terminals.

Two terminals are fixed at the end and side respectively. A small indicator dial—marked Deep, Normal and High—is included for fixing behind the knob on the front of the panel.

On test in a receiver, we found the effect on the reproduction of speech and music to be most marked. With the unit set at "Normal," no alteration in the tone or volume was noticed, but on turning to either the "Deep" or "High" settings, the results were apparent.

After listening to an orchestral piece with the unit set to give a good bass response, it was found a great advantage to be able to turn to the "High" setting for speech, which had the effect of removing all "boominess" with little reduction of signal strength.

A good and useful component!

A useful "luxury" component is the Bulgin de-luxe tone control

The All-wave Battery Three

Designed by the "Wireless Magazine" Technical Staff

In these pages the "Wireless Magazine" Technical Staff describes the construction of a battery-operated three-valver using efficient screened coils covering the short wavebands of from 12 to 84 metres in addition to the normal broadcast wavelengths. Interest in short-wave listening is growing, and with this set the battery user will have a reliable receiver covering all wavelengths between 12 and 2,000 metres. The set is cheap to build and gives especially good results

NOW that the short-wave stations are comparatively reliable and it is possible to obtain good entertaining programmes from all over the world, a receiver that will tune down below 100 metres is a great advantage.

Short-wave Advantages

The original thrill obtained when tuning-in far away medium-wave stations is partially gone, for most efficient three- or four-valve sets of modern design will tune in some forty to eighty stations without difficulty.

A short-wave or all-wave set will help to regain some of the thrill of the early days when, during the early afternoon, the whole family can listen to programmes from America, South Africa, and even Australia. When normal broadcast stations are not transmitting any programmes that suit you, it is very useful to be able to go down to below 100 metres and take your pick there.

That the short waves are of programme value and that they are extremely popular has been proved many times over, but in these days when cost is of primary importance few home constructors can spare the money to build a separate short-wave set, or even a simple short-wave converter.

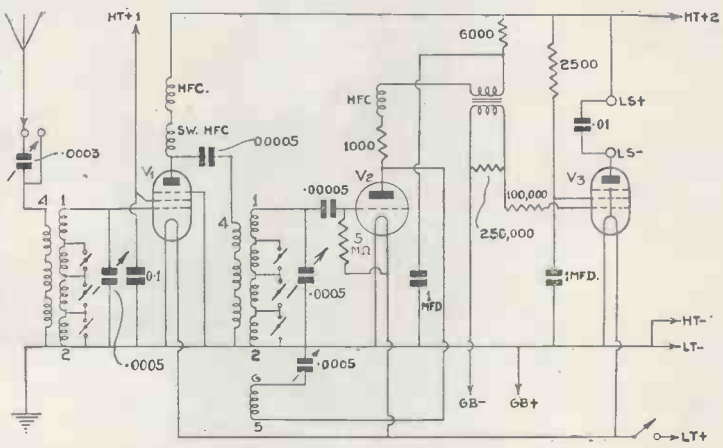
Last year in *Amateur Wireless* was described a four-valve all-wave receiver using special coils, with internal switching, so that short-, medium- and long-wave stations could be tuned-in at will. The amazing success of the receiver embodying these coils made it quite obvious that all-wave receivers are very popular amongst home constructors.

Improved Coils

These coils have been improved and modified out of all recognition and are supplied completely screened, so they can be included in highly efficient receivers, using valves with high amplification factors

Realising that a four-valve all-wave set was no longer necessary in view of the improved components, we decided to try a three-valver which would be as simple to operate on 15 metres as it is on 1,500 metres. This would enable the family man to tune-in American and other long-distance stations with almost the same degree of reliability, as he would some of the more-distant European stations.

With this end in view, the All-wave



CIRCUIT OF THE ALL-WAVE BATTERY THREE
The circuit is quite simple, yet has features that ensure satisfactory results. A high-frequency pentode is used in the high-frequency stage followed by a triode detector transformer coupled to the output pentode

LOW-FREQUENCY SIDE
This close-up photograph shows the low-frequency side of the set. It will be noticed that the fixed resistances are suspended in the wiring

Battery Three was evolved. This is a receiver using two multi-electrode valves so that the performance is more like that of a four- or five-valver than that of a simple three-valver.

Selectivity and Sensitivity

There is no doubt that screened pentodes used in conjunction with highly efficient tuning coils account for the exceptional selectivity and the sensitivity of this simple receiver.

We have always been of the opinion that in the hands of the home constructor a simple set will give more satisfactory and consistent results, for it is only the ardent experimenter who can satisfactorily operate a receiver that is a mass of control knobs.

Coupling the Aerial

In this all-wave three we have the aerial coupled to the special all-wave coil through a .0003-microfarad preset condenser or directly to the coil. On the medium waves the selectivity is adequate when the aerial is taken directly to the coil (omitting the condenser), but on the short waves, when the aerial is often on the long side causing damping and lack of oscillation, the aerial-series condenser more than justifies its inclusion.

The aerial coil is tuned by means of a .0005-microfarad condenser, which ensures a wide waveband range and, as it is controlled by an exceptionally smooth slow-motion dial, no difficulty is experienced in logging the short-wave stations.

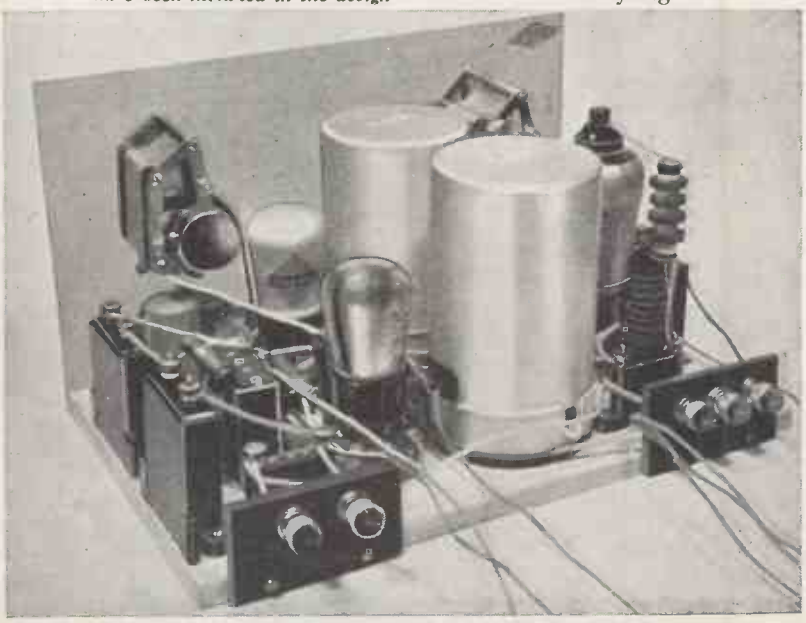
One of the new Cossor screened pentodes is used in the high-frequency stage and this valve does give very high stage gain—and even below 20 metres amplifies the incoming signal many times. No one can really appreciate the value of an efficient high-frequency stage on the short waves until they have actually tried tuning in weak stations with a screen-grid set after they have been used to a straight two- or three-valver. Not only is the volume greater, but the receiver is more steady in every way.

In the anode circuit of the high-frequency pentode is an all-wave choke which tunes between 12 and 2,000 metres, but as some readers may feel inclined to put in any old choke they may have beside them, to prevent trouble, we have included a second choke in series with it, which is suitable for all wave-lengths between 12 and 200 metres. The idea of this extra choke is that should the reader use an ordinary broadcast choke, the use of the additional special short-wave choke will ensure the receiver operating satisfactorily on the short waves.

TWO HIGH-FREQUENCY CHOKES
To make certain that the results are satisfactory over all wavebands, two high-frequency chokes have been included in the design

Primary Winding

A tuned-grid circuit couples the high-frequency and detector valves, but the output from the high-frequency valve is not fed directly to the grid coil. In both the aerial and grid coils the input is fed into a primary winding, and as each wave-range on the coil has its own primary the efficiency is kept at an extremely high level.



BACK VIEW OF THE ALL-WAVE BATTERY THREE
Here is the set, complete with valves and coil covers, ready for fitting into the cabinet. The valves from left to right are the detector, output pentode, and high-frequency pentode. The high-frequency and detector valves are of the metallised type

Many may wonder at the unusual values of the grid condenser and grid leak in the detector stage. After exhaustive tests we found that a .00005-microfarad grid condenser was superior to the conventional .0001-microfarad or .0002-microfarad on wavelengths below 150 metres and as it did not affect the results on the medium or long wavebands it was obviously the best value to use.

Grid-leak Value

Similarly with the grid leak. Although the 2-megohm leak originally used was satisfactory, by increasing it to 5 megohms the reaction was considerably smoother.

Reaction is by the conventional Reinartz method, but notice that the moving plates of the reaction condenser are connected to earth, so preventing any possible trace of hand-capacity.

High Primary Inductance

A 1 : 3 low-frequency transformer with a high primary inductance couples the detector valve to the pentode valve.

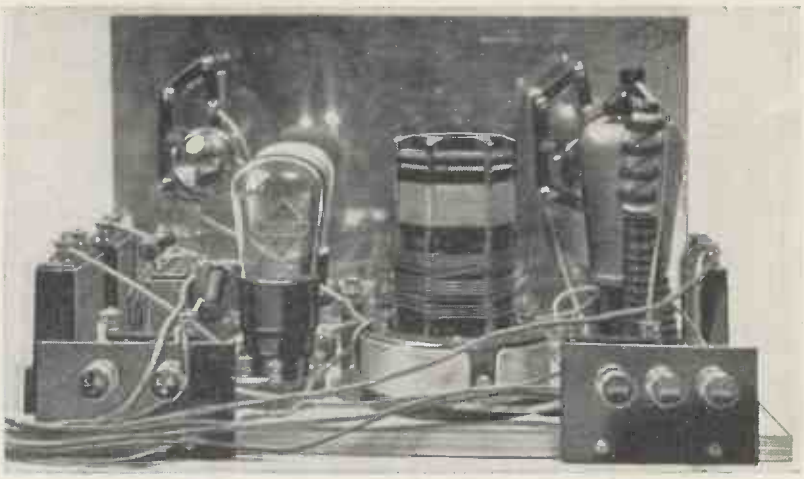
Very special care was taken in choosing this low-frequency transformer, for this component can affect both the reaction and quality. The .25 megohm resistance across the secondary helps to attenuate the top notes and in conjunction with the .01-microfarad condenser across the loud-speaker acts as a tone corrector.

The 100,000-ohm resistance in series with the control grid of the pentode prevents any unwanted high-frequency currents reaching the loud-speaker and so causing feed-back. The use of adequate decoupling and plenty of by-pass condensers accounts for the exceptional stability of this receiver, even down to the minimum wavelengths to which the coils will tune.

So much for the theoretical circuit.

Full constructional details are given in these pages, as well as numerous illustrations showing the layout of the various components. We would, however, remind our readers that a full-size blueprint, showing every wire numbered and with the exact positions of the components, is available.

If you use the coupon on the last page of this issue by July 31, the blueprint can be obtained for 6d. post paid, instead of 1s. Address your application to the "Wireless Magazine" Blueprint Department, 58-61 Fetter Lane, London, E.C.4, and ask for W.M.365.



AN EFFICIENT DESIGN FOR ALL BATTERY USERS

The three separate windings on the all-wave coil can be seen in the centre. At the top is the long-wave winding, in the centre the medium waves, and the short-wave windings are at the bottom

Constructional Hints

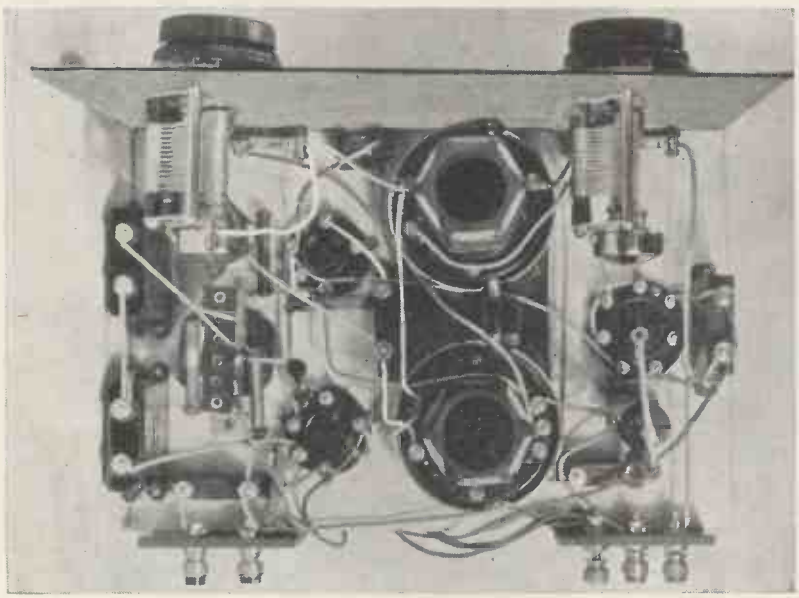
Now a few hints on the construction. The metal panel and the metallised baseboard are held together by means of wood screws along the base and not by panel brackets. As the receiver is almost bound to be fitted in a wooden cabinet, our opinion is that brackets are redundant. Both of the tuning condensers are fitted directly to the metal panel, but to prevent noisy contacts the moving plates are earthed separately.

On the extreme left of the panel is the aerial pre-set condenser. Take special care to isolate this from the metal panel by means of the ebonite bushes supplied, otherwise there will be a dead short and you will not hear any signals.

Preventing Noise

On the right of the panel is the reaction condenser (.0005-microfarad), and although the moving plates of this are connected to earth, instead of relying on the automatic contacts between the spindle and the panel we have separately earthed the moving plates to prevent a noisy background.

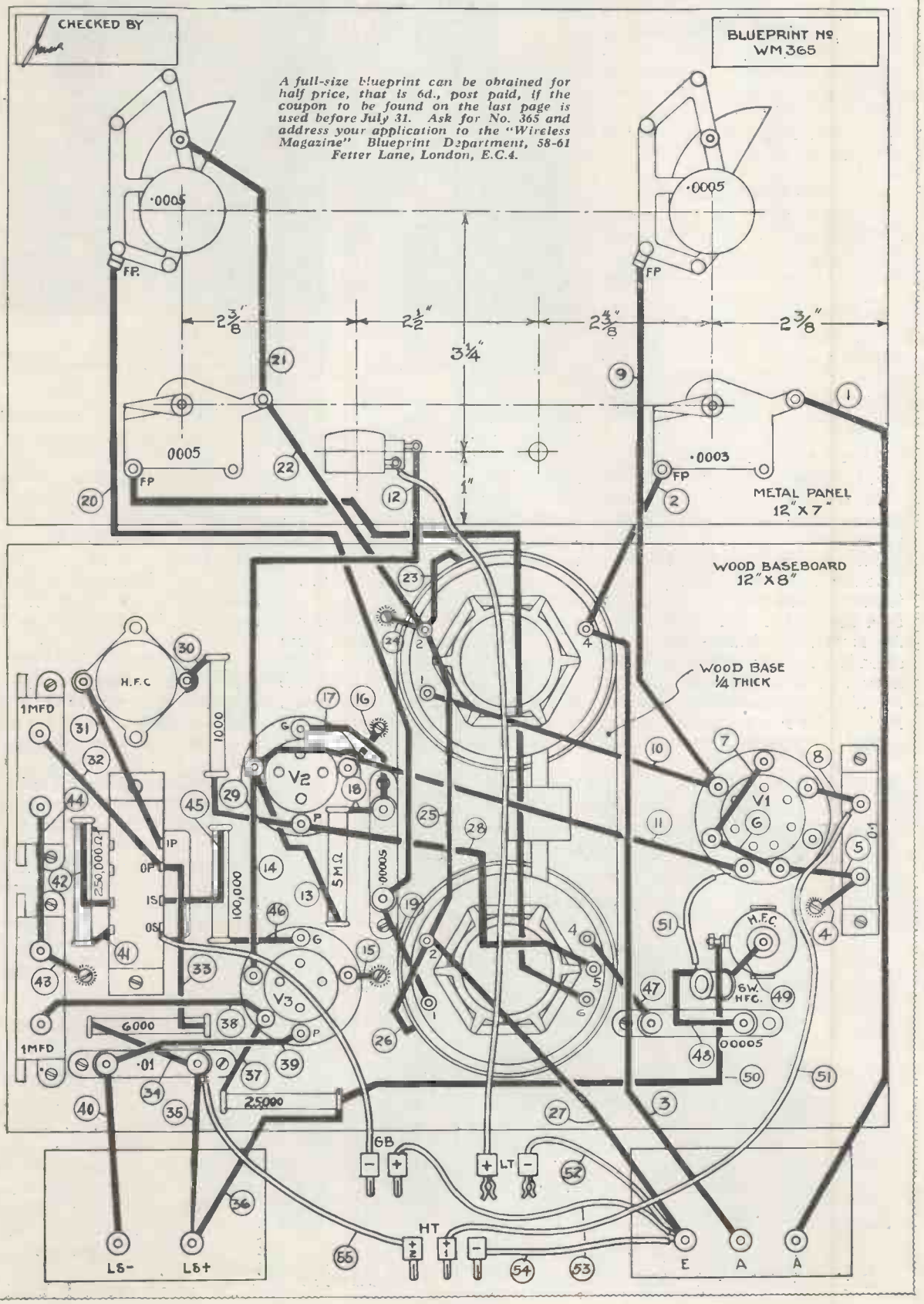
The on-off switch is fitted to a



PLAN VIEW OF THE ALL-WAVE THREE

Used in conjunction with the half-scale wiring plan on page 560, readers should have no difficulty in making a good constructional effort. There are no snags and the set should be built up quite easily in an evening

Half-scale Layout and Wiring Plan



right-angle metal bracket, one half of which is screwed to the baseboard and the other half held firmly up against the metal panel by means of a locknut on the on-off switch.

An important control on the panel is the wave-change switch, which has four positions: S_1 for wavelengths between 12 and 34 metres; S_2 for 27 to 84 metres; and the usual medium and long waves.

Self-cleaning Contacts

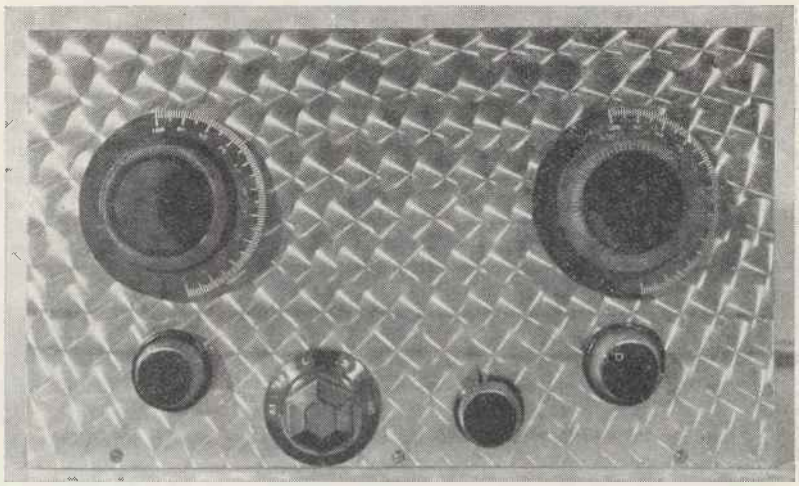
For readers living in a relay-station area or who wish to tune in Fécamp, we took special precautions to ensure that the minimum medium-wave wavelength was under 200 metres.

Switching on a four-range coil might cause trouble if it were poorly designed, but in a Lissen coil the contacts are such that the make-and-break action also cleans the contact points, thus ensuring clean connections at all times.

Mounting the Coils

Both of the tuning coils are mounted off the metallised baseboard by means of a block of three-ply wood. The idea of this is not to isolate the coils from the baseboard, but to raise the knob on the panel so that the edge of the indicating plate does not foul the table on to which the receiver is placed.

Between the two coils is a connecting bush and a 1-in. square hole should be cut in the plywood strip to allow the bush to rotate without fouling.



LAYOUT OF THE CONTROLS

The two main tuning dials are in the centre of the panel: the aerial-tuning condenser is on the left and the grid-tuning on the right. From left to right the controls at the bottom are the aerial-series condenser, wave-change switch, on-off switch and reaction control

The first valve is a Cossor high-frequency pentode, type 210SPT, which is fitted with a standard seven-pin base. The second valve between the grid-tuning condenser and the coil nearest the panel is the detector, a metallised 210Det. The final valve is a 220HPT pentode which gives a high output with very moderate high-tension current.

A double-capacity high-tension battery of 120 volts is ample to ensure good quality and sensitivity. There are three high-tension tappings: H.T. negative; H.T.+1, plugged into the 60- or 70-volt tapping; and H.T.+2, plugged into the 120- or 150-volt tapping (if you have a battery with a high voltage). G.B.—1 should be plugged into approximately 6 volts when using the Cossor 220HPT pentode.

Getting Correct Voltages

The high tension to the detector valve is brought down to the correct value by means of the fixed resistances in the anode circuit of this valve The same remarks apply to the auxiliary grid of the pentode.

In order to make quite sure that the voltage applied to its grid is lower than that applied to the anode a resistance of 2,500 ohms must be connected in series with the auxiliary grid of the pentode.

Operation is simplicity itself. On medium and long waves the aerial pre-set condenser should be adjusted to give the required degree of selectivity. Volume is adjusted by the reaction condenser and if the tuning condensers are kept more or less in step stations will be received at every two or three degrees around the dial.

Tuning for Short-wavers

On the short wavelengths—that is, with the switch turned to either S_1 or S_2—great care must be taken in manipulating the tuning dials.

The pre-set condenser in series with the aerial should be adjusted so

Continued on page 571

COMPONENTS NEEDED FOR THE ALL-WAVE BATTERY THREE

	£	s.	d.
BASEBOARD			
1—Peto-Scott Metaplex 12 in. by 8 in.		1	6
CHOKES, HIGH-FREQUENCY			
1—Eddystone, type 505		4	6
1—Eddystone, type 948		2	9
1—Wearite screened, type HFP (or Bulgin, Goltone)		3	6
COILS			
2—Lissen all-wave screened, type 5386	1	14	6
CONDENSERS, FIXED			
3—T.C.C., type 34, values: .00005- (2), .01-microfarad (or Dubilier, Telsen)		5	6
3—T.C.C., type 50, values: .1-, 1-microfarad (2) (or Dubilier, T.M.C. Hydra)		6	10
CONDENSERS, VARIABLE			
2—J.B. .0005-microfarad, type Popular Log		15	0
1—Polar .0005-microfarad, type Compax (or Lissen, Graham Farish)		2	6
1—Polar .0003-microfarad, type Compax (or Lissen, Graham Farish)		2	6
HOLDERS, VALVE			
2—Benjamin five-pin (or W.B., Telsen)		1	8
1—Benjamin seven-pin (or W.B., Telsen)		2	0
PANEL			
1—Peto-Scott aluminium 12 in. by 7 in.		3	6
PLUGS, TERMINALS, ETC.			
5—Belling Lee wander plugs, marked: HT+1, HT+2, HT—, GB—, GB+ (or Clix, Eelex)		1	0
2—Belling Lee wander plugs, marked: LT+, LT— (or Clix, Eelex)			4
5—Belling Lee terminals, type M, marked: Aerial 1, Aerial 2, Earth, LS—, LS+ (or Clix, Eelex)		1	10
RESISTANCES, FIXED			
6—B.A.T., values: 1,000-, 2,500-, 6,000-, 100,000-ohm, 250,000-, 5-megohm (or Erie, Lissen)		5	3
SUNDRIES			
2—Ebonite strips 3 in. by 1¾ in., say			6
1—1-in. metal mounting bracket, say			2
3-ply wood 7½ in. by 3 in., say			2
Round tinned copper wire No. 20 gauge, for connecting, say			6
Oiled sleeving, say			9
4 yd. thin flex, say			4
SWITCH			
1—Bulgin rotary on-off, type S91		1	9
TRANSFORMER, LOW-FREQUENCY			
1—Slektun ratio 1:3, type unshrouded (or Lissen, Telsen)		5	6
ACCESSORIES			
BATTERIES			
1—Ever Ready 120-volt high-tension, type Winner		11	0
1—Ever Ready 9-volt grid-bias, type Winner		1	0
1—Smith's 2-volt accumulator, type 2RGN7		10	6
CABINET			
1—Peto-Scott, type EN3		15	0
LOUD-SPEAKER			
1—Blue Spot Star, cabinet model	4	18	6
VALVES			
1—Cossor 210SPT (met.)		15	6
1—Cossor 210Det. (met.)		7	0
1—Cossor 220HPT		16	6

The prices mentioned are those for the parts used in the original set; the prices of alternatives as indicated in the brackets may be either higher or lower.

H.M.V. photo

A. Croom-Johnson, creator of "Soft Lights and Sweet Music," with his vocalist, Elizabeth Welch, admiring the new H.M.V. Super-het Four-forty. One of their records is reviewed by Chopstick this month

Choosing Your Records

New Record Releases Critically Reviewed

By WHITAKER-WILSON

QUITE the star production of the month is Richard Strauss's tone poem, *Don Quixote*, recorded by the Berlin State Opera Orchestra, with the composer conducting and with Georg Kniestadt, solo violinist; Kari Reitz, viola; and Enrico Mainardi, 'cello. This is on Decca Polydor records LY6087-6091, costing 3s. 6d. each.

It is a lovely work, exquisitely rendered. This is, of course, for the connoisseur and something to add proudly to a collection of only the best orchestral records.

A nice group of Parlophones. First, a 12-in. piano record, with Rachmaninoff's *Prelude in G Minor*, next in popularity to the hackneyed C sharp minor, and an arrangement by Liszt of a waltz from Gounod's *Faust*. Both are played by Eileen Joyce, whose playing has won my admiration (E11252, 4s.).

Next (R1832, 2s. 6d.), two sketches written by Geoffrey Clayton, an old personal friend, of whom I have lost sight for some years now. One is called a *Record Broadcast* and the other *The Super-het*. I think both will appeal to you. Excellent satire.

Lighter still, two piano selections played really remarkably by Patricia Rossborough. *Did You Ever See a Dream Walking? When You Were the Girl on the Scooter*, and other ditties appear on this disc. A clever piece of playing (Parlophone R1749, 2s. 6d.).

If you want another Tauber record with orchestra, I sincerely recommend *The Night* and one called *Ideale*. Both are sung in German. The first is by Rubinstein and the second by Tosti. Tauber at his best!

H.M.V. C2668, 4s., is quite a pleasant affair, especially to Irishmen. It is called *Danny Malone—Medley*. He, of course, is the "meddler," and such popularities as the *Kerry Dance*, *Off to Philadelphia*, and *My Auld Irish Mother* fill two sides of an entertaining disc. He sings sympathetically, with a nice Irish inflection, in tune, and with good diction. What more?

Changing the thought entirely, I recommend H.M.V. C2662, on which Browning Mummery sings *On With the Motley* and *Your Tiny Hand is Frozen*, one from *Pagliacci*, the other from *La Bohème*. A nice voice, not too "tenory," yet with a musical quality. Very expressive rendering of both arias.

Parlophone photo

Patricia Rossborough, the famous syncopated pianist, who you often hear over the air, has recorded a medley for Parlophone

H.M.V. C2664 is a record by Miliza Korjus. One side is Proch's *Variations* and the other Strauss's *Voices of Spring*. Accompanying her is the Berlin State Opera Orchestra, so there is not much the matter with it. A fine rhythm characterises the entire rendering. Korjus is fine in the Strauss.

Going a little higher in the matter of price—and certainly no lower in that of quality—you should aspire to H.M.V. DB2131, 6s., where Tito Schipa, tenor, sings *Plaisir d'Amour* and *O del Mio Amato Ben*. I am greatly impressed with both sides.

The B.B.C. Symphony Orchestra plays Beethoven's *Coriolanus* overture, under Dr. Boult, on H.M.V. DB2101. If you have heard it broadcast by the same means, you may be glad to have this. It is a faithful representa-

tion in permanent form of what I, personally, have heard them do many times on the air and in Queen's Hall. A very good record.

H.M.V. DB4412 attracts me considerably. Maria Ivogün, whom I have not heard before to my knowledge, sings two arias in German with the Berlin Orchestra accompanying her. A lovely voice and the music by Johann Strauss. Do ask to hear this. I think you will love it. I do!

I am quite interested in a record called *Let's go to Germany*. It is a practical travel talk in German, with an introduction in English by Hermann Winter. Very valuable if you are going to Germany. An excellent lesson in pronunciation.

A couple of Deccas of interest. (F3961, 1s. 6d.), is a Grenadier Guards record —*Drink to Me Only* and a *Savoy Hunting Medley*; F3982 is Tommy Handley doing that entertaining *Silly Girl* and *Coom Pretty One*, which I think Leslie Sarony wrote. It is excellent.

Columbia (DX580, 4s.) and the B.B.C. Wireless Military Band between them make an excellent job of the *Oberon* overture of Weber, arranged by Dan Godfrey. It comes out amazingly well. This is one of the best military bands in England.

Some other Columbia records of an attractive nature are *The Blue Danube* waltz (DB1375, 2s. 6d.), played by the Orchestre Raymonde; Harold Williams sings *Farming* and other songs from the fair on DB1376; and

H.M.V. Photos

You have all heard the story of Danny Malone's rise to star rank by his H.M.V. recordings. He has made a medley which is reviewed here. (Left) The famous Italian tenor, Tito Schipa, has just made another red label disc for H.M.V.

Albert Sandler playing *For Love of You* on DB1378.

Norman Long—well up to scratch—in *Marrers* and the immortal *I've Brought You Some Narcissus*, *Cis*, too should be heard.

Additional Records Reviewed

By CHOPSTICK

LIGHT SELECTION

★**Wonder Bar—Film Songs Selection**, The Bohemians, 4s., **COL DX583.**

This record will help to conjure up memories of that famous musical show, *Wonder Bar*, which has now been adapted for the films. The show is full of delightful tunes and the Bohemians know how to get the best from them. Do you need reminding of the big hits? Here are some; "Elizabeth," "Goin' to Heaven on a Mule," "Don't Say Goodnight," "Why Do I Dream Those Dreams" and, of course "Wonder Bar." A good twelve-incher this!

LIGHT SONGS

★**Carlyle Cousins Medley,** Carlyle Cousins, 1s. 6d. **DECCA F3978**

A fine medley of syncopated choruses by that famous broadcasting trio, which brought the house down at Radiolympia last year. They are accompanied here by Quaglino's Quartet. This is syncopated singing at its best and will appeal to everyone. Some of the best numbers in the medley are: "California Here We Come," "I'll See you in the Morning," "Sentimental Gentleman from Georgia," "I Can't Give You Anything But Love," and, of course, that number that is invariably included in every medley, "Dinah."

(*a*) **I've Found a New Baby,** (*b*) **Put On Your Old Grey Bonnet,** The Mills Brothers, 2s. 6d. **BRUNS 1761**

Marvellous fellows these Mills Brothers! I hope you listened to their "human orchestral" broadcasts. This disc gives you the Mills Brothers at their usual high standard. That is the only comment necessary!

"**Soft Lights and Sweet Music,**" Elizabeth Welch, 2s. 6d. **H.M.V. B8172**

This is parts three and four in the series H.M.V. are issuing of Austen Croom-Johnson's broadcast series "Soft Lights and Sweet Music." Real soothing music admittedly, but perhaps on the too-dreamy side. Here are the contents; "Getting Sentimental Over You," "Japanese Sandman," "Goodnight, Sweetheart," "Lazy Day," and "Sweet Sue."

DANCE MUSIC

★(*a*) **Because It's Love** (f.), (*b*) **Little Dutch Mill** (f.), B.B.C. Dance Orchestra, 2s. 6d. **COL CB751**

A really outstanding B.B.C dance band disc. In (*b*) they have really excelled themselves. I believe that the tune itself is the best we have had this year. The B.B.C. people have combined a real delicate orchestration with a splendid piano solo by Bert Read and vocal by Les Allen to make their greatest recording success yet.

★(*a*) **Goodnight, Lovely Little Lady,** (f.), (*b*) **Lonely Feet,** (f.), Jack Jackson and his Orchestra, 2s. 6d. **H.M.V. B6489**

I look forward every month to these H.M.V.-Jackson recordings, There are always fine tuneful numbers, well recorded and ideal for dancing. (*a*), from the film, *Three Sisters*, is good, but the record is worth half-a-crown for (*b*), from the film, *We're Not Dressing*. This has the best vocal trio I have come across recently.

(*a*) **Indiana** (f.), (*b*) **Ol' Man River,** (f.), Casa Loma Orchestra, 2s. 6d. **BRUNS 1755**

(*a*) is typical Casa Loma. The high spot is some fine solo work by the clarinet, tenor saxophone and trumpet players. You should hear this—an example of how to get the most out of dance rhythm. (*b*) is a super hotted up concoction of "Ol' Man River"—from the *Show Boat*. Here, I suppose, we come up against the question of whether tunes like this should be adapted for jazz. My verdict is this: (*b*) is a triumph of arrangement and a jolly good entertainment.

★(*a*) **Love's Serenade** (slow f.), Mills Blue Rhythm Band, (*b*) **It Should Be You** (f.), Henry Allen, Jnr., and His Orchestra, 2s. 6d. **H.M.V. B6487**

Love serenading to me sounds more like a funeral march with a strong rhythmic accompaniment in which the piano plays a very important part. (*b*) is nothing more or less than a series of hot instrumental solos with a fine swinging rhythm. Allen, with his trumpet, is the star performer. He does blow!

(*a*) **Repeal the Blues** (f.), (*b*) **Easy Come, Easy Go,** (f.), Johnny Green and His Orchestra, 2s. 6d. **BRUNS 1757**

Following the batch of Columbia recordings of piano solos by John W. Green, Brunswick gives us a disc of two popular hits played by Green's own American band. It is a splendid disc admittedly, but the real bright spot of both sides is a fine vocal by a "real cute" lady. Gee, she can croon!

(*a*) **True** (f.), **Swaller Tail Coat,** (quickstep), Roy Fox and His Band, 1s. 6d. **DECCA F3987**

This is Roy Fox at his best. (*a*) is one of his quiet tuneful numbers and (*b*)—not noisy—a jolly hot quickstep with brilliant team playing by the band.

My Impressions of the "Two H.F." Portable

Last month we published full constructional details of the "Two H.F." Portable—a self-contained set having two variable-mu high-frequency stages, detector and a twin-pentode output stage. This set has aroused much attention among readers, and here we present an independent test report which, besides giving many useful operating hints, will give you an idea of the outstanding quality and sensitivity given by this set. May we remind readers that a full-size blueprint of the "Two H.F." Portable can be obtained for 1s., post paid.

WHEN I was given the Two H.F." Portable to test I was told that it was the outcome of many weeks experimental work. My reply to this is that the time has certainly not been wasted, for it is an excellent set. I was privileged to have it only for one evening, but that was quite long enough to prove its worth.

The first point that struck me was the strength and quality obtained from the local station. The output resembled that of the average mains set and the quality on the little built-in moving-coil loud-speaker was excellent—a pleasant surprise if you are used to the average "portable quality."

This output was not confined to the local. Most of the principal Continental stations were brought in at "uncomfortable" room strength, many without the use of reaction.

As in all portables, the directional properties of the frame were very noticeable, but as the cabinet is provided with a small turntable this feature caused very little trouble, and often enabled me to bring a poor station up to full loud-speaker strength.

It was also useful from the point of view of selectivity, as unwanted transmissions could generally be eliminated from the programme to which we were listening by rotating the set.

CHASSIS-BUILT FOR EFFICIENCY
The set is built up on a metal chassis to ensure stability as well as to give a neat appearance. As you can see, the layout is particularly clean

ATTRACTIVE EXTERNAL APPEARANCE
The four controls are grouped close together on the front of the neat oak cabinet. The set is self-contained with a moving-coil loud-speaker

Good Selectivity

Apart from the directional properties of the frame, however, the tuning of the set seems quite selective. This is not surprising considering there are three tuning circuits.

The sensitivity is of a high order and can be varied considerably by means of the screen voltage applied to the high-frequency pentode.

Generally speaking, it is best to work with about 60 to 70 volts on the screen, although to obtain the maximum sensitivity it is possible to put this up to the full 120 volts without introducing serious instability.

In the latter case, however, the current taken by the high-frequency valves is high and would result in the high-tension battery having a short life.

The single-knob tuning control is of great advantage when searching for

stations, although adjustment of the frame-aerial trimmer is usually necessary to bring the signals up to full strength. On the set I handled, the trimmer capacity had to be gradually increased with increasing wavelength.

The other three controls are the variable-mu volume control, reaction control, and the wave-change switch. The latter has a positive snap action and is remarkably free from noise.

Forty-five Certainties

During an hour and a half in the evening I was able to identify forty-five stations, thirty-four of which were on the medium wave-band. I listened to Hamburg quite clear of the London Regional and Strasbourg with only a faint background. Frankfurt was also well received clear of London National, a remarkable feat of selectivity for a portable set.

I was surprised to receive the Madrid station on 274 metres, as this has only a power of 2 kilowatts and is a poor station in my part of the world. Such stations as Beromunster, Vienna, Rome, Poste Parisien and Fécamp, etc., provided excellent programmes and were obtained at full loud-speaker strength without the use of reaction.

On the long waves all the usual programmes were obtained with the exception of Oslo, which, for some unaccountable reason, I could not find anywhere—of course, it may not have been transmitting.

Just before breakfast on the following morning I switched the set on again to see what the daylight range was like, and succeeded in getting eight programmes.

The whole of the tests were carried out in or near Leigh-on-Sea, Essex. During one afternoon the set underwent critical examination at my local tennis club. As you can see by the photograph reproduced in these pages, some of the players forsook tennis for a while to listen to the radio.

Frame-aerial Tip

Just one point. During daylight, when distant foreigners are wanted, do not forget to take advantage of the directional properties of the frame aerial. It will make all the difference between good and indifferent results.

I have no hesitation in recommending you to build the portable—I shall certainly do so myself when I have a little time to spare. *S.O.M.*

STATIONS HEARD ON THE "TWO H.F." PORTABLE

Station	Dial Reading
MEDIUM WAVES	
Fécamp	9
Gleiwitz	16
Lille	17
Frankfurt	19
Moravska-Ostrava	20½
London National	21½
Madrid	23
Scottish National	28½
Heilsberg	29½
Breslau	31½
West Regional	33½
Poste Parisien	35
Brno	37
Hamburg	38½
Radio Toulouse	39
London Regional	41½
Strasbourg	44
Berlin Funkstunde	48
Scottish Regional	50½
Leipzig	53
Toulouse	54
Midland Regional	55
Marseilles	57½
Munich	59
Rome	63
Paris	66½
North Regional	71
Prague	73
Brussels	75
Vienna	90
Mühlacker	91½
Athlone	92½
Beromunster	95
Budapest	98
LONG WAVES	
Croydon	12
Moscow	15
Kalundborg	36
Luxembourg	39
Unidentified	43
Motala	46
Eiffel Tower	51
Daventry National	55
Königswusterhausen	59
Radio Paris	67½
Huizen	85

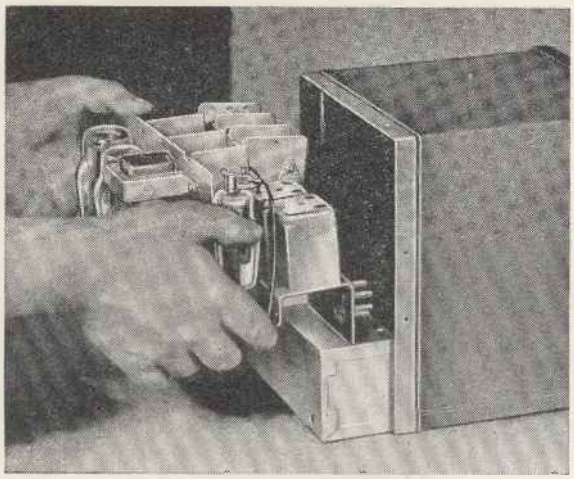
SIMPLICITY THE KEYNOTE

This back view of the portable shows very clearly the neat arrangement of the set chassis and batteries in the cabinet

LIST OF PARTS NEEDED FOR THE "TWO H.F." PORTABLE

	£ s. d.
CHASSIS	
1—Peto Scott aluminium, 12 in. by 6¼ in. by 3 in., complete with screens	8 6
CHOKE, HIGH-FREQUENCY	
1—Varley screened, type BP26 (or Bulgin, Telsen)	4 6
COILS	
2—Telsen matched screened, type W422	17 0
CONDENSERS, FIXED	
7—T.M.C. Hydra, type tubular, values: .0002-, .0003-, .001-, .005-, .05-microfarad (3) (or Erie)	5 3
1—T.M.C. Hydra 1-microfarad, type 25 (or Dubilier, T.C.C.)	2 3
CONDENSERS, VARIABLE	
1—British Radiophone .0005-microfarad three-gang, type 604, with slow motion drive type 803	1 6 6
1—Lissen .0005-microfarad, type LN5103 (or Telsen, Graham Farish)	2 6
1—Polar .0001-microfarad, type Compax (or Lissen)	2 6
HOLDERS, VALVE	
1—Clix four-pin, type chassis mounting	8
3—Clix, seven-pin, type chassis mounting	3 0
PLUGS, TERMINALS, ETC.	
6—Belling-Lee wander plugs, marked: H.T.+1, H.T.+2, H.T.—, G.B.—1, G.B.—2, G.B.+ (or Clix, Eelex)	1 0
2—Belling-Lee spade terminals, marked; L.T.+, L.T.— (or Clix Eelex)	4
6—Belling-Lee sockets and plugs, type 1077, marked: red (3), black (3) (or Clix, Eelex)	2 6
RESISTANCES, FIXED	
5—Claude Lyons, values: 30,000.-100,000-(2), 250,000-ohm, 2 megohm (or Erie, Siemen-Schukert)	4 4
RESISTANCE, VARIABLE	
1—British Radiophone 50,000-ohm, with 3-point switch, type 484	6 0
SUNDRIES	
2 ft. screened sleeving, say	6
Round tinned copper wire, No. 20 gauge, say	6
Oiled sleeving, say	9
5 yd. thin flex, say	5
14 yd. Litz wire, 27/42, say	3 9
2 oz. D.S.C. wire, No. 28, say	1 0
1—J.B. gang coupler, type 2003	9
Ebonite rod, ¼ in. diam., 4½ in. long, say	3
1—Bulgin knob, type K14	4½
Aluminium bracket for mounting trimming condenser, say	3
SWITCHES	
3—Bulgin on-off toggle, type S80B, with 6 in. length of 5/32 in. rod and K14 knob	5 9½
TRANSFORMER, LOW-FREQUENCY	
1—Wearite, type PPA	13 6
ACCESSORIES	
BATTERIES	
1—Ever Ready 120-volt high-tension, type Portable 18	15 0
1—Ever Ready 9-volt grid-bias, type Winner	1 0
1—C.A.V. 2-volt accumulator, type 2VN11/1	14 0
CABINET	
1—Kebtex, type BWD	1 12 6
LOUD-SPEAKER	
1—Rola permanent-magnet, type FR5PM70	1 9 6
VALVES	
2—Marconi VP21 (or Osram)	1 11 0
1—Cossor 210 Det (or Mullard PM2DX	7 0
1—Marconi QP21 (or Osram)	1 2 6

The prices mentioned are those for the parts used in the original set; the prices of alternatives as indicated in the brackets may be either higher or lower



EASILY DETACHABLE FOR REPAIRS
The Motorola set chassis is so arranged that in the event of a breakdown it can easily be removed from its metal container and repaired or replaced without ony trouble

All the Latest in Car Radio

Reviewed by the "W.M." Technical Staff

DURING the past year or so we have tried to form some ideas on what would be the ultimate end of car radio. Would it become universal and even fitted by car manufacturers, or would it die the slow death of so many new ideas? So far we have failed to find any definite facts upon which to base a conclusion.

Coming into Favour

The radio exhibition last year saw the first serious attempt by set manufacturers to popularise the car radio type of receiver.

What has been the result so far? Until the last month or so sales have been so very slow that we thought that car radio was a thing of the past. Just recently, however, with the better weather and the introduction of some really good sets, there has been a decided reaction in favour of radio in cars.

Not so Easy!

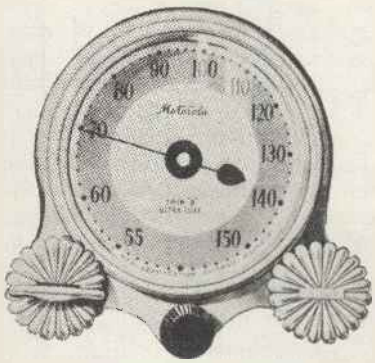
In the past, many manufacturers came to the conclusion that selling car radios was an easy thing, and a quick way of making a good profit. Consequently, instead of designing sets with special components to stand vibration, heat and the general rough and tumble of motor-car travelling, they used standard types.

Instead of the general public rushing in as anticipated, there was considerable apathy to buy receivers which were an obvious compromise and sounded like the portable receivers of the early days.

Even then some of the manufacturers wondered why it was that the sales in America exceeded 1,000,000 sets a year.

The favourable American conditions were not borne in mind. Over there everything is in favour of car radio. Cars are much larger so that the space beneath the facia board houses quite a large receiving unit.

Long distance freight vans and passenger coaches, which make journeys of 3,000 miles or so, are equipped with loud-speakers and headphones. Americans have realised that radio at night helps to keep sleepy drivers awake, while on this side of the Atlantic the powers that be shivered in their shoes at the very idea.



NOT A SPEEDOMETER
This is the Motorola remote control unit which fits on the steering column of a car. It is indirectly illuminated to prevent dazzle

American car drivers are accustomed to make long journeys across the continent so that a radio is almost indispensable.

Companies are being formed in U.S.A. with the sole idea of making *car sets for cars* and not *modifying standard sets*.

Consequently these advantages backed by a good sales drive are bringing a large reward.

These points having been realised by British set makers, we now have real car-radio sets *actually available*.

In spite of the Government refusing to make any definite statement as to whether or not they will ban radio in cars, the man in the street is beginning to realise that there is something in car-radio after all.

Snags Overcome

Most of the snags have been overcome. Quality is good, range almost as good as the home set, fading negligible, and there is no ignition interference.

There are four firms in the forefront with car-radios through sheer merit and attention to detail. They are Motorola, Philco, Lissen, and Majestic.

These four firms are in a position to supply receivers that are equal to the finest in the world. Motorola have concentrated on car-radio and nothing else. They were quick to realise that with a new toy the car-radio owner would be very critical about performance, and would compare it with the family set.

So Motorola decided that notwithstanding the poor aerial, vibration, temperature, power supply problems, and ignition interference, their car-radio set would be as good or even better than the average home receiver.

Self-contained Outfit

A few words about these Motorola sets. The Dual-"6" model is a single unit receiver complete in itself, as the radio-receiver chassis, loud-speaker, power pack and noise-filter system are all in one metal container.

The remote control is fitted to the steering column, and can be supplied with liners to fit any diameter steering column.

This is one of the few controls we have tried with the aeroplane type of indirectly illuminated dial. In appearance it looks very similar to a speedometer except that it has three control knobs. Here again we were surprised to find that in addition to the usual tuner and volume control knobs there was a tone control.

Locking the Set !

The knobs cannot be removed, so there is no possibility of any of them working loose through vibration. The receiver can be put out of action and locked by means of a Yale type of lock and key. In addition to the spark suppressor resistances fitted in the engine, the radio receiver is fitted with a special noise-filter system built into the receiver as an integral part.

This removes all traces of background noise and reduces the number of external wires very considerably.

We noticed that the set could be removed from its metal container in a matter of seconds; all connections being made by sockets. When the receiver is slid into the container special pins make contact with the sockets.

Easily Repaired

In the unlikely event of a breakdown it can be removed and a new chassis put in its place in a very short space of time.

The Motorola receivers are all super-hets and designed to give 6-kilocycle selectivity, which is considerably better than can be claimed for the average home set. A vibrator converter running off a 6- or 12-volt accumulator gives an output of 220 volts and is enough to ensure excellent quality.

As car radio would be almost useless without automatic volume control, this point has been given special attention. Their success can be judged from the performance, for bridges, cuttings between hills, and shielding from large towns make no appreciable difference to the volume or quality.

All components used have been designed to withstand a rise in temperature up to 240 degrees, a point not likely to be reached in normal conditions.

The Dual Model " 6 " is intended to be fixed beneath the facia board, but in cars where this is not possible the Twin 8 can be used instead. This can be fitted under the running board, beneath the back seats, or to the dashboard above the engine.

The Twin 8 is really the last word in receivers for car use, and will bring in fifty to sixty stations under the worst conditions.

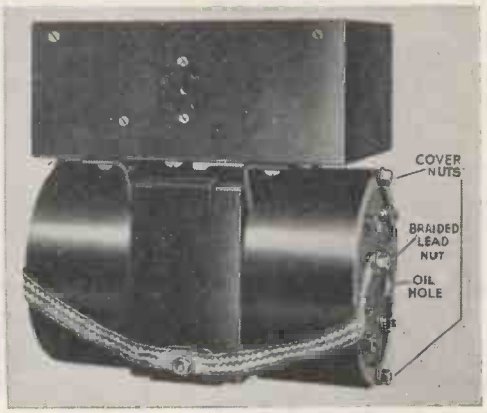
Some idea of the automatic-volume-control efficiency can be obtained from figures supplied by the makers. They claim that the volume output is uniform with a signal input varying between 4 and 500,000 microvolts.

The price of the Twin 8 is £26 5s., and the Dual 6 £18 18s.

Now for Philco. Philco decided that if car radio is to become universally used in this country the prices must be comparable with those of the family set.

As a step in the right direction they reduced the price of the Transitone Model 10—brought out last year—from £33 12s. to £16 16s., and at the same time improved it out of all recognition.

This new model embodies full automatic volume control and four-point tone control. The whole unit is housed in a metal container less than 12 in. square. As it is fixed by only three bolts, installation is a very speedy matter.



GENERATOR AND FILTER UNIT

The generator and filter unit of the Motorola car-radio set fits on to the dashboard of the car

A special Philco vibrator converter runs from the car accumulator and supplies the required high- and low-tension voltages so that the receiver is on a par with a mains-driven set.

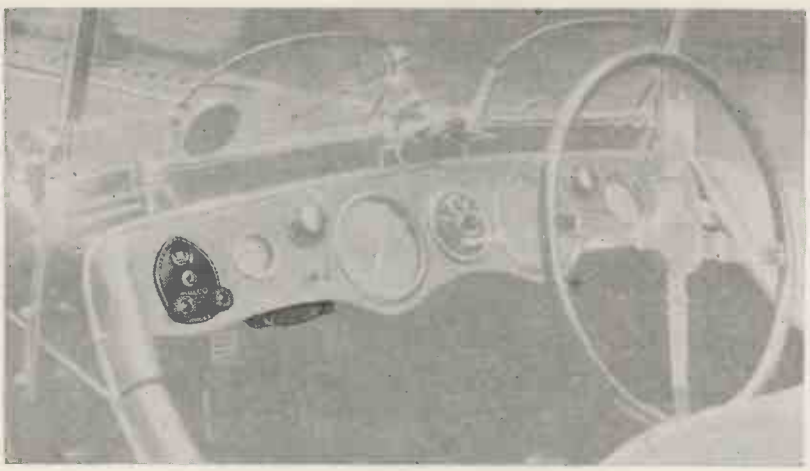
Last Word in Efficiency

Their six-valve super-het circuit is the last word in efficiency. Background noises are kept down to a low level, while Continental stations can be tuned in with the car travelling at high speed. A point that we noticed was that the control knobs could be used without difficulty when wearing thick motoring gloves.

The quality, with an output in the region of 2,500 milliwatts, bears comparison with the best home receiver.

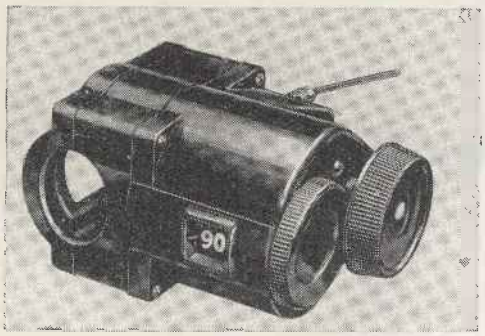
Lissen's, who introduced their first car-radio receiver at the last radio exhibition, have now brought their one model right up to date to include all of the latest ideas developed during the past few months.

Actually they have two models, but both fundamentally the same. One is for 12-volt and the other for 6-volt systems. The first model is



HOW THE PHILCO TRANSITONE SET IS CONTROLLED

Here you see the radio control unit of the facia panel of the Hon. Peter Aitken's touring Frazer-Nash car. The Philco set and loud-speaker are fitted underneath the facia panel. The outfit does not take up much room



LISSEN CAR-RADIO CONTROL

This Lissen car-radio outfit is unique in that the switching on the set is controlled by electrical relays from the remote control unit

type 26006, and the second type 26001, and both cost £16 16s.

The circuit is a complete departure from the more popular American practice of using multi-valve super-het receivers.

Straight—Not Super-het

Lissen's are firmly convinced that super-hets mean background noise, so they have pinned their faith to the reliable three-stage high-frequency amplifier followed by diode detection and intermediate low-frequency stage with a special class-B output.

Dual-range iron-core coils are used having a tuning range of between 200 and 520 metres on the medium waves and 830 to 2,100 metres on the long. The whole receiver is housed inside a watertight container with an easily removable cover.

Illuminated Controls

All operating is done from the steering column. The remote-control unit includes tuner, volume and wave-range controls, as well as the master on-off switch. Both wave-range tuning scales are illuminated—the medium waves in red and the long waves in green.

A loud-speaker of the moving-coil type is supplied in a " poke-proof " case, which can be fitted to the underside of the facia board or to any other convenient part.

Ample volume is obtainable from all but the very distant stations, and on the locals an output of 2,500 milliwatts is given.

A point, with which we were impressed, was the method of switching. Instead of the usual Bowden wire arrangement, Lissen's use a particularly effective electrical relay system.

Yet another system is favoured by the Majestic Co., who have produced a six-valve super-het receiver with full automatic volume control, tone correction, and provision for an additional loud-speaker. The loud-speaker and receiver are both housed in the same case, which is fitted with brackets so that it can be screwed to the underside of the facia board. This system does enable the receiver to be installed in quick time.

An aeroplane type of dial, fitted to the steering column, is illuminated and harmonises with the remainder of the facia board.

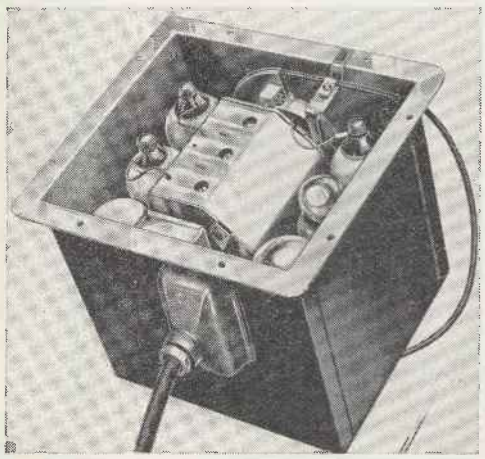
Remote control is provided for tuning, volume and master switching. The receiver, when switched off, can be locked with a Yale-type lock and key. This Majestic set costs £21.

After weighing up all of the evidence it does seem as if the British manufacturers are making a valiant and *successful* attempt to popularise radio in cars.

We do feel that a word from the Government on the legal position would do a lot to put car radio either on or off the wireless map.

As most of the resistance manufacturers are now in a position to supply the special noise suppressor resistances for fitting in series with the sparking plugs, the last snag in car-radio is overcome. These manufacturers have conducted tests on the best value of resistance to be used, and it is a simple matter to get maximum noise suppression without affecting engine performance.

Dubilier, Erie, and other resistance manufacturers can supply the home constructor with a deal of information on the best value resistance to use with different cars.



INTERIOR OF THE LISSEN CAR-RADIO

The Lissen car-radio set is contained in a strong metal case which fits under the back seats of the car, or, in fact, in any convenient place

For the Constructor

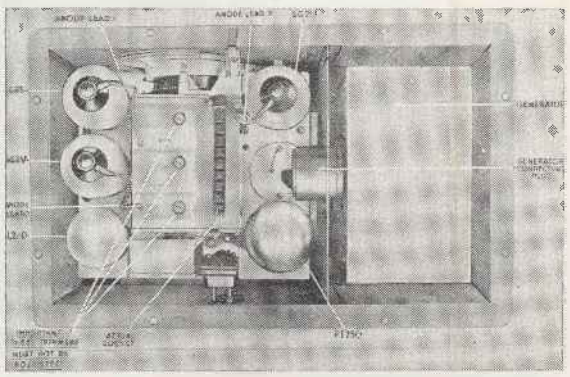
The home constructor should remember that *car radio receivers are not difficult to make*. In fact with a little care quite effective four-valve receivers can be made at home which will give good results, and cost of construction is comparatively cheap.

We have experimented with a constructor four-valve receiver using a tuned aerial stage and an untuned grid stage; it gave excellent results on the more powerful stations. The size of the cabinet was kept down to approximately 9 in. square, and by using a metal chassis and Catkin valves the receiver was almost unbreakable.

Midget Components

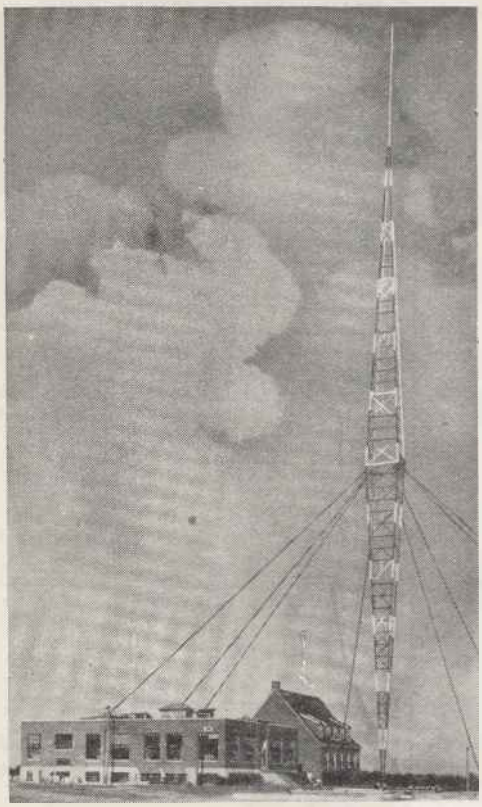
Certain manufacturers are in a position to supply midget tuning condensers and midget dual-range coils, so there is no reason for the home constructor not building, say, a super-het with single dial control. The necessary power supply can be obtained from the car accumulator, via a rotary or vibrator converter which gives an output of between 200 or 300 volts at 50 milliamperes.

The car chassis is used as an earth connection, while Harbro coloured cable can be tacked around the car roof for an aerial.



" STRAIGHT " CAR-RADIO OUTFIT

The Lissen car-radio set is the only British set that does not use a super-het circuit. Three high-frequency stages are used in a straight circuit



AMERICA'S 831-FT. AERIAL
The aerial mast of WLW, America's new 500-kilowatt transmitter. The mast is insulated from the ground, for it is itself the aerial

ON THE CREST OF THE WAVES

Radio News From All the World
By JAY COOTE

AUSTRIA

Vienna Experimental, a 3-kilowatt station which was regularly working on the long waveband before the Lucerne Plan came into operation, has again made its appearance in the ether. It can be heard every Monday, Wednesday and Saturday on 1,255 metres (239 kilocycles) from about 2000 B.S.T.

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CZECHOSLOVAKIA

Tests are being carried out by the old Prague-Strasnice station (3 kilowatts) in the early morning hours on 249.2 metres. It will be known as Prague No. 2, and when overhauled and brought up to date will provide an alternative programme for listeners in the Czech capital.

As most of the Central European powers now possess a short-wave transmitter for the relay of their radio programmes overseas, the Czech Ministry has drawn up plans to install suitable apparatus at Podebrady, near the capital. The new station would combine the duties of a relay for transmissions to the U.S.A. with those of a public wireless telephony service.

EGYPT

The old fortress of Ras-el-Tin, at the mouth of Alexandria harbour, has been selected as the site of the 1-kilowatt station destined to provide that city with a relay of the Cairo programmes. The transmitter will work on 267.4 metres.

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FINLAND

In order to do away with a number of smaller relays, the Finnish Broadcasting Company has secured government financial assistance with a view to the installation of a 150-kilowatt station to replace the present Lahti transmitter. Engineers are now exploring the country in the hope of finding a more favourable central site for the new station.

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JUGOSLAVIA

A proposal has been put forward by the Jugoslavian authorities to construct a new broadcasting station in the Slovene town of Maribor (pre-War: Marburg), which is situated near the Austrian border. Its aim is to counteract the transmissions of Graz which, during the past few months, have assumed a political character.

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LITHUANIA

Klaipeda, a port on the Baltic better known perhaps under its former name of Memel, is to be the site of a new broadcasting transmitter destined to relay the Kaunas programmes. It has not yet been decided whether or not to replace the station in the capital, but if such a course is carried out the 7-kilowatt plant would be transferred to another part of the country to work on 222.6 metres (1,348 kilocycles).

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POLAND

Work on the new Mokre high-power station is being hurried forward and every effort is being made to get the transmitter ready by the end of this summer. The studios will be installed at Torun (Thorn).

It is expected that the new station will take over the Poznan channel.

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SPAIN

According to a recent report, the Spanish Government appears to have agreed definitely on a complete reorganisation of the broadcasting network and will not delay a start on the new scheme. It has been decided to endow the capital with a super-power station, working on the channel allotted in the long waveband and, in addition, to erect in the provinces six medium-wave stations varying from 40 to 60 kilowatts.

An agreement has been reached in respect to the fifty-odd private transmitters, which have been installed during the past three years. They will be allowed to carry on their broadcasts providing they do not cause interference.

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UNITED STATES

At Carlstadt (New Jersey) a new 2.5-kilowatt transmitter with the call sign WNEW has been recently installed; it works on 240 metres and is on the air from midday until 5 a.m. B.S.T. daily.

THE "W.M." RADIOGRAM SUPER

Continued from page 509

It will save a lot of trouble if the holes for the connections are marked in pencil with the small letters as indicated on the blueprint.

With regard to a suitable loud-speaker for use with this radio gramophone, we have indicated a very good model in the list of parts. This is of low-resistance type, but incorporates its own input transformer. On the other hand, if it is desired to use several loud-speakers externally it is better that the transformer should be placed inside the set and leads taken direct to the speech coils.

About Loud-speakers

The position therefore is that if several loud-speakers are to be used the internal transformer on the reproducer can be cut out and the leads from the speech coil taken direct to the Ferranti transformer. On the other hand, if only an internal loud-speaker is to be used the Ferranti transformer can be dispensed with and the input transformer on the loud-speaker employed.

We have not sufficient space at our disposal this month to give a report on the set's performance. This will appear, with a list of stations, in the next issue.

THE ALL-WAVE BATTERY THREE

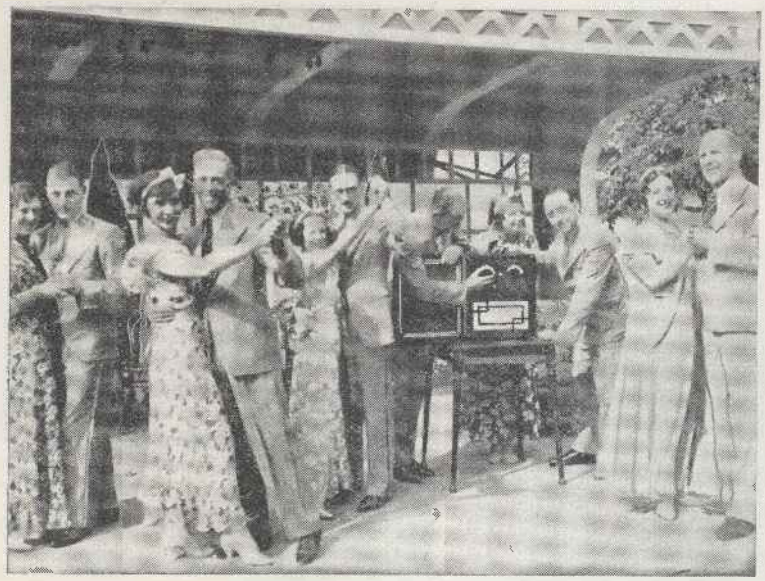
Continued from page 561

that the receiver oscillates quite freely over both short wavebands. With a long aerial the condenser will have to be almost fully out of mesh, but with an indoor or moderately short aerial considerably more capacity will be required.

Except that the tuning is so very much sharper, and that the set must almost be on the point of oscillation, no trouble should be experienced in tuning in a large number of short-wave stations.

In the beginning, it is perhaps an advantage for the inexperienced operator to keep the receiver oscillating all the time. When some high-pitched chirps are heard, this indicates the carrier wave of the station and all you have to do is to decrease the reaction until the carrier is resolved into a signal.

Slight readjustments of the tuning condenser should then bring in the station at good volume.



Entertaining the entertainers! Here is the famous "W.M." receiver, the Spectrum Portable, providing dance music for a concert party at Llandudno

Notes and Jottings

IT is certainly a pleasure to see good use being made of the Spectrum Portable at Llandudno. The photograph, reproduced at the top of this page, was taken at Happy Valley and shows Charles Wade's Concord Follies Concert Party enjoying a bout of dancing to Henry Hall's band during an interval between performances.

As you can well imagine, the Spectrum Portable with its QP21 output valve gives plenty of volume for dancing in the open air. This fine portable was fully described in the April, 1934 issue of "Wireless Magazine." It is a three-valver with a screen-grid high-frequency amplifier, detector and twin-pentode valve sequence and is entirely self contained. A moving-coil loud-speaker is used.

There are plenty of fine days to come this summer and, if you want a set for outdoors, you will find the Spectrum a first-rate outfit. Those who require a larger portable should read the report on the "Two H.F." Portable published in this issue.

◆ ◆ ◆

Talking about concert parties, readers who live in the South of England will be interested to know that they can meet many broadcasting favourities on the pier at Worthing this season.

Worthing's show is called *Radio Mirror*, and the cast includes such well-known favourities as Leonard Henry, Beryl Orde, Clarence Wright, who at one time conducted the Savoy Orpheans, and the famous Eight Step Sisters.

◆ ◆ ◆

Holiday news reminds us about the floating radio showroom which will be cruising around the Norfolk Broads this summer. C. W. Willmott, a Norwich dealer, has hired a large motor cruiser having three cabins. One he has fitted up as a showroom, another has service gear and a battery charger and the third is fitted with a receiver and transmitter so that people on the cruiser can keep in touch with head office.

The *Glow of Light*, as the boat is called, has been fitted out with the co-operation of the Marconiphone Co., and carries a large figure of a "Marconi Man" on the prow. Such is enterprise!

◆ ◆ ◆

The H.M.V. show train is continuing its tour of the country's principal towns during July. We gave full details of this railway radio exhibition last month, but in case you missed the details the show train consists of three special carriages in which are an up-to-date exhibition of H.M.V. sets and gramophones.

Readers can visit the show, but they must get tickets from their local H.M.V. dealers.

Here are the places and dates in July on which you can visit the train: Edinburgh, July 2 and 3; Newcastle, July 4; Sunderland, July 5; Middlesborough, July 6 and 7; Scarborough, July 9; York, July 10; Hull, July 11 and 12; Leeds, July 13 and 14; Bradford (Forster Square), July 16; Huddersfield, July 17; Doncaster, July 18; Grimsby, July 19; Sheffield, July 20 and 21; Derby, July 23; Nottingham, July 24; Leicester, July 25; Northampton, July 26; Cambridge, July 27 and 28; Norwich, July 30 and Ipswich, July 31.

◆ ◆ ◆

Philips Lamps has just installed an interesting self-timing device incorporating a photo-electric cell relay at the new Welsh Harp Greyhound Track. The apparatus is so arranged that the winning dog itself stops the timing watch.

The release of the dogs from the trap starts the stop watch, which is connected with the photo-electric cell. As soon as the nose of the winning dog interrupts an invisible beam at the finishing line, the photo-electric cell stops the watch.

◆ ◆ ◆

To prevent any misrepresentation the service engineers of Electrical and Music Industries, Ltd., have been provided with an identification card on which is the engineer's signature and photograph.

We are asked to remind dealers and set owners to ask every service engineer calling upon them to produce his card before being allowed indoors to "put the wireless right." If you don't, you may be the looser of money or of other valuables.

◆ ◆ ◆

Decca has sent us two sampler records for dealer use to introduce to listeners—or should we say gramofans—four new albums of selections from the classics. There isn't space to tell you the contents of these albums, but we can say that they have been arranged and chosen by Christopher Stone the inimitable.

The four albums contain tip-top classics. You can get full details from your dealer or from the Decca Record Co., Ltd., of 1-3 Brixton Road, London, S.W.

We understand that supplies of British-made Tungsram valves will be available in the autumn. The new factory, which is being built at Tottenham, is making excellent progress.

◆ ◆ ◆

McMichael Radio, Ltd., has had five sets approved by the Central Council for School Broadcasting for use in schools. The sets passed are the Lodex Five, Duplex Mains Four Portable, A.C. and D.C. models of the Supervox and the new super-het mains set.

◆ ◆ ◆

New moving-coil loud-speakers are always an interesting news item for the home constructor. Goodmans (Clerkenwell), Ltd., are in the news this month for they have just brought out a new reproducer which they claim to have a double bass peak at 40 and 75 cycles and dipping slightly at 50 and 100 cycles to avoid hum troubles.

It is also claimed to reproduce notes with a frequency as low as 25 cycles and as high as 7,500 cycles. They are available with all values of field winding and cost 35s. By the way, they are of the energised type.

◆ ◆ ◆

We have heard a lot about new factories to cope with the ever growing radio business. Cossors' are putting up a huge new factory at Highbury, a photograph of which is on page 493.

Another firm who are extending is Aerodyne Radio, Ltd. Aerodyne are building a new factory at Tottenham which will give an additional floor space of between 50,000 and 60,000 sq. ft. It is hoped to have this new factory in full operation by next September.

◆ ◆ ◆

The public-address engineers of the Marconiphone Co. will beat their own record for a day's work this month. No fewer than five large installations will be in use in various parts of the country on July 18. In all there will be 129 loud-speakers and fourteen microphones in use on one day.

◆ ◆ ◆

Following the successful inauguration of the new Marconi broadcasting station at Cape Town, the African Broadcasting Co. has decided to install two more high-power stations, one at Grahamstown and the other at Pietermaritzburg. They will be identical to the Cape Town transmitter and will be manufactured at Marconi's Chelmsford works.

◆ ◆ ◆

One more thought about the holidays! The General Steam Navigation Co., Ltd., has installed super radio gear for microphone announcements and music broadcasts on its pleasure steamers, which run daily throughout the summer between Tower Pier, London and Southend, Margate, Ramsgate and Clacton.

On their new steamer, *Royal Eagle*, the gear is a de-luxe job giving an undistorted output of 35 watts, which is fed into eight Epoch super-cinema moving-coil loud-speakers placed in various parts of the ship.

Two are mounted in special baffle boxes on deck, two are in the ship's glass-enclosed lounge, and the remaining four in the dining saloons.

The ship's current of 100 volts D.C. is used for driving a large rotary converter which gives a voltage of nearly 1,500 volts necessary for the two Ediswan ES75 output valves.

Public address enthusiasts who take a trip to the sea via London River, will gladly be shown the "innards" of the installation by the officer in charge.

Short Waves with the Seventy-seven Super

MANY hundreds of "W.M." readers who built the Seventy-seven Super, described in the Dec. 1932 issue of "Wireless Magazine" will be interested in a converter being used by a Kingsbury reader to bring in short-wave stations.

The circuit is reproduced here for the benefit of readers who would like to try their hand with short-waves on this set.

Recommended Converter

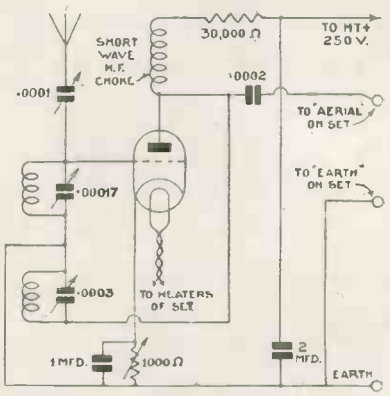
Most constructors will be able to build the recommended converter from the circuit diagram. The converter is connected to the Seventy-seven Super in the ordinary way, but it must be borne in mind that the set must be tuned to a long wavelength.

The best wavelength will be found by trial; our Kingsbury correspondent states that a wavelength of 1,000 metres gives the best results.

Regarding the results to be obtained he says that "W3XAL can usually be heard in the adjoining room at splendid volume and free from excessive fading. In fact, this station with Pittsburgh, Springfield, Boston and Schenectady give results equal to most of the Continental stations heard on the broadcast wavebands."

He goes on to say that he considers this combination of Seventy-seven Super and converter equal to the best short-wave commercial receiver, irrespective of price.

People who have doubts about the entertainment of short-wave listening will be keenly interested in this enthusiastic listener's opinion of short-wave entertainment. He says that "short-waves are definitely of



Circuit of the short-wave converter recommended for use with the Seventy-seven Super by a Kingsbury reader

splendid entertainment value with a good super-het such as a converted Seventy-Seven Super.

"One can *hear* the programmes, and for the long-distance fan there are dozens of stations to investigate when one has time to spare. We rarely fail to hear the stock exchange report and the Kiddies Club from Boston, followed by the 'Singing Lady' at full loud-speaker strength."

Such a recommendation should convince those who believe that short-wave listening is not so thrilling as is frequently suggested.

YOU CANNOT GO WRONG IF YOU USE A

FULL-SIZE BLUEPRINT

Each blueprint shows the position of each component and every wire and makes construction a simple matter. Copies of "Wireless Magazine" and of "Amateur Wireless" containing descriptions of most of these sets can be obtained at 1s. 3d. and 4d., respectively, post paid. Index letters "A.W." refer to "Amateur Wireless" sets and "W.M." to "Wireless Magazine" sets. Send, preferably, a postal order (stamps over sixpence unacceptable) to "Wireless Magazine," Blueprint Dept., 58-61 Fetter Lane, London, E.C.4.

And here are over 50 more to choose from—

CRYSTAL SET (6d.)

1931 Crystal Set	AW308
4 Station Crystal Set	AW427

ONE-VALVE SETS (1s. each)

Easy to Build One	AW304
Portable Short-wave One	AW354
B.B.C. One-valver	AW387
Short-wave One-valver	AW429

TWO-VALVE SETS (1s. each)

A Two for 7 Metres (D, Trans)	WM295
A.C. Quality Gem (D, Trans)	WM312
The Companionette (D, Pen-A.C./D.C.)	WM358

★

SPECIAL HALF-PRICE OFFER

Blueprints of the following "Wireless Magazine" sets described in this issue are obtainable at the special price, given below, if the coupon on last page is used before June 30, 1934.

Six-guinea A.C./D.C. Three (SG, D, Pen), WM364 ... ... **6d.**

All-wave Battery Three (SG, D, Pen), WM365 ... ... **6d.**

"WM" Radiogram Super (8 valve A.C. Super-het) WM366 ... ... **9d.**

"A.W." Iron-core Two (D. Trans)	AW395
"A.W." Iron-core Two with Q.P.P.	AW396
Big Power Melody Two, with Lucerne Coils (SG, Trans)	AW338A
B.B.C. National Two, with Lucerne Coils (D, Trans)	AW377A
Lucerne Minor (Det, Pen)	AW426
Home Station A.C. 2 (D, Pen)	AW374
B.B.C. National Two (D, Trans)	AW377
Melody Ranger Two (D, Trans)	AW388
Consolectric Two (D, Pen) A.C.	AW403
Lucerne Minor (D. Pen.)	AW426

THREE-VALVE SETS (1s. each)

C.B. Three (D, LF, Class-B)	WM333
Duo-tuned Three (SG, D, Pen)	WM341
A.C. Transportable (SG, D, Pen)	WM347
All-wave Three (D, 2LF)	WM348
"W.M." 1934 Standard Three (S.G., Det, Pen)	WM351
Emigrator (A.C. set : 14-500m.) (S.G., D., Pen)	WM352
£3 3s. Three (SG, D, Trans)	WM354
Heptode Super Three (A.C. Super-het)	WM359
Iron-core Band-pass Three (SG, D.QP 21)	WM362
James Push-push Three (SG, D, Q.P.P.) (1/6)	AW378
Everybody's Home Radiogram (SG, D, Trans)	AW381
Home-lover's New All-electric 3 for A.C. mains (SG, D, Trans)	AW383
Our Up-to-the-Minute Three (SG, Westector, LF, Trans)	AW384
Class-B Three (D, Trans, class B)	AW386
A.C. Triodyne (SG, D, Pen)	AW399
Home-built Coil Three (SG, D, Trans)	AW404
Fan and Family Three (D, 2LF)	AW410
£5. 5s. S.G.3 (SG, D, Trans)	AW412
39/- Lucerne Ranger (SG, D, Trans)	AW422
Penta-quester (S.G., D, Pen)	AW431

FOUR-VALVE SETS (1s. 6d. each)

Calibrator (SG, D, RC, Trans)	WM300
Table Quad (SG, D, RC, Trans)	WM303
"Words and Music" Radiogram (2 SG, D, Trans)	WM307
"Words and Music" Radiogram de Luxe (SG, D, RC, Q.P.P.)	WM307a
Home Short-waver (SG, D, RC, Trans)	WM311
Empire Short-waver (SG, D, RC, Trans)	WM313
Calibrator de Luxe (SG, D, RC, Trans)	WM316
All-metal Four (2 SG, D, Pen-A. C. Mains)	WM329
Self-contained Four (SG, D, LF, Class B)	WM331
All-progress Four (Battery Super-het)	WM335
Merrymaker Super (A.C. Super-het)	WM345
1934 A.C. Quadradyne (2SG, D, Pen)	WM349
Lucerne Straight Four (SG, D, LF, Trans)	WM350
Universal Merrymaker (A.C./D.C. Super-het)	WM356
"A.C. Melody Ranger" (SG, D, RC, Trans)	AW380
"A.W." Ideal Four (2SG, D, Pen)	AW402
2 H.F. Four (2 SG, D, Trans)	AW421
Lucerne Major (256 SG, Trans)	AW433

FIVE-VALVE SETS (1s. 6d. each)

New Class-B Five (SG, D, LF, Class-B)	WM340
Class-B Quadradyne (2 SG, D, LF, Class-B)	WM344
James Short-wave Super (Super-het)	AW328
Simple Super (Super-het)	AW340
The Etherdyne (Super-het)	AW406
1934 Century Super (Battery super-het)	AW413

SIX-VALVE SETS (1s. 6d. each)

1932 Super 60 (Super-het)	WM269
1932 A.C. Super 60 (A.C. Super-het)	WM272
"W.M." D.C. (Super-het)	WM321
James Class-B Super (Super-het with iron-cored coils)	WM326
Welcome Portable with class-B output stage	WM325
Connoisseurs' Super (A.C. Super-het)	WM334
James Super Straight Six (2 SG, D, LF, Push-pull)	WM339
Lucerne Super (battery super-het)	WM355

SEVEN-VALVE SETS (1s. 6d. each)

Super Senior (Super-het)	WM256
Seventy-seven Super (A.C. Super-het)	WM305
Q.P.P. Super 60 (Super-het)	WM319

PORTABLES (1s. 6d. each)

Town and Country Four (SG, D, RC, Trans)	WM282
Everybody's Portable (five-valve Super-het)	WM291
Welcome Portable (six-valve Super-het)	WM322
Spectrum Portable (SG, D, QP21)	WM357
"Two H.F." Portable (2SG, D, QP21)	WM363
General-purpose Portable (SG, D, RC, Trans)	AW351

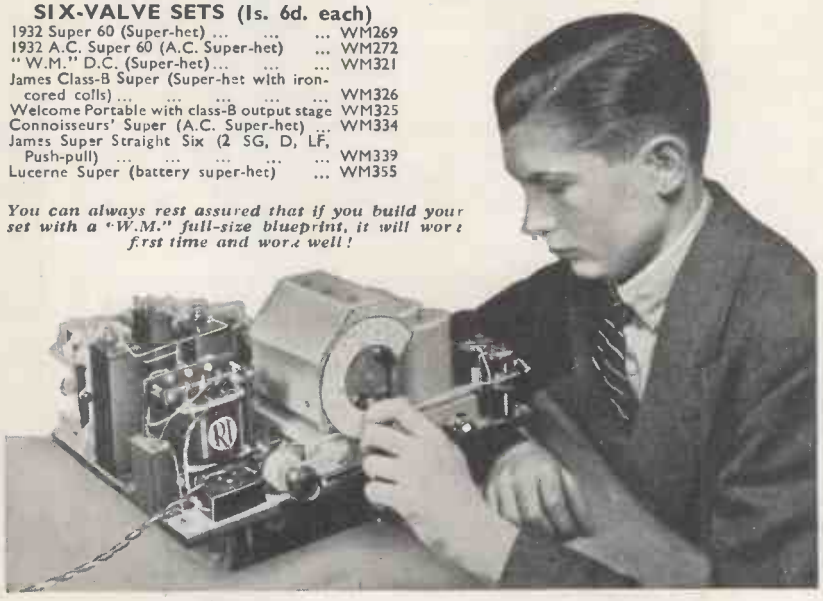
AMPLIFIERS (1s. each)

10-watt A.C. Amplifier	WM360
10-watt D.C. Amplifier	WM361
Universal Push-pull Amplifier	AW300
"A.W." Record Player (LF, Push-pull)	AW319
Battery-operated Amplifier	AW362
"A.W.'s" Push-push Amplifier	AW376
Class-B Gramophone Amplifier	AW391
Universal A.C. Amplifier (3-valve)	AW411
Five Q.P.P. Output Circuits	AW315

MISCELLANEOUS (1s. each)

A.C. Short-wave Converter	WM353
"A.W." Trickle Charger	AW352
Plug-in Short-wave Adaptor	AW382
Experimenters' D.C. Mains Unit	AW430
Experimenters' A.C. Mains Unit	AW432
Add-on Band-pass Unit	AW359
Plug-in Short-wave Adaptor	AW382

You can always rest assured that if you build your set with a "W.M." full-size blueprint, it will work first time and work well!



BLUEPRINT COUPON

Valid only until July 31, 1934 (or until August 31, 1934, for overseas readers)

FOR ONE BLUEPRINT ONLY

If you want a full-size blueprint of any ONE of the sets constructionally described in this issue for half price, cut out the above coupon and send it, together with a postal order, to Blueprint Department, WIRELESS MAGAZINE, 58-61 Fetter Lane, London, E.C.4.

This coupon is valid for a blueprint of any ONE only of the following sets at the prices indicated :—

SIX-GUINEA A.C./D.C. THREE (page 519), No. WM364, price 6d., post paid.

ALL-WAVE BATTERY THREE (page 557), No. WM365, price 6d., post paid.

"W.M." RADIOGRAM SUPER (page 503), No. WM366, price 9d., post paid.

INFORMATION COUPON

Valid only until July 31, 1934 (or until August 31, 1934, for overseas readers)

If you want to ask any questions, cut out the above coupon and send it, together with a postal order for 1s. and stamped addressed envelope, to the Information Bureau, WIRELESS MAGAZINE, 58-61 Fetter Lane, London, E.C.4.

Note that not more than two questions may be asked at a time and that queries should be written on one side of the paper only.

Under no circumstances can questions be answered personally or by telephone. All inquiries must be made by letter so that every reader gets exactly the same treatment.

Alterations to blueprints or special designs cannot be undertaken : nor can readers' sets or components be tested.

If you want advice on buying a set, a stamped addressed envelope only (without coupon or fee) should be sent to the Set Selection Bureau, WIRELESS MAGAZINE, 58-61 Fetter Lane, London, E.C.4.

THE SIX-GUINEA A.C./D.C. THREE

Continued from page 523

Then before the set is tried out for the first time, the mains dropping resistance—fitted to the top of the chassis—must be adjusted to correspond with the voltage of your domestic supply. Three tappings are provided, covering all supplies between 200 and 250 volts.

Operating the set needs very little explanation. It is switched on by the toggle switch, on the back of the chassis, you will remember, and the wave-change switch is set for either the long or medium waves as desired.

Tuning the Set

There is only one knack of tuning this set, that is, if it can be called a knack. The two tuning dials should be turned almost in step and the aerial-input control adjusted to get the required degree of selectivity. To get the utmost selectivity, the aerial-input control should be set as far to *minimum* capacity as possible and the reaction control *advanced* till the set is on the verge of oscillation.

One word about the cabinet. The cabinet we have specified is well made and is very reasonable in price. We have not included the price of the cabinet in the six guineas, because, no doubt, some readers may have a cabinet in stock or they may prefer to buy a more expensive one to fit in with some particular home furnishing arrangement.

About the Test Report

That this outfit lives up to the fine reputation of "W.M." sets is borne out by the independent test report that appears on page 524. Some thirty-five stations were logged in a short test.

There is no need for us to point out to readers that every "W.M." set undergoes thorough tests, both in the laboratory and independently, before details are published. "W.M." has a great reputation and it is going to live up to it!

We want readers to remember that we are always pleased to hear about the results—good or bad—that they get from "W.M." sets. Any remarks about the set's performance are always of great help to the Technical Staff in the design of future sets. And do not forget that half a guinea is paid for every photograph of a "W.M." set published.

INDEX TO ADVERTISERS

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is SPECIFIED EXCLUSIVELY

for the W.M. ALL-WAVE THREE

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A valve that is far better than the ordinary D.C. type and even better than an A.C.; yet works as either! Tungsram's supreme achievement! No need for alterations if your supply changes from D.C. to A.C.! No need for a transformer! "Wireless Magazine" exclusively specify for their SIX GUINEA A.C./D.C. THREE H.P.2118 **(14/6)**, R.2018 **(10/6)**, P.P. 2018 **(17/-)**, and V. 2018 **(10/6)**.

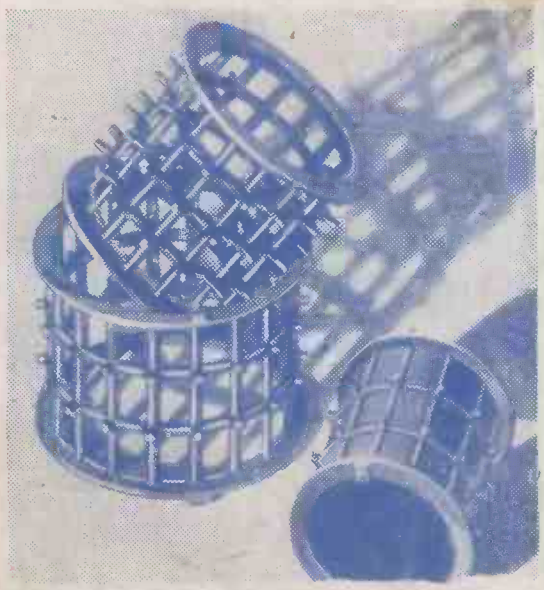
There's a Tungsram for every radio need

TUNGSRAM VALVES

Tungsram Electric Lamp Works (Gt. Brit.), Ltd., 72 Oxford Street, London, W.1
TAS/Tu.50

Mention of the "Wireless Magazine" will ensure prompt attention

A Ferranti Transformer has NO equal!



Here are the three special insulating formers with their moulded-in pegs for external connection anchorage. Note the air-spacing for windings, and the absence of paper, cotton, or other hygroscopic material which causes breakdown.

These are the wound formers—three and a half miles of wire in an AF5! Winding is done by compressed air turbine driven machines—thus avoiding all trace of mechanical stress which is inseparable from direct driving.

The completed AF5—neat, compact, without an equivalent.

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As an instance, take only the windings of an AF5. (A similar structure is employed in nearly all Ferranti Audio and Output Transformers.) The accompanying photos tell their own story; the captions give interesting details.

Add to these points the fact that Ferranti Transformers were the first to give good results even in the early days when the characteristics of valves made quality reproduction far more difficult than it is to-day, and you will know just why FERRANTI Transformers are the first choice of expert radio engineers.

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AF10 at 8/6 is of similar, though not identical, structure.

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